World Journal of Laparoscopic Surgery

An Official Publication of the World Association of Laparoscopic Surgeons, UK

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Editorial

10.5005/wjols-14-3-v

Another year of dealing with the impact of COVID is going on. Nearly everyone has been touched by the pandemic of Omicron, and it's worthwhile to remember this impact. Researchers in South Africa and around the world are conducting studies to better understand many aspects of Omicron and will continue to share the findings of these studies as they become available. It feels like we're gradually emerging out of hibernation. May we hope that it is a year where we are all less impacted by the ongoing pandemic and begin to return to some sort of normalcy in whatever form that may now take. We have one useful article in this issue regarding COVID-19 and Surgical Preparedness.

In this issue of WJOLS we have many interesting articles. Laparoscopic Intersphincteric Resection and Colon Shaping for Low Rectal Cancer Treatment is a very informative article for colorectal surgeons. Another good paper is regarding Laparoscopic Totally Extraperitoneal Using Three-dimension Mesh to Treat Bilateral Inguinal Hernia in Adults. For gynecologists, in this issue, we don't have much information but I want to assure you that in coming issue we will have more gynecological laparoscopic articles.

Don't forget to check the website for further details and very informative high-definition laparoscopic surgery videos (www.wjols.com). I am hopeful that by the time new year 2022 rolls around we will be all able to travel without excessive restrictions and hope to see many of you. The most effective steps individuals can take to reduce the spread of the COVID-19 virus are to keep a physical distance of at least 1 meter from others; wear a well-fitting mask; open windows to improve ventilation; avoid poorly ventilated or crowded spaces; keep hands clean; cough or sneeze into a bent elbow or tissue, and get vaccinated when it's your turn.

Here's wishing you and your loved ones a Happy and Prosperous 2022! May the new orbit fill our hearts and our homes with healing, happiness, and smiles!

Have a great new year ahead! Stay safe!

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ORIGINAL ARTICLE

Role of Laparoscopy in Diagnosis of Abdominal Tuberculosis

Sarfaraj Pathan[1], Smita V Kakade[2], Sachin Ambre[3]

Abstract

Introduction: To study the efficacy of visual impression of the peritoneal cavity by laparoscopy in the diagnosis of abdominal tuberculosis (TB).

Materials and methods: Fifty patients with suspected abdominal Kochs underwent diagnostic laparoscopy, and the visual impression was compared with other tests like acid-fast bacillus (AFB) stain, AFB culture, histopathology, TB PCR and Gene Xpert.

Observations: Out of 50 patients, 42 (84%) had positive visual findings on laparoscopy characterized by enlarged lymphadenopathy, ascites, peritoneal tubercles, and interbowel adhesions. Thirty-eight (76%) patients had positive histopathological findings and TB PCR, while thirty-nine (78%) patients had positive Gene Xpert. So, laparoscopic visualization of abdominal cavity is 100% sensitive for the diagnosis of abdominal tuberculosis.

Conclusion: Laparoscopy is a safe and rapid method for the diagnosis of abdominal TB.

Keywords: Abdominal tuberculosis, Laparoscopy, Visual impression.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1459

Introduction

Tuberculosis (TB) has an incidence of 211 cases per 100,000 population and adds about 2.8 million cases to the total pool every year.[1] Abdominal TB is a major contributor to extrapulmonary TB both incidence wise and mortality wise. It accounts for 11–16% of cases of TB.[2–4] It presents a clinical dilemma due to its myriad ways of presentation. A battery of investigations like erythrocyte sedimentation rate (ESR), ultrasonography (USG), computed tomography, ZiehlNeelsen staining, acid-fast bacillus (AFB) culture, and biopsy has been used conventionally to diagnose abdominal TB. However, none of these are considered the gold standard for the diagnosis of abdominal TB.[5] Recent advances in molecular and immunological studies like TB PCR and Gene Xpert assay have improved the rates of detection, but they are expensive and time-consuming. Previously, the diagnosis and treatment of abdominal Kochs were based on either blind biopsy or visual findings on laparotomy.[6] Recently, greater experience and availability of laparoscopy has made it possible to have a direct visual impression of the abdominal cavity with the added benefit of biopsy. Various studies have proven laparoscopy to be a rapid, safe, and most specific procedure for the diagnosis of abdominal Kochs.[2,3,7–9] Ours is an attempt to establish the role of laparoscopy for the diagnosis of abdominal Kochs. We have compared the visual findings by laparoscopy with other tests like AFB stain, AFB culture, TB PCR, Gene Xpert, and histopathology to prove the efficacy of diagnostic laparoscopy.

Aims and Objectives

To study the efficacy of visual impression of peritoneal cavity by laparoscopy in the diagnosis of abdominal tuberculosis.

Materials and Methods

Our study included 50 patients who presented with features suggestive of abdominal TB.

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How to cite this article: Pathan S, Kakade SV, Ambre S. Role of Laparoscopy in Diagnosis of Abdominal Tuberculosis. World J Lap Surg 2021;14(3):145–148.

Source of support: Nil

Conflict of interest: None

Inclusion Criteria

- Patients between the age-group of 18–60 years.
- Symptoms of abdominal TB—abdominal pain, weight loss, night sweats, low-grade fever, or evening rise of temperature.
- Elevated ESR.
- Mantoux test positivity.
- Abdominal USG showing mesenteric lymphadenopathy—more than or equal to 1 cm; Small bowel mesenteric thickening—1.5 cm or more.

Procedure

All patients underwent diagnostic laparoscopy under general anesthesia. Ports are placed as shown in Figure 1. A 10 mm, 30° laparoscope was inserted through the infraumbilical port using Hasson's technique. The peritoneal cavity was systematically examined as follows: Parietal peritoneum, small bowel loops with mesentery, appendix, large bowel, subdiaphragmatic area, liver, stomach, pelvis, and the rest of the cavity. Peritoneal-free fluid was collected. The mesentery was traced from ileocecal region proximally to look for enlarged mesenteric lymph nodes and

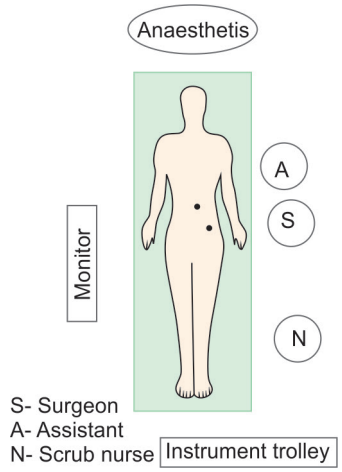


Fig. 1: Operating room setup

bowel wall tubercles. Biopsy of abdominal tubercles and enlarged mesenteric lymph nodes was taken and sent for histopathology, AFB culture, TB PCR, Gene Xpert. Peritoneal fluid was sent for the analysis, microscopy, AFB staining, and AFB culture. Postoperatively, most of the patients were started orally after 24 hours.

Observations and Results

The mean age of the patients was 35.08 years, in the range of 18–60 years. Out of 50, there were 33 male and 17 female patients. All 50 patients underwent diagnostic laparoscopy. The visual findings on laparoscopy were recorded. Positive findings on visual impression were as follows: free fluid in the abdomen, peritoneal tubercles, enlarged mesenteric lymph nodes, and intraabdominal adhesions (Fig. 2). We compared visual impression on laparoscopy with other investigative parameters done on samples collected intraoperatively from AFB staining, AFB culture, histopathology, TB PCR, and Gene Xpert. AFB staining showed a positive result in 20 (40%) cases. Peritoneal fluid AFB culture showed a positive result in 28 (56%) cases. Histopathological examination was positive in 38 (76%) cases. TB PCR was positive in 38 (76%) cases. Gene Xpert was positive in 39 (78%) cases. Gene Xpert is the most sensitive test for the diagnosis of TB and was considered standard for starting antitubercular treatment in our study.

Out of 50 patients, 38 patients had tuberculous lymphadenitis as a histopathological diagnosis. Reactive lymphadenitis as a histological diagnosis was found in the remaining 12 patients. Among the group of reactive lymphadenitis, one patient had positive Gene Xpert as well as positive visual findings, so this patient was started on AKT.

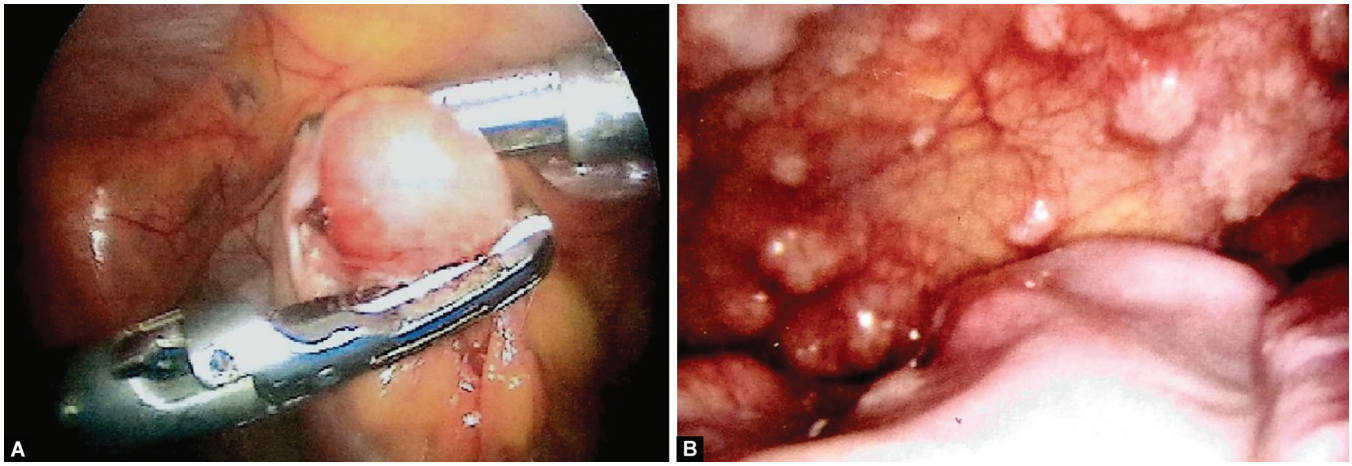
On laparoscopy, 42 (84%) patients were found to have positive findings suggestive of TB. Those patients who had positive Gene Xpert, TB PCR, and histopathology had positive visual findings. All 39 patients who had positive Gene Xpert were started on antitubercular treatment (Table 1). It suggests that visual impression coincides with positive Gene Xpert, TB PCR, and histopathology. Only three patients had positive visual findings on laparoscopy and had negative Gene Xpert. This shows that laparoscopy has 100% sensitivity for the diagnosis of TB when compared with other tests (Tables 2 and 3).

1. $\text{Sensitivity} = \frac{TP}{TP + FN} = \frac{39}{39} = 100\%$
2. $\text{Specificity} = \frac{TN}{TN + FP} = \frac{8}{11} = 72.7\%$
3. $\text{Positive predictive value} = \frac{TP}{TP + FP} = \frac{39}{42} = 92.8\%$
4. $\text{Negative predictive value} = \frac{TN}{TN + FN} = \frac{8}{8} = 100\%$

Discussion

TB is one of the commonest diseases of mankind for decades, and the incidence is rising due to the increased incidence of the human immunodeficiency virus and other immunocompromised conditions.[2–4,10,11] It continues to be an important medical, social, and economic problem in many developing countries where public health and sanitation are minimal.[12] The disease has a high incidence and is fairly curable provided it is diagnosed early and treated adequately. However, failure to do so causes increased severity of disease and the development of multidrug resistance. This is why a prompt and accurate diagnosis of this disease is very important.

Abdominal TB is the most common extrapulmonary manifestation of TB accounting from 11–16% of cases.[2–4,13,14] It can develop at any age but is more common in patients of 25–45 years.[4,12] The peritoneum and intestine are the most frequently involved sites of abdominal Kochs and present with nonspecific symptoms like fever, ascites, and abdominal pain, mimicking other chronic abdominal conditions.[2,3,7–11,13] The clinical features of abdominal TB are vague. Whereas the diagnosis of pulmonary TB can be done fairly easily with a noninvasive procedure on an outpatient basis, the diagnosis of abdominal TB poses a greater challenge. Delay in diagnosis and treatment can be a significant cause of morbidity and mortality. Due to its unusual presentation, a high index of suspicion is needed for diagnosis.[7–9,14] Among all the tests done, not a single test is conclusive for starting AKT. The routinely done laboratory tests and radiological tests are inconclusive.[3] The value of Mantoux test remains uncertain. Raised ESR is found in many patients, but it is not conclusive. Examination of ascitic fluid is helpful but needs a collection of around 1 L of ascitic fluid followed by centrifugation. The yield of organisms on staining and culture is very low. Moreover, culture requires 6–8 weeks for the mycobacterium colony to appear, causing a delay in diagnosis and treatment. TB PCR test for M.TB in biopsy and culture may be diagnostic, but it requires obtaining a tissue sample, for which laparotomy had to be done.[10] The most confirmatory option for diagnosis was a biopsy or direct viewing of the peritoneal cavity by laparotomy, and AKT was started accordingly. Earlier, the percutaneous peritoneal biopsy was another procedure used to diagnose TB but had a low sensitivity due to its blind nature and also risk of bowel perforation, visceral injury, etc.[13] Thus, many patients underwent laparotomy, and the diagnosis was made by visual findings on laparotomy or biopsy taken during laparotomy. But, it caused many complications increasing the morbidity and mortality of the patients.



Figs 2A and B: Intraoperative findings. (A) Mesenteric lymph node biopsy; (B) Parietal wall tubercles

Table 1: Comparison of various methods for the diagnosis of TB with a visual impression

Study group	*Visual findings S/o TB*	*AFB staining*	*AFB culture*	*Histopathology*	*TB PCR*	*Gene Xpert*
50	42	20	28	38	38	39
Percentage	84	40	56	76	76	78

Table 2: Sensitivity and specificity test

Visual impression	*Disease*	*No disease*	*Total*
Positive	True-positive (39)	False-positive (3)	42
Negative	False-negative (0)	True-negative (8)	8
	39	11	50

Table 3: Comparison of all tests with laparoscopy

	Sensitivity (%)	*Specificity (%)*	*Positive predictive value (%)*	*Negative predictive value (%)*
AFB staining	51.28	100	100	36.66
AFB culture	59.57	100	100	36.66
Histopathology	97.4	100	100	91.66
TB PCR	97.4	100	100	91.60
Gene Xpert	100	100	100	100
Laparoscopy	100	72	92.85	100

In the last few years, laparoscopy has emerged as a safe and rapid investigation for the direct visualization of the peritoneal cavity in cases of suspected abdominal Kochs. Laparoscopy under general anesthesia permits the observation of the entire peritoneal space and provides tissue samples in targeted areas for histopathology.[3] Few complications during laparoscopy are reported without any mortality. Thus, laparoscopy can be safely performed in all patients suspected to have abdominal TB for rapid diagnosis rather than relying on conventional methods that may take up to 4–6 weeks.

In our study, we have made an attempt to find the efficacy of diagnostic laparoscopy in abdominal TB. We have compared visual impression during laparoscopy with different tests like AFB stain, AFB culture, histopathology, TB PCR, and Gene Xpert.

AFB staining is positive in 40% of subjects. The sensitivity and specificity were 51.28 and 100%, respectively. The positive predictive value was 100%, and the negative predictive value was 91.66%.

AFB culture is positive in 56% of subjects. The sensitivity and specificity were 59.57 and 100%, respectively. The positive predictive value was 100%, and the negative predictive value was 36.66%.

Histopathology is a very specific method for the diagnosis of abdominal TB. In our study, (38/50) 78% of the patients who were diagnosed to have TB had histopathology findings suggestive of TB. The association was statistically significant (p <0.05). The sensitivity of the test was 97.4%, and the specificity was 100%. The positive predictive value was 100%, and the negative predictive value was 91.66%.

TB PCR is a highly sensitive method. In our study, it was positive in (38/50) 76% of patients who were diagnosed to have TB in laparoscopy. The association was statistically significant (p <0.05). The sensitivity of the test was 97.4%, and the specificity was 100%. The positive predictive value was 100%, and the negative predictive value was 91.66%.

Gene Xpert is a newer technique that is based on the same principle as PCR. In our study, it was found to be present in (39/50) 78% of the cases diagnosed after laparoscopy. Hence, it is a highly sensitive method for diagnosing abdominal TB. The association was statistically significant (p <0.05). Gene Xpert was found to be the most sensitive test in diagnosing abdominal TB. The sensitivity and specificity of the test were 100%.

Diagnostic laparoscopy is a minimally invasive procedure that enables us to directly visualize the peritoneal cavity and is completely safe in expert hands.[13] In our study, direct visualization of abdominal TB yielded positive results in (42/50) 84% of cases. The sensitivity of the test was 100% and specificity 72%. The positive predictive value is 92.8%, and the negative predictive value is 100%. Table 2 shows the comparison between all the tests with laparoscopy. On calculation, the diagnostic accuracy of laparoscopy was found to be 0.94 in our study, which is excellent accuracy.

Laparoscopic findings are suggestive of TB, that is, intraabdominal adhesions, peritoneal tubercles, mesenteric lymph nodes, and ascitic fluid correlated with tissue diagnosis of abdominal TB in maximum cases. According to visual impression, 6% of patients were overdiagnosed as positive predictive value of 92% and negative predictive value of 100%, which indicate that visual impression is negative; then. there is a 100% chance for the patients to have no disease. We have considered Gene Xpert as the standard to start AKT. All patients diagnosed with the visual examination are supported by biopsy and Gene Xpert. Otherwise, all 50 patients had to be started on AKT on empirical basis based on the clinical symptoms and radiological findings. The use of diagnostic laparoscopy obviates the need for starting on AKT in additional eight patients.

Our findings also support previous work on the value of laparoscopy as the most sensitive diagnostic test for abdominal TB with its advantage of histological confirmation.[7,8,15,16] It decreases the cost of added investigations and improves prognostic outcomes and can be treated as a gold standard.[8] It helps in the early diagnosis and treatment of patients with abdominal TB. It is also less invasive and obviates the need for laparotomy.[9,15,16]

Conclusion

Laparoscopy can diagnose abdominal TB in a minimally invasive manner by providing direct visualization of the abdominal cavity. Laparoscopy with tissue biopsy and cultures provides the most reliable, rapid, and correct diagnosis of abdominal TB preventing the need for more expensive procedures. In conclusion, for the diagnosis of abdominal TB, laparoscopy can be used as a primary investigation rather than the last resort, and the threshold for diagnostic laparoscopy should not be too high.

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ORIGINAL ARTICLE

Early and Delayed Laparoscopic Cholecystectomy in Acute Calculus Cholecystitis: A Prospective Randomized-comparative Study

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Abstract

Background: Acute cholecystitis is a very common gastrosurgical emergency. The timing of laparoscopic cholecystectomy (LC) in cases of acute cholecystitis is still a matter of debate. In general, delayed LC is preferred because of higher morbidity and conversion rate when LC is performed in acute cholecystitis.

Aim and objective: To compare the various parameters and outcomes between early and delayed laparoscopic cholecystectomies with safety and feasibility evaluation.

Materials and methods: A prospective, randomized controlled, interventional study was conducted from October 2017 to February 2019. Patients with a diagnosis of acute cholecystitis post-randomization were assigned into the early group ($n = 50$; LC within 72 hours of admission) and the delayed group ($n = 50$; initial conservative treatment followed by delayed LC 6–12 weeks later). The primary outcome measures were intraoperative and postoperative complications (bile duct injuries, bile leak, and wound infection), morbidity, mortality conversion, and length of hospital stay. The secondary outcome measures were the mean duration of surgery, the mean blood loss, other complications (subhepatic collection, postoperative pneumonia), and unsuccessful nonoperative management.

Results: In our study, the conversion rate in early laparoscopic cholecystectomy (ELC) group was 5 (10%) and delayed laparoscopic cholecystectomy (DLC) group was 7 (14%), respectively. The mean operative time was 77.30 ± 20.078 vs 66.94 ± 29.501 minutes; p <0.001 in ELC and DLC groups, respectively; the mean blood loss was 82.60 ± 59.67 vs 65.40 ± 74.21; p <0.007 in ELC and DLC groups, respectively. Postoperative complication was 4 (8%) vs 7 (14%) for ELC and DLC groups, respectively. However, the patients in the ELC group had a significantly shorter hospital stay (4.46 ± 1.32 vs 6.0 ± 2.54 days; p <0.002).

Conclusion: Early cholecystectomy is safe and feasible in patients with acute cholecystitis. Early cholecystectomy offers definitive treatment as it eliminates risks of failed conservative management and repeated episodes of acute cholecystitis with the advantage of shorten mean hospital stay without increased morbidity and mortality.

Keywords: Acute cholecystitis, Cholecystectomy, Early cholecystectomy, Laparoscopic.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1465

Introduction

For symptomatic cholelithiasis, laparoscopic cholecystectomy (LC) is a gold standard treatment. The timing of LC in acute calculus cholecystitis is still a matter of considerable debate and related controversies. Before the laparoscopic era, randomized studies revealed that the strategy of early open cholecystectomy within 7 days of the onset of symptoms was preferred as it provided shorter hospital stay and reduced potential risk of complications, such as pancreatitis, gangrenous, or emphysematous cholecystitis, without an increase of postoperative morbidity and mortality.[1,2]

Till 1990, acute cholecystitis was considered as a contraindication for LC due to increased postoperative morbidity, longer operative time, and higher conversion rate.[3,4] Consequently, delayed LC (DLC) was preferred after conservative medical treatment on the assumption that inflamed tissue is more vulnerable to laparoscopic intervention and may increase the risk of complications. In the last 15–20 years, as the surgeons excelled in laparoscopic surgeries, with improvement in laparoscopic devices and instruments, even acute cases were considered for LC. Randomized trials and meta-analysis have demonstrated that there was no difference in early LC (ELC) and DLC groups in terms of conversion rate, bile duct injuries, postoperative morbidity, and mortality. Moreover, the ELC group has reported the significantly shortened hospital stay and incurred low cost.[5]

Despite the evidence, DLC is still preferred in clinical practices due to controversial timings for LC in cases of acute cholecystitis.[6,7]

The aim of this study was to compare various parameters and outcomes between ELC and DLC with safety and feasibility evaluation. Outcomes were compared in terms of operative time, intraoperative and postoperative complications, length of postoperative, and total hospital stay between ELC and DLC groups.

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How to cite this article: Lal S, Rohitaj R, Najim Md, *et al*. Early and Delayed Laparoscopic Cholecystectomy in Acute Calculus Cholecystitis: A Prospective Randomized-comparative Study. World J Lap Surg 2021;14(3):149–156.

Source of support: Nil

Conflict of interest: None

Material and Methods

Patients and Methods

This study was a prospective randomized interventional study conducted in the Department of Surgery, at Postgraduate Institute of Medical Sciences and Research and Employee State Insurance Corporation Model Hospital, New Delhi, India from October 2017 to February 2019 after approval from the institutional ethical committee. Written and informed consent was obtained from each patient for inclusion in the study, LC, and conversion to open.

Inclusion Criteria

Acute cholecystitis patients admitted to the Department of Surgery of age from 18 to 60 years of either sex, with the American Society of Anesthesiologists (ASA) grade I and II, were included. Right upper abdominal pain, temperature more than 98.6°C, total leukoctes counts (TLC) more than 10,000/dL, or both, and presence of gallstones, thickened and edematous gallbladder (GB) wall with pericholecystic fluid were considered as diagnostic criteria. Finally, intraoperative findings were reckoned as diagnostic for acute cholecystitis.

Exclusiosn Criteria

Exclusion criteria included patients with simple biliary colic, obstructive jaundice, choledocholithiasis, gallstone-induced acute pancreatitis, post-endoscopic retrograde cholangiopancreatography, previous biliary tract surgery, previous abdominal surgery, biliary peritonitis, decompensated liver cirrhosis, intra-abdominal abscess, GB polyp, or malignancy, ASA grade III and IV, refusal of surgery, acute cholecystitis in pregnancy, and other contraindication to surgery.

Sample Size Calculation

Sample size calculation was done on the basis of the study of Gutt et al.[8] in which the overall complications were 14.1 and 40.4% in early group and delayed group, respectively. Considering the 80% power and 5% level of significance, the minimum number of patients required was 40 in each group. The sample size was increased by 10% on the basis of the assumption of nonparametric statics and dropout, and finally we consider 50 patients in each group.

Randomization

Block randomization with a sealed envelope system was used. We prepared randomly generated ten opaque sealed envelopes assigning A and B in five blocks each: A represented the ELC group and B represented the DLC group. Patients who underwent LC within 72 hours of symptoms were included in the ELC group, whereas LC done after 6–12 weeks were included in the DLC group. These patients were initially managed conservatively (broad-spectrum intravenous antibiotics and intravenous fluid resuscitation) and discharged when asymptomatic.

Data Collection

Data were collected from the index admission of patients, which included age, sex, associated comorbidities, BMI, past history of biliary disease, history of previous abdominal surgeries, duration of symptoms, and clinical examination. Other data included were laboratory, radiological, intraoperative, and postoperative parameters.

LC was performed by conventional four ports operative technique. Certain modifications were done as and when required, like GB decompression, use of laparoscopic specimen retrieval bag, epigastric port enlargement, suction/irrigation, and subhepatic closed suction drain placement.

Conversion to open cholecystectomy was done through right subcostal incision during difficulty in dissection, excessive bleeding, and adhesion of Calot's triangle. The drain was removed after 24–72 hours postoperatively. Surgical procedures were performed by surgeons having more than 5 years of experience of LC in a single surgical unit. All patients were allowed to eat and drink 6–8 hours postsurgery, in the absence of nausea or vomiting. Intramuscular diclofenac injection was advised for pain relief. Antibiotics were prescribed as per hospital protocol.

Primary outcome measures were conversion to open surgery, mean duration of hospital stay, complications (bile leak, bile duct injuries, and postoperative wound infection), and mortality. The secondary outcome measures were the mean duration of surgery, intraoperative blood loss, other complications (subhepatic collection, postoperative pneumonia), and unsuccessful nonoperative management.

Statistical Analysis

The data were entered in an Excel spreadsheet and analyzed by the Statistical Package for Social Sciences (SPSS) version 21.0. Categorical variables were presented in number and percentage (%). Continuous variables were presented as mean ± standard deviation (SD) and median. Normality of data was tested by the Kolmogorov–Smirnov test. Quantitative variables were compared using the unpaired *t*-test/Mann–Whitney test while qualitative variables were compared using the Chi-square test/Fisher's exact test. A p value of <0.05 was considered statistically significant.

Results

A total of 145 concordant patients were assessed for the study, out of which 45 patients were excluded as per criteria (Flowchart 1). The comparison group had 50 patients each with post-randomization at the final analysis. As shown in Table 1, both groups were comparable and equally distributed in respect of age, sex, body mass index, laboratory reports, radiological parameters, and comorbidities. There was no failure of conservative treatment in the delayed group which required urgent surgery. Various parameters were observed and evaluated pre-, intra-, and postoperatively.

The physical examination findings were similar in comparison groups. The pain duration, first symptoms, and previous biliary symptoms were comparable in both the groups. The use of antibiotics was significantly more common in the DLC group (49; 98%) as compared to the ELC group 5 (10%); p <0.001. All patients had pain in right hypochondrium. Murphy's sign was positive in 45 (90%) and 40 (80%) of ELC and DLC groups, respectively. Laboratory findings, viz TLC, Kidney function test (KFT), and liver function test (LFT), were comparable in both the groups (Table 1). The ultrasound findings were also comparable in both the groups (Table 2).

The mean intraoperative time and the mean intraoperative blood loss were significantly higher in the ELC group. The mean operative time was 77.30 ± 20.078 vs 66.94 ± 29.501 minutes; (p <0.001) and the mean blood loss 82.60 ± 59.67 vs 65.40 ± 74.21 mL; (p <0.007) in ELC and DLC groups, respectively. No patients in the comparison groups required blood transfusion.

Conversion to open cholecystectomy and achievement of critical view of safety were comparable in both the groups. The adhesion in Calot's triangle, adhesion with the inferior surface of the liver, tensely distended GB, and mucocele/pyocele were more common in the ELC group (p <0.010) (Table 3).

Flowchart 1: Consort flow diagram of the various stages of trial

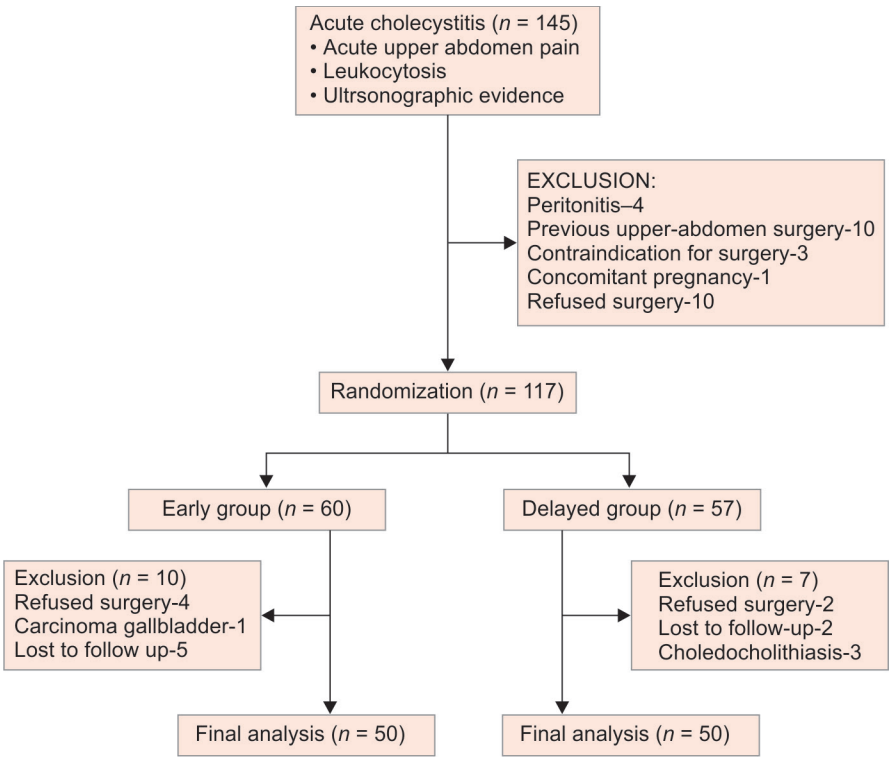

Table 1: Clinical data and laboratory results of patients

Variables	*ELC group (N = 50)*	*DLC group (N = 50)*	*p value*
Age (mean), years	41.0 ± 12.29	38.04 ± 11.38	0.195
Sex: Male	8 (16)	10 (20)	0.603
Female	42 (84)	40 (80)	
BMI (kg/m^2)	23.38 ± 2.72	22.93 ± 2.78	0.414
ASA	I/II	I/II	—
Clinical feature			
Pain duration, mean (hours)	25.0 ± 9.539	23.24 ± 7.305	0.199
Frist attack	34 (68)	36 (72)	—
Previous biliary symptoms	16 (32)	18 (36)	0.673
Previous antibiotics administration	5 (10)	49 (98)	<0.001
Temperature ($^\circ$F), mean	99.8 ± 0.1	99.9 ± 0.2	0.612
Nausea/vomiting	49 (98)	49 (98)	1.00
RHC pain	50 (100)	50 (100)	1.00
Murphy's sign	45 (90)	40 (80)	0.161
Laboratory finding			
Hemoglobin gm/dL	12.886 ± 1.15	12.45 ± 1.17	0.543
White blood cells(N*10^3)	13.04 ± 2.59	12.20 ± 2.49	0.194
Serum bilirubin(mg/dL)	0.867 ± 0.22	0.740 ± 0.14	0.392
SGOT (IU/L)	46.66 ± 18.28	36.96 ± 11.41	0.090
SGPT (IU/L)	47.92 ± 19.97	38.16 ± 14.14	0.071
ALP (IU/L)	215.38 ± 90.07	179 ± 52.98	0.065
Serum amylase (IU/L)	55.16 ± 22.12	36.58 ± 8.79	0.081
Comorbidities			
Diabetes mellitus	3 (6)	3 (6)	0.648
Hypertension	5 (10)	6 (12)	
COPD	1 (2)	1 (2)	
Hypothyroidism	1 (2)	2 (4)	

RHC, right hypochondrium; Figure in parentheses denotes percentage

Table 2: USG findings for the patients

Characteristics/parameters	*ELC group (n = 50)*	*DLC group (n = 50)*	*p value*
Gallstones: Single	7 (14)	5 (10)	0.538
Multiple	43 (86)	45 (90)	
Thickened GB	48 (96)	42 (84)	0.840
Distended GB	46 (92)	47 (94)	0.768
Pericholecystic fluid	22 (44)	20 (40)	0.536
Murphy's sign	45 (90)	46 (92)	0.167

Table 3: Intraoperative findings, modification, and complications

	ELC group (n = 50)	*DLC group (n = 50)*	*p value*
Intraoperative finding			
Mean operative time (minute)	77.30 ± 20.078	66.94 ± 29.501	<0.001
Mean blood loss (mL)	82.60 ± 59.67	65.40 ± 74.21	0.007
Conversion to open Cholecystectomy	5 (10)	7 (14)	0.538
Critical view of safety achieved			0.452
Yes	45 (90)	43 (86)	
No	5 (10)	7 (14)	
Adhesion in Calot's triangle	39 (78)	24 (48)	
Adhesion with inferior surface of liver	24 (48)	7 (14)	
Tensely distended gallbladder (GB)	36 (72)	14 (28)	
Contracted GB	0 (0)	6 (12)	0.010
Turbid bile	8 (16)	3 (3)	
Perforated GB	2 (4)	0 (00)	
GB gangrene	3 (6)	0 (00)	
Mucocele/pyocele	32 (64)	10 (20)	
Operative modifications			
GB decompression	40 (80)	20 (40)	<0.001
Endo-bag retrieval of GB	19 (38)	9 (18)	0.026
Epigastric port enlargement	10 (20)	11 (22)	0.806
Suction/irrigation	44 (88)	23 (46)	<0.001
Subhepatic drain	40 (80)	21 (42)	<0.001
Intraoperative complications			
Spillage of bile/stone	4 (8)	3 (6)	
GB perforation	3 (6)	2 (4)	
Cystic artery bleeding	3 (6)	6 (12)	0.583
Liver bed bleeding	00	1 (2)	
Accessory bile duct leak	00	1 (2)	
Bowel injury	00	1 (2)	

More operative modifications were required in the ELC group, viz GB decompression, laparoscopic bag retrieval of a specimen, suction/irrigation, and subhepatic drain placement. No significant difference was noted in both the groups with intraoperative complications, like bile/stone spillage, GB perforation, and cystic artery bleed. No bile duct injury occurred in both the groups. One patient in the DLC group had an accessory bile duct leak, which was identified by magnetic resonance cholangiopancreatography and managed conservatively (Table 3).

Multiple causes were found in both the groups for conversion as shown in Table 4, which were comparable and statistically not significant. Cholecysto-colonic fistula and Mirizzi syndrome were found in one patient of the DLC group.

Total hospital stay was 4.46 ± 1.32 vs 6.0 ± 2.83 days in ELC and DLC groups, respectively. The difference was statistically significant $p < 0.002$. Statistically no difference was found in subhepatic drain duration and postoperative hospital stay. The requirement of postoperative analgesia and use of antibiotics were comparable in both the groups. The postoperative complications in terms of pulmonary, wound infections, intra-abdominal infections, and bile leak were similar in both the groups (Table 5). Feature of acute cholecystitis on histopathological examination was more prevalent in the ELC group ($p < 0.001$) (Table 6).

Discussion

On ultrasound screening, gallstones are found in 5 to 20% of the adult population.[9] The gallstone-related complications, such as acute cholecystitis, develop in 1 to 4% of patients.[10] Acute cholecystitis is the most frequent cause for hospitalization among

Table 4: Causes of conversion to open cholecystectomy

Cause	*ELC group (n = 5)*	*DLC Group (n = 7)*	*p value*
Dense adhesion	5 (10)	6 (12)	0.567
Difficulty in identifying Calot's	4 (8)	6 (12)	0.800
Bleeding	5 (10)	6 (12)	0.567
Technical difficulty	4 (8)	6 (12)	0.800
Cysto-colonic fistula	0	1 (2)	—
Mirizzi syndrome	0	1 (2)	—

Table 5: Postoperative variables and complications

Variables	*ELC group*	*DLC group*	*p value*
Postop hospital stay (days)	1.96 ± 1.24	2.46 ± 2.54	0.768
Total hospital stay (days)	4.46 ± 1.32	6.0 ± 2.83	0.002
VAS			
Day 1	3.60 ± 0.67	3.74 ± 0.52	0.262
Day 2	1.32 ± 0.86	1.40 ± 0.96	0.674
Postoperative analgesia			
12 hours	42 (84)	46 (92)	0.498
24 hours	15 (30)	19 (38)	
Duration of antibiotics (days)	2.98 ± 2.93	2.90 ± 3.3	0.661
Complications *N* (%)			
Pulmonary complications	1 (2)	3 (6)	
Bile duct injuries	00	00	
Wound infections	2 (4)	3 (6)	0.423
Intra-abdominal infections	1 (2)	00	
Bile leak	00	1 (2)	

Table 6: Gallbladder histopathology

	ELC group N = 50 (%)	*DLC group N = 50 (%)*	*p value*
Acute gangrenous cholecystitis	4 (8)	0	<0.001
Acute cholecystitis	25 (50)	0	
Acute on chronic cholecystitis	14 (28)	3 (6)	
Chronic cholecystitis	7 (14)	47 (94)	
Total	50 (100)	50 (100)	

all gastrointestinal diseases.[11] For symptomatic cholelithiasis, LC is "the gold standard" for definite treatment. LC in acute cholecystitis is still considered a challenging procedure due to anticipated anatomical difficulties. Traditionally, elective cholecystectomy is preferred after weeks of strict medical therapy, called "cool down". In the interval period, more than 20% of these patients do not respond to medical treatment or develop recurrent cholecystitis. This leads to multiple readmission and emergency surgery in more than 50% of patients.[12]

For good outcomes, "the timing of surgery" is of great significance. Preferably, the surgery should be performed promptly after the presentation at hospital. The norm of early surgery within golden 72 hours of symptoms in acute cholecystitis has been advocated, which has been proven safe and feasible.[13,14]

Merely, such early surgery in clinical practice is not always possible due to logistic difficulties and the availability of experienced surgeons in an emergency. The timing for surgery in the early group varies from 72 hours to 7 days, whereas it may vary from 6 to 12 weeks in the delayed group We performed LC in the ELC group within 72 hours of symptoms whereas in the DLC group, 6–12 weeks after the symptoms. The bile duct injury remains the most important entity for comparison of the outcome, safety, and feasibility of the study.

The rates of minor bile duct injury and major bile duct injury after laparoscopic surgeries are 0.1–1.7% and 0.1–0.9%, respectively.[15] Well-known risk factors for bile duct injuries are obesity, local inflammation, and perioperative bleeding.[15] No patient in our study had bile duct injury.

Similar findings were reported by Kolla et al.,[16] Gul et al.,[17] Sánchez-Carrasco et al.[18] The meta-analysis by Menahem et al. suggested that the rate of major bile duct injury was insignificant in both ELC and DLC groups [2/247, 0.8% vs 2/223, 0.9%; relative risk (RR), 0.96; 95% confidence interval (CI), 0.25–3.73; $p = 0.950$].[15] Similarly, Skouras et al.[19] found no significant difference in the incidence of postoperative complications and the bile duct injury ratio (0.5% for the ELC group vs 1.4% for the DLC group; $p = 0.54$).[19]

In our study, the mean blood loss was significantly more in ELC than DLC group, because of inflammatory reactions leading to neovascularity, adhesions around GB, and Calot's triangle in the acute phase of acute cholecystitis (82.60 ± 59.67 vs 65.40 ± 74.21 mL; p <0.007). However, no patient required blood transfusion. Similarly, recent studies reported more blood loss in the ELC group.[17,18]

The higher conversion rate obviates the advantage of ELC. However, various meta-analysis of randomized studies showed that conversion to open surgery in ELC and DLC groups ranged from 12.7 to 20.7% and from 13.9 to 23.6%, respectively.[15,20–23]

There were different reasons for conversions in the comparison groups:

ELC group: The edematous, friable, and distended GB perforated when grasped and bleeding.

DLC group: Contracted GB, dense adhesions, and difficult exposure obscured the Calot's triangle due to chronic inflammation.[24] Our study found the conversion rate 5 (10%) and 7 (14%) in ELC and DLC groups, respectively.

The increased duration of operation from 10 to 30 minutes for the ELC group as compared to the DLC group was demonstrated in studies.[15,17,19,25–29] We found the duration of operation was 77.30 ± 20.07 and 66.94 ± 29.5 minutes in ELC and DLC groups, respectively (p <0.001). The significant increased operative time in the ELC group was due to inflammation, edema, thickened and distended GB, adhesions, and bleeding, which required more operative modifications. The most common technical modifications included the following: (i) GB decompression to facilitate better grasping and exposure of Calot's triangle. (ii) The liberal use of suction and irrigation devices required for dissection and control of bleeding. (iii) The use of laparoscopic specimen retrieval bag for stone and GB extraction to avoid port-site infections.[16,26] Reversely, Abdelkader and Ali,[27] Kohga et al.,[25] and Chhajed et al.[30] have demonstrated that the DLC group had more operative time (Table 7). The increased operative time in the DLC group may be because of maturation of the surrounding inflammation leading to fibrosis, dense adhesions, and scaring and contracted GB, which makes dissection difficult.

The requirement of subhepatic drain was more common in the ELC group due to inflammation and exudates. The placement of postoperative drainage tube was significantly more frequent in ELC group than DLC group as demonstrated by Menahem et al.[15] [77.8 vs 37.3%; odds ratio (OR), 6.18; 95% CI, 3.19–11.99; p <0.001].[15] In our study, the subhepatic drain required was 40 (80%) and 21 (42%) in ELC and DLC groups, respectively (p <0.001).

The risk of postoperative wound infection varies in studies. The risk of postoperative infection was twice as high in the DLC group as in the ELC group, as reported by Sánchez-Carrasco et al.[18] (OR = 1.98; 95% CI 1.78–2.17; p <0.05),[18] whereas Gurusamy et al.[21] reported a higher proportion of infections in the ELC group. We found that the wound infection was comparable in both the groups (p = 0.423).

The overall complication rates were significantly less in the ELC group or comparable with the DLC group as in various studies (Table 8). A meta-analysis suggests that overall morbidity was statistically insignificant in both groups.[15,19,28]

Our study indicates that the DLC group had a higher rate of overall complications than the ELC group. However, these complications were minor and statistically insignificant (p = 0.423). The comparison groups had no mortality. The ELC group has a significantly lower mean total length of hospital stay as compared to the DLC group. Skouras et al. reported that the

Table 7: Outcome of laparoscopic cholecystectomy for acute cholecystitis: comparison of results in the literature

Authors	Study design	N (ELC/DLC)	Age (year) (mean ± SD, range)		Mean duration of surgery (minutes) (mean ± SD, range)		Blood loss (mL) (mean)		Conversion N (%)		Total hospital stay (days)	
			ELC group	DLC group	ELC group	DLC group	ELC group	DLC group	ELC group	DLC group	ELC group	DLC group
Kolla et al.[16]	Pros/Rct	20/20	41.5 ± 11.4	38.6 ± 11.4	104.3 ± 44	93.0 ± 45	228.5 ± 142	114.5 ± 92	5 (25)	5 (25)	4.1 ± 8.6	10.1 ± 6.1
Gul et al.[17]	Pros/Rct	30/30	—	—	98.83	80.67	173.33	101.0	3 (10)	4 (13.33)	—	—
Gutt et al.[8]	Pros/Rct	304/314	55.6 ± 16.3	56.8 ± 17.1	—	—	—	—	30 (9.9)	33 (11.9)	5.4 (4–6)	10.03 (7–12)
Ozkardes et al.[32]	Pros/Rct	30/30	58.0 ± 10.4	59.43 ± 16.60	67.0 ± 28.51	71.33 ± 24.06	—	—	4 (13.3)	0 (00)	—	—
Agrawal et al.[35]	Pros/Rct	50/50	47.28 ± 14.5	50.96 ± 17.0	69.4 ± 29.59	66.4 ± 15.97	159.6 ± 58.11	146.8 ± 52.69	4 (16)	2 (8)	4.16 ± 1.21	8.6 ± 2.04
Roulin et al.[31]	Pros/Rct	42/44	55.8 ± 16.8	57.9 ± 16.6	91 (70–114)	88 (71–118)	—	—	1 (2.4)	0 (0)	4 (3–4)	7 (5–11)
Abdelkader and Ali[27]	Retro	50/50	40.4 ± 13.6	41.2 ± 13.9	85.1 ± 25.08	110.4 ± 21.4	83.8 ± 8.9	90.4 ± 46.3	1 (2)	3 (6)	5.24 ± 1.66	9.6 ± 3.69
Kohga et al.[25]	Retro	288/177	65.5 ± (25–92)	69 (23–96)	105 (47–279)	124 (50–296)	—	—	4 (1.3)	19 (10.7)	—	—
Chhajed et al.[30]	Pros/Rct	30/20	44.2 ± 11.4	39.5 ± 11.7	69.3 ± 15.3	108.5 ± 16.9	—	—	0 (00)	5 (25)	4.9 ± 2.1	7.4 ± 1.8
Arafa et al.[26]	Pros/Rct	74/74	41.1 ± 6.9	45.45 ± 7.5	126.55 ± 31.96	109.94 ± 39.45	216.17 ± 26.12	133.2 ± 53.42	9 (12)	17 (23)	7.56 ± 1.88	12.77 ± 3.36
Present study	Pros/Rct	50/50	41.02 ± 12.39	38.04 ± 11.83	77.30 ± 20.07	66.94 ± 29.50	82.60 ± 59.67	65.40 ± 74.21	5 (10)	7 (14)	4.46 ± 1.32	6.0 ± 2.83

Pros, prospective; RCT, randomized controlled trial; Retro, retrospective

Table 8: Comparison the complications of various studies

				Overall complications, N (%)		
Study	*Year*	*Study design*	*No. of patients (ELC/DLC)*	*ELC group*	*DLC group*	*p value*
Kolla et al.[16]	2004	Pros/RCT	20/20	4 (20)	3 (15)	0.456
Gul et al.[17]	2013	Pros/RCT	30/30	6 (20)	4 (12)	0.863
Gutt et al.[8]	2013	Pros RCT	304/314	43 (14.1)	127 (40.4)	<0.001
Ozkardes et al.[32]	2014	Pros/RCT	30/30	8 (26.7)	0 (0)	0.002
Agrawal et al.[35]	2015	Pros/RCT	50/50	8 (32)	2 (8)	0.353
Roulin et al.[31]	2016	Pros/RCT	41/41	6 (14.6)	8 (19.4)	1.000
Kohga et al.[25]	2018	Retro	288/177	14 (4.8)	23 (12.9)	0.001
Chhajed et al.[30]	2018	Pros/RCT	30/20	1 (3.3)	5 (25)	0.007
Arafa et al.[26]	2019	Pros/RCT	74/74	20 (27)	42 (56.7)	<0.001
Present study	2019	Pros/RCT	50/50	11 (22)	14 (28)	0.583

median total length of hospital stay was shorter in ELC group by 4 days (p <0.001).[19] Further, Menahem et al.[15] found that the mean total length of hospital stay was 5.4 vs 9.1 days in ELC and DLC groups, respectively (p <0.001).[15] Repeated admission for recurrent symptoms and a higher rate of conversion have led to more hospital stays. Studies showed that the total hospital stay was more in DLC group, except in the studies of Kolla et al.[16] and Roulin et al.[31] (Table 7). We found that the mean total hospital stay was comparatively less in ELC group as compared to DLC group for acute cholecystitis (p <0.002).

Studies showed that ELC was more economical and resulted in a better quality of life.[32–34] This may be due to shorter hospitalization and devoid of conservative treatment in the ELC group. We are working in the government-funded hospital; the cost of treatment was therefore not assessed as it was free.

Moreover, meta-analysis of recent randomized studies points toward decreased incidence of postoperative wound infection, shorten total hospital stay, incurred low cost, increased mean duration of surgery, patient's satisfaction, quality of life, and decreased lost working days in the ELC group. Furthermore, no differences in bile leakage, bile duct injuries, morbidity, and conversion to open surgery were reported.[22,23,28]

Conclusion

ELC in acute cholecystitis is safe and feasible in comparison to elective cholecystectomies. ELC avoids recurrent symptoms due to multiple episodes of acute cholecystitis and is a definite treatment for cholecystitis in failed conservative management Moreover, ELC is more advantageous as it provides patients safety and lesser hospital stay. It has economic benefits due to lesser morbidity and mortality.

Acknowledgment

Authors gratefully acknowledge the help of Dr Subhajeet Dey, Dir. Professor of Surgery, ESI-PGIMSR and Model Hospital, Basaidarapur, New Delhi, in the revision of this manuscript by doing peer review and valuable suggestions.

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ORIGINAL ARTICLE

Laparoscopic Diagnosis and Treatment of Nonpalpable Testes in a Tertiary Care Center

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Abstract

Background: Cryptorchidism is the commonest genitourinary anomaly in boys. Laparoscopy has been the mainstay for the management of nonpalpable testis.

Aim and objective: This study has been done to assess the role of laparoscopy in diagnosing and treating nonpalpable testes.

Materials and methods: Medical records of 160 patients of laparoscopic testicular exploration, during a 10-year period, were retrospectively analyzed. All 160 boys with 320 testicular units were examined prior to surgery—118 of the 320 testicular units were normally descended (37%), 9 had palpable undescended testicular units (3%), and 193 testicular units (60%) were nonpalpable.

Results: After laparoscopy, 111 of the 193 nonpalpable testicular units were found to be intra-abdominal, 32 were atrophic testes, 22 were peeping testes, 19 were intracanalicular, and 9 were vanishing testes. Of the 111 intra-abdominal testicular units according to the location in relation to the deep inguinal ring, 51 of the testicular units were located within 2 cm from the deep inguinal ring. Among these, 49 cases underwent single-stage laparoscopic orchidopexy and 2 patients required laparoscopic mobilization followed by open orchidopexy due to long loop vas. Sixty testicular units were found greater than 2 cm from the deep inguinal ring and were managed by two-stage Fowler–Stephens laparoscopic orchidopexy.

Conclusion and clinical significance: Laparoscopy is safe and effective in managing nonpalpable testis. Single-stage orchidopexy is the treatment of choice for intra-abdominal testis located within 2 cm from the deep inguinal ring with pliable testicular vessels and two-stage surgery is required for intra-abdominal testis located more than 2 cm from the deep inguinal ring and with nonpliable testicular vessels.

Keywords: Laparoscopy, Nonpalpable testes, Testicular units, Undescended.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1476

Introduction

Undescended testis is a common condition referred to pediatric surgeons, as cryptorchidism is the most common genitourinary anomaly in boys. It is found in 3% of full-term neonates, rising to 30% with prematurity. About 20% of maldescended testes are nonpalpable.[1–3] Management of nonpalpable testis provides many challenges from accurate localization to successful repositioning of the testicular units. Laparoscopy has been found to be a useful tool in both these aspects.[4] The aim of our study was to assess and discuss the role of laparoscopy in managing nonpalpable testis.

Materials and Methods

We retrospectively reviewed documents of all children below 12 years of age undergoing laparoscopy for nonpalpable testis over a study period of ten years after getting institutional ethical committee clearance. All boys with undescended testes presenting to the outpatient clinic were examined for palpability of testis. Children with palpable undescended testicular units were posted for open orchidopexy through an inguinal incision and not considered in this study. If the testis was not palpable, an ultrasound of the abdomen and inguinoscrotal region was performed and the child was posted for orchidopexy, once older than 6 months. Possibility of different findings and procedures was always discussed with parents prior to the surgery.

A careful physical examination under general anesthesia was always performed in the operating room prior to laparoscopy. If the testis was palpable, the child was operated on by open technique and was therefore excluded from the study sample. In case the testis was not palpable, we proceeded with laparoscopy.

A 5-mm port was inserted by open technique for the telescope via a subumbilical curved incision. We used a 5-mm 30° telescope for all cases. Pneumoperitoneum was created and diagnostic laparoscopy was conducted to locate the testis and to note its size, any abnormalities, distance from the deep inguinal ring and iliac vessels, pliability of testicular vessels, presence of an open deep inguinal ring, and the presence of a long loop of vas deferens entering the deep ring. Further procedure was decided accordingly.

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How to cite this article: Shenoy NS, Sanghvi BV, Shah R, *et al*. Laparoscopic Diagnosis and Treatment of Nonpalpable Testes in a Tertiary Care Center. World J Lap Surg 2021;14(3):157–161.

Source of support: Nil

Conflict of interest: None

If a closed deep ring with blind-ending vas and vessels was found, and no testicular tissue was seen on inguinal exploration, the testis was deemed to be vanishing and so no further procedure was done. In case hypoplastic testicular vessels with vas deferens enter a closed deep ring, then the testis was deemed atrophic and further surgery for the removal of nubbin and the placement of prosthesis was planned at puberty.

When normal testicular vessels and vas deferens were found entering an open deep ring, then the testis was deemed to be intracanalicular and an open orchidopexy was done in these patients.

When the testis was present just at the level of the deep ring and it pops back into inguinal canal on insufflation, then it was termed a peeping testis and an open orchidopexy was done in initial part of this series but later single-stage laparoscopic orchidopexy was done for these testes.

In laparoscopic orchidopexy, two 5- or 3-mm secondary ports/direct instruments were created on both sides in the midclavicular line at the level of the umbilicus under vision, depending on the age of the patient and surgeon preference. In the case of intra-abdominal testes, they were divided into two groups based on their location relative to the deep inguinal ring and pliability of testicular vessels.

In case testis located more than 2 cm proximal to the deep inguinal ring (high location) and testicular vessels were not pliable (Fig. 1), then two-stage Fowler–Stephens procedure was done laparoscopically with an interval of 6 months in between the two stages. Vessels were either clipped with 5-mm titanium clips or coagulated with bipolar cautery in the first stage.

When the testis was located less than 2 cm (low location) from the deep inguinal ring and testicular vessels were found to be pliable, then single-stage laparoscopic orchidopexy was done.

Results

One hundred and sixty patients were taken for our study after checking the inclusion and exclusion criteria from the records maintained. The age of surgery ranged from 9 months to 12 years.

One hundred and sixty boys with 320 testicular units were examined prior to surgery—118 of the 320 testicular units were normally descended (37%), 9 had palpable undescended testicular units (3%), and 193 testicular units (60%) were nonpalpable (Fig. 2).

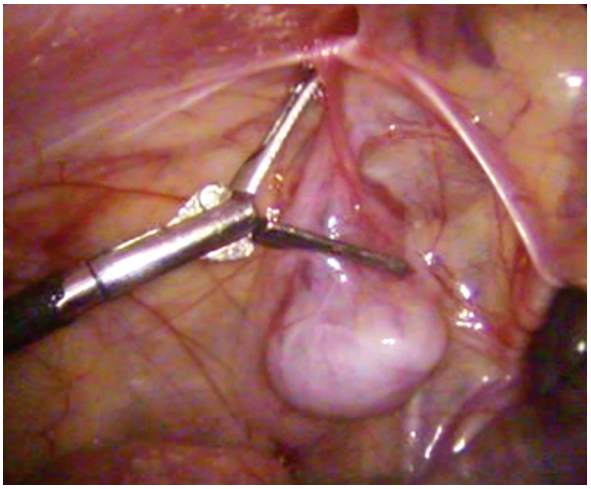

Fig. 1: Intraoperative photograph showing testis located more than 2 cm proximal to the internal inguinal ring (high location)

Out of the 193 nonpalpable testicular units, 49 were unilateral right nonpalpable testicular units, 78 left nonpalpable testicular units, and 66 were bilateral nonpalpable testicular units before anesthesia.

After laparoscopy, 111 of the 193 testicular units were found to be intra-abdominal, 32 were atrophic testes, 22 were peeping testes, 19 were intracanalicular, and 9 were vanishing testes (Table 1).

After the clinical examination, there were 78 patients with left nonpalpable testicular units, 49 patients with right nonpalpable testicular units, and there were 33 patients in whom testicular units could not be palpated bilaterally.

After laparoscopy of the 78 patients with left nonpalpable testis, 34 testicular units were intra-abdominal in location, 9 testicular units were vanishing testis, 7 were intracanalicular, 21 were atrophic, and 7 were peeping testicular units.

Among the 49 patients with right nonpalpable testicular units on examination after laparoscopy, 31 testicular units were intra-abdominal, 6 testicular units were intracanalicular, 2 were atrophic, and 10 were peeping testicular units.

On examination, 33 patients had bilaterally nonpalpable testicular units, i.e., 66 testicular units were nonpalpable. After laparoscopy, 46 testicular units were intra-abdominal, 6 were intracanalicular, 9 were atrophic, and 5 were peeping testis.

Of the 78 patients with left nonpalpable testicular units, 34 had intra-abdominal testes. Of these, 20 were amenable to single-stage laparoscopic orchidopexy and 14 patients required two-stage surgery. Nine patients with vanishing testis just required a diagnostic laparoscopy to confirm the diagnosis. Of seven patients

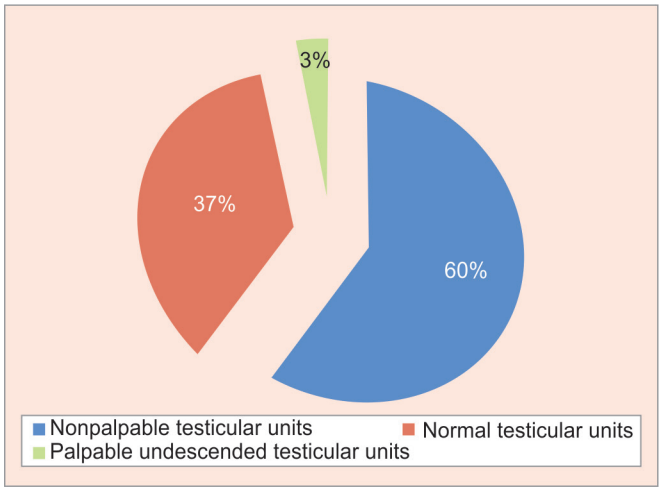

Fig. 2: Distribution of testicular units according to a location in the study group

Table 1: Final diagnosis depending on the location of the testes

Location after laparoscopy	*Number of testes (n = 193)*
Intra-abdominal	111
Vanishing	9
Intracanalicular	19
Atrophic	32
Peeping	22

Table 2: Distribution of surgery done in intra-abdominal testicular units

Procedure	*Single-stage laparoscopic orchidopexy*	*Stephen Fowler stage 1 Stephen Fowler stage 2*	*Laparoscopic mobilization of vessels and open orchidopexy*
Total number of testicular units	49	60	2

with peeping testicular units, four required open orchidopexy, while in three patients, single-stage laparoscopic orchidopexy was done. In case hypoplastic spermatic vessels with vas deferens enter a closed deep inguinal ring, the testis was deemed atrophic and further surgery for the removal of nubbin and placement of prosthesis was planned at puberty.

Of the 49 patients with intra-abdominal right nonpalpable testicular units, 31 were intra-abdominal; of these, 12 were amenable to single-stage laparoscopic orchidopexy, 2 patients needed laparoscopic mobilization with inguinal exploration for long loop vas, and 19 needed two-stage procedure. Out of 10 patients with peeping testicular units, 9 required open orchidopexy, while in 1 patient, single-stage laparoscopic orchidopexy was done. Six intracanalicular testicular units underwent open orchidopexy.

Thirty-three patients had bilateral nonpalpable testicular units. Of these 66 units, 46 were intra-abdominal testes. Of these, 19 testicular units were possible to bring down by single-stage bilateral orchidopexy and 27 testicular units required two-stage surgery. Out of five peeping testicular units, four required open orchidopexy, while in one patient, single-stage laparoscopic orchidopexy was done. Six intracanalicular testicular units underwent open orchidopexy. Out of nine atrophic testicular units, five had diagnostic laparoscopy, one unit had laparoscopic nubbinectomy, and the rest three had open nubbinectomy.

When we studied the location of the intra-abdominal testis according to the location in relation to the deep inguinal ring, we found that 51 of the testicular units were located within 2 cm of the deep inguinal ring. Of these, 49 cases underwent single-stage laparoscopic orchidopexy and 2 patients required laparoscopic mobilization followed by open orchidopexy due to long loop vas. Sixty testicular units were found beyond 2 cm from the deep inguinal ring and all were managed by two-stage Fowler–Stephens laparoscopic orchidopexy (Table 2).

There were no complications after the surgical procedure. There were no inguinal or scrotal infections. Patients were discharged on the same evening or the next day, depending on parental comfort and distance from the hospitals. Boys with bilateral repairs were generally kept for one night.

Single-stage orchidopexy was tougher in older children. Testicular placement in older boys was frequently high scrotal, despite the near distance from the ring and pliable vessels.

We saw no testicular losses after Fowler–Stephens first-stage orchidopexy. Testicular placement was satisfactory after the second stage in all patients operated by staged the Fowler–Stephens technique.

Discussion

Cryptorchid or undescended testes are those which fail to migrate to the base of the scrotum and occupy a final position either in the groin or within the abdomen; the risk factors being, excessive estrogen exposure during pregnancy, intrauterine growth retardation, and prematurity.[1] It has been stated that around 4–5% of males are born with undescended testes, which may be unilateral or bilateral. This incidence decreases to around 1–2% at the age of 3 months, due to the spontaneous descent in the first few months of life.[2] The risk of neoplastic changes in an intra-abdominal testis is about 5%. In about 9 out of 10 men with bilateral undescended testes and in about a third of men with a unilateral undescended testis, azoospermia may be present. Increased risk of infertility, malignant changes, trauma, and a realistic possibility of psychological stigma on patients with cryptorchid testis warrants its treatment.[3]

Descent of testes is a complex embryological process. Most literature reviews suggest that the complex remodeling and migration of the gubernaculum into the scrotum under the effects of androgens and calcitonin gene related peptide (CGRP) production by the genitofemoral nerve are the possible causes of cryptorchidism. Inadequacy of androgen production by the developing testis as a result of subnormal pituitary or placental stimulation is the cause of testicular maldescent. Androgens act through the genitofemoral nerves; hence, a minor deficiency of either of the two nerves may be the cause of unilateral undescended testis.[3]

Radiological imaging may be done by ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI). Several data with ultrasonography (USG) have shown a sensitivity of 44% and a specificity of 70%.[5] Elder, in 2002, suggested USG to be unnecessary to assess boys with nonpalpable testes.[6]

The timing of the surgery is controversial. The principle of orchidopexy is based on the idea that temperature effect is reversible once the testis is placed in the scrotum and it aims to prevent abnormal gonocyte maturation. Currently, around 6–12 months of age is taken as the age for surgery in most pediatric centers. Therefore, it is recommended that undescended testes (UDT) surgery should be done in the first year of life (most probably within 3–6 months). The surgical principle for cryptorchidism is testicular mobilization that includes separation and ligation of the processus vaginalis and other investing structures of the testes and their attachments, before relocating them within the scrotum.[3]

Current studies in the literature suggest that nonpalpable testes should be managed laparoscopically. Radiological investigations may or may not be used as an adjunct.[1] Laparoscopic management of nonpalpable testis was first described by Jordan et al. in 1992. In 1976, Cortesi et al. introduced a diagnostic laparoscopy as a treatment modality for the nonpalpable testis.[7] Index study emphasizes the role of laparoscopy as an invaluable tool for the holistic management of nonpalpable testes as it has helped in the localization of all the 182 nonpalpable testicular units.

It has been reported that approximately one in five cryptorchid testes is not palpable.[2] It might be intra-abdominal, intracanalicular, atrophic, or even totally absent. Vanishing testis reportedly results from perinatal vascular accidents or intrauterine testicular torsions. Vanishing testis needs no further intervention after the diagnosis, and in these cases, laparoscopy is most advantageous as it avoids an inguinal exploration. In atrophic testis, the atrophic element needs to be removed and inguinal exploration is unnecessary without testicular implant placement in the same sitting.[1] Index study had 41 patients with atrophic and vanishing testis. The inguinal exploration was deferred in these cases. These boys will require testicular implant at puberty, when the excision can be done through the inguinal incision. Elder had observed that testicular vessels and vas entering a closed deep

inguinal ring suggest an atrophic testicular remnant, but if the deep ring is patent, a normal or hypoplastic testicle is likely to be found.[8] Following this principle, inguinal explorations were deferred in patients with atrophic testes.

It can be suggested that the management of nonpalpable testes depends strongly on the initial laparoscopic findings. Visualization of the vas and vessels seen to be entering the inguinal canal via the deep ring purports a groin exploration. If only a remnant testicular nubbin is discovered, then excision should be undertaken. Alternatively, if on laparoscopy, either the vas or the vessels stop in the abdomen or are absent or there is a blind-ending vas without vessels, no further operative procedure is necessary. If, following laparoscopy for bilateral nonpalpable testes, no functioning testicular tissue is discoverable, appropriate counseling and endocrinological opinion need to be taken. These children will be infertile and will even require medical induction of puberty. Testicular prostheses may be inserted at a postpubertal age. Sufficient length of the testicular vessels and cord should be ensured before attempting this single-stage procedure. In patients with insufficient cord length and nonpliable testicular vessels, laparoscopic Fowler–Stephens orchidopexy is the procedure of choice.[1]

In some intra-abdominal testes, after distal gubernacular division and dissection of peritoneum, it is perfectly possible to do a single-stage laparoscopic orchidopexy. In an index study after laparoscopy, 111 of the 193 nonpalpable testicular units were found to be intra-abdominal. Of these, 50 of the intra-abdominal testes underwent a single-stage laparoscopic orchidopexy, all of these testes were located within 2 cm from the deep inguinal ring with pliable testicular vessels. This group of patients was the most benefited by laparoscopy as accurate diagnosis as well as surgical correction was achieved in the same single sitting. Ismail et al. in their study did single-stage laparoscopic orchidopexy successfully in 26 testes of the 75 nonpalpable testes.[4]

Sixty-one of the intra-abdominal testes in our study were not amenable to single-stage orchidopexy as the testes were located beyond 2 cm from the deep ring with no pliable testicular vessels. For these patients, laparoscopic staged Fowler–Stephens procedure was done. Ferdous et al. in their series could manage 19 cases of the 69 cases with intra-abdominal testes laparoscopically without inguinal exploration by Fowler–Stephens technique.[9]

Fowler–Stephens in 1959 described the division of testicular vessels in the first stage, to aid mobilization, thereby leaving the testes to rely on collateral blood supply along the vas deferens. Testicular atrophy was seen in 50% of cases who underwent this procedure.[10] Ransley proposed a two-stage procedure in 1984, with an interval between vessel division and testicular mobilization. He showed promising results.[11] For the two-stage Fowler–Stephens technique, success rates as high as 88% have been reported by Denes et al.[12,13] However, they reported only 33% rate success using single-stage Fowler–Stephens surgery.[14] Elyas et al. in 2010 reported a higher success rate with two-stage Fowler–Stephens orchidopexy than the single-stage approach (85 vs 80%).[15] Chang et al. in 2001 reported an 85% success rate of laparoscopy for single-stage or two-stage management of nonpalpable testis which is similar to the rate in the index study.[16]

A newer technique of two-stage laparoscopic traction orchidopexy (SLTO) for the high intra-abdominal testis leading to elongation of the spermatic vessels was described by Shehata in 2008. This technique allows the retention of the native blood supply in instances where there are doubts of vascularity with the Fowler–Stephens technique. Shehata proposes that the weight of the intestines over the pedicle leads to a gradual increase in length without spasm, intimal tear, or occlusion of spermatic vessels.[17] We are at present studying the efficacy of this new technique; however, these patients are outside the purview of the current series.

Clinical Significance and Conclusion

We conclude that for the management of nonpalpable testes, laparoscopy is the gold standard. It is more cost-effective than radiological tests for the localization of intracanalicular and peeping testes that are not localized even on examination under anesthesia.

Single-stage orchidopexy is the treatment of choice for intra-abdominal testis lying within 2 cm from the deep inguinal ring with pliable testicular vessels, and two-stage surgery is required for intra-abdominal testis located beyond 2 cm from the deep inguinal ring or with nonpliable testicular vessels. However, testicular placement can be suboptimal with single-stage orchidopexy in older boys. Staged Fowler–Stephens orchidopexy has good results with minimal testicular loss.

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ORIGINAL ARTICLE

Laparoscopic Intersphincteric Resection and Colon Shaping for Low Rectal Cancer Treatment

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Abstract

Aim and objective: This paper was conducted to examine the results of laparoscopic intersphincteric resection and colon shaping for low rectal cancer treatment in adults.

Materials and methods: Data were collected, including general characteristics, preoperative and postoperative characteristics, and long-term treatment outcomes. The Kaplan–Meier survival analysis was performed to assess the survival rate of 48 months after surgery.

Results: Of 43 patients with low rectal cancer, subtotal intersphincteric resection was the primary surgical method at 37.2%. The colon was mainly shaped "J" at 51.2% of the patients. According to Kirwan classification, there were 83.7% of the patients at grade I; and this rate decreased to 62.9% after surgery (p <0.05). According to Wexner score, before surgery, 62.8% of the patients had a score <5, which reduced to 48.8% after surgery (p >0.05). The mean survival time was 41.53 ± 2.37 months, with a cumulative survival probability of 48 months of 78.8%. There was no difference in survival rate between patients with different stages of cancer and colon shaping.

Conclusion: Laparoscopic intersphincteric resection and colon shaping were effective in low rectal cancer treatment. Colon shaping was an effective method of improving bowel function in cases of subtotal or total intersphincteric resection.

Keywords: Colon shaping, Laparoscopic surgery, Low rectal cancer.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1473

Introduction

Low rectal cancer is malignancy, accounting for a high rate of about 40–45% of the colorectal cancer diseases. The common treatment is multimodal therapies that combine surgery and adjuvant therapy, with or without preoperative chemotherapy. In the early 20th century, Ernest Miles' surgical method was considered the standard approach for the treatment of low rectal cancer, with abdominoperineal resection.[1,2]

In the later stages, the treatment target for low rectal cancer has changed. In addition to the three primary goals of the treatment, including increasing survival, improving quality of life, and reducing recurrence rates, preserving the function of patients after treatment has been set as a priority to ensure rectal cancer patients' quality of life. In 1972, Park and Percy successfully performed sphincter-saving surgery. In 1982, Heald introduced a complete mesenterectomy and quickly became standard in rectal cancer surgery. Since then, the requirement to save sphincters has been prioritized in rectal cancer treatment.[3,4]

In 1984, based on the anatomical development of the anorectal region and the discovery of the layer between the two sphincter muscles and the structure of the sphincter muscles, Rudolf Schiessel introduced the intersphincteric resection and colo-anal anastomosis by hand stitching.[5–7] In 2005, Schiessel et al. reported long-term results, providing the foundation for intersphincteric resection in rectal cancer surgery. This study also mentioned sphincter regeneration or using an artificial anal sphincter.[1–7] In 2010, Bujko et al. published a study of 948 patients showing that a distance from 1 cm or more from the tumor to the anal margin is sufficient to guarantee surgical success in terms of oncology. In the group of patients with a distance of less than 1 cm or 5 mm, if the disease condition reaches R0, the rate of local recurrence was 1.7% or lower.[8] In addition, laparoscopic surgery has been shown to have many advantages over this period over open abdominal surgery, especially in abdominal/pelvic area surgery. Laparoscopic intersphincteric resection has become the standard surgical method.[9]

However, after surgery for rectal tumors, bowel function often has disorders due to surgical intervention in the sphincter. Schiessel proposed a method of rectal shaping by the colon to reduce the number of bowel movements while assessing factors influencing the indications for colon shaping and factors affecting the frequency of defecation after surgery.[7] This study was conducted to evaluate the effectiveness of laparoscopic

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How to cite this article: Nguyen TV, Dao MQ, Nguyen HL, *et al.* Laparoscopic Intersphincteric Resection and Colon Shaping for Low Rectal Cancer Treatment. World J Lap Surg 2021;14(3):162–165.

Source of support: Nil

Conflict of interest: None

intersphincteric resection and colon shaping for low rectal cancer treatment in adults.

Materials and Methods

Study Design and Patients

A case series was conducted on 43 patients diagnosed with low rectal cancer and underwent laparoscopic intersphincteric resection at Thanh Nhan Hospital, Hanoi, Vietnam. Criteria for selection included: (1) primary low rectal cancer diagnosed by biopsy; (2) tumor-anal margin distance ≤6 cm; (3) cancer stage from T3 or less as classified by Union for International Cancer Control (UICC); (4) having laparoscopic intersphincteric resection; (5) with or without colon shaping, and (6) accepting to participate in the study. Exclusion criteria included: (1) tumor-anal margin distance more than 6 cm; (2) tumor-anal margin distance less than 6 cm but switching from laparoscopic surgery to open surgery; (3) tumor-anal margin distance less than 6 cm but the tumor recurs. The research was approved by the Institutional Review Board at Thanh Nhan Hospital, Hanoi (Code: 02/BVTN-HDDD).

Surgical Technique

The patient was placed in a supine position. The patient's head was set low and tilted to the right. A 10-mm trocar was placed above or below the navel; then, gas was pumped into the peritoneal cavity. A 5-mm trocar was placed in the left pelvic fossa, a 10–12-mm trocar was placed in the right pelvic fossa and 2–3 cm from the upper anterior pelvic spine, and finally, a 5-mm trocar was placed on the outer margin of the abdominal straight muscle on the right, with a distance of about 10 cm to the first trocar.

First, we dissected the lateral and medial surface area of the sigmoid colon and rectum, along with the left colonic adhesion. We continued to identify the sigmoid artery, and the lower mesenteric artery, from which we dissected with forceps to reveal the lower mesenteric artery. After that, we used clips, Hemolock, or sutures to control and cut this artery. At the cut site of the blood vessel, we cut the mesenteric sigmoid and descending colon to the left to free this part of the colon. The rectum was dissected that the organs from the rectum to the lifting muscles moved completely according to the principle of total mesorectal excision. In the posterior side of the rectum, we dissected the nonvascular area in front of the sacrum and behind the rectum, closely following the curvature of the mesorectum, to avoid tearing the mesorectum, when also not damaging the anterior sacrum. On both sides of the lower rectum, we used a harmonic scalpel or a LigaSure knife to stop bleeding and avoid damage to the pelvic plexus located outside of the lateral ligament. In the anterior rectum, we dissected the surface between the mesorectum and genital organs, helping to release the entire rectum.

Next, we performed surgery to reveal the entire anus and episiotomy. We used the Lone Star Valve (Lone Star Medical Products Inc., Houston, Texas) to expose the anal area and dissect the anal canal 5 mm under the dentate line. We removed the entire internal sphincter or the deep muscle bundle of the external sphincter with the entire mesorectum, going upward until we met the laparoscopic dissection plane. Through the anus, we pull out the sigmoid colon and rectum with the mesorectum and then cut and connect these bowel segments. We shaped the colon into the ileal pouch and performed one layer of end-to-end anastomosis. We put a surgical drain that connects the rectum to the anus and ends in the epis. Then, we pumped gas into the peritoneum, rechecked, and then put 01 18F surgical drain in the abdominal/pelvic area through the 5-mm hole in the left side. Then, we removed the gas and closed the trocar hole.

Variables and Data Collection

Patients were examined for functional symptoms, physical symptoms, and some subclinical indicators and imaging diagnoses (e.g., ultrasound, chest X-ray, and computed tomography). Patients underwent a colonoscopy of the entire colon and rectum to evaluate the tumor location, the shape of the tumor, degree of invasion, circumference of the rectum, number of tumors, tumor in the colon, polyp status, and biopsy. Endoscopic ultrasound was performed to assess the degree of invasiveness, degree of serosal invasion, and degree of sphincter invasion and lymph node metastasis. The postoperative disease stage was divided according to tumor-node-metastasis (TNM) standards of the UICC. Functional assessment was performed according to Kirwan classification with five grades:[10]

- Grade I: Perfect
- Grade II: Incontinent to gas
- Grade III: Occasional minor leak
- Grade IV: frequent major soiling
- Grade V: colostomy

Wexner score was used to evaluate three components of fecal incontinence (solid, liquid stools, and flatus).[11]

After surgery, patients were scheduled to reexamine periodically 6, 12, 18, 24, 36, and 48 months or any time if the patient had abnormal symptoms. For patients who did not go to the hospital, information was obtained through short, easy-to-understand questionnaires that were sent to patients and families, or calling to patients and their families. We also monitored patients by phone and regularly inquired to note any abnormal signs (if any). Low rectal cancer-related fatalities were recorded.

Data Analysis

Research indicators were directly recorded through examination, monitoring, and evaluation of treatment results. Data were recorded in medical records. Information from medical records was coded, cleaned, and verified. The SPSS 20.0 (Statistical Package for Social Science) software was used to analyze data. Kaplan–Meier estimates were conducted to measure the overall and disease-free survival rates. A log-rank test was used to compare the characteristics of fatal and nonfatal patients. $p < 0.05$ was statistically significant.

Results

In 43 patients with low rectal cancer, the mean age was 68.7 ± 13.3 years. The proportion of male patients was 62.8%. Most patients had an anal margin of 4 to less than 5 cm (53.5%). The invasion degree was mainly at T2 (60.5%). According to the TNM classification, the cancer was mainly in stage III (39.5%) and II (37.2%). Subtotal intersphincteric resection was the primary surgical method at 37.2%. The colon was mainly J-shaped with 51.2% of the patients (Table 1).

Table 2 shows that, according to Kirwan classification, there were 83.7% of the patients at grade I. This rate decreased to 62.9% after surgery. There were 13.9% of the postoperative patients reaching grade III. The difference was statistically significant. According to Wexner score, before surgery, 62.8% of the patients had a score <5. This rate after surgery was 48.8%. There were four patients with Wexner scores between 10 and 20 points. The

Table 1: Clinical and surgical characteristics

Characteristics	*Frequency*	*Percentage*
Age (year), mean (SD)	68.7 ± 13.3	
Gender, male	27	62.8
Tumor-anal margin distance		
5–6 cm—(N1)	16	37.2
4–<5 cm—(N2)	23	53.5
<4 cm—(N3)	4	9.3
Invasiveness		
T1	6	14.0
T2	26	60.5
T3	11	25.5
TNM classification		
I	10	23.3
II	16	37.2
III	17	39.5
IV	0	0.0
Surgical method		
Partial intersphincteric resection	13	30.2
Subtotal intersphincteric resection	16	37.2
Total intersphincteric resection	14	32.6
Colon shaping		
None	13	30.2
J-shape	22	51.2
Side-to-end	8	18.6

Table 2: Functional results according to Kirwan classification and Wexner score before and after surgery

	Preoperative		*Postoperative*		
Characteristics	*n*	*%*	*n*	*%*	*p value*
Kirwan classification					
I. Perfect	36	83.7	27	62.9	0.02
II. Incontinence to gas	7	16.3	10	23.2	
III. Occasional minor leak	0	0.0	6	13.9	
Wexner score					
<5	27	62.8	21	48.8	0.09
5–10	16	37.2	18	41.9	
10–20	0	0.0	4	9.3	

difference in the Wexner score between before and after surgery was not statistically significant ($p > 0.05$).

Figure 1 shows that the mean survival time of the patient was 41.53 ± 2.37 months, the cumulative probability of survival at 48 months was 78.8%.

The mean survival time of patients in stages I, II, and III was 43.4 ± 4.2, 41.9 ± 3.8, and 41.2 ± 3.4 months, respectively. The probability of survival at 48 months according to stages I, II, and III was 85.7, 80.0, and 77.9%, respectively. The log-rank test showed no difference in disease stage and duration of survival (Fig. 2).

Comparing between groups with colon shaping (value = 1) and without colon shaping (value = 0), the log-rank test showed no difference in survival time between the two groups ($p > 0.05$) (Fig. 3).

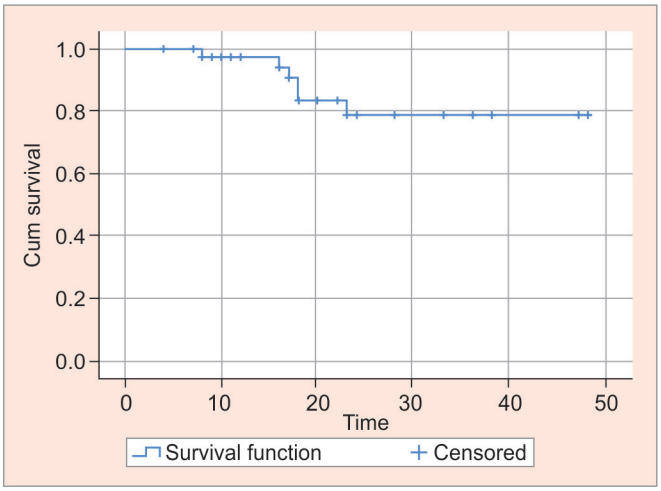

Fig. 1: Survival probability of low rectal cancer patients after surgery

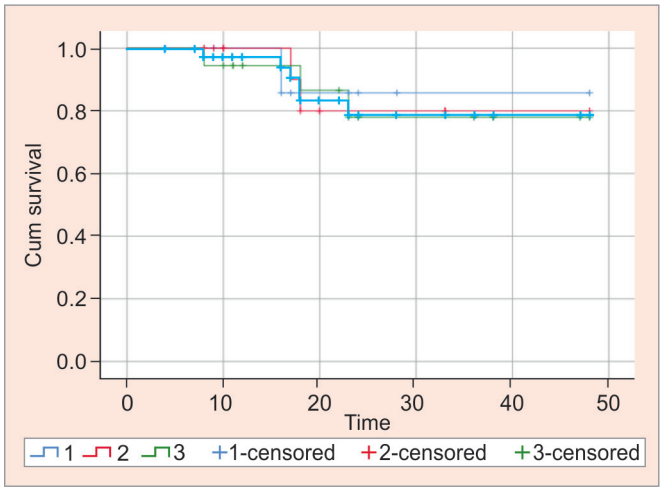

Fig. 2: Survival probability of low rectal cancer patients by TNM stages

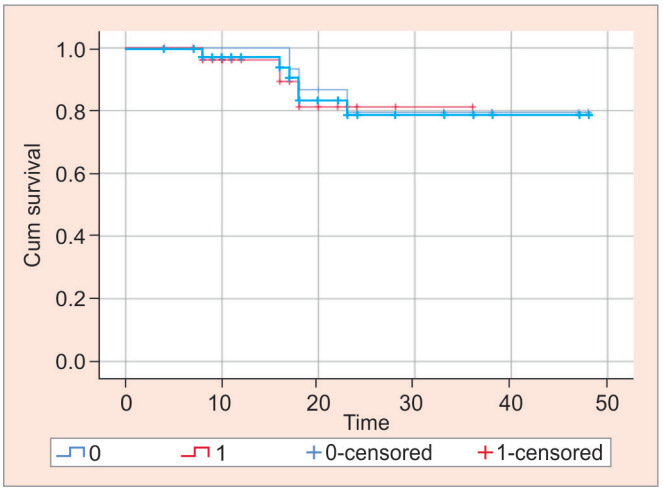

Fig. 3: Survival probability of low rectal cancer patients after surgery according to colon shaping characteristics

Discussion

Selecting surgical methods for low rectal cancer depends on the degree of tumor invasion in the sphincter, the stage of invasion, and the distance from the tumor to the margin of the anus. The distance can be determined by using magnetic resonance imaging of the abdominal/pelvic area. In our study, there were 16 cases (37.2%) having tumors located 5–6 cm away from the anal margin, 23 cases (53.5%) having tumors located 4–5 cm from the anal margin, and 4 cases (9.3%) having tumors located less than 4 cm from the anal margin. Recent studies show that tumors with a distance of less than 2 cm to the anal margin can reach R0 and rectal tumors often spread across the mesorectum and up the abdominal/pelvic area along with the lymph node. The lower the distance indicated, the better chance of sphincter-saving.[8]

In this study, 16 cases had to perform surgery to remove the entire inner sphincter and perform colon shaping. For cases under 60 years old, and the frequency of bowel movements was less than two times a day, we did not perform colon shaping but anastomosis. Results showed that the frequency of bowel movements after surgery was relatively good, including the ability to control fluid and gas. Cases with colon shaping were divided into two groups, including J-shape and side-to-end shape, which were based on colon length after rectal resection, mesenteric thickness, and pelvic diameter. For patients with colons longer than 5 cm after cutting, we could choose J-shape and side-to-end shape depending on the experience of the surgeon. Whereas for groups with colon lengths less than 5 cm, we could only perform side-to-end shape or no shaping. In most cases, we found that the colon diameter dilated to more than 5 cm; therefore, colon diameter had little effect on the selection of shaping method in our study.[7–9,12]

Regarding postoperative treatment for sphincter-saving, we followed a recovery procedure on the 7th day after surgery, including eating normal meals, limiting water intake, and defecating more than three times per day. The patient received loperamide and rehabilitated pelvic floor muscle function. We also met two cases with urinary disorders after surgery. They were rehabilitated and recovered after 10 days of training. In this study, before surgery, 100% of the patients had Wexner score below 10 (mean = 5.7 ± 2.2). There were 62.8% of the patients had a score below 5 points and 37.2% had a score of 5 points or above. This was because the low rectal tumor affected the anal canal, and in addition to causing the patient to defecate many times, the tumor also affected the anal pressure. At 1 month after the surgery, patients had a mean score of 9.3 ± 4.5, and four cases with a Wexner score above 10 points. After 3 months of rehabilitation, patients' scores improved significantly. Using Kirwan classification before surgery, results showed that all patients had grades I and II, or in other words, patients were difficult to control gas. However, after surgery, 13.9% of the patients were classified in-group grade III. This group corresponded to a group with a Wexner score of more than 10 points, which was similar to the previous study.[13]

In our study, the maximum follow-up time was 48 months, and the cumulative survival rate at the 48th month was 78.8%. The mean survival time according to disease stages I, II, and III were 43.4 ± 4.2, 41.9 ± 3.8, and 41.2 ± 3.4 months, respectively, with the corresponding survival probability of being 85.7, 80.0, and 77.9%. Morino. M studied 70 low rectal cancer cases undergoing laparoscopic surgery, with a 5-year overall survival rate of 80.7%, and the survival rates for stages I, II, and III were 92, 79, and 73%, respectively.[14] Thus, the survival rate after 4 years in our study was equivalent to other studies.

Conclusion

This study showed that laparoscopic intersphincteric resection and colon shaping were effective in low rectal cancer treatment. Colon shaping was an effective method of improving bowel function in cases of subtotal or total intersphincteric resection.

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ORIGINAL ARTICLE

Comparison of Intraoperative Findings with Ultrasonographic Scoring for Predicting Difficult Laparoscopic Cholecystectomy

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Abstract

Introduction: Nowadays laparoscopic cholecystectomy is the gold standard treatment for symptomatic gallstone disease (GSD). Prediction of "difficult laparoscopic cholecystectomy" (DLC) may decrease morbidity and mortality as well as reduce the average cost of therapy. At present, very few scoring systems are available to predict the degree of difficulty during surgery.

Aim and objective: To compare the outcome of intraoperative findings with preoperating scoring to predict DLC.

Materials and methods: Two-hundred and nine patients were having GSD, operated by a single experienced surgeon in 2-year duration. Various preoperative predictors and intraoperative parameters of DLC were used for scoring and categorizing the difficulties, into (0–5), (6–10), and (10–15) as early, difficult, and very difficult surgical procedures, respectively.

Result: History of hospitalization for acute cholecystitis, overweight with BMI ≥27.5 kg/m^2, palpable gallbladder, wall thickness >4 mm, and impacted stone were the most accurate preoperative predictors of DLC in the age-group of above 50 years. Statistically, a significant association was determined by comparing preoperative evaluation with the intraoperative outcome.

Conclusion: The preoperative and intraoperative scoring system can be helpful for assessment, experience, and decision-making. These scoring systems deserve a large-scale prospective study for validation.

Keywords: Acute cholecystitis, Gallstone disease, Intraoperative scoring.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1477

Introduction

In India, the prevalence of gallstone disease is estimated at around 4%.[1] About 1–2% of asymptomatic patients may develop symptoms that require cholecystectomy per year.[2] Laparoscopic cholecystectomy (LC) is a procedure with about 0.5% mortality and 10% morbidity.[3]

Abdominal ultrasonography (USG) is sensitive and specific between 84 and 99% to diagnose extrahepatic biliary diseases and detect gallstones size between 1.5 and 2 mm in diameter. Preoperative USG is functional in accessing surgical difficulties or even the possibility of laparotomic conversion.[4,5] Existing scores use as subjective scales to identify high-risk patients, derive risk-assessment models, and evaluate the risk of conversion from laparoscopic to open procedure. However, conversion is not a good reflection of operative difficulty. In contrast, operative time is considered as reproducible criteria of the encountered difficulty for a surgeon.[6]

The study aimed to compare the preoperative predictive factors that determine difficult LC (preoperative scoring) with intraoperative parameters (intraoperative scoring).

Materials and Methods

A prospective observational study was done in Department of General Surgery, Institute of Medical Sciences, Banaras Hindu University (UP) with a sample size of 209 patients of both sexes (age 14–74 years) having symptomatic gallstone disease (GSD). All patients were admitted to the SS Hospital, Banaras Hindu University, Varanasi, from September 2016 to July 2018. Exclusion criteria were LC performed with other combined laparoscopic procedures in the same setting, LC with common bile duct exploration, contraindications to LC, like cardiopulmonary disease, coagulopathies, and end-stage liver disease, and gallbladder anomaly. After written informed consent, all patients underwent elective LC by an experienced laparoscopic surgeon.

History of the patients, clinical examination, and laboratory and radiological investigations were the factor to diagnose the GSD. The preoperative anticipating factors for LC were as similar as defined in the preoperative scoring system.[7] In addition, while doing LC, various intraoperative parameters were calculated which were used for categorizing and grading LC as easy, difficult, and very difficult as shown in Table 1. In each patient, the scores (both preoperative and intraoperative) were compared for predicting difficult laparoscopic cholecystectomy (DLC). LC was carried out using CO_2 pneumoperitoneum with 12–13 mm Hg pressure and standard four-port manner (two 10 mm and two 5 mm). Total

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How to cite this article: Kumar S, Saroj SK, More RS, *et al*. Comparison of Intraoperative Findings with Ultrasonographic Scoring for Predicting Difficult Laparoscopic Cholecystectomy. World J Lap Surg 2021;14(3):166–170.

Source of support: Nil

Conflict of interest: None

Table 1: Intraoperative scoring and difficulty levels—our criteria

Intraoperative parameters	*Scores*	*Grading*
Time taken <60 minutes, thin GB wall having no/<50% omental adhesion, no stone in the Hartman's pouch, no bile spillage, no injury to duct or artery	0–5	Easy
Time taken 60–120 minutes, thick GB wall having >50% omental adhesion/buried GB, stone impacted in the Hartman's pouch, and/or bile or stone spillage and/or injury to duct	6–10	Difficult
Time taken >120 minutes or conversion	11–15	Very difficult

operation time was considered from the first port site incision to the last port closure. The data were statistically analyzed using SPSS 16.0. Receiver operating characteristic (ROC) curve analysis was used to estimate difficulty.

Declaration of Patients Consent

The authors certify that consent forms have been obtained from each patient. In that form, the patients have given their consent for their general and other clinical information to be reported in the journal. The patients understand that their personal information will not be published and due efforts will be made to conceal their identity.

Results

A total of 209 patients with symptomatic gallstone disease undergoing LC were included in this study. The patient characteristics are shown in Table 2. Out of 209 patients, 111 (53.1%) patients were found easy during surgery, while 86 (41.1%) patients were found difficult. Five patients had a duration of surgery >120 minutes while 7 patients were converted to open, due to dense adhesion with difficulty in delineating anatomy of Calot's triangle, so these 12 (5.8%) patients were considered as very difficult (Table 3).

Through preoperative evaluation, 98 (46.88%) patients were predicted to be difficult/very difficult while 95 (45.45%) surgery of patients was difficult/very difficult, whereas 3 (1.43%) patients turned out to be on an easy surgery. However, the cases predicted to be easy on preoperative evaluation were 111 (53.11%) patients, of which 108 (51.67%) patients were easy, whereas 3 (1.43%) patients turned out to be difficult/very difficult on surgery, and by comparing preoperative and intraoperative evaluation (p <0.001), statistically significant association was found (Table 3).

On comparing the preoperative outcome with risk factors in predicting difficult LC, acute cholecystitis, overweight with BMI >27.5 kg/m^2, palpable GB, ≥4 mm of wall thickness, and obstructed stones were found as significant in bivariate analysis, whereas other factors, such as sex, abdominal scar, and pericholecystic collection, were found insignificant in above 50 years of age-group. On comparing the intraoperative outcome with risk factors, we found almost similar observations as shown in Table 4.

The study evaluated the ROC curves for prediction of intraoperative outcome through the preoperative score at cutoff point of 5.5 and area under the curve (AUC) of 0.974 [95% CI: (0.95–0.99); p <0.001], and showed 96.9 and 97.3% of sensitivity and specificity, respectively (Table 5, Fig. 1). In addition, the ROC curve for very difficult vs difficult cases at cutoff point of 8.5 and AUC of 0.782 (95% CI: 0.60–0.96; p = 0.002) showed the sensitivity of 75% and specificity of 62.0%, as shown in Table 5 and Figures 2 and 3.

Table 2: Preoperative predictive factors of DLC (preoperative scoring system), according to Randhawa and Pujahari[7]

Parameters		*Score*	*No. (%)*
Age	≤50	0	144 (68.90)
	>50	1	65 (31.10)
Sex	Female	0	144 (68.90)
	Male	1	65 (31.10)
History of hospitalization for acute cholecystitis	No	0	136 (65.10)
	Yes	4	73 (34.90)
BMI	<25 + 25–27.5	0–1	148 (70.81)
	>27.5	2	61 (29.19)
Abdominal scar	No	0	125 (59.80)
	Infraumbilical + supraumbilical	1–2	84 (40.20)
Palpable gallbladder	No	0	130 (62.20)
	Yes	1	79 (37.80)
Wall thickness	<4 mm	0	148 (70.82)
	≥4 mm	2	61 (29.18)
Pericholecystic collection	No	0	157 (75.11)
	Yes	1	52 (24.89)
Impacted stone	No	0	142 (67.94)
	Yes	1	67 (32.06)
Easy		0–5	
Difficult		6–10	
Very difficult		11–15	

Discussion

Difficult laparoscopic cholecystectomies have an inbuilt risk of conversion, due to dense adhesions of the gallbladder or inability to delineate the anatomy.[8] Conversion to open cholecystectomy is considered a wise decision of the operating surgeon. Age is a risk factor for difficult GB surgery.[9] Lee et al. found that for difficult LC, late-adulthood (>50 years) age-group considered as significant risk factor.[10] The study established a significant association between the difficulty level of surgery in bivariate analysis and the late-adulthood age-group in both preoperative (p <0.001) and intraoperative (p <0.001) outcomes. An independent risk for conversion is controversial in male. However, the study did not find any significant association between different sex and difficulty level of surgery through bivariate analysis in preoperative and intraoperative outcomes, likewise Liu et al.[11] findings.

Bhondave et al. and Nidoni et al. reveal that prior attacks of acute cholecystitis were a significant predictor of difficult LC (p = 0.0002).[12,13]

BMI >27.5 was found to be a significant risk factor in preoperative and intraoperative outcomes, in concordance with the study by Randhawa and Pujahari and Naik and Kailas.[7,14] Hence, the study concludes that obesity is considered a risk factor for difficult LC.

Previous abdominal surgery may have caused adhesions between the viscera and omentum or abdominal wall.[15] Bhondave et al. and Gupta et al. scars over the abdomen were statistically not significant and did not contribute to difficult LC (p = 0.149).[12] The abdominal scar was found as statistically insignificant while palpable GB was found to be predictor of difficult LC, clinically

Table 3: Table showing preoperative evaluation, intraoperative finding, and outcome

1. Correlation between the preoperative score and the outcome				
Preoperative scores	*Easy*	*Difficult*	*Very difficult*	*Total*
0–5	108 (51.67)	2 (0.96)	1 (0.48)	111 (53.11)
6–10	3 (1.44)	84 (40.19)	11 (5.26)	98 (46.89)
11–15	—	—	—	—
Total	111 (53.11)	86 (41.15)	12 (5.74)	209 (100)

2. Comparison of preoperative evaluation with difficulty in performing laparoscopic cholecystectomy			
	Intraoperative difficult/ very difficult cases [n (%)]	*Intraoperative easy cases [n (%)]*	*Total*
Preoperatively difficult/very difficult cases	95 (45.45)	3 (1.44)	98 (46.89)
Preoperatively easy cases	3 (1.44)	108 (51.67)	111 (53.11)
Total	98 (46.89)	111 (53.11)	209 (100)

3. Comparison between preoperative evaluation and intraoperative findings			
	Number of cases easy on surgery [n (%)]	*Number of cases difficult/very difficult on surgery [n (%)]*	*p value*
Number of cases easy on preoperative evaluation	108 (51.67)	3 (1.44)	<0.001
Number of cases difficult/very difficult on preoperative evaluation	3 (1.44)	95 (45.45)	

Table 4: Preoperative and intraoperative outcome with risk factors

	Preoperative outcome				*Intraoperative outcome*			
Risk factors	*Easy (n = 111)*	*Difficult (n = 98)*	*Odds ratio (95% CI)*	*p value*	*Easy (n = 111)*	*Difficult (n = 86)*	*Odds ratio (95% CI)*	*p value*
Age								
≤50	92 (82.9)	52 (53.1)	4.28 (2.27–8.07)	<0.001	92 (82.9)	44 (51.2)	4.62 (2.41–8.85)	<0.001
>50	19 (17.1)	46 (46.9)			19 (17.1)	42 (48.8)		
Sex								
Female	78 (70.3)	66 (67.3)	1.146 (0.63–2.06)	0.648	78 (70.3)	58 (67.4)	1.14 (0.62–2.09)	0.670
Male	33 (29.7)	32 (32.7)			33 (29.7)	28 (32.6)		
History of hospitalization for acute cholecystitis								
No	89 (80.2)	47 (48.0)	4.39 (2.38–8.09)	<0.001	89 (80.2)	39 (45.3)	4.87 (2.59–9.16)	<0.001
Yes	22 (19.8)	51 (52.0)			22 (19.8)	47 (54.7)		
BMI								
≤27.5	93 (83.8)	55 (56.1)	4.03 (2.12–7.68)	<0.001	93 (83.8)	47 (54.7)	4.28 (2.21–8.29)	<0.001
>27.5	18 (16.2)	43 (43.9)			18 (16.2)	39 (45.3)		
Abdominal scar								
No	72 (64.9)	53 (54.1)	1.56 (0.89–2.73)	0.112	72 (64.9)	45 (52.3)	1.68 (0.94–2.99)	0.075
Infraumbilical + supraumbilical	39 (35.1)	45 (45.9)			39 (35.1)	41 (47.7)		
Palpable gallbladder								
No	82 (73.9)	48 (49.0)	2.94 (1.65–5.25)	0.0002	82 (73.9)	40 (46.5)	3.25 (1.78–5.91)	<0.001
Yes	29 (26.1)	50 (51.0)			29 (26.1)	46 (53.5)		
Wall thickness								
<4 mm	92 (82.9)	56 (57.1)	3.63 (1.92–6.85)	<0.001	92 (82.9)	48 (55.8)	3.83 (1.99–7.35)	<0.001
≥4 mm	19 (17.1)	42 (42.9)			19 (17.1)	38 (44.2)		
Pericholecystic collection								
No	86 (77.5)	71 (72.4)	1.30 (0.69–2.45)	0.401	86 (77.5)	63 (73.3)	1.25 (0.65–2.41)	0.493
Yes	25 (22.5)	27 (27.6)			25 (22.5)	23 (26.7)		
Impacted stone								
No	87 (78.4)	55 (56.1)	2.83 (1.55–5.17)	0.0005	87 (78.4)	47 (54.7)	3.00 (1.61–5.59)	0.0003
Yes	24 (21.6)	43 (43.9)			24 (21.6)	39 (45.3)		

Table 5: ROC curve and its AUC for prediction of intraoperative outcome based on preoperative score

	Cutoff point	*AUC (95% CI)*	*p value*	*Sensitivity (%)*	*Specificity (%)*
Difficult/very difficult vs easy	5.5	0.974 (0.95–0.99)	<0.001	96.9	97.3
Difficult vs easy	5.5	0.975 (0.95–0.99)	<0.001	97.7	97.3
Very difficult vs difficult	8.5	0.782 (0.60–0.96)	0.002	75.0	0.62

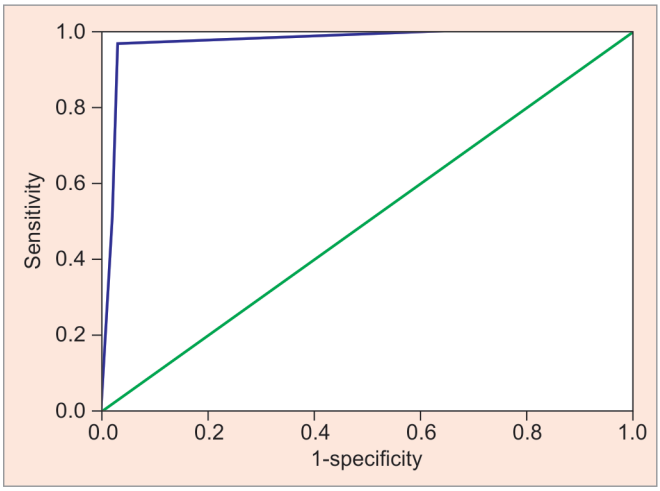

Fig. 1: ROC curve and its AUC for prediction of intraoperative outcome based on preoperative score (difficult/very difficult vs easy)

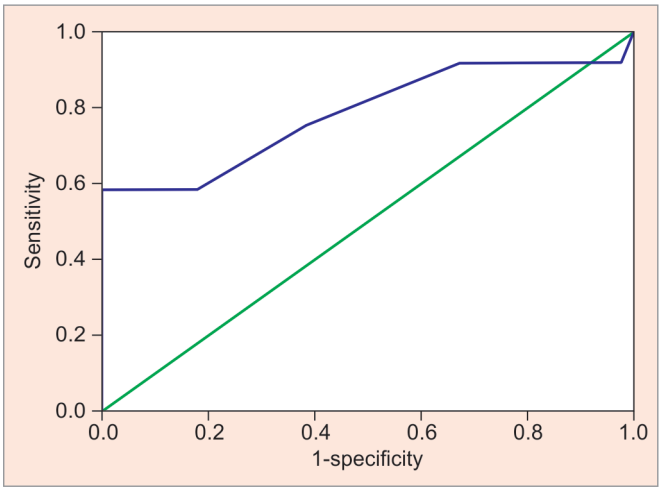

Fig. 3: ROC curve and its AUC for prediction of intraoperative outcome based on preoperative score (very difficult vs difficult)

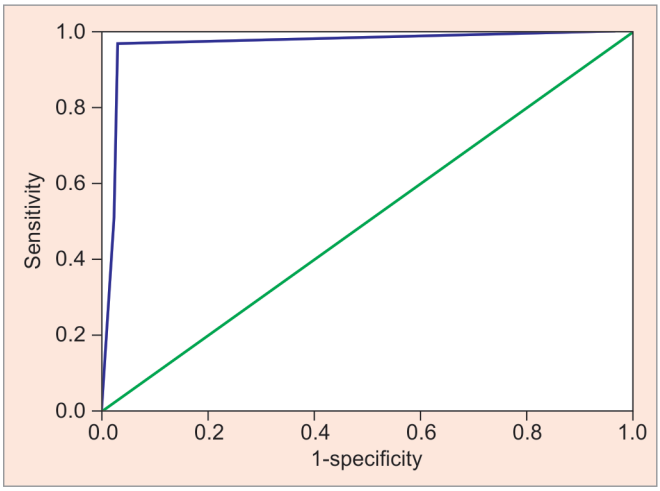

Fig. 2: ROC curve and its AUC for prediction of intraoperative outcome based on preoperative score (difficult vs easy)

palpable GB may be due to distended GB, mucocele of GB, thick-walled or owing to adhesions between the GB and the omentum.[16]

Difficult dissection of GB is associated with initial increased gallbladder wall thickening.[17] A significant correlation between the GB wall thickness and the difficulty level of surgery was observed in bivariate analyses of preoperative and intraoperative findings. Bhondave et al. and Saleem and Abdallah[18] found a similar result. Association between pericholecystic collection and difficulty level of surgery was not significant in bivariate analyses of preoperative and intraoperative findings which is similar to Naik et al.[14] But studies done by Nidoni et al. and Bhondave et al. had been found differing from our results.

Study obstructed stone at the neck of GB was found to be statistically significant in the bivariate analysis of preoperative and intraoperative findings. Kidwai et al. also found difficulty during the procedure due to impacted stone at Hartmann's pouch.[19] Conversion to open is required in 2–15% of patients undergoing elective LC.[12] In the present study, out of 209 patients, 202 cases had undergone laparoscopic cholecystectomy while 7 (3.3%) cases had converted to open.

ROC curve was to predict the intraoperative outcome based on preoperative score, and we observed that the preoperative scoring system is reliable for predicting the intraoperative outcome in LC. The present study was in concordance with the results of Saleem and Abdallah.[17] The present study also showed that a relation between preoperative score and intraoperative score of LC patients was statistically significant (p <0.001).

Conclusion

In the study, the most accurate preoperative predictors of the potential operative difficulty and conversion to open procedure in above 50 years age-groups were having the history of hospitalization for acute cholecystitis, overweight with BMI ≥27.5 kg/m^2, palpable gallbladder, ≥4 mm wall thickness, and impacted stone. The intraoperative scoring system should be standard criteria, and both scoring systems (preoperative and intraoperative) will be going to help the surgeon to take an early decision. Still, this scoring system deserves a large-scale prospective study for validation of the scoring method and establishing its efficacy.

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ORIGINAL ARTICLE

Veterinary Laparoscopy in India: A Future Perspective

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Abstract

Laparoscopic surgery is a highly specialized and rapidly evolving field in veterinary science. Since laparoscopic surgery has an enormously broad scope and a high impact on welfare of animals, competence in this field should urgently be promoted and provided in India. At present, we are lacking a well-designed training course having dedicated facilities with all the instruments to maximize hands on experience for better learning of this highly sophisticated technique. We need to inculcate this technique in the veterinary education from the undergraduate program for effective learning. Initially some foundational program for learning this minimally invasive technique should be planned followed by advanced courses/trainings depending upon the specialization of veterinarians. Nowadays veterinarians across the world have started using this technique but in India, there exists no specific training programs for laparoscopy surgery, so there is urgent need to explore and implement laparoscopic training program for the veterinarians for getting them exposed in the field of laparoscopic surgery. In this article, we will discuss about the current scenario of veterinary laparoscopy, laparoscopy education and training programs availabilities, and the future perspective of implementing veterinary laparoscopy in India.

Keywords: Laparoscopy perspective, Laparoscopy training, Minimally invasive surgery, Veterinary education, Veterinary laparoscopy surgery, Veterinary surgery.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1469

Laparoscopy is one of the most promising diagnostic and therapeutic aids among the several current surgical technologies used in veterinary medicine. Laparoscopic surgery is the third major advancement in the field of surgery after anesthesia and asepsis. Laparoscopic surgery, a minimally invasive type of procedure, is done by inserting the laparoscope into the patient through a tiny (less than 1 inch long) incision, and it was first performed on a dog in 1901. Since then, this technique has been explored mainly for the benefits of human beings only, and there were either none or very few veterinarians who have started the use of laparoscopic surgeries all over the globe. Laparoscopy started with animals but has not been used much in the field of veterinary science. Nowadays veterinarians across the world have started using this technique, but in India, we still need to train more and more veterinarians for laparoscopic surgery. There is scarcity of training centers having adequate facilities, i.e., dry laboratory training, cadaver training, simulator, and finally hands on live animals. So, there is a dire need of intensive course on laparoscopy in India, having focus on providing essential skills and procedures required for safe laparoscopy surgery.

Laparoscopy has its origins in the discipline of endoscopy, and much of its history may be traced back to the advancement of endoscopic methods. The concept and the framework for laparoscopic surgery was initially discovered over a century ago. The technique's introduction into the field of general surgery, on the other hand, is a comparatively new development. Several attempts were made to construct endoscope-like instruments in mid-1800s, but the first effective open-tube endoscope was developed in 1853 by Desormeaux, which was used to examine the urethra and the bladder. Many physicians later refined the original endoscopic models, notably Kussmaul and Nitze, and began using their new instruments in their medical practice.[1]

However, major breakthrough in this field was the work done by Kelling[2] on live dogs by attempting laparoscopy or endoscopically examining the peritoneal cavity in 1901 and called this examining procedure "celioscopy." It started from diagnostic biopsies under direct examination to become a vital part of gynecological practice. Technology continued to evolve, but the most significant breakthrough was the introduction of a video computer chip in 1986. This technological advancement allowed the operating surgeon to project a magnified picture of the operative field onto a monitor while also freeing both of his hands, making it easier to undertake complex laparoscopic surgeries thus facilitating the integration of laparoscopy into field surgery. When we talk about humans, the first laparoscopic cholecystectomy on a human patient was performed in 1987 by the French physician Mouret, while the first laparoscopic cholecystectomy in India was performed in 1990 at JJ Hospital in Mumbai.[3] All the aforementioned research and development in case of laparoscopy and endoscopy have been possible only due to animal studies.

Nowadays, veterinarians across the world have started using this technique, but in India, there exists no specific training program. Most of the interested veterinarians from India are going abroad for training, so there is a dire need to promote veterinarians for adopting and using laparoscopy in their routine practice. Laparoscopic surgery is growing at fast rate in veterinary surgery because of the increasing awareness and interest of veterinarians

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How to cite this article: Kumar R, Bhumika, Yadav I. Veterinary Laparoscopy in India: A Future Perspective. World J Lap Surg 2021;14(3):171–172.

Source of support: Nil

Conflict of interest: None

in India due to reported advantages such as faster recovery, lower risks, small incision better visibility, and fewer complications. Laparoscopic surgery may provide a number of benefits but loss of depth perception, loss of touch, reduced degree of mobility for instruments, and the adoption of positions that are not usually ergonomic for long periods of time are some of the downsides of laparoscopic surgery for the surgeon. Thus, it becomes necessary for a surgeon to get enough hands-on experience in dry lab environment using simulators before moving to patients.

Laparoscopy can lead to a major revolution in veterinary surgery as surgery done using laparoscopy has faster wound healing due to small size of incision, thus providing better results in species which are generally difficult to keep immobile. Government of Himachal Pradesh has started a project of sterilization in monkeys using laparoscopy to control the population of monkeys who are responsible for great losses in agricultural crops, because it produces a relatively small surgical wound that requires very little postoperative care or regular dressings.[4] Few veterinarians in metro cities have also started to use this technique, but still they lack good expertise and are also devoid of potential patients.

Laparoscopy is divided into two parts mainly:

- Surgical laparoscopy: A number of surgical procedures are being done presently in field of veterinary surgery such as ovariectomy, gastropexy, laparoscopically assisted enterotomy, cystotomy, and urethrocystoscopy.
- Diagnostic laparoscopy: Laparoscopy was also used for visualizing, examining, and collecting biopsies from different organs from different species of animals. Pregnancy diagnosis has also been done successfully using laparoscopy, but with the introduction of sonography, its use in pregnancy diagnosis has become obsolete.[5] Laparoscopy has also been used for insemination and embryo transfer of animals.

The biggest advantage of laparoscopic surgery is that animals experience less pain and discomfort, primarily because of the smaller incisions, which results in less damage to both the affected area and the surrounding tissues. Additionally, it results in less blood loss, reduced risk of infections, reduced anesthesia time, and significantly shorten their recovery time. Veterinarians can not only use this revolutionary new tool for various surgical procedures but also as an aid to help disease diagnosis. Laparoscopic surgery is a growing area of clinical expertise that has benefited from many scientific breakthroughs in recent years, resulting in better outcomes and fewer surgery-related complications, eventually benefiting our voiceless animals.

While the basic scope has remained relatively unchanged over time, the equipment quality has certainly improved. The training must also improve as laparoscopic instrumentation and methods improve. Overall, surgeons are more concerned with equipment that will facilitate and simplify surgery than with their own skill development. It is worth noting that the majority of these inherent laparoscopic surgical difficulties are linked to the lack of expertise of surgeon and his team, with a higher incidence occurring during the early stages of the learning curve.[6]

While laparoscopy has been available in human medicine for quite some time now, it is still not as prevalent in veterinary surgery. Veterinary laparoscopy certainly has advanced, but we hope to see it expand even further. Most surgeries that are being done in veterinary medicine can be done laparoscopically. Some of the more commonly performed procedures include spay, cryptorchid neuter, abdominal exploratory, biopsy of internal organs, bladder stone removal, gastropexy to prevent gastric dilation volvulus. Laparoscopic surgical techniques allow veterinarians to perform procedures with less risk and discomfort, which is a win for all involved.

Laparoscopic science has an enormously broad scope and a high impact on welfare of animals; competence in this field should urgently be promoted and provided in India. Efforts should be made to train the veterinarians in the field of laparoscopy to improve their understanding and learn surgical skills in laparoscopy, which will be very helpful for the veterinarians in acquiring not only techniques and responsibility toward animals but also help them to develop an ethical attitude toward animals by improving animal welfare.

We would like to see more veterinarians shifting from conventional surgery to laparoscopic surgery. The capacity for a veterinary hospital to offer laparoscopic surgery necessitates a large financial investment, both in terms of the time it takes for a veterinarian to obtain the advanced training required to operate laparoscopic equipment and in terms of the cost of equipment itself. Increased training availability is a good start, but equipment cost reductions would be even better. We hope that future perspective of implementing laparoscopy surgery can be achieved by providing cost-effective newly developed intensive hands-on training program on veterinary laparoscopic surgery in the centers having the state-of-the-art facilities and infrastructure where participants can launch their journey for keyhole surgery using laparoscopy. This type of centers will help participants to develop the psychomotor skill for laparoscopic surgery by a distributed practice training program consisting of theory, dry lab, cadaver training, simulator training, and finally wet lab practice. The overall goal will be to train veterinarians for changing their approach and practice so that they can implement this technique with greater insight and confidence for the benefit of voiceless animals in Indian context.

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ORIGINAL ARTICLE

Evaluation of Open vs Laparoscopic Pyeloplasty in Children: An Institutional Experience

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Abstract

Background: An ureteropelvic junction (UPJ) obstruction is a blockage of urine passage from the renal pelvis to the upper ureter. Back pressure inside the renal pelvis can cause renal damage and function deterioration. In children, the adynamic segment, crossing vessel, ureteral valves, and sticky bands are the most common causes of UPJ obstruction. The surgical rebuilding of the UPJ to drain and decompress the kidney is known as pyeloplasty. The process, benefits, limits, and post-operative results of open and laparoscopic pyeloplasty are examined in this research.

Materials and methods: The study included children diagnosed with pelviureteric junction obstruction in the Urology Department at our institute between January 2016 and December 2019. Ultrasound, micturating cystourethrogram, and diethylenetriamine pentaacetate (DTPA) were used to evaluate them.

Results: Around 45 of the 70 instances involved boys. Twenty-one were discovered prenatally and confirmed postnatally using ultrasonography. The most prevalent kind of presentation was abdominal mass in 44 (42.8%) of the youngsters. There were 35 open and 35 laparoscopic pyeloplasties performed. The laparoscopic pyeloplasty group had a mean total operating time of 99.2 minutes with stent implantation, compared to 80.5 minutes in the open group. The mean glomerular filtration rate (GFR) and differential renal function improved in both groups; however, the difference was not statistically significant ($p > 0.05$). The postoperative analgesic need was much reduced in the laparoscopic group as compared to open pyeloplasty.

Conclusion: The major drawback of laparoscopic pyeloplasty is the length of time it takes to complete the procedure. It necessitates exceptional intracorporeal suturing skills, and the benefit is that it has a lower rate of morbidity, shorter hospital stays, and better aesthetic results than the open technique.

Keywords: Laparoscopy, Open surgery, Pyeloplasty.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1483

Introduction

Urine flow blockage from the renal pelvis to the upper ureter is referred to as ureteropelvic junction (UPJ) obstruction. Back strain inside the renal pelvis can cause renal damage and degeneration. A primary obstructive lesion in the UPJ is most frequent in youngsters, although it can occur in adults and the elderly as well. Adynamic segment, crossing vessel, ureteral valves, and sticky bands are all etiologies causing UPJ blockage in youngsters. Pyeloplasty is the surgical reconstruction of the UPJ to drain and decompress the kidney. If remaining renal function is acceptable, it is most usually used to treat a UPJ blockage.[1,2] The usual surgical therapy for UPJ blockage is dismembered Anderson-Hynes pyeloplasty. This renal pelvis surgery relieves the obstruction by completely eradicating the stenotic adynamic section of the UPJ and creating a larger conduit from the remaining ureter and renal pelvis tissue.[3] The techniques, advantages, and postoperative results of open pyeloplasty versus laparoscopic pyeloplasty are compared in this study.

Aims and Objectives

The purpose of this study was to compare the procedures used in open and laparoscopic pyeloplasty, as well as the advantages and disadvantages of each treatment. The goal of this study was to compare the outcomes of open and laparoscopic pyeloplasty.

Materials and Methods

The study included children diagnosed with pelvic–ureteric junction (PUJ) blockage at our institute's Urology Department between January 2016 and December 2019. An ultrasound of abdomen, micturating cystourethrogram, and DTPA study were used to assess them. This research is both prospective and retrospective. The research included 70 children with PUJ obstruction, 15 of whom were female and 45 of whom were male. The children's symptoms and signs were assessed. Renal function tests, ultrasonography of abdomen, micturating cystourethrogram, and DTPA were used to accomplish this. The patients were randomized to either open or laparoscopic pyeloplasty. They were assessed for renal function, postoperative pain, and hospital stay both before and after surgery. The inclusion criteria are met by all patients with PUJ obstruction. Cases with concomitant reflux and recurring cases are exclusion criteria. A

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How to cite this article: Pogula VR, Galeti EH, Omkaram K, *et al*. Evaluation of Open vs Laparoscopic Pyeloplasty in Children: An Institutional Experience. World J Lap Surg 2021;14(3):173–176.

Ethics approval: Approved by the Institutional Ethical Committee.

Source of support: Nil

Conflict of interest: None

thorough history is collected, including age, gender, stomach discomfort, fever, and urinary tract infections. It was also necessary to gather information about one's past and family history.

Procedure

Open Pyeloplasty

It is feasible to perform this procedure through a variety of incisions, but we went with an extraperitoneal flank incision. The restricted UPJ segment is surgically removed, and the renal pelvis is anastomosed to the spatulated upper ureter. Assuming the renal pelvis is extensively dilated; in this case, it was regularly reduced in size by chopping off unneeded tissue. It is then sutured such that it streamlines down toward the anastomosis, and a double J stent and a flank drain are placed across the anastomosis. They were removed 48–72 hours following surgery. If a vascular abnormality is discovered near the UPJ, the anastomosis is done anterior to the vascular.

Laparoscopic Pyeloplasty

The patient was in an ipsilateral kidney position. The camera was implanted by a 10-mm umbilical trocar, and two functioning ports were positioned in the mid-clavicular line. The kidney can be located posterior and lateral to the colon. The kidney was surrounded by the posterior peritoneum, which extends from the higher pole to about 3 cm below the lower pole. It is critical not to separate Gerota's fascia's lateral attachments, as this would enable the kidney to "flip" medially. Because the renocolic ligaments have been detached, the colon can migrate medially and offer exact passive exposure to the UPJ. Following the psoas muscle directly medial to the bottom pole of the kidney, the ureter was found. The ureter differs from the gonadal veins in this it moves peristaltically. The primary treatment for resolving UPJ blockage is Anderson–Hynes repair. To make this repair easier, the pelvis is dissected to allow for better vision and mobility for a tension-free anastomosis with the ureter. At the PUJ, the ureter was then cut using scissors. Prior to doing surgery on a highly redundant pelvis, a reduction must be performed. The ureter was then spatulated on its lateral side. Following a freehand intracorporeal suturing procedure, a Double J stent is inserted.

Results

Pelvic–ureteric junction blockage was detected in 70 children. The majority of the 70 children were under the age of 5 years, with 54 (77%) being under the age of 1 year, and 11 (15%) being under the age of 1 year (Fig. 1).

A 3:1 ratio was found among the 70 children, with 45 (64.2%) male children and 15 (21.2%) female children (Table 1).

Left-sided obstruction affected 40 (57.14%) children, right-sided blockage affected 25 (35.71%), and bilateral blockage affected 5 (7.14%) of the 70 children (Table 1).

Ultrasonography was used to find 21 of the 70 infants antenatally, and postnatal confirmation was obtained. A mass abdomen was the most common presenting symptom (44.8%), followed by a urinary tract infection (UTI; 21.5%), pain (8.4%), and antenatally (21%).

A total of 35 open and 35 laparoscopic pyeloplasties were done, with all of the children in the laparoscopic group having unilateral PUJ obstruction.

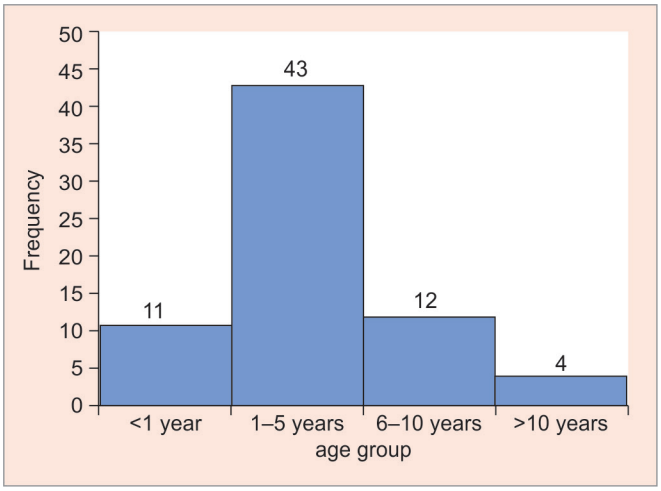

Fig. 1: Histogram of age groups of study subjects

Table 1: Distribution of variables of study subjects in the two groups ($n = 70$)

Variables	*Open procedure*	*Laparoscopy*
Sex		
Male	26	29
Female	09	06
Mass		
Present	15	19
Absent	20	16
UTI		
Present	10	12
Absent	25	23
Pain		
Present	03	05
Absent	32	30
Antenatal detected		
Yes	11	10
No	24	25
Side		
Right	12	13
Left	18	22
Bilateral	05	0
Complications		
Present	02	0
Absent	33	35

In the laparoscopic pyeloplasty group, the mean total operating time with stent installation was 99.2 minutes, compared to 80.5 minutes in the open group.

The mean GFR preoperatively in the open pyeloplasty group was 37.86, with the majority of patients having a GFR between 30 and 50. Five individuals had GFRs ranging from 15 to 20. In comparison, the average postoperative GFR increased to 41.02 (Table 2).

The mean GFR preoperatively in the laparoscopic pyeloplasty group was 38.05; the majority of patients had a GFR between 30 and 50. Three individuals had GFRs ranging from 15 to 20. In comparison, the average postoperative GFR improved to 40.15 (Table 2).

The DTPA renogram demonstrated improved differential renal function in 58 of the 70 patients, 30 of whom were from the laparoscopic group and 28 of whom were from the open group. In 10 patients, 5 from the open group and 5 from the laparoscopic group, the DTPA renogram remained unaltered (Table 2). The remaining two showed just a little drop in differential function. The two patients had pyeloplasty redone. Both were members of the open group. The postoperative analgesic demand was much lower in laparoscopic pyeloplasty compared to open pyeloplasty. The length of analgesic required was also much shorter in the laparoscopic group. The mean hospital stay after laparoscopic pyeloplasty was 3.15 days, which was substantially smaller than the open group's mean of 8.30 days. The average follow-up in available patients was 33.5 months, and 34.5 months in laparoscopic cases. There was just one conversion from laparoscopic to open surgery in the laparoscopic group due to technical difficulties. Owing to a significant decline in differential renal function, two children in the open group had redo pyeloplasty. When compared to the open group, patients in the laparoscopic group had less scarring at the incision site.

Discussion

Among the 70 patients, 21 were found antenatally, accounting for 30% of instances, although, in the literature, approximately 50% of patients have been observed antenatally.[4] Of the 21 individuals, 11 were operated on before the age of 1 year, while the rest were operated on before the age of 5 years. According to our series, left-sided lesions were the most prevalent, accounting for 57.14%, followed by right-sided lesions, which corresponds to the literature study, which offers 66% when compared to the opposite side.[5] Male children are more typically impacted than female by a factor of three, although the literature study revealed a factor of two. According to the symptoms, the majority of the children had a mass abdomen (62.8 %), with other symptoms including UTI and pain being less common. To avoid kidney injury, some studies have advocated early treatment.[6] A small number of studies have found that affected kidneys with acceptable differential renal function at the time of diagnosis are less likely to have renal function deterioration after surgery. Differential renal function did not improve following pyeloplasty, according to previous investigations, regardless of prior renal functional condition.[7]

To distinguish the blocked PUJ, diuretic renography (DTPA) has been frequently used. Few researchers, however, have questioned the interpretation of diuretic renography obstructive patterns to diagnose PUJ blockage. The use of a 20-minute washout after a diuretic challenge to diagnose blockage is effective in symptomatic older children and adults, but assuming the same criteria can be applied to an asymptomatic group of young children has aroused debate.[4] Both the open and laparoscopic groups had a postoperative diuretic renogram to see whether the differential renal function and GFR had improved. Preoperatively, the open group's mean GFR was 38.32. Five individuals had the lowest GFR of 15–20. In comparison, the average postoperative GFR improved by 40.8. Preoperatively, the mean GFR in the laparoscopic group was 39.8, with the majority of patients having a GFR between 30 and 50. Three individuals had the lowest GFR of 15–20. In comparison, the average postoperative GFR improved by 41.2%. There was no significant difference in GFR improvement between the two groups ($p > 0.05$; Table 3). The DTPA renogram revealed improved differential renal function in 58 of the 70 patients, with 30 patients having undergone laparoscopic surgery and 28 had undergone

Table 2: Descriptive statistics of study subjects in the two groups ($n = 70$)

	Group	*N*	*Mean*	*Std. deviation*	*t value*	*p value*
Preop GFR (mL/min)	Open	35	37.86	16	0.049	>0.05
	Lap	35	38.05	16.4		
Preop differential function	Open	35	38.50	10.2	0.072	>0.05
	Lap	35	38.33	9.7		
Postop GFR (mL/min)	Open	35	41.02	14.2	0.925	>0.05
	Lap	35	40.15	11.6		
Postop differential function	Open	35	41.31	9.1	0.136	>0.05
	Lap	35	41.00	9.4		

Preop, preoperative; Postop, postoperative

Table 3: Comparison of means of certain variables between the two groups

	Group	*N*	*Mean*	*Std. deviation*	*t value*	*p value*
Preop GFR (mL/min)	Open	35	37.86	16	0.049	>0.05
	Lap	35	38.05	16.4		
Preop differential function	Open	35	38.50	10.2	0.072	>0.05
	Lap	35	38.33	9.7		
Postop GFR (mL/min)	Open	35	41.02	14.2	0.925	>0.05
	Lap	35	40.15	11.6		
Postop differential function	Open	35	41.31	9.1	0.136	>0.05
	Lap	35	41.00	9.4		

Preop, preoperative; Postop, postoperative

open surgery. In 10 patients, the DTPA renogram remained steady, 5 in the open group and 5 in the laparoscopic group. The differential function of the remaining two decreased. Both of the youngsters who had their pyeloplasty redone were from the open group. The difference in improvement in differential renal function between the two groups was not significant ($p > 0.05$; Table 3).

After pyeloplasty, the postoperative analgesic need was way lower in the laparoscopic group than those in the open group. The period of analgesic usage was also significantly reduced in the laparoscopic group. In the laparoscopic group, the mean postoperative hospital stay was 3.15 days, contrast to 8.25 days in the open group. The average follow-up time for open surgeries was 33 months, whereas it was 34 months for laparoscopic procedures. In the laparoscopic group, there has only been one open surgery conversion. Two individuals in the open group had pyeloplasty redone due to a significant decline in differential renal function. Individuals in the laparoscopic group exhibited less scarring at the incision site than those in the open group.

The success rate of laparoscopic pyeloplasty is extremely high, at 87.98%.[7] We obtained a 97.1% success rate in this study. Conversion to an open method was seen as a failure.

In the published series,[8,9] the sole drawback seems to be the extended operative time. However, Zhang et al.[7] found that the laparoscopic (retroperitoneal) group took less time than the open group. As laparoscopic surgery becomes more ingrained in resident training, more complicated methods, such as intracorporeal suturing, become less intimidating. Furthermore, advanced intracorporeal suturing and knotting skills, as well as the development of new robotic equipment, may minimize operating time.[10] The Da Vinci robot's performance-enhancing function seems to reduce the difficulties of intracorporeal suturing. The total complication rate of laparoscopic pyeloplasty has been reported to range from 4 to 13% in the literature.[7] There were no complications and only one conversion to open surgery in our research.

Conclusion

Laparoscopic pyeloplasty is a safe and effective procedure that follows a well-established procedure. When compared to laparoscopic surgery, open pyeloplasty has a shorter operating time. The sole downside of laparoscopic pyeloplasty over open surgery is that it takes longer and needs a high level of intracorporeal suturing competence. There were no redo instances with laparoscopic pyeloplasty in our research. In comparison to open pyeloplasty, this surgery offers less morbidity, shorter hospital stays, and superior aesthetic results. For PUJ blockage, laparoscopic pyeloplasty has become the gold standard.

Authors Contributions

All authors have read and approved the manuscript.

Acknowledgments

The authors extend their sincere thanks to all the children and their parents who participated in the study.

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ORIGINAL RESEARCH

Study of Incidental Carcinoma Gallbladder in Operated Cases of Gallstone Disease at Tertiary Care Hospital in Eastern Uttar Pradesh

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Abstract

Background and objectives: Due to the late detection of primary carcinoma of gallbladder (CaGB), the overall prognosis has remained poor with a 5-year survival of 5–10%. In practice, after elective cholecystectomy for presumably benign gallbladder disease, primary CaGB is an unexpected histopathological finding in resected specimens. Current study aims to determine the incidence of incidental CaGB and to determine factors predictive of CaGB in patients operated for chronic cholecystitis.

Materials and methods: In this single center, prospective observational study, analysis of incidence and various biological characteristics of 200 consecutive patients with chronic cholecystitis was done who underwent cholecystectomy and were subsequently histologically diagnosed as incidental CaGB. Results of the study were compiled, tabulated, and analyzed using statistical methods, and inference was drawn.

Results: In the study, five patients were diagnosed with incidental CaGB histologically after cholecystectomy for chronic cholecystitis, and the incidence of incidental CaGB was 2.5%. Sociodemographic parameters and pathophysiological observations are additionally drawn to determine factors predictive of primary CaGB.

Conclusions: In view of the study findings, it may be inferred that chronic cholecystitis is a significant surgical disease in our population. This is significant because laparoscopic cholecystectomy is being more commonly used for the treatment of chronic cholecystitis in which there are considerable chances of perioperative spillage of biliary contents because of which there are possibilities for the very early gallbladder carcinoma becoming a disseminated disease. The operating surgeon should have high index of suspicion regarding this incidental but fatal gastrointestinal malignancy.

Keywords: Carcinoma, Cholecystectomy, Gallbladder, Incidental, Laparoscopic.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1475

Introduction

Gallbladder cancer is the most common malignant tumor of the biliary tract worldwide and the fifth most common cancer involving the gastrointestinal (GI) tract.[1,2] Primary carcinoma of gallbladder (CaGB) clinically resembles benign disease because of which it is detected late in its course. In practice, after elective cholecystectomy for presumably benign gallbladder disease, primary CaGB is an unexpected histopathological finding in 1–3% resected specimens. It is prevalent mainly in sixth and seventh decades of life. The overall prognosis has remained poor because of the late detection of the disease with a 5-year survival of 5–10%. Before the era of computed tomography (CT) scan and ultrasonography (USG), the rate of correct preoperative diagnosis was only 8.6%, which has improved considerably with the use of newer imaging techniques. Still a preoperative diagnosis of early gallbladder carcinoma (EGBC) is rarely made, where the 5-year survival is 91–100%. Most of the available literature is reported from developed countries, which have a different socioeconomic culture and health setup from that of a developing country such as India.[1,2]

The purpose of undertaking this study was that a reasonably high number of CaGB patients have been noted in the Gangetic planes of Uttar Pradesh, which forms the area of our study. We have undertaken a study of the incidence of CaGB in operated cases of gallstone disease, which included all cases who underwent cholecystectomy (laparoscopic/open) at Department of Surgery in a tertiary care referral hospital in eastern Uttar Pradesh, India, on consecutive 200 patients. The study involves the analysis of incidence and various biological characteristics of patients of gallstone disease who underwent cholecystectomy and were subsequently histologically diagnosed as incidental CaGB.

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How to cite this article: Jain V, Mishra RY, Gupta M, *et al.* Study of Incidental Carcinoma Gallbladder in Operated Cases of Gallstone Disease at Tertiary Care Hospital in Eastern Uttar Pradesh. World J Lap Surg 2021;14(3):177–182.

Source of support: Nil

Conflict of interest: None

Materials and Methods

The study comprised a single center, prospective observational study. This study was conducted at Department of Surgery in

a tertiary care referral hospital in eastern Uttar Pradesh, India, on 200 consecutive patients who underwent cholecystectomy (laparoscopic/open) for chronic cholecystitis between October 2014 and May 2016. An informed written consent was taken.

Inclusion Criteria

All patients who underwent cholecystectomy (laparoscopic/open) for chronic cholecystitis.

Exclusion Criteria

- Diagnosed or suspected case of CaGB.
- Patients not fit for surgery.

Parameters Studied

- Detailed history and clinical examination.
- Baseline investigative work up.
- Special investigations like prothrombin time (PT), USG whole abdomen, CT scan abdomen, magnetic resonance cholangiopancreatography—where indicated, endoscopic retrograde cholangiopancreatography (ERCP)—where indicated.
- Histopathology.

Statistical Analysis

SPSS statistical software was used for analysis. One-way analysis of variance test was used to compare between two groups. To test the association between variables, Fisher's exact test was used. The *P*-value less than 0.05 was considered as significant. Results of the study were compiled, tabulated, and analyzed using statistical methods, and inference was drawn. All information recorded in the proforma was verified. The results were compared with data obtained from different geographical regions. A total of 200 consecutive chronic cholecystitis patients who satisfied the study criteria were incorporated as the study group. This study was ethically conducted in accordance with Declaration of Helsinki.

Results

Results and findings observed in studied sample are presented in the subsequent sections.

Intraoperative Findings

Intraoperative findings are depicted in Table 1 and Figure 1. In most of the patients, gallbladder (GB) was distended, adhesion was minimal, and GB contained multiple or single stones.

Histopathology Findings

Different biopsy findings are mentioned in Table 2 and Figure 2. According to the biopsy report, five cases were diagnosed as CaGB, usually infiltrating up to lamina propria. Most of these were adenocarcinoma. Rest were frank chronic cholecystitis.

Final Diagnosis

Among 200 patients, 195 had chronic cholecystitis, and 5 cases were diagnosed as CaGB in the postoperative settings from their biopsy report (Table 3; Figure 3). These cases are incidental CaGB.

Comparative Results between Chronic Cholecystitis and Incidental CaGB

Demographic Profile

Age

- Among the incidental CaGB patients, mean age: 45.4 years; median age: 36 years; standard deviation: 18.64; mode: 30; minimum age: 30 years; maximum age: 76 years (Tables 4 and 5).
- Among chronic cholecystitis patients, mean age: 44.15 years, median: 44; mode: 45; standard deviation: 14.67; minimum age: 6 years; maximum age: 78 years (Tables 4 and 5).
- $p = 0.85$ (unpaired *t*-test)—not significant.

Table 1: Intraoperative findings of our study group ($N = 200$)

Operative finding	*Frequency*	*%*	*Valid %*	*Cumulative %*
Valid				
GB distended, adhesion-minimal	165	82.5	82.5	82.5
GB contracted, adhesion+	21	10.5	10.5	93
GB contracted, adhesion−	9	4.5	4.5	97.5
GB distended, adhesion+	5	2.5	2.5	100
Total	200	100.0	100.0	

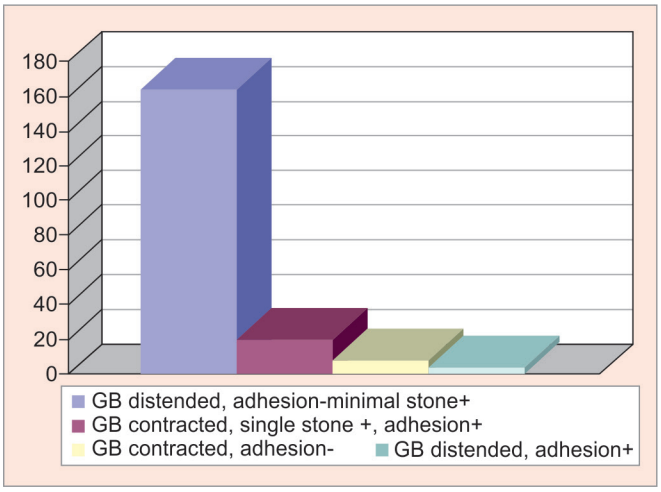

Fig. 1: Bar graph showing intraoperative findings of our study group ($N = 200$)

Table 2: Histopathology examination findings of our study group ($N = 200$)

Histopathological examination (HPE)	*Frequency*	*%*	*Valid %*	*Cumulative %*
Valid				
Chronic cholecystitis	195	97.5	97.5	97.5
Dysplasia bordering to adeno Ca *in situ*	1	0.5	0.5	98
Well-differentiated adeno CaGB (pT3NxMx)	1	0.5	0.5	98.5
Moderately differentiated adeno CaGB (pT3NxMx)	1	0.5	0.5	99
Poorly differentiated adeno CaGB (pT2NxMx)	1	0.5	0.5	99.5
Poorly differentiated adeno CaGB (pT3NxMx)	1	0.5	0.5	100
Total	200	100.0	100.0	

Other Demographic Profiles

- Among incidental CaGB patients, 40% were male and 60% were female; 29.74% of chronic cholecystitis patients were male and 70.1% were female (Table 6).
- Regarding incidental CaGB patients, 40% were doing desk job, 60% were housewives.
- Among chronic cholecystitis patients, 19.48% were doing desk job, 9.2% were retired persons, and 66.66% were housewives (Table 6).
- In total, 40% of incidental CaGB patients lived in rural area and 60% in urban area; 69.23% of chronic cholecystitis patients lived in rural area and 30.77% in urban area (Table 6).
- Table 7 shows statistical tests for demographic profiles in CaGB vs chronic cholecystitis patients.

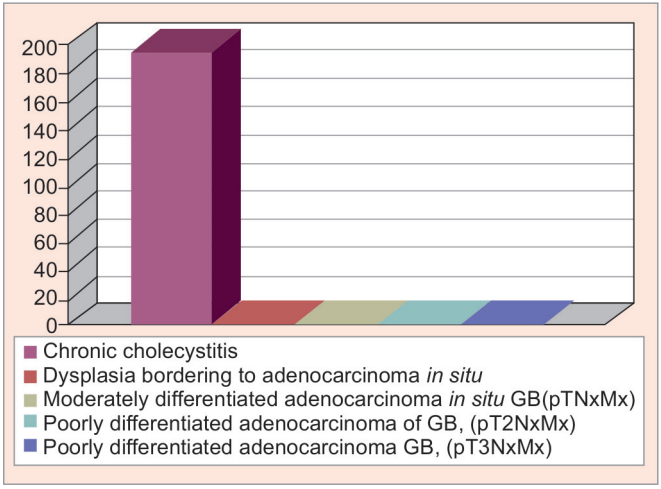

Fig. 2: Bar graph showing histopathology examination findings of our study group (*N* = 200)

Table 3: Frequency of CaGB patients in study group (*N* = 200)

	Frequency	*%*	*Valid %*	*Cumulative %*
Valid				
CaGB	5	2.5	2.5	2.5
Chronic cholecystitis	195	97.5	97.5	100.0
Total	200	100.0	100.0	

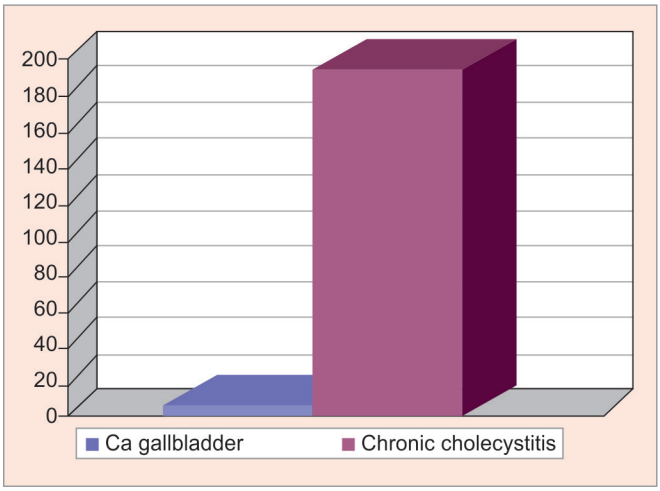

Fig. 3: Bar graph showing frequency of CaGB patients in study group (*N* = 200)

Table 4: Age comparison in CaGB vs chronic cholecystitis patients (*N* = 200)

		Cases					
		Valid		*Missing*		*Total*	
	Diagnosis	*N*	*%*	*N*	*%*	*N*	*%*
Age	CaGB	5	100.0	0	0.0	5	100.0
	Chronic cholecystitis	195	100.0	0	0.0	195	100.0

Table 5: Age distribution in CaGB vs chronic cholecystitis patients (*N* = 200)

Age	*CaGB (N = 5)*	*Chronic cholecystitis (N = 195)*
Minimum age	30	6
Maximum age	76	78
Median age	36	44

Table 6: Demographic profiles in CaGB vs chronic cholecystitis patients (*N* = 200)

	Incidental CaGB (n = 5)		*Chronic cholecystitis (n = 195)*		*Total (n = 200)*	
Case profile	*No.*	*%*	*No.*	*%*	*No.*	*%*
Sex: male	2	40	58	29.74	60	30
Sex: female	3	60	137	70.16	140	70
Occupation: desk job	2	40	38	19.48	40	20
Occupation: retired person	0	0	18	9.2	18	9
Occupation: housewife	3	60	130	69.23	133	66.5
Rural	2	40	135	69.23	137	68.5
Urban	3	60	60	30.77	63	31.5

Table 7: Statistical tests for demographic profiles in CaGB vs chronic cholecystitis patients

Parameter	*p value*	*Test*	*Comment*
Sex: male/female	0.63	#Fisher's Exact test	*Not significant
Occupation housewife—others	0.98	Do	Do
Rural/urban	0.37	Do	Do

#Fisher exact test used. *p <0.05 significant

Patient's History

After cross-tabulation, the following results were obtained. Table 8 shows symptom comparison in CaGB vs chronic cholecystitis patients as mentioned as follows:

- Among five CaGB patients, four (80%) had upper abdominal pain and one (20%) had no pain. Among 195 chronic cholecystitis patients, 149 (76.02%) patients had upper abdominal pain.
- Forty percent of incidental CaGB patients had nausea and 60% had no nausea.
- Among chronic cholecystitis patients, 38.46% had nausea.
- Among incidental CaGB patients, 20% had vomiting, 80% had no vomiting. Among chronic cholecystitis patients, 17.43% had vomiting.

Table 8: Symptoms comparison in CaGB vs chronic cholecystitis patients ($N = 200$)

	Incidental CaGB (n = 5)		*Chronic cholecystitis (n = 195)*		*Total (n = 200)*	
Chief complaints	*No.*	*%*	*No.*	*%*	*No.*	*%*
Upper abdominal pain	4	80	149	76.02	153	76.5
Nausea	2	40	75	38.46	79	39.5
Vomiting	1	20	34	17.43	36	18
Fever	1	20	6	3	8	4
Upper abdominal mass	0	0	0	0	0	0
Weight loss	0	0	8	4	8	4
Anorexia	2	40	17	8.7	19	9.5
Jaundice	1	20	4	2	5	2.5

Table 9: Statistical tests for symptoms in CaGB vs chronic cholecystitis patients

Parameter	*p value*	*Test*	*Comment*
Upper abdominal pain	0.72	Chi-square with Yate's correction	Not significant
Nausea	0.69	Do	Do
Vomiting	0.65	Do	Do
Fever	0.42	Do	Do
Anorexia	0.11	Do	Do
Jaundice	0.27	Do	Do

- Among incidental CaGB patients, 20% had fever. Among chronic cholecystitis patients, 3% had fever.
- Among incidental CaGB patients, 0% had mass, 100% had no mass. Among chronic cholecystitis patients, 0% had mass and 100% had no mass.
- Among incidental CaGB patients, 0% had weight loss, 100% had no weight loss, and 4% of chronic cholecystitis patients had weight loss, 96% had no weight loss.
- Forty percent of incidental CaGB patients had anorexia, 8.7% of chronic cholecystitis patients had anorexia.
- Among incidental CaGB patients, 20% had jaundice. Among chronic cholecystitis patients, 2% had jaundice and 98% were normal.
- Rest of the clinical features, investigations and intraoperative findings also resemble with chronic cholecystitis.
- It was also noted that among the incidental CaGB patients, four patients had laparoscopic cholecystectomy in which there are more chances of biliary spillage. Thus, possibility of the very early disease becoming a disseminated disease.
- Table 9 shows statistical tests for symptoms in CaGB vs chronic cholecystitis patients.

Follow-up

- One-hundred and ninety-five patients with histopathological examination (HPE) report symptoms of chronic cholecystitis were followed up for a period of 1 week postcholecystectomy.
- Two patients with poorly differentiated adeno CaGB (pT3NxMx) and poorly differentiated adeno CaGB (pT2NxMx) lost to follow up.
- Two patients with well-differentiated adeno CaGB (pT3NxMx) and moderately differentiated adeno CaGB (pT3NxMx) underwent radical cholecystectomy and followed up subsequently for 1 month in surgery outpatient department (OPD) and later in oncology OPD.

One patient with dysplasia bordering to adeno CaGB *in situ* was followed up after 1 month for 3 months and then 3 monthly. Subsequent radiological studies were normal.

Discussion

Inapparent (also called occult or incidental) GBC is defined as GBC unrecognized before or at operation and detected for the first time on HPE of the gallbladder, which has been removed for presumed gallstone disease.[3]

In our study, among the Incidental CaGB patients, minimum age was 6 years; maximum age was 78 years, and mean age was 43.46 years. This finding is in accordance with previous studies. Shukla et al.[1] reported mean age of the CaGB patients to be 50 years (range 40–60 years.), the mean age of 1,728 patients from 29 series, reported upon since 1960, was 65.2 years with incidence of CaGB of 0.1, 1.5, 8.9, 19.6, 37.0, and 32.0% in third, fourth, fifth, sixth, seventh, and eighth decades, respectively.[4]

Among 200 chronic cholecystitis patients, 30% are male and 70% are female. This could be because of the fact that cholecystitis is most common in female. Thus, in a hospital-based study, women patients form a majority.

Piehler and Crichlow[4] showed that "Carcinoma of the gallbladder is predominantly a disease of elderly females of 2,998 patients from 51 series reported over last 20 years, there were 2,292 females (75%) and 706 males (25%), a female to male ratio of 3.2:1.[4] In the study by IARC under SEARCH program, gallbladder cancer was found to be commonest among women (56%) with cancer of the ampulla of the Vater coming second with 30%".

According to our study, CaGB is common in female population because chronic cholecystitis is common in female population.

Among 200 patients, 66.5% patients were housewives, 20% were doing desk job. This could be explained by the Indian socioeconomic status and literacy rate.

Among 200 patients, 68.5% are from rural area and 31.5% are from urban area indicating geographical distribution of cases in population.

Shukla et al.[1] reported an incidence of 4.4% of all malignancies and 0.03% of total hospital admissions from Varanasi, India. Chao and Greager[19] reported an incidence of 2.5/100,000 population and found CaGB in 1–3% of cholecystectomy specimens. In our study, the incidence of incidental CaGB is 2.5%. Table 10 depicting comparison of incidence rate of incidental CaGB by various authors.

Clinical features of patients in this study were as follows.

Among 200 patients, 76.5% patients have upper abdominal pain. In this population, 39.5% had nausea, 18% patient had vomiting, fever was present in only 4% of patients, 0% patient had abdominal mass, 4% patients had weight loss, 9.5% had anorexia, and 2.5% patients had clinical jaundice. In comparison, data regarding the presentation of CaGB are presented in Table 11 depicting comparison of clinical symptoms of GBC by various authors.

Pain was present in 47–97% of patients. This is comparable to the data (76.5%) in our study. Similarly, anorexia, weight loss, nausea, and vomiting were comparable in this study, and jaundice is a feature of advanced CaGB. This shows that there are no clinical features that would be suggestive of CaGB in a patient who presents with symptoms of chronic cholecystitis (Table 11).

Table 10: Comparison of incidence rate of incidental CaGB by various authors

Studies	*Number of incidental CaGB*	*Total cholecystectomy*	*Incidence rate (%)*
Daphna[5] et al.	6	1697	0.3
Tantia[6] et al.	19	3205	0.6
Mittal[7] et al.	13	1305	0.9
Morera[8] et al.	4	372	1.1
Amanullah[9] et al.	8	428	1.9
Shigeki[10] et al.	4	84	4.7
Present study	5	200	2.5

Table 11: Comparison of clinical symptoms of GBC by various authors

Series	*Pain*	*Anorexia*	*Jaundice*	*Weight loss*	*Nausea/ vomiting*
Piehler and Crichlow	76%	34%	38%	39%	32%
Shieh et al.[11]	60.4%	43.7%	35.4%	33.3%	35.4%
Al-Hadeedi et al.[12]	47.3%	39.4%	36.4%	39.4%	10.5%
Shukla et al.	85%	40%	60.3%	14.9%	24.7%
Klamer and Max[13]	70%	—	40%	40%	30%
Silk et al.[14]	78.5%	35.6%	28.5%	45.7%	35.6%
Perpetuo et al.[15]	97%	—	44%	77%	64%
Kelly and Chamberlain[16]	74%	—	32%	48%	51%
Chao et al.[17]	81.1%	4.1%	32.4%	1.4%	16.2%
White et al.[18]	83%	—	47%	70%	—
Chao and Greager[19]	54.1%	18.9%	45%	28.4%	18.9%

No suggestive parameter of incidental CaGB could obtain from this comparison. Other parameters were also compared, but no result obtained. Only intraoperative findings are suggestive of CaGB in a few cases. These findings include adhesions, thickening, irregularity of GB wall, and disappearance of shiny appearance of gallbladder.

The following parameters of incidental CaGB were compared with chronic cholecystitis patients: Among incidental CaGB patients, mean age was 49.11 years, median age was 47 years, minimum age was 30 years, and maximum age was 76 years. Among incidental CaGB cases ($n = 5$), male patients were 40% and female patients were 60%. Among incidental CaGB patients, 40% were doing desk job, and 60% were housewives. Among incidental CaGB patients, 40% were living in urban area and 60% were living in rural area. Among incidental CaGB patients, 80% had pain abdomen and 20% had no pain. Among incidental CaGB patients, 40% had nausea and 20% had vomiting. Among incidental CaGB patients, 0% had weight loss. Among incidental CaGB patients, 100% had no jaundice. USG was normal (i.e.: only suggestive of chronic cholecystitis) in 100% of incidental CaGB cases.

No clinical, biochemical, or radiological parameters were found as preoperative predictor of CaGB in patients who underwent cholecystectomy for chronic cholecystitis.

There are no characteristic clinical features of EGBC. Unfortunately, it becomes clinically apparent only when it is locally advanced; the symptoms being due to invasion of neighboring organs. In two series, both from areas with a high incidence of GBC, where the index of suspicion was high, none of the EGBC was diagnosed clinically and almost half of these were first diagnosed on HPE of resected specimen, thereby highlighting the elusive nature of EGBC.[20,21]

All patients diagnosed with incidental CaGB were subsequently underwent staging work up with contrast enhanced CT abdomen and tumor markers. They were discussed among a team of surgical oncologist, GI surgeon, pathologist, radiologist, and radiation oncologist. They were managed as per consensus, which could be a second operation like completion cholecystectomy, or chemotherapy, chemoradiotherapy, palliative biliary drainage by ERCP, PTBD, or best supportive care at home.

It was also noted that among the incidental CaGB patients, four patients had laparoscopic cholecystectomy in which there are more chances of biliary spillage. Thus, possibility of the very early disease becoming a disseminated disease.

Conclusion

- In our study, the incidence of incidental CaGB was 2.5%.
- Unfortunately, no clinical, biochemical, or radiological parameters were suggestive or predictive of CaGB in patients who underwent cholecystectomy for gallstone disease.
- Further analysis revealed incidental CaGB was predominantly a disease of elderly female patients. The mean age was 45.4 years and 60% of incidental CaGB cases were female.
- In view of the findings from this study, it may be concluded that chronic cholecystitis remains a significant surgical entity in our population. However, the suspicion of incidental CaGB should be borne in mind.
- This is important as laparoscopic cholecystectomy is being increasingly used for the treatment of chronic cholecystitis. Also, if there is perioperative spillage of biliary contents, there is a possibility of the very early disease becoming a disseminated disease. The operating surgeon should have high index of suspicion regarding this not so uncommon and uniformly fatal GI malignancy.

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RESEARCH ARTICLE

COVID-19 and Surgical Preparedness

Mohit Sharma[1], Priyanka Devgun[2]

Abstract

Aim and objective: The rapid and large-scale spread of coronavirus disease-2019 (COVID-19) pandemic has become a major cause of concern for healthcare professionals. The purpose of this study was to determine the preparedness of surgical specialty personals in managing surgery during COVID-19 pandemic.

Materials and methods: The present study was conducted online from May 5, 2020, to June 5, 2020, through a predesigned and pretested questionnaire-based proforma on the preparedness of surgical practice related to COVID-19 infection circulated through Google Forms. The participants selected were serving in Punjab and holding allopathic degrees in any of the surgical specialties. Exclusion criteria were responses by nonsurgical specialists and incompletely filled proforma. A total of 412 responses were received, out of which 318 were valid responses in terms of completeness of proforma. The data so collected were compiled and statistically analyzed by SPSS v.21 (IBM).

Results: Three-hundred and eighteen received responses were analyzed. Mean age was 42.3 ± 10 years. Male-to-female ratio was 2.38:1. Majority of the respondents were from general surgery specialty 130 (40.8%). Two-hundred and thirty-eight respondents were from private sector and 80 from public sector. One-hundred and sixty-six (52.2%) respondents reported existence of standard protocols and triage for COVID-19 at their workplace. Two-hundred and fourteen (67.2%) respondents stated that they usually get patients tested for COVID-19 before elective surgery. Two-hundred and seventeen (68.2%) of the respondents reported checking out the correct sequence of donning and doffing the personal protective equipment (PPE). Of the 170 respondents who had consumed hydrochloroquine as recommended by the Indian Council of Medical Research (ICMR), 114 (67%) were private practitioners and 56 (32.9%) were public healthcare sector professionals.

Conclusion: Surgical community need guidelines on how to deliver surgical services safely and successfully during COVID-19 pandemic.

Keywords: COVID-19 pandemic, COVID-19 and Punjab, Healthcare professionals, Surgical workforce.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1466

Introduction

The world has been reeling under the effects of coronavirus disease-2019 (COVID-19) since the beginning of the year 2020—a year which was to be a landmark year for achievement of multiple targets of the sustainable development goals. The COVID-19 pandemic has also shown us that the world is truly one, both in terms of the havoc it has caused and in the solidarity the world has shown in combating the pandemic. It has demonstrated that the very basic principles of primary healthcare are the only principles through which the end of the pandemic can be sought. It has underlined the fact that no one is safe until everyone is safe.

Most of the world, including India, has been under repeated episodes of partial or complete lockdown to contain the spread of the pandemic while buying time to shore up their healthcare resources and healthcare infrastructure. While every effort was made during lockdowns to protect the smooth delivery of essential services like health services, huge lapses were identified. This paper is an attempt to quantify the gaps in the delivery of surgical interventions and procedures during the lockdown period.

India is a federation of 28 states and 8 union territories. Punjab is one of the states of India with a population of almost 2.7 crores as per the Census of India 2011. There is one doctor for every 789 Punjabis, the ratio being one of the healthiest doctor–patient ratios in the country.[1] There are 20 districts in Punjab where both the public sector and the private sector play a pivotal role in the delivery of healthcare services. There are 2076 medical institutions in the state out of which 636 have broad specialities.[2] There are 51685 registered medical practitioners with Punjab state medical council as on June 30, 2020.[3] No parallel figures were available for the private sector.

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How to cite this article: Sharma M, Devgun P. COVID-19 and Surgical Preparedness. World J Lap Surg 2021;14(3):186–190.

Source of support: Nil

Conflict of interest: None

Materials and Methods

The present study was conducted online from May 5, 2020, to June 5, 2020, through a predesigned and pretested proforma circulated through Google Forms. The participants selected were serving in Punjab and were functional professionally in either public or private healthcare sectors and holding allopathic degrees in any of the surgical specialties. The purpose of the study was explained to the participants, their consent was taken, and the confidentiality of the information was assured. Institutional ethical clearance was taken for the study. Exclusion criteria were responses by nonsurgical specialists and incompletely filled proforma. A total of

412 responses were received, out of which 318 were valid responses in terms of completeness of proforma. The data so collected were compiled and statistically analyzed by SPSS v.21 (IBM).

Results

Three-hundred and eighteen responses received were analyzed. Mean age of the responding surgical specialist was 42.3 ± 10 years. Male-to-female ratio of the respondent was 2.38:1 (male = 224, female = 94). Most of the respondents, i.e., 168 (52.8%), were aged between 40 and 59 years (Table 1). Majority of the respondents, i.e., 130 (40.8%), were from general surgical specialty (Table 2) followed by ophthalmology 42 (13.2%), obstetrics and gynecology 37 (11.6%), orthopedics 35 (11.0%), and otolaryngology 32 (10.0%). One-hundred and twenty-two out of 224 male respondents were general surgeons and 37 out of 94 female respondents were practicing in obstetrics and gynecology.

The respondents were further categorized into two sectors—private (n = 238) and public health (n = 80)—to assess the level of preparedness for performing surgical procedures and interventions in the COVID-19 pandemic (Table 3). As far as the health institutional infrastructure and policies were concerned, 166 (52.2%) respondents reported the existence of standard protocol and triage for COVID-19 at their workplace. On comparing this between public and private sectors, the probability of following these standard protocols and triage for COVID-19 in practice was 1.68 times higher among private practitioners—132 (79.5%) cases, than among those in public healthcare personel—34 (20.4%) cases. The difference was statistically significant (p = 0.02).

One-hundred and forty-three (44.9%) respondents reported the presence of dedicated COVID-19 recovery wards. This response number was significantly higher in private healthcare providers, i.e., 118 (82.5%), than in public healthcare providers, i.e., 25 (17.4%), p = 0.006.

Just 34 (10.6%) of the respondents admitted to having a negative-pressure operation theater and 15 (4.7%) of the respondents claimed to have separate staff for operating COVID-19 suspected or confirmed cases. However, no statistically significant difference was found between public and private care in relation to the availability of negative-pressure operation theater (p = 0.2) and dedicated separate auxiliary staff for COVID-19 surgeries (p = 0.07).

Two-hundred and fourteen (67.2%) respondents stated that they usually get patients tested for COVID-19 before elective surgery (Table 4). This response was largely from the private healthcare providers, i.e., 192 (89.7%), as compared to public healthcare providers, i.e., 22 (10.2%). The likelihood of presurgery testing for COVID-19 was 11.04 times higher in private healthcare responders, and the difference was found to be highly statistically significant (p = 0.00). Twenty-six (83.8%) participants from private sectors affirmed that they perform elective surgeries with basic minimum surgical team compared with five (16.1%) participants from public sectors, and the difference was statistically not significant (p = 0.11).

Two-hundred and seventeen (68.2%) respondents reported checking out the correct sequence of donning and doffing the personal protective equipment (PPE). One-hundred and sixty-three (75.1%) private hospital respondents and 54 (24.8%) public hospital respondents were following the correct procedure and sequence for donning and doffing PPE. The difference was found to be statistically nonsignificant (p = 0.43). About 62.2% complained about impaired visual acuity due to repeated fogging while wearing PPE during surgery.

Of the 43 respondents who stated that they had cut down on aerosol-generating procedures, 32 (74.4%) were in private sector and 11 (25.5%) in public sector. No statistically significant difference was found in these two groups in terms of deliberate lessening of aerosol-generating procedures (p = 0.46). Fifteen (63.5%) participants from private sector have deferred surgery

Table 1: Distribution of the respondents according to the age and sex

Age (years)	*Males*	*Females*	*Total*
20–39	21 (61.7%)	13 (38.2%)	34 (10.6%)
40–59	116 (69.0%)	52 (30.9%)	168 (52.8%)
60–79	87 (75.0%)	29 (25.0%)	116 (36.4%)
Total	224 (70.4%)	94 (29.5%)	318 (100%)

Table 2: Study subjects according to their surgical specialty and sex

Surgical specialty	*Males*	*Females*	*Total*
Surgery	122 (93.8%)	8 (6.1%)	130 (40.8%)
Orthopedics	34 (97.1%)	1 (2.8%)	35 (11.0%)
Ophthalmology	27 (64.2%)	15 (35.7%)	42 (13.2%)
Otolaryngology	18 (56.2%)	14 (43.7%)	32 (10.0%)
Obstetrics and gynecology	0	37 (100%)	37 (11.6%)
Dentistry	04 (50.0%)	04 (50.0%	08 (2.5%)
Others (anesthesia)	19 (55.8%)	15 (44.1%)	34 (10.6%)
	224 (70.4%)	94 (29.5%)	318 (100%)

Table 3: Distribution of the respondents according to infrastructure and SOP preparedness for surgical interventions during COVID-19

Infrastructure and SOPs preparedness for COVID-19	*Private sector respondent (n = 238)*	*Public sector respondents (n = 80)*	*OR (CI)*	*p value*
Standard protocol and triage for COVID-19 at workplace (n = 166), i.e., 52.2%	132 (79.5%)	34 (20.4%)	1.68 (1.01–2.81)	0.02
Dedicated COVID-19 recovery and wards (n = 143), i.e., 44.9%	118 (82.5%)	25 (17.4%)	2.16 (1.27–3.70)	0.006
Negative-pressure operation theaters and anterooms (n = 34), i.e., 10.6%	29 (85.2%)	5 (14.7%)	2.08 (0.77–5.57)	0.2
Separate paramedical and axillary staff for operating COVID-19 patients (n =15), i.e., 4.7%	14 (93.3%)	1 (6.7%)	4.9 (0.6–38.2)	0.07
Have verified the correct procedure and sequence for donning and doffing PPE (n = 217), i.e., 68.2%	163 (75.1%)	54 (24.8%)	1.04 (0.60–1.79)	0.43
Impaired vision due to fogging N = (198) 62.2%	147 (%)	51 (%)	0.91 (0.54–1.55)	0.42

Table 4: Practices for COVID-19 protection

	Private sector respondents (n = 238)	*Public sector respondents (n = 80)*	*OR (CI)*	*p value*
Patients tested for COVID-19 before elective surgery (*n* = 214), i.e., 67.2%	192 (89.7%)	22 (10.2%)	11.04 (6.11–19.76)	0.000
Taken/intend to take hydrochloroquine recommended by ICMR (*n* = 170), i.e., 53.4%	114 (67.0%)	56 (32.9%)	0.39 (0.22–0.67)	0.0007
Taking immunity boosters (*n* = 213), i.e., 66.9%	165 (77.4%)	48 (22.5%)	1.50 (0.81–2.58)	0.06
Operating with basic minimum surgical team (*n* = 31), i.e., 9.7%	26 (83.8%)	5 (16.1%)	1.83 (0.68–4.96)	0.11
Cut down on aerosol-generating procedures (*n* = 43), i.e., 13.5%	32 (74.4%)	11 (255%)	0.97 (0.46–2.03)	0.46
Prefer open surgery to laparoscopic surgery (*n* = 62), i.e., 19.4%	36 (58.0%)	26 (42.0%)	0.37 (0.20–0.66)	0.0006
Usually defer elective surgery due to COVID-19 scare (*n* = 24), i.e., 5.9%	15 (62.5%)	09 (37.5%)	0.5 (0.22–1.26)	0.08

compared to nine (37.5%) from public sector due to COVID-19 scare (p >0.05). Thirty-one participants (9.7%) were operating with minimum surgical team, 26 (83.8%) public sector, and 5 (16.1%) private sector ($p = 0.11$).

A total of 62 respondents implied that they would prefer open surgery to laparoscopic surgery of which 36 (58%) were in private sector and 26 (42%) in public sector. Surgical practitioners in private sector were less likely to prefer open surgery to laparoscopic surgeries OR = 0.37 (0.20–0.66), and the difference was found to be highly statistically significant (p <0.001).

Of the 170 respondents who had consumed hydrochloroquine as recommended by the Indian Council of Medical Research (ICMR), 114 (67%) were private practitioners and 56 (32.9%) were public healthcare sector professionals. The odds of the health providers in public sector consuming hydrochloroquine were 0.39 times lesser than those in private sector, and the difference in consumption of hydrochloroquine was highly significant among the two groups (p <0.001). However, no statistically significant differences were found in the two groups as far as the consumption of immunity boosters was concerned ($p = 0.06$).

Discussion

The COVID-19 infection caused by severe acute respiratory syndrome coronavirus-2 (SARS-COV-2) after its origin in China in December 2019 has overwhelmed the healthcare systems across the world.[4] A major challenge for the surgical society is to maintain the provision of essential services while at the same time preserving the precious resources and preventing exposure to healthcare personal.[5] The Indian Government declared complete lockdown on March 24 with further extension till May 4 on April 14.[6] Initially all the elective surgery work both in private and public sector was suspended completely. This impact of COVID-19 on surgeons' daily practice and education was profound. This study is an online survey with the aim to know the status of preparedness of surgical community in conducting routine work in the ongoing pandemic. Response of 318 participants (238 private sector and 80 public sector) were analyzed.

In our study, mean age of the respondents was 42.3 ± 10 years, with 40.8% of respondents from general surgery specialty. As expected large number of participants were male with a male-to-female ratio of 2.38:1. Our study has shown that only 52.2% of participants in their surgical setup affirmed to have standard protocols and triage for COVID-19 patients, further private sector is 1.68 times more likely to have protocol surgical management of COVID-19 cases compared to public sector ($p = 0.02$). Similarly, 44.9% of the respondents reported the presence of dedicated COVID-19 postsurgery recovery wards. This facility was more with private sector participants—118 (82.5%), as compared to public healthcare providers—25 (17.4%), $p = 0.006$.

In view of aerosol transmission of COVID-19, a dedicated operation theater with negative pressure is required.[7] In our study, we found that just 34 (10.6%) of the respondents admitted to having a negative-pressure operation theater, and there was no statistically significant difference between public and private care in relation to availability of negative-pressure operation theater ($p = 0.2$). Considering the logistics and cost involved in redesigning operation theater complexes with negative-pressure facility, it seems to be a near impossible recommendation to implement. The UK and Ireland surgeon colleges have recommended to stop positive-pressure ventilation during the procedure and 20 minutes after the patient has left the operation theater.[8] The risk of surgical smoke has been recognized since a long time, advent of COVID-19 has brought into sharp focus again.[9] Apart from operating room setup, theater personnel and surgical equipment are other means to manage harmful effect of smoke. Mowbray et al.[10] have discussed various filters, extractors, and nonfilter devices to manage surgical smoke. In our analysis, 43 respondents stated to have cut down on aerosol-generating procedures of these majority 32 (74.4%) were in private sector as compared to 11 (25.5%) in public sector. No statistically significant difference was found in these two groups ($p = 0.46$). Various surgical associations have recommended a minimum number of operating room staff while performing surgeries.[11,12] In our study, 9.7% of the respondents confirmed to be following operation with minimum staff members ($n = 31$). Larger number was from private sector—26 (83.8%), in comparison with private sector—5 (16.1%). However, the difference was statistically insignificant ($p = 0.11$).

The risk of airborne transmission of virus is a possibility in both open and laparoscopic surgeries because both have propensity to generate aerosols. Li et al. suggested that risk in open surgery is less as artificial pneumoperitoneum is not created.[13] The UK and intercollegiate board[14] has stated that "laparoscopy is considered to carry some risks of aerosol-type formation and infection and

considerable caution is advised." However, the level of risk is unknown. Thirty-six (58%) of the respondents in the private sector and 26 (42%) in the public sector implied that they would prefer open surgery to laparoscopic surgery. Surgical practitioners in private sector were less likely to prefer open surgery to laparoscopic surgeries OR = 0.37 (0.20–0.66), and the difference was found to be highly statistically significant (p <0.001).

Fifteen (63.5%) participants from private sector have deferred surgery compared to nine (37.5%) from public sector due to COVID-19 scare (p >0.05).

As stated, early initial response was to halt elective procedure in the interest to preserve resources and aid in preventing further spread of disease. In our study, 62.5% of private practitioner compared to 37.5% of public sector surgeons deferred elective surgery with the statistical significant difference between two groups ($p = 0.08$).

In vitro studies have shown chloroquine to be effective against severe acute respiratory syndrome-associated coronavirus (SARS-COV).[15] Chloroquine was suggested as drug for treating SARS during epidemic.[16] However, due to lack of double-blind randomized control study, the true efficacy of chloroquine in treating coronavirus was never established. Chloroquine and its related drugs were tentatively included among drugs for use in containing the burden of COVID-19.[17] Hydroxychloroquine 400 mg twice a day on day 1and then 400 mg once a week thereafter have been recommended for asymptomatic healthcare workers taking care of suspected or confirmed COVID-19 patients as per the guidelines of ICMR.[18] In our study, 170 respondents had consumed hydrochloroquine as recommended by ICMR—114 (67%) were private practitioners and 56 (32.9%) were public healthcare sector professionals. The odds of the health providers in public sector consuming hydrochloroquine were 0.39 times lesser than those in private sector, and the difference in consumption of hydrochloroquine was highly significant among the two groups (p <0.001). However, no statistically significant differences were found in the two groups as far as consumption of immunity boosters was concerned ($p = 0.06$).

Various guidelines have recommended to get reverse transcription–polymerase chain reaction (RT-PCR) for COVID-19 done before elective surgery. However, it may not be feasible in every situation due to the lack of enough resources for testing. As found in our survey, only 67.2% got it tested before surgery. Our study has shown that more private sector surgeons got it tested—192 (89.7%) compared to public sector surgeons—22 (10.2%). The difference was statistically significant ($p = 0.00$).

Surgeons who remain in close contact with patients' body fluids while performing surgical procedures are therefore at increased risk of exposure and contracting COVID -19 infection.[19,20] The PPE is required with proper donning and doffing for adequate protection. Adequate use of PPE depends not only upon the availability but also on comfort and training.[21,22] The use of PPE during surgery raised concerns about its impact on surgery performance, overall comfort, and surgeon fatigue. In our study, 62.2% of surgeons reported impaired vision and difficulty in performing surgery. Carlos et al. in their study reported that 54% of the surgeons felt hampering of surgery performance with PPE.[23] Proper technique and sequencing should be adhered while donning and doffing PPE to prevent getting infected with COVID-19. Two-hundred and seventeen (68.2%) of the respondents reported checking out the correct sequence of donning and doffing the PPE. Our survey has showed that 217 (68.2%) were aware of the correct sequence of donning and doffing the PPE. One-hundred and sixty-three (75.1%) of private hospital respondents and 54 (24.8%) of the public hospital respondents were following the correct procedure and sequence for donning and doffing the PPE. The difference was found to be statistically nonsignificant ($p = 0.43$). In a questionnaire-based survey among the medical students and healthcare professionals in Urban Mumbai, Modi et al.[24] found adequate awareness in 71.2% of the individuals. We recommend the help of various online resources available for adequate guidance.[25,26] Occupational health and safety are of paramount importance to minimize the risk of transmission to surgical professionals and to provide optimum care to patients.

One of the limitations of this study was that the nonresponse rate could not be calculated. However, since our survey is anonymous, we believe that the participants were truly honest in responding.

Conclusion

The COVID-19 pandemic has profoundly impacted the surgeons' daily practice. Surgical services vary widely depending upon local and regional variation and health system configuration. There is a need to implement periodic educational interventions and training programs on surgical practice in reference to COVID-19 pandemic.

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RESEARCH ARTICLE

Adopting "Culture of Safety for Laparoscopic Cholecystectomy" in a Rural Hospital: A Prospective Observational Study

Mohd Riyaz Lattoo[1], Prince Ajaz Ahmad[2], Sadaf Ali Bangri[3]

Abstract

Background: The most feared complication of laparoscopic cholecystectomy is injury to bile duct. Different strategies have been proposed to avoid this serious complication. Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) "Culture of Safe Cholecystectomy" is one such strategy.

Aim: This study was done to evaluate and validate SAGES "Culture of Safe Cholecystectomy" components modified and tailored to the setting of a rural hospital with emphasis on a bystander surgeon.

Materials and methods: This was a prospective study of 382 patients with gallstone disease who underwent surgery at District Hospital, Anantnag, a rural hospital from September 2016 to September 2018.

Results: Mean age of patients was 43 years. Two-hundred and ninety-eight (78%) patients were females, and 84 (22%) were male with male female ratio of 1:3.54. Most common indication was chronic cholecystitis in 213 patients (55.7%). Bystander surgeon was present in all cases. Critical view of safety (CVS) was achieved in 256 patients (67%). Rouviere's sulcus was present in 242 patients (63.3%). Bailout option was adopted in 19 patients (4.97%). Conversation to open cholecystectomy was done in 11 of the 382 patients (2.87%). Most common indication for conversion was inability to achieve CVS. Mean duration of surgery was 45 minutes. None of the patients in our study had bile duct injury.

Conclusion: SAGES culture of safe cholecystectomy can be modified to make it applicable to rural hospitals in developing countries where more reliance can be put on a detached bystander surgeon who is likely available in the vicinity.

Keywords: Bile duct injury, Calot's triangle, Common bile duct, Cholangiography, Cholelithiasis, Laparoscopic cholecystectomy.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1470

Introduction

In modern surgical practice, laparoscopic cholecystectomy (LC) is the most frequent surgical procedure performed on digestive tract worldwide.[1] It is considered to be the procedure of choice for the treatment of symptomatic gallstone disease.[2] Iatrogenic bile duct injury (BDI) is the most concerning complication after LC. The incidence of this complication is variable but usually approaches 0.5%.[3,4] BDI continues to happen, and despite advances in technology, there has been no decline in rate of injury.[5] About 97% of iatrogenic biliary ductal injury are attributed to visual misinterpretation of biliary anatomy during the procedure.[6] Many strategies have been proposed to avoid this serious complication. Society of American Gastrointestinal and Endoscopic Surgeons' (SAGES) culture of safe cholecystectomy is a strategy directed to decrease this complication. It consists of six components.[7] This study was done to evaluate and validate these components, modified and tailored to the setting of a rural hospital with emphasis on a bystander surgeon.

Materials and Methods

This was a prospective study conducted at District Hospital Anantnag, a rural health care center located in the Indian valley of Kashmir, from September 2016 to September 2018. Three-hundred and eighty-two patients admitted for LC were enrolled. Clinical history, physical examination, blood counts, biochemistry, and abdominal ultrasound were routine in all patients. Preanesthetic check-up was done in all. The operations were done in elective setting under general anesthesia with four-port technique. We excluded patients with body mass index >30 (as our rural hospital was not equipped with facilities to operate on obese patients) and patients with acute cholecystitis who presented beyond 72 hours of symptom development from our study. We adopted components of safe cholecystectomy tailored to our settings of a rural hospital with emphasis on bystander surgeon as detailed below.

- Operating surgeon dissected Calot's triangle and ensured that critical view of safety (CVS) was achieved.
- Starting dissection from a fixed extra biliary point, i.e., Rouviere's sulcus.
- Intraoperative time-out before transecting cystic duct and artery.

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How to cite this article: Lattoo MR, Ahmad PA, Bangri SA. Adopting "Culture of Safety for Laparoscopic Cholecystectomy" in a Rural Hospital: A Prospective Observational Study. World J Lap Surg 2021;14(3):191–194.

Source of support: Nil

Conflict of interest: None

- Availability of a detached observer in all cases. The bystander surgeon would stand by monitor to watch and observe the procedure with a keen intent and would alert the operating surgeon if any wrong space of dissection was entered or incorrect duct was being dissected. To ascertain this, the bystander surgeon would always ensure that the operating surgeon is ventral to Rouviere's sulcus when present and has achieved CVS before clipping and dividing any structure. Minute-to-minute feedback was provided by the detached observer in difficult situations, so that the surgeon can accept the need for plan modification if by a given hypothesis placement of cognitive map is a misfit.
- Adopting bailout options as merited by the situation early in course of procedure.

For logistic reasons, intraoperative cholangiography (IOC) was not done in our hospital. All patients were advised to attend outpatient clinics at regular intervals of 1 week, 1 month, and 6 months. Telephonic communication was kept for any patient who defaulted to visit outpatient clinics.

Results

Mean age of patients was 43 years (range 16–82 years). Two-hundred and ninety-eight (78%) patients were females, and 84 (22%) were male, with a male female ratio of 1:3.54. Indication of surgery is detailed in Table 1. Most common indication was chronic cholecystitis in 213 patients (55.7%). Adaptation of components of safe cholecystectomy is detailed in Table 2. CVS was achieved in 256 patients (67%). Rouviere's sulcus was present in 242 patients (63.3%). Intraoperative time-out was done in all patients. Bystander surgeon (independent second observer) was present in all cases. Bailout option as shown in Table 3 was adopted in 19 patients (4.97%). Conversation to open cholecystectomy was done in 11 of the 382 patients (2.87%). Subtotal cholecystectomy was done in 7 of the 382 (1.83%) patients. In two patients, it was possible to do a laparoscopic subtotal cholecystectomy. Tube cholecystostomy was done in one patient (1.3%). Reason for adopting bailout options are discussed in Table 4. Most common indication was inability to achieve CVS. Mean duration of surgery was 48 minutes. Mean duration of hospital stay was 24 hours in laparoscopic group and 72 hours in open cholecystectomy subset of patients. No patient was lost to follow up. In our study, there was no instance of BDI. We report a low conversion rate of 2.5% and is probably because of exclusion criteria adopted by us (Table 4).

Table 1: Indications of cholecystectomy

Indications	*No.*	*Percentage*
Chronic cholecystitis	213	55.7%
Acute cholecystitis	81	18.84%
Biliary colic	72	21.20%
Asymptomatic gallstone disease	13	3.4%
Biliary pancreatitis	7	1.83%
Gb polyp	4	1.047%
Empyema	3	0.78%

Table 2: SAGES safe cholecystectomy components (tailored to rural setting)

Components	*Numbers*	*Percentage*
(a) Use of CVS	256	67.01%
(b) Starting dissection from fixed point	242	63.35%
(c) Use of intraoperative timeout	382	100%
(d) Availability of a bystander surgeon	382	100%

Table 3: Bailout options adopted

Options	*Numbers*	*Percentage*
(i) Open cholecystectomy	11	2.87%
(ii) Subtotal cholecystectomy	7	1.83%
(a) Open	5	1.30%
(b) Lap	2	0.52%
(iii) Tube cholecystectomy	1	0.26%

Table 4: Indications for bailout

1. Inability to achieve CVS	7/19	36.84%
(a) Tissue inflammation	6/19	31.57%
(b) Fibrosis of Calot triangle	5/19	26.3%
(c) Severe adhesion	4/19	21.05%
(d) Unclear anatomy	3/19	15.79%
2. Inability to procced at expected pace	2/19	10.52%
3. Technical difficulties in handling GB	2/19	10.52%
4. Contracted/shrilled GB	2/19	10.52%
5. Bleed in surgical field (from GB bed)	1/19	10.52%
6. Cirrhotic liver with varices in hepatocystic triangle	1/19	5.26%
7. Hidden GB	1/19	5.26%
8. Mirzzi syndrome	1/19	5.26%
9. Hemodynamic instability secondary to pneumoperitoneum	1/19	5.26%
10. Suspected GB malignancy	1/19	5.26%

Discussion

Gallstone disease is a common disease affecting general adult population.[8,9] LC has evolved as the standard of care treatment for management of this disease due to its various advantages.[10–12] Although it is invariably accepted as a safe procedure, complications still happen in approximately 5% of patient.[13] Of these, BDI remains the most feared and dreadful complication of LC that at times can be life-threatening. The etiology is multifactorial, but misidentification of anatomy is perhaps the most important factor responsible for BDI mishap.[14] Way et al. concluded that primary cause of BDI was a visual perceptual illusion in which the surgeon misidentifies common bile duct (CBD) as cystic duct. Erroneous technical skills were identified as the primary mechanism of injury in only 3% of cases.[6] To minimize the risk of BDI, SAGES, in 2014, formed the Safe Cholecystectomy Task Force, with the aim of propagating a culture of safety around LC.[7] Following six steps were described to create a culture of safe cholecystectomy and minimize the risk of BDI: (a) identification of the cystic duct and artery by using CVS, (b) awareness of the potential for aberrant anatomy, (c) identification of anatomy using IOC or any other relevant method, (d) intraoperative time-out or pause during surgery before clipping and dividing the structures in Calot's triangle for verification of anatomy, (e) early adaptation of the bailout options, (f) call for help from another surgeon whenever required.

The CVS has been adapted for clear identification of structures in Calot's triangle to reduce the risk of BDI.[15] The requirements are as follows: The hepatocystic triangle must be cleared of all the fatty and fibrous tissue. Second, the lowest one-third of the gallbladder must be separated from the liver bed. The third requirement is to ensure that only two structures are seen to be entering the gallbladder. Once these three criteria have been fulfilled, CVS is said to be attained. Most surgeons around the world acknowledge the importance of CVS during LC for prevention of biliary injury.[16,17] There has been indirect evidence from literature to suggest that the use of the CVS is helpful in preventing BDI. None of the patients in the study conducted by Yegiyants and Collins had an injury to biliary ducts because of visual misidentification when CVS was achieved.[16] CVS was achieved in 998 of the 1,046 patients in the study conducted by Avgerinas et al. who reported a conversion rate of 2.7%. Five patients had minor bile leak that resolved spontaneously. They didn't report any major BDI.[18] Heistermann et al. evaluated 100 patients who had LC in whom CVS was achieved. Only one patient in their study had postoperative cystic duct stump leak.[19]

Variations in biliary anatomy are common.[14] Variable biliary anatomy can predispose to BDI. Awareness to variation in biliary anatomy can be enhanced by starting from a fixed point a concept borrowed by Huge from maritime and aviation industries.[20] Rouviere's sulcus is one such extra biliary fixed point.[20] The right portal pedicle runs in this fissure and thus demarcates the plane of the porta hepatis. The dissection during the procedure should always stay anterior to this sulcus. Minimal incidence of BDI has been reported in a large series of LC by Huge et al.[21] and Singh and Ohri[22] when dissection is done ventral to this sulcus.

As per SAGES recommendations, it is advised to keep IOC available as an integral tool while performing LC. Selective use, however, has been practiced more commonly.[23] Utility of IOC is, however, controversial as many authors report it to be time-consuming and complex procedure. It is also considered to be inefficient with few authors suggest that many surgeons may not be able to read it correctly.[24,25] As per the current literature, there is no level evidence to suggest the use of IOC.[26] An alternative is laparoscopic ultrasonography, but it is subject to significant interoperator variability.[27,28] Another method to identify and continuously map the biliary anatomy is near-infrared fluorescent cholangiography, which is technically easy but the data as of now are insufficient to suggest its role in minimizing biliary injury.[14] Due to the lack of expertise or for logistic reasons, these methods of mapping biliary anatomy are not available in most rural hospitals in India.

Intraoperative time-out should be considered by operating surgeon always in the process of dissection of Calot's triangle. This step helps to confirm that the CVS has been achieved. The proposed disadvantage of this step is that this step is adopted by the operating surgeon who may still suffer from the heuristic error.[29] As already discussed, injuries stem principally from misidentification secondary to visual misperception rather than error of skill, knowledge, or judgement.[6] This visual misperception is a result of misplaced cognitive map,[30] and sometimes this illusion is so compelling as to end into an error. A detached observer can be helpful in this situation.[31] The detached observer present should agree with the surgeon that CVS has been achieved. Hori et al. have also advised to take the opinion of an independent detached surgeon while demonstrating CVS as he is unbiased and free from the any heuristic impression of the primary surgeon.[32] Surgical colleague can act as an unbiased observer free from heuristic impression of operating surgeon. He or she can ascertain whether the CVS is achieved or not, whether it is safe to continue dissection in the assumed plane, and when to apply stopping rules. Kapoor also suggests that the primary surgeon should always call another surgical colleague for opinion and assessment of the biliary ductal anatomy, if in doubt, before the structures of Calot's triangle are divided.[29] The new and unbiased input of the detached observer can avoid the visual perception error of the primary surgeon. He calls this "in vicinity colleaguography."

Bystander surgeon for the reason that he is detached is more likely to seek information from surgical field and more likely to recognize misplacement of cognitive map by the operating surgeon that can result in spatial disorientation.[31] He is more alert for cues from surgical environment if demanded by the situation. He can refute the working hypothesis which the operator has entertained. Significance of unexpected observation may go unrecognized by the operating surgeon due to conformation bias.[6] Since detached observer is not committed to a judgment and is free from confirmation bias, he may be able to attach significance to some unexpected observation.[31] As mentioned by Way et al. in their seminal paper, "human performance cannot be pushed to perfection and that most fruitful correction strategy often lies outside the individual."[6] Bystander surgeon can be considered as one such outside correction strategy.[31]

Alternative or bailout options should be considered in those cases where achievement of CVS remains elusive due to dense adhesions, uncertain anatomy, or severe inflammation.[14] Conversion to open cholecystectomy is the most practical option in this situation. The decision to convert to open should take into consideration the experience of surgeon since difficult LC usually suggests a difficult open cholecystectomy with chances of biliary injuries remaining higher.[14] Subtotal cholecystectomy may also be considered in select situations. It can be done by laparoscopic or open method. Surgical cholecystostomy tube drainage is a safe alternative in difficult situations. In case of inexperience, the best possible method to prevent BDI may be to abort the procedure and referral to the higher center.

Conclusion

SAGES culture of safe cholecystectomy can be modified to make it applicable to rural hospitals in developing countries, where due to logistic and other reasons, IOC is not available. More reliance can be put on a detached bystander surgeon who is likely available in the vicinity.

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RESEARCH ARTICLE

Laparoscopic Totally Extraperitoneal Repair Using Three-dimension Mesh to Treat Bilateral Inguinal Hernia in Adults

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Abstract

Aim: This study is aimed to examine the effectiveness of laparoscopic totally extraperitoneal (TEP) repair using three-dimension (3D) mesh to treat bilateral inguinal hernia in adults.

Materials and methods: We conducted case series on 50 patients with bilateral inguinal hernias undergoing laparoscopic TEP surgery using 3D mesh at Thanh Nhan Hospital from January 2017 to June 2019.

Results: Of 50 patients, 66.0% of patients had a direct inguinal hernia and 34.0% of patients had an indirect inguinal hernia. The diameter of the herniated hole was mainly from 1.5 to 3 cm in 84.0% of patients. There were 82% of patients using small 3D mesh (8.5 × 13.7 cm) and one case required mesh fixation (2.0%). Seven patients (14.0%) had complications during surgery. The average postoperative pain time was 2.2 ± 1.5 days (1–15 days). Pain degree decreased gradually from day 1 to day 3. By day 3 after surgery, 94% of patients had only slight pain, two patients (4.0%) had mild pain, and one patient (2.0%) had moderate pain. All patients were followed for a mean of 21.4 ± 11.8 months (minimum 1 month, maximum 40 months). At 1 month postoperative, there was one patient with chronic pain in the groin (2.1%). After 6, 12, and 24 months, no recurrence was recorded.

Conclusion: TEP laparoscopic surgery using 3D mesh is a safe, feasible, and effective method in bilateral inguinal hernia in adults, with low rates of complications and recurrence.

Keywords: Bilateral inguinal hernia, Laparoscopic totally extraperitoneal, Three-dimension mesh.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1471

Introduction

An inguinal hernia is a phenomenon where organs or tissues in the abdomen protrude through the groin or a weak spot of the abdominal muscles, on the inguinal ligament under the skin or down the scrotum. This is a common medical condition occurring in 1–5% of the general population, of which 15–20% are bilateral inguinal hernias.[1,2] Annually, in the United States, more than 800,000 inguinal herniation surgeries are performed, and about 15% of which are bilateral inguinal hernias.[2]

Laparoscopic surgery for inguinal hernia was first reported by Ger.[3] Since then, inguinal hernia treatment has undergone revolutionary technical advances. Among the surgical methods of laparoscopic inguinal hernia, laparoscopic totally extraperitoneal (TEP) and the transabdominal preperitoneal (TAPP) approaches are the widely accepted alternatives with superiority over open surgery such as pain relief, reduction of postoperative complications, short hospital stays, and early return to normal activities.[4–6]

In addition to technical innovations, the advent and the development of artificial mesh revolutionarily change the inguinal hernia treatment. In 1950, Francis Usher used a flat polypropylene mesh for the first time to treat inguinal hernia and surgical herniation. Since then, the artificial mesh has been widely used to reduce the rate of recurrent inguinal hernia.[7] However, a disadvantage of the flat artificial mesh is that it is easy to roll and move from the placement or increase the postoperative pain by 4–6% due to the use of fixed tools or sutures.[8] To minimize this drawback, in 1999, Bell was one of the first surgeons to use a three-dimension (3D) mesh with the bending shape according to the anatomical structure of the groin area in laparoscopic surgery for the treatment of inguinal hernia.[9] Since then, many studies around the world have shown that the use of 3D mesh in the treatment of inguinal hernia is safe and effective as well as causes low postoperative pain rate and low recurrence rate.[4,7,9]

For bilateral inguinal hernia, until now, there is still much debate about the choice of treatment strategy (simultaneous or unilateral repair), approaches (open surgery, TEP, or TAPP), or

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How to cite this article: Nguyen PV, Dao MQ, Ha QV, *et al*. Laparoscopic Totally Extraperitoneal Repair Using Three-dimension Mesh to Treat Bilateral Inguinal Hernia in Adults. World J Lap Surg 2021;14(3):195–200.

Source of support: Nil

Conflict of interest: None

artificial mesh fixation and selection.[2,10–12] Gass et al. reviewed 6,505 unilateral inguinal hernia patients and 3,048 bilateral inguinal hernia patients treated with 3D TEP laparoscopic surgery and showed no difference significantly in terms of postoperative hospital stay and surgical referral rate, but reduced cost and number of treatment days compared to those with double surgeries.[2,12] Therefore, for bilateral inguinal hernia, TEP is a safe, viable treatment option that can be performed with results similar to that of unilateral herniation surgery.[2,12,13] This study aimed to evaluate the effectiveness of 3D artificial mesh in TEP surgery among Vietnamese adults with inguinal hernia.

Materials and Methods

Study Design and Patients

We performed a case series at Thanh Nhan Hospital, Hanoi, Vietnam. Eligible patients were people aged 18 years old or above; were diagnosed as bilateral inguinal hernia based on clinical and radiology examination (ultrasound, computed tomography); and were treated with TEP surgery to place an artificial 3D mesh outside the peritoneum. Other selection criteria included patients having complete medical records and patients who agreed and signed informed consent to participate in the study. Exclusion criteria included: (1) unilateral inguinal hernia, choking hernia, recurrence hernia; (2) patients with contraindications to TEP laparoscopic surgery for inguinal hernia; (3) patients with systemic or bilateral inguinal infection; (4) patients with pre-anesthesia health classification score, American Society of Anesthesiology (ASA) >III; (5) patients with blood clotting disorder; (6) patients who did not agree to participate in the study; and (7) patients with incomplete medical records. The study was approved by the Institutional Review Board (IRB) of Thanh Nhan Hospital (Code: 01/BVTN-HDDD).

Surgical Preparation

All patients admitted to the hospital were clinically examined and performed paraclinical tests, such as abdominal ultrasound, blood biochemistry, basic hematology, echocardiography (for patients over 60 years old), electrocardiogram, or chest X-ray. Then, we consulted specialists in cardiology, endocrinology, and anesthesia to assess the condition of the patient and treat any medical diseases (if any) before surgery. We explained to patients and their families about surgical techniques, complications in surgery, and possible postoperative complications. The patients had completely fasted before surgery for at least 6 hours and evacuated stool in enema twice before surgery by Fleet 133 mL. We then cleaned and marked the operating area. We then let the patients to urinate 30 minutes before surgery to ensure that the bladder was collapsed. No urinary catheter was placed before and during surgery. Cephalosporin generation II or III was used for intravenous 30 minutes before surgery and repeated 6 hours after surgery.

A laparoscopic surgery machine was prepared with full equipment including monitors, image transceivers from cameras, CO_2 pumps, and cold light sources. We used one trocar 10 mm and two trocars 5 mm, two optic endoscopies with 10 and 5 mm with diameter 30° or 0° viewing angle, laparoscopic grasper 5 mm (grasper), laparoscopic dissector 5 mm, electric hook (L-hook), needle-bearing pliers, endoscope, straw, clip Hemlock 5 mm, and other common open surgery tools. In this study, we used 3D meshes from the Bard-Davol (France) (trade name 3DMax™ Mesh) with polypropylene structure, size 8.5 × 13.7 cm or 10.8 × 16 cm.

Surgical Procedures

The surgical procedures were performed as per the following steps: First, all the patients underwent endotracheal anesthesia, lying on their back in Trendelenburg position, with their hands closed along the torso. The first trocar with a 10 mm diameter was placed at the navel. We dissected through peritoneum with fingers and pumped CO_2. We then placed the remaining two trocars with 5 mm diameter in three positions (Fig. 1).

Then, we performed dissection of the anterior peritoneal cavity, treated the right herniated sac (Figs 2A and B), and dissected the right anterior peritoneum, revealing the lateral umbilical folds, the right inferior epigastric artery, and lateral abdominal wall to the lower margin of the pelvic lumbar muscle. For a direct inguinal hernia, we pushed the herniated sac into the abdominal cavity. For indirect inguinal hernia, we performed constriction and cut at the neck of the herniated sac. Subsequently, we dissected the anterior peritoneum and treated the same left side herniation sac similarly to the opposite side.

We used a 3D MAX™ polypropylene mesh from Bard-Davol (France), with dimensions of 8.5 × 13.7 cm or 10.8 × 16 cm. After the peritoneal cavity on the two sides was dissected large enough, we inserted two artificial 3D meshes through the 10 mm trocar. We then placed the 3D Max mesh in the position that the outer corner of the mesh was placed on the outer pelvic artery; the top of the mesh was placed in the inguinal ligament; the directional marker (blue) was placed on the pubic tubule helping to align the grid in the correct position; the upper edge of the net was placed in front which was far enough to cover the entire myopectineal orifice (the distance from the edges of the mesh to myopectineal orifice was at least 2.5–3 cm). We did not actively fix the mesh (Fig. 3). We released CO_2 under the direct camera observation and closed the trocar holes.

Variables

In this study, we collected the following information from patients:

Patient Characteristics

Age, sex, history of abdominal surgery, body mass index (BMI), inguinal hernia classification by anatomical location (direct, indirect), and herniation diameter.

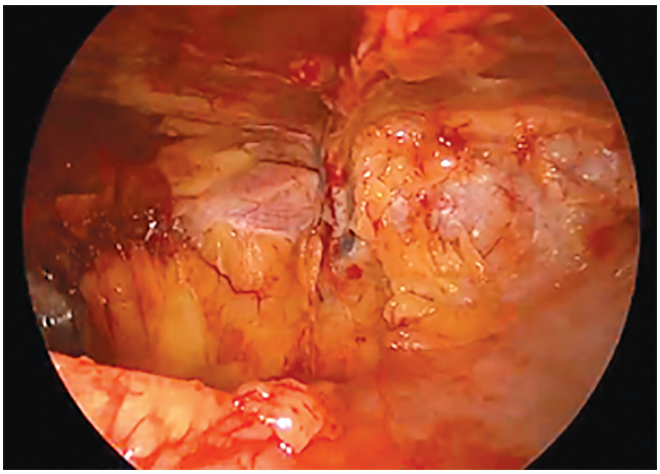
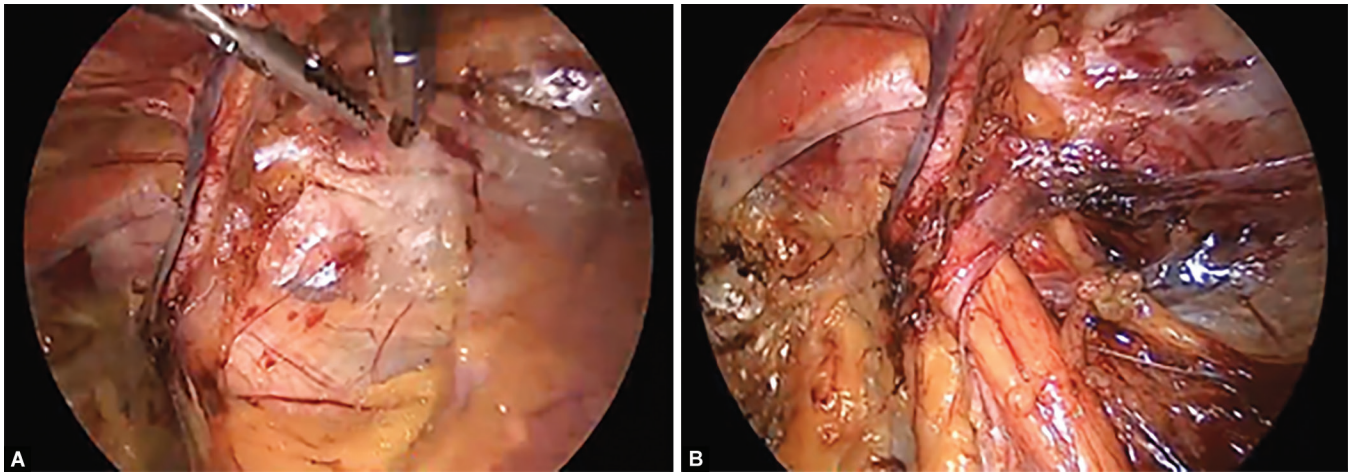
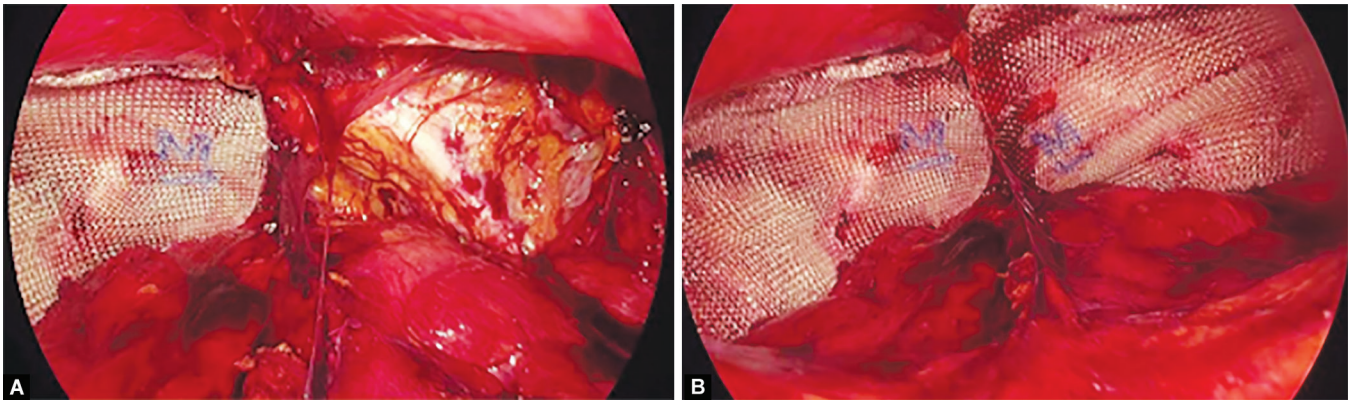


Fig. 1: Creation of anterior peritoneum and trocar placement



Figs 2A and B: Dissection of the (A) Anterior peritoneal cavity; and (B) Treatment of herniated sac



Figs 3A and B: Placing the artificial 3D mesh completely outside the peritoneum

Technical Characteristics

Mesh size, reinforced mesh fixation, complications, surgical switching (open surgery or TAPP surgery), mesh placement and fixation time, and total surgery time.

Short-term Results

Postoperative pain time, early complications, and hospital stays. For pain level, we asked the patients to report their pain by using a 10-point visual analog scale (VAS) 1, 2, and 3 days after surgery and classified patients into five levels: no pain (0), slight pain (1–2), mild pain (3–4), moderate pain (5–6), severe pain (7–8), and extreme pain (9–10). Short-term results were further classified into four levels:

- Good: No complications after surgery.
- Fair: Having complications but not requiring any interventions such as epidermal numbness in the thigh area, hematoma, and self-absorbed scrotal hematoma.
- Moderate: Having complications that require intervention but not re-surgery such as urinary retention, scrotal hematoma, or scrotal fluid accumulation that requires interventions, superficial wound infection to separate the incision.
- Poor: Have to perform re-surgery or die during hospitalization.

Long-term Results

Patients were scheduled to be re-examined at the time of 1 month, 6 months, and 1 year after surgery and the end of the study to examine complications (chronic pain, reticulum movement, reticulocytosis), recurrence rate, and causes (if any). Long-term results were classified into four levels:

- Good: No complications, no recurrence
- Fair: Self-absorbed scrotal fluid.
- Moderate: Chronic pain in the groin and testicular cord that responded to medical treatment within 1 year.
- Poor: Recurrence; chronic pain in the groin and testicular cord that lasted more than 1 year without response to medical treatment or required surgical intervention; testicular atrophy.

Statistical Analysis

Data were collected and analyzed using SPSS 20.0 software (IBM Corp., New York, USA). Descriptive statistics were performed by using mean ± standard deviation (X ± SD) for continuous variables, and frequency and percentage for categorical variables. Chi-squared and Fisher's exact tests were used to examine differences between left and right inguinal hernia. The *p*-value <0.05 was used to determine statistical significance.

Results

A total of 50 patients with bilateral inguinal hernia underwent TEP laparoscopic surgery using artificial 3D mesh. The mean age of the patients was 52.1 ± 17.2 years old. All patients were male. Four patients (8.0%) had a history of abdominal surgery, including two

patients having a laparoscopic appendectomy (4.0%), one patient having cholecystectomy (2.0%), and one patient having open appendectomy (2.0%). The average BMI was 21.3 ± 2.6 kg/m^2 (Table 1).

In terms of clinical and surgical technical features, Table 2 shows that 66.0% of patients had a direct inguinal hernia and 34.0% of patients had an indirect inguinal hernia. The diameter of the herniated hole was mainly from 1.5 to 3 cm with 84.0%. There were 82.0% of patients using small 3D mesh (8.5 × 13.7 cm) and one case required mesh fixation (2.0%). Seven patients (14.0%) had complications during surgery including peritoneal perforation (four patients—8.0%), bleeding during dissection, peritoneal perforation and bleeding, damage to the inferior epigastric artery, and vascular bundle lesions in the testicular cord. Neither of the patients had to use an additional trocar or switch surgery. The average mesh insertion and fixation time was 21.9 ± 4.3 minutes (range 15–40 minutes), and the average surgical time was 75.2 ± 11.0 minutes (range 60–100 minutes). No difference was found regarding clinical and surgical characteristics between right and left inguinal hernia ($p > 0.05$).

Table 1: Demographic and clinical characteristics

Characteristics	*Frequency*	*Percentage*
Age (years), mean (SD)	52.1 ± 17.2	
Gender		
Male	50	100.0%
Occupation		
Retired	20	40.0%
Self-employed	18	36.0%
Blue-collar worker	4	8.0%
Farmer	1	2.0%
Student	3	6.0%
Office staff	4	8.0%
Comorbidities, Yes	11	22.0%
Body mass categories		
Underweight	4	8.0%
Normal weight	41	82.0%
Overweight/obesity	5	10.0%
Time of onset (months)		
<12	43	86.0%
12–<36	4	8.0%
≥36	3	6.0%

Table 3 shows the degree of pain after surgery. The average postoperative pain time was 2.2 ± 1.5 days (1–15 days). Pain degree decreased gradually from day 1 to day 3. By day 3 after surgery, 94% had only slight pain, two patients (4.0%) had mild pain, and one patient (2.0%) had moderate pain. The difference in pain level from day 1 to day 3 after surgery was statistically significant with $p < 0.05$.

Table 4 depicts that early postoperative complications were observed in five patients (10.0%), including hematoma in the groin–scrotal region (4.0%), wound infection (2.0%), numbness in the outer thigh (2.0%), and urinary retention and numbness in the outer thighs (2.0%).

All patients were followed for a mean of 21.4 ± 11.8 months (minimum 1 month, maximum 40 months). At 1 month postoperative, there was one patient with chronic pain in the groin (2.1%). After 6, 12, and 24 months, no recurrence was recorded (Table 5).

Discussion

In this study, we performed the TEP laparoscopic surgery using 3D meshes to treat a bilateral inguinal hernia. In most cases, we used small 3DMax meshes (8.5 × 13.7 cm) for each side of the herniation.

Table 2: Clinical and surgical characteristics

	Right inguinal hernia (n = 50)		*Left inguinal hernia (n = 50)*		*Total (n = 100)*		
Characteristics	*n*	*%*	*n*	*%*	*n*	*%*	*p value*
Inguinal hernia classification							
Direct	35	70.0%	31	62.0%	66	66.0%	0.45
Indirect	15	30.0%	19	38.0%	34	34.0%	
Abdominal organ herniation							
None	48	96.0%	45	90.0%	93	93.0%	0.42
Small intestine	1	2.0%	2	4.0%	3	3.0%	
Omentum	1	2.0%	3	6.0%	4	4.0%	
Diameter of herniated hole							
<1.5 cm	8	16.0%	4	8.0%	12	12.0%	0.40
1.5–<3 cm	41	82.0%	43	86.0%	84	84.0%	
≥3 cm	1	2.0%	3	6.0%	4	4.0%	
Technique for dissection and treatment of herniated sac							
Push herniated sac into abdomen	35	70.0%	31	62.0%	66	66.0%	0.45
Constrict and cut herniated sac	15	30.0%	19	38.0%	34	34.0%	
Artificial 3D mesh used							
Small mesh 8.5 × 13.7 cm	41	82.0%	41	82.0%	82	82.0%	1.00
Large mesh 10.8 × 16.0 cm	9	18.0%	9	18.0%	18	18.0%	
Mesh fixation							
No	49	98.0%	50	100.0%	99	99.0%	1.00
Yes	1	2.0%	0	0.0%	1	1.0%	

Table 3: Pain degree after surgery

	Pain degree				
	Slight pain	*Mild pain*	*Moderate pain*	*Severe pain*	*VAS score*
After surgery	*n (%)*	*n (%)*	*n (%)*	*n (%)*	*Mean (SD)*
1st day (T_1)	0 (0.0%)	5 (10.0%)	42 (84.0%)	3 (6.0%)	5.1 ± 0.7
2nd day (T_2)	6 (12.0%)	42 (84.0%)	2 (4.0%)	0 (0.0%)	3.0 ± 0.8
3rd day (T_3)	47 (94.0%)	2 (4.0%)	1 (2.0%)	0 (0.0%)	0.9 ± 0.7
p value (T_1–$T_{2)}$			<0.01		<0.01
p value (T_2–$T_{3)}$			<0.01		<0.01

Table 4: Early postoperative complications

Early postoperative Complications	*Frequency (n = 50)*	*Percentage (%)*
Hematoma in groin-scrotal region	2	4.0%
Wound infection	1	2.0%
Numbness in the outer thighs	1	2.0%
Urinary retention and numbness in the outer thighs	1	2.0%

Table 5: Short- and long-term surgical outcomes

	After surgery (n = 50)		*After 1 month (n = 47)*		*After 6 months (n = 39)*		*After 12 months (n = 30)*		*After 24 months (n = 17)*	
Outcome	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Good	44	88.0	46	97.9	39	100.0	30	100.0	17	100.0
Fair	6	10.0	1	1.8	0	0.0	0	0.0	0	0.0
Moderate	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Poor	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

For patients with large herniated hole, weak inguinal muscles or in elderly patients with comorbidities that frequently increased abdominal pressure, we actively used a large mesh (10.8 × 16.0 cm) for each side of the herniation to cover myopectineal orifice and that the upper and lower margins of the mesh were at least 2.5–3 cm from the herniation hole. One of the advantages of the 3D mesh is the flexible structure and shape with the anatomical structure of the groin area. Thus, when placing the 3D mesh into the peritoneal cavity, the 3D mesh automatically attaches itself to the posterior wall structures of the groin, thereby covering the entire myopectineal orifice. Therefore, in most of our cases, we did not need to fix the mesh. Only one case had to sew the mesh tension through endoscopy with Vicyl 3/0 sutures because the mesh was folded when placed in the peritoneal cavity.

In literature, whether mesh fixation (with protacks or sutures) is necessary or not is controversial. While some authors considered mesh fixation to be necessary to reduce the risk of mesh slipping, which helped to reduce recurrence rates, other authors argued that fixing was not necessary as there was no difference in the recurrence rate.[14] In addition, mesh fixation might increase the risk of nerve damage caused by the use of protack and increase surgical costs.[14] In a study of Acar et al. on 178 patients (98 patients had right inguinal hernias, 72 patients had left inguinal hernias, and 8 patients had bilateral inguinal hernias), patients were treated with TEP laparoscopic surgery using 3D mesh (Bard 3D Max) with an average follow-up period of 45 months. Results showed that there was no difference in the rates of complications (both short- and long-term) between the two groups, with and without mesh fixation. The author suggested that the mesh fixation in TEP surgery with a 3D mesh did not increase the complication and recurrence rates compared with the group without mesh fixation.[14] According to Krishna et al., the two-point protack fixation can be performed in elderly patients with large herniation, weak abdominal wall muscle, and based on the operator's decision.[6]

All of our patients were successfully treated with TEP laparoscopic surgery using 3D mesh, with no additional trocar or switching to surgery. The percentage of switching surgical methods when performing TEP laparoscopic surgery to treat bilateral inguinal hernia in Gass et al.'s study was 1.1%.[2] Krishna's study had a total of 81 patients who had to change the surgical method (TAPP or open surgery).[6] The average total surgical time in this study was 75.2 ± 11.0 minutes (range 60–100 minutes) and the average mesh insertion and fixation time was 21.9 ± 4.3 minutes. The time of 3D mesh insertion surgery for bilateral inguinal hernia treatment in Krishna's study was 77.9 ± 26.2[6] and 60.3 minutes in Kockerling et al.'s study.[15] Our study had nice cases of complications during surgery (14%), which was higher than some previous studies. According to Gass et al., the complications rate in TEP laparoscopic surgery for bilateral inguinal hernia was 3.1%.[2] The rate in the study of Kockerling et al. was 1.45%.[15] Krishna et al. showed that 4.3% of patients had complications in surgery, such as damage to the lower epigastric artery during peritoneal cavity surgery.[6]

Most authors emphasize the advantages of using non-fixed 3D mesh in TEP laparoscopic surgery for bilateral inguinal hernia, thereby reducing the risk of nerve damage and relieving pain

after surgery. The study of Ayyaz et al. showed that for the group of patients with mesh fixation, the average pain level was 4.7 ± 0.68, which was significantly higher than the group of patients without mesh fixation at 4.1 ± 0.86 with $p < 0.001$.[16] In our study, with most cases without mesh fixation, the average postoperative pain time of 2.2 ± 1.5 days was observed, which was similar to other studies.

Early complications after TEP laparoscopic surgery might include urinary retention, epididymitis, wound infection, hematoma, fluid accumulation, and chronic pain in the groin–scrotum.[14,17] According to Gass, patients undergoing bilateral TEP endoscopy had an early complication rate of 3.2%.[2] This rate in the study of Kockerling was 1.82%.[15] In our study, early complications were found in 10.0% of patients.

All patients were followed for a mean of 21.4 ± 11.8 months (minimum 1 month, maximum 40 months). One patient (2.1%) was observed with chronic pain in the groin area, who also had prolonged pain after surgery, possibly due to the process of dissection or mesh fixation in the surgery, causing damage to the nerve branch. The rate of chronic pain after inguinal hernia ranged from 1 to 63%.[18] For this patient, at the time of follow-up after 1 and 3 months, the pain reduced gradually but still made the patient feel uncomfortable. The patient was treated with pain relievers, anti-inflammatory drugs, and the pain gradually decreased after 5 months.

Conclusion

TEP laparoscopic surgery using 3D mesh is a safe, feasible, and effective method in bilateral inguinal hernia in adults, with low rates of complications and recurrences. However, with the limited sample size and follow-up time of the study, it is necessary to perform further studies with a larger sample size and longer follow-up time to evaluate the effectiveness of this method.

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RESEARCH ARTICLE

Umbilical Port Site in Laparoscopic Cholecystectomy: A Possible Strategy to Avoid Complications

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Abstract

Laparoscopic cholecystectomy is the gold standard for the surgical treatment of symptomatic cholecystolithiasis. A skin incision is made above the umbilicus, an area that is infrequently exposed to UV light, soaps, and contains a large amount of bacteria. The purpose of this study is to examine the effect of the use of topical prophylactic antibiotic to prevent post-videolaparo-cholecystectomy infection at the umbilical port site. Our outcomes display that in patients treated with topical antibiotics, umbilical port site infections occurred less often than in the patients not treated. Further studies are required to determine what other procedures should be engaged to decrease the high rate of infections.

Keywords: Laparoscopic cholecystectomy, Topical antibiotic therapy, Umbilical port site infection.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1472

Introduction

Elective laparoscopic cholecystectomy, also known as minimally invasive cholecystectomy, has become the treatment of choice for the surgical treatment of symptomatic cholecystolithiasis.[1,2]

It is performed through four small incisions, two ports of 10 mm and two additional 5 mm entrees each in the standard position with the legs opened.[3]

The skin should be cut for about 10–12 mm approximately in length just above the umbilicus. The subcutaneous fat is dissected with the help of forceps and scissors. The abdominal fascia is elevated with the Kocher hemostatic forceps, and a little incision is made through the fascia. The peritoneum is exposed and opened carefully by a scalpel. Sutures through abdominal fascia are positioned to lock the Hasson port.

The umbilicus is a zone of the body that is not set out to UV light, rarely cleansed, and contains a large amount of bacteria.[4]

The minimal skin injury during laparoscopic cholecystectomy guarantees a lower risk of wound infection, but umbilical port site infection in laparoscopic cholecystectomy procedure is reported to be 9%[5,6] especially for a difficult operation.

The aim of this study was to investigate how the use of topical prophylactic antibiotic can improve post-VLC infection rate at the umbilical port site, because there is no scientific agreement on the practice of it.

Materials and Methods

Study Design and Participants

From September 2013 to December 2019, more than 1,200 patients with cholecystolithiasis underwent VLC, in the Division of General Surgery, Department of Surgical and Medical Sciences of the University of Foggia, School of Medicine, Polyclinic of Foggia, Italy. Nine-hundred and sixty patients were analyzed in the study, affected by the same clinical scenario.

Exclusion criteria were patients who used antibiotics during the previous 7 days (for causes unrelated to the surgery), finding of unpredicted acute cholecystitis, unintentional gallbladder rupture, and change to an open procedure.

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How to cite this article: Pacilli M, Tartaglia N, Pavone G, *et al*. Umbilical Port Site in Laparoscopic Cholecystectomy: A Possible Strategy to Avoid Complications. World J Lap Surg 2021;14(3):201–204.

Source of support: Nil

Conflict of interest: None

The selected patients were randomized into three groups: Rifamycin group (RG): 320 patients treated by application of rifamycin on the site; Gentamicin group (GG), 320 patients was treated with gentamicin; and control group (CG) was not treated (320 patients).

Rifamycin and gentamicin are often utilized on the skin for the treatment of contaminations caused by germs, founded on the specific evidences about the drug. Skin plagues, pyodermitis, dermatitis, abscesses, infected wounds, and exposed trauma are some examples.

Surgical Technique and Administration of Antibiotic Therapy

Systemic antibiotic prophylaxis was applied, to all patients, with prophylactic intravenous administration of 2 g of cefazolin. Immediately before of the operation, surgical field was prepared by washing all the abdomen, disinfection by iodopovidone (focus on umbilical and periumbilical skin), and final step with 0.9% saline solution.

A 12-mm Hasson trocar was inserted through the umbilicus incision and three supplementary trocars (5 mm at the right quadrant for the left surgeon's hand, 10 mm at the upper left quadrant for the right hand, finally to divaricate the liver 5 mm, at the epigastrium) were introduced. An anterograde cholecystectomy is performed, and the gallbladder is pulled out through the umbilical incision always with a protection container.

Only the umbilical fascia is closed, with a hand-sewn interrupted suture using 0 polyglactin 910 (Vicryl, Ethicon). The skin is closed applying staples, in all cases.

The same surgical tools were adopted to perform the VLC operative technique in all 960 cases.

Postoperative dressings were performed routinely at 1, 5, and 10 postoperative days (POD), and in the last dressing, the stitches were removed.

Protocol for the control group, no topical antibiotic application was expected. The dressing was performed only with disinfection of the wounds using iodopovidone and replacement of the patch.

The procedure for the patients belong to rifamycin and gentamicin group had the identical stages as the aforementioned protocol, but rifamycin and gentamicin was applied according to following scheme:

- Preoperative phase: Twelve hours before VLC, application on the umbilical and periumbilical skin of iodopovidone, affixing a sterile patch with 3 mL of rifamycin (RG) or gentamicin (GG) on the umbilicus.
- Intraoperative phase: After suturing the umbilical access, the area is disinfected and then was affixed a sterile patch with 3 mL of rifamycin (RG) or gentamicin (GG) on the umbilical wound.
- Postoperative phase: At each dressing, application of sterile patch with 3 mL of rifamycin (RG) or gentamicin (GG) on the umbilical wound (1, 5, 10 POD).

The assessed features were the following: (1) pain insisted on umbilical region (pain scale from 0 to 10); (2) analgesic drugs to treat umbilical region pain; (3) signs of phlogosis of the umbilical wound defined according to the Southampton score[7] as follow: grade 0: normal healing, grade I: erythema, grade II: erythema plus additional signs, grade III: haemoserous release, grade IV: pus discharge, grade V: severe wound infection.

On the 90th post-VLC day, the incidence of incisional hernia in the umbilical region was recorded.

Statistical Analysis

Collected data were examined using statistical package for social sciences software (SPSS version 11.0) by means of the analysis of variance (ANOVA) test to compare the means of independent samples, and Chi-square test used for categorical variables.

Results

During the last dressing, all patients were asked for the value of pain during the postoperative period and the possible use of painkillers (administration for more than 2 days).

The first graph shows (Fig. 1) the mean values of the postoperative notes of pain localized on the umbilical area in patients in each groups.

The means of this three independent samples (treatments) have been analyzed using ANOVA test. There is a statistically significant differences, between the pain values reported among these three groups with a lower values in the RG and GG groups (p <0.001).

The second graph (Fig. 2) shows the percentages of patients in each group, who reported taking pain relievers for more than 2 days in the postoperative period.

In the CG, 250 patients revealed that they had taken pain-relieving drugs (for a period longer than 2 days), 198 patients in the RG, and 203 in the GG. The data obtained were analyzed statistically, using the Chi-square test, showing a not statistically significant results (p >0.05)

Southampton scoring system was applied to all the umbilical wounds. The values are reported in Figure 3.

- In the control group, Southampton scoring system reveals in 144 cases scored a grade 0—normal healing (45%); 38 cases scored grade I—normal healing with mild bruising or erythema (12%); 86 cases scored grade II—erythema plus other signs of inflammation (27%); 24 cases scored grade III—clear or haemoserous discharge (7%); 19 cases scored grade IV—pus/purulent discharge (6%); and 9 cases scored grade V—deep o severe wound infection (3%).
- In the Rifamycin group, Southampton scoring system reveals in 152 cases scored a grade 0 (48%), 85 cases scored grade I (27 %), 66 cases scored grade II (21 %), 7 cases scored grade III (2%), 5 cases scored grade IV (1%), and 5 cases scored grade V (1%).
- In the Gentamicin group, Southampton scoring system reveals in 159 cases scored a grade 0 (49%), 80 cases scored grade I (25 %), 60 cases scored grade II (19 %), 10 cases scored grade III (3%), 6 cases scored grade IV (2%), and 5 cases scored grade V (2%).

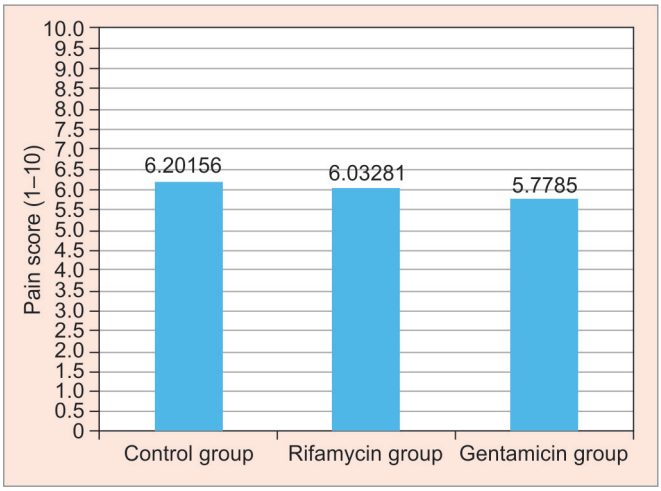


Fig. 1: Mean value pain score

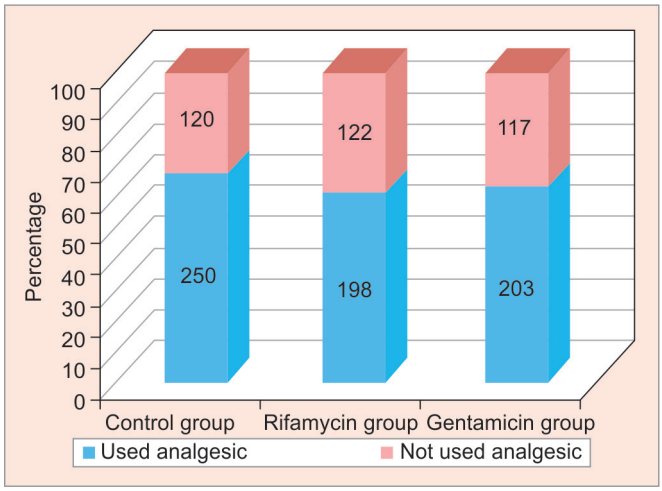
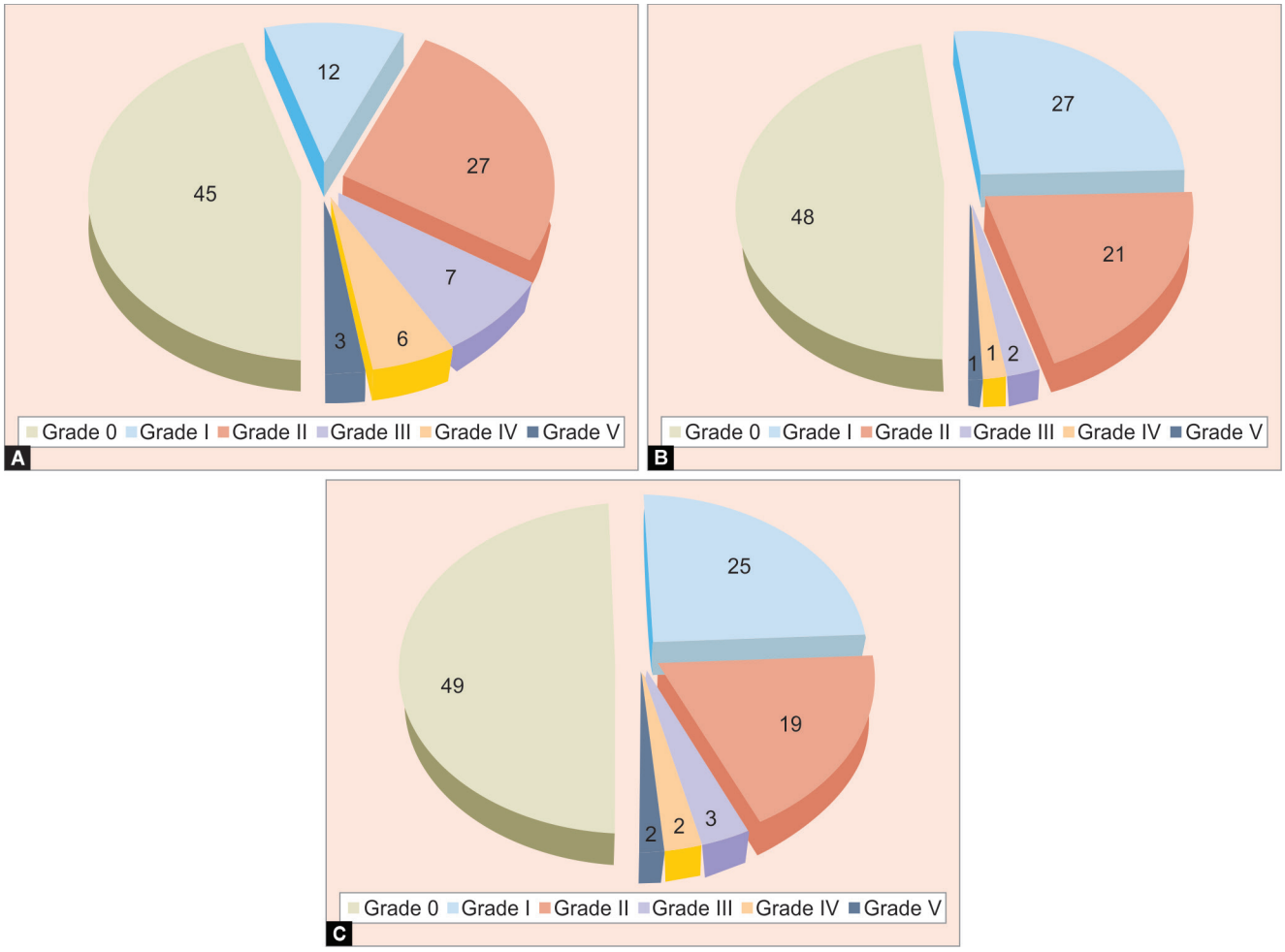


Fig. 2: Analgesic drugs



Figs 3A to C: Southampton score (A) Control group; (B) Rifamycin group; (C) Gentamicin group.
grade 0: normal healing; grade I: erythema; grade II: erythema plus other signs; grade III: haemoserous discharge; grade IV: pus discharge; grade V: severe wound infection

In the immediate postoperative phase (12, 24 hours after surgery), clinical data were recorded at and also on the fifth and tenth post-VLC day. All the patients were evaluated to surgical ambulatory up to the complete healing. Ninety days after VLC, seven cases of incisional umbilical hernias were reported in the control group, one in rifamycin group, and two in the gentamicin group.

Data have been analyzed using Chi-square test (p <0.001) showing a statistically significant differences between the three groups.

Discussion

In the interpretation of our results, the use of topical antibiotic therapy about wound infection in elective laparoscopic cholecystectomy has proven to be a good method in preventing wound complications. Our results show that in patients treated, umbilical port site infections occurred less often than in the control group. Even pain score between the study groups and the control group is statistically different. Analgesic usage was found to be lower in the two groups treated, but the results are not statistically significant, and the difference between the groups was small.

All laparoscopic operations are characterized by smaller surgical wounds and less exposed to infections,[8–10] but precisely because there are small incisions and the intervention is a routine operation very practiced, a less serious complication like this does not deserve to be underestimated.

The possibility of wound infection is caused mainly by the interaction of the microbial burden, local wound settings, and the host's immune status.[11] The role of systemic prophylactic antimicrobial therapy is still not well defined[12,13] and can only be useful when these other factors are under control.

Surgeons' diagnosis of infection can have a main influence on surgical wound infection rates; therefore, an accurate, specific, and homogeneous definition of infection is important to improving patient recovery.[14,15]

Conclusion

We performed this study for evaluate whether the application of topical antibiotic therapy can significantly improve the postoperative period, reducing the rate of an annoying complication such as umbilical wound infection.

According to the results of this study, umbilical port site infections happened less often in patients treated with rifamycin and gentamicin than in not treated patients.

More studies are needed to assess what other measures should be adopted to decrease the high rate of infection, and whether the application of local antibiotic therapy plus careful disinfection of the

surgical site can replace the administration of systemic antibiotic therapy in laparoscopic surgery.

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RESEARCH ARTICLE

A Comparative Study between Open Appendicectomy and Laparoscopic Appendicectomy: A Single-center Experience

Vikram Yogish[1], Himanshi Grover[2], Velineni Bharath[3]

Abstract

Appendicitis is a surgical emergency that is encountered by surgeons all over the world. Today, laparoscopic appendicectomy is the ideal procedure that is done for a case of appendicitis.

Aim: The aim of the study is to show the benefits of laparoscopic appendicectomy and to determine the advantages of laparoscopic appendicectomy over the conventional open method of appendicectomy.

Materials and methods: This was a prospective study that was carried out from March 2016 to February 2019. The study was conducted at SRM Medical College Hospital and Research Centre, Kattankulathur, Tamil Nadu, India. Investigations, such as complete blood count (CBC), X-ray of the abdomen, ultrasound abdomen, and CT scan of the abdomen, were done. A total of 101 patients were studied, and the results obtained were tabulated. The statistics were analyzed using SPSS package 16.0. Ethical clearance was obtained from the institutional ethics committee.

Results: From our study, it was found that for most of the patients who presented with appendicitis, laparoscopic appendicectomy was the procedure of choice (66.33%). The duration of surgery for most of our patients was 60 minutes or less. Moreover, 82.35% of patients who underwent open appendicectomy and 89.55% of patients who underwent laparoscopic appendicectomy stayed in the hospital for only 3 days or less after surgery.

Conclusion: Our study shows the benefits of laparoscopic appendicectomy and the reason that it is the procedure of choice in cases of appendicitis.

Keywords: Appendicitis, Laparoscopic appendicectomy, Open appendicectomy, Ultrasound abdomen.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1468

Introduction

Appendicitis is a surgical emergency that is encountered by surgeons all over the world. In order to diagnose a condition of appendicitis accurately, a detailed history and a thorough clinical examination must be done. Investigations, such as complete blood count (CBC), ultrasound abdomen, and CT scan of the abdomen, are very useful that may be done to arrive at the diagnosis of appendicitis. As far as the intervention for a case of appendicitis is concerned, surgery may be done either through open or laparoscopic method. Today, laparoscopic appendicectomy is the ideal procedure that is done for a case of appendicitis. However, it is also important to know when to convert a case of laparoscopic appendicectomy to open appendicectomy.

Aim

The aim of the study is to show the benefits of laparoscopic appendicectomy and to determine the advantages of laparoscopic appendicectomy over the conventional open method of appendicectomy.

Materials and Methods

This was a prospective study that was carried out from March 2016 to February 2019, for a period of 3 years. The study was conducted at SRM Medical College Hospital and Research Centre, Kattankulathur, Tamil Nadu, India. A detailed history was collected and a thorough clinical examination was done. Investigations, such as CBC, X-ray of the abdomen, ultrasound abdomen, and CT scan of the abdomen, were done. The CT scan of the abdomen was done only when absolutely required. A total of 101 patients were studied, and the results obtained were tabulated. The statistics were analyzed using SPSS package 16.0. Ethical clearance was obtained from the institutional ethics committee.

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How to cite this article: Yogish V, Grover H, Bharath V. A Comparative Study between Open Appendicectomy and Laparoscopic Appendicectomy: A Single-center Experience. World J Lap Surg 2021;14(3):205–207.

Source of support: Nil

Conflict of interest: None

Results

From the results of our study, it was found that for most of the patients who presented with appendicitis, laparoscopic appendicectomy was the procedure of choice (66.33%). The patients usually presented to the hospital with complaints of abdominal pain over the right lower quadrant. The hospital stay for most of our patients was 3 days or less. Moreover, 82.35% of patients who underwent open appendicectomy and 89.55% of patients who underwent laparoscopic appendicectomy stayed in the hospital for only 3 days or less after surgery. The duration of surgery for most of our patients was 60 minutes or less. It was also seen that the patients who underwent laparoscopic appendicectomy were able to return to work faster than those who had to undergo the conventional open method of appendicectomy (Tables 1 to 6).

Table 1: Age-group of patients who underwent appendicectomy

Age (years)	Open appendicectomy (n = 34)	Percentage	Laparoscopic appendicectomy (n = 67)	Percentage
20–30	7	20.58	31	46.26
31–40	10	29.41	15	22.38
41–50	5	14.70	10	14.92
51–60	8	23.52	4	5.97
61–70	4	11.76	7	10.44

Table 2: Gender of patients who underwent appendicectomy

Gender	Open appendicectomy (n = 34)	Percentage	Laparoscopic appendicectomy (n = 67)	Percentage
Male	20	58.82	40	59.70
Female	14	41.17	27	40.29

Table 3: Presentation of patients with appendicitis

Presentation	No. of patients	Percentage
Abdominal pain over the right lower quadrant	72	71.28
Nausea	20	19.80
Vomiting	25	24.75
Fever	45	44.55

Table 4: Duration of hospital stay for patients who underwent appendicectomy

Duration of hospital stay after surgery (days)	Open appendicectomy (n = 34)	Percentage	Laparoscopic appendicectomy (n = 67)	Percentage
3 days or less	28	82.35	60	89.55
4–7 days	4	11.76	5	7.46
8–15 days	2	5.88	2	2.98

Table 5: Duration of surgery for patients who underwent appendicectomy

Duration of surgery (minutes)	Open appendicectomy (n = 34)	Percentage	Laparoscopic appendicectomy (n = 67)	Percentage
60 minutes or less	20	58.82	37	55.22
61–90 minutes	10	29.41	23	34.32
91–120 minutes	4	11.76	7	10.44

Table 6: Return to routine work time for patients who underwent appendicectomy

Return to routine work (days)	Open appendicectomy (n = 34)	Percentage	Laparoscopic appendicectomy (n = 67)	Percentage
7 days or less	15	44.11	45	67.16
8–14 days	10	29.41	15	22.38
More than 15 days	9	26.47	7	10.44

Discussion

Today, laparoscopic appendicectomy is considered a safe and effective method to treat appendicitis. When a patient is admitted in the hospital with appendicitis, initially antibiotics must be started and then a decision must be taken on the need for appendicectomy. A large series of laparoscopic appendicectomy for acute appendicitis initially came from Germany and was published by Pier et al.[1] Laparoscopic appendicectomy has several advantages over the conventional open method of appendicectomy. In the laparoscopic method, the patient's recovery is quicker, and the patient can also return to his or her routine work at the earliest. The amount of pain that the patient may endure is far less in the laparoscopic method than in the open method. Ortega et al., in their study of 135 patients, showed that the pain level was much less in the laparoscopic method as compared to the open method.[2] The problem of wound infection is also much less in the laparoscopic method. Marzouk et al. also showed in his study that the postoperative wound infection rate was much less in the laparoscopic method.[3] The length of hospital stay is significantly reduced if a laparoscopic appendicectomy is done as compared to the open method. In their studies, Ray-Offor et al.,[4] Rbihat et al.,[5] and Vellani et al.,[6] showed that the length of hospital stay was much shorter for the patients who underwent laparoscopic appendicectomy. In our study, the patients who underwent laparoscopic appendicectomy had a hospital stay of 3 days or less after surgery. The operative time is also reduced quite a bit in case of laparoscopic appendicectomy. Our study also shows that most of our patients had an operative time of 60 minutes or less. The need for analgesia reduces significantly in the case of laparoscopic appendicectomy. Biondi et al., in their study of 593 patients, showed that laparoscopic appendicectomy was associated with a shorter hospital stay, with a less need for analgesia and with a faster return to daily activities.[7] Shaikh et al. also showed in their study the need for lesser requirement of analgesia following laparoscopic appendicectomy.[8] Li et al. also reported similar findings in their meta-analysis.[9] In the case of young women, further care is needed while making a diagnosis of appendicitis since the differential diagnosis of right lower quadrant pain is extensive and includes gynecologic pathology as well.[10] In addition, Azaro et al. had previously conducted studies to show that laparoscopic appendicectomy is a safe procedure.[11] The port placement and the sites of the incisions are extremely important while performing laparoscopic appendicectomy. Studies have been done to improve cosmesis in cases of laparoscopic appendicectomy (Tables 7 and 8).[12]

Conclusion

From our study, it was found that laparoscopic appendicectomy (66.33%) was the preferred choice of surgery for appendicitis. The hospital stay was 3 days or less for most of our patients. Moreover, 82.35% of patients who underwent open appendicectomy and 89.55% of patients who underwent laparoscopic appendicectomy stayed in the hospital for only 3 days or less after surgery. The duration of surgery was 60 minutes or less in 58.82% of patients

Table 7: Comparison of presentation of patients with appendicitis

Presentation	*Our study*	*Rangarajan et al.*[13]	*Yakan et al.*[14]
Abdominal pain over the right lower quadrant	71.28%	66.67%	89%

Table 8: Comparison of procedure done between our study and another study

Procedure	*Our study*	*Yau et al.*[15]
Open appendicectomy	33.66%	28.27%
Laparoscopic appendicectomy	66.33%	71.72%

who underwent open appendicectomy and in 55.22% of patients who underwent laparoscopic appendicectomy. The patients who underwent laparoscopic appendicectomy were able to return to work faster (67.16%) than those who underwent open appendicectomy. This shows that laparoscopic appendicectomy has a clear advantage over open appendicectomy and the reason that laparoscopic appendicectomy is the procedure of choice in cases of appendicitis.

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RESEARCH ARTICLE

Laparoscopic Management of Hiatus Hernia

Mela Ram Attri[1], Irfan Nazir Mir[2], Irshad Ahmad Kumar[3]

Abstract

Introduction: Hiatus hernia is axial type of hernia occurring at the esophageal opening of diaphragm. Large hiatal hernias have increased risk for severe complications that can include gastric strangulation, bleeding, and perforation. This study presents our technique and results of laparoscopic management of hiatus hernia.

Materials and methods: This study was done retrospectively on 42 patients from data over a period of last 10 years (April 2010–March 2020) in a tertiary care hospital.

Results: Total number of patients included in our study were 42. The range of age and the mean age of patients were 22–60 years and 38.36 (SD 8.018), respectively. Heartburn (32, 76.19%) was the most common symptom. Nissen's fundoplication was our primary choice performed in 37 (88.1%) patients. Few of our patients were comorbid and frail to whom Toupet's repair (4, 9.52%) and gastropexy (1, 2.3%) were performed, optimum to their conditions. Out of 42, mesh was placed in 17 (40.48%) patients including all the type IV and few of the type III patients. The mean operative time, mean blood loss, and hospital stay were126.90 (SD 12.781 minutes), 62.14 (SD 17.605 mL), and 4.60 (SD 1.127 days), respectively. Two patients were converted to open procedure. Recurrence occurred in three (7.1%) patients of type III hernia in whom only fundoplication was done without mesh placement.

Conclusion: This study concluded that laparoscopic management of hiatus hernia is a feasible and safe option, with a very low morbidity and mortality rate.

Keywords: Esophagogastroduodenoscopy, Gastroesophageal junction, Gastroesophageal reflux disease, Hiatus hernia.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1474

Introduction

Hiatus hernia is axial type of hernia occurring at the esophageal opening of diaphragm. It is classified into four types according to the anatomic characteristics.[1] Type I hernia being the most common is also known as sliding hiatal hernia. Characteristic feature of this type of hernia is the migration of gastroesophageal junction (GEJ) into the posterior mediastinum. Type II, or true paraesophageal hernia, is characterized by herniation of the gastric fundus into the mediastinum alongside the esophagus, with the GEJ remaining in an intra-abdominal position. Type III hernias, also called mixed hernias, involve herniation of the stomach with the GEJ into the mediastinum. Type IV hernias are rare and are characterized by an intrathoracic stomach along with associated viscera such as the spleen, colon, small bowel, or pancreas. Large hiatal hernias representing 5–10% of all hiatal hernias.[2] Various symptoms occur in patients with hiatus hernia namely obstructive symptoms (chest pain, vomiting, postprandial), respiratory symptoms (asthma, cough, dyspnea), or gastroesophageal reflux disease (GERD). Large hiatal hernias have increased risk for severe complications that can include gastric strangulation, bleeding, and perforation.[3,4] In Istanbul, Nissen, in 1937, performed first fundoplication to prevent the gastroesophageal reflux. In it, Nissen performed a transpleural cardia resection and protected the anastomosis within a gastric fold.

Since the 1950s, the repair of hiatal hernias has been performed traditionally via open laparotomy or thoracotomy.[5] The first laparoscopic hiatal hernia repair was done by Cuschieri et al.[6] in 1992. The first fundoplication without resection was performed in 1955 and reported in 1956.[7] Various modifications were introduced into the technique commenced by the coworker of Nissen and Rossetti. The total wrap commonly performed nowadays was introduced by Donahue and Bombeck in 1977 and validated by DeMeester in 1986. In this technique, full mobilization of the GEJ and posterior fundus with division of the upper short gastric vessels and a crural repair is done. The length of the wrap has been reduced over these years to the current 2.0 cm, and another modification made was ensuring a loose, "floppy" fundoplication.[8,9]

The morbidity with the open approach was mostly associated with the wound. With the extension of laparoscopy to other procedures other than cholecystectomy, the morbidity of the procedures was avoided to a large extent; faster recovery and earlier return to normal function were achieved.[10] This study presents our technique and results of laparoscopic management of hiatus hernia, performed by a single surgeon, in last 10 years.

Materials and Methods

A retrospective cohort study of 42 patients operated laparoscopically was done. We analyzed retrospectively the data recorded from patients who underwent laparoscopic

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How to cite this article: Attri MR, Mir IN, Kumar IA. Laparoscopic Management of Hiatus Hernia. World J Lap Surg 2021;14(3):208–211.

Source of support: Nil

Conflict of interest: None

repair for hiatal hernia, by a single surgeon, over a period of 10 years between April 2010 and March 2020 in Government Medical College, Srinagar. All patients were first examined by Department of Gastroenterology. The patients were worked up vis-à-vis symptomatic evaluation, barium meal, and esophagogastroduodenoscopy (EGD). Patients who had hiatus hernia grade II, III, and IV were included in the study. Patients were optimized for surgery and were kept fasting for 8 hours prior to the procedure. All patients underwent antibiotic prophylaxis and prophylaxis for deep vein thrombosis.

Exclusion Criteria

- Medically unfit patients.
- Patients with previous gastroesophageal surgery.
- Type I hiatus hernia.
- Esophageal motility disorders.

Operative Technique

Procedure was started under general anesthesia; urinary catherization for monitoring and Ryle's tube for stomach decompression were placed. Pneumoperitoneum (12–15 mm Hg) was created by Veress needle, and patient was placed in a reverse Trendelenburg position. Five trocars are inserted into the peritoneal cavity at the epigastrium, the right subcostal area, the left subcostal area, above the umbilicus on the middle abdominal line, and at 4–5 cm lateral to the midline in the left upper quadrant. Surgeon stands in-between the legs (French position); primary and secondary assistants on either side of patient. Procedure was started with liver retraction and commencement of lesser omentum division keeping GEJ under traction. Phrenoesophageal membrane was then dissected starting from anterior aspect of hiatal opening resulting in mobilization of esophagus and visualization of crura taking care of the two vagi. Mediastinal dissection of esophagus was done for lengthening of intraabdominal esophagus and reduction of hernia. Gastric fundus was then mobilized for the wrap by dissection of short gastric vessels, sometimes gastrosplenic ligament also. Esophageal hiatus was then narrowed down by suturing the crura with nonabsorbable sutures under a large 50–60 Fr bougie. About 2 cm anti reflex wrap was then made by grasping posterior aspect of gastric fundus with a blunt forceps placed posteriorly to the esophagus and calibrating with a large 50–60 Fr bougie. In cases where total fundoplication was not feasible, a partial posterior fundoplication was performed. In type IV and few of type III hiatal hernia, U-shaped mesh [mixed mesh polypropylene + polytetrafluoroethylene (PTFE)] was placed around the hiatus and fixed with the tacks. No drains were placed, and procedure was completed by closing the port sites.

Postoperative care was taken for the prevention of postoperative nausea and vomiting. Barium radiography was done on second postoperative day. Orals were started on postoperative day 2. Patients were discharged once tolerating orals.

Follow-up

Patients were followed up at 1 month, 6 months, and then annually. The follow-up included routine general examination, barium radiography, and EGD.

Statistical Analysis

The recorded data were compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0. Continuous variables were summarized as mean ± SD, and categorical variables were expressed as frequencies and percentages. Chi-square or Fisher's exact test, whichever appropriate, was applied for categorical data. A *p*-value of less than 0.05 was considered statistically significant.

Results

A total number of patients included in our study were 42 after fulfilling the inclusion and exclusion criteria. Our study included 24 (57.14%) female and 18 (42.86%) male patients. The range of age was 22 to 60 years and the mean age of patients was 38.36 (SD 8.018). The study was conducted over 14 (33.33%), 18 (42.86%), and 10 (23.81%) patients of type II, III, and IV hiatal hernia, respectively, as shown in Table 1.

Heartburn (32, 76.19%) was the most common symptom followed by regurgitation (27, 64.29%) and epigastric pain (25, 59.52%). Some patients also complaint of pulmonary symptoms with chest pain (16, 38.1%) as most common symptom followed by breathing difficulty (14, 33.33%). Two (4.76%) of the procedures were converted to open repair owing to the nonavailability of bariatric instruments as the patients were obese (BMI >30) and dissection became difficult with the available instruments. Posterior crurorraphy was done in all the patients. Nissen's fundoplication was our primary choice performed in 37 (88.1%) patients. Few of our patients were comorbid and frail to whom Toupet's repair (4, 9.52%) and gastropexy (1, 2.3%) were performed, optimum to their conditions. Out of 42, mesh was placed in 17 (40.48%) patients including all the type IV and few of the type III patients as shown in Table 2.

The mean operative time was 126.90 (SD 12.781 minutes), with operative duration decreasing with each procedure performed. The mean blood loss and hospital stay were 62.14 (SD 17.605 mL) and 4.60 (SD 1.127 days), respectively, as shown in Table 3.

Table 1: Patient profile

Total	42 (100%)
Gender	
Female	24 (57.14%)
Male	18 (42.86%)
Type of hernia	
II	14 (33.33%)
III	18 (42.86%)
IV	10 (23.81%)
Mean Age	38.36 ± 8.018 (22–60) years

Table 2: Symptomatology and procedure

Variable	*Type*	*Frequency*
Total		42 (100%)
Symptoms	Heartburn	32 (76.19%)
	Epigastric pain	25 (59.52%)
	Regurgitation	27 (64.29%)
	Chest pain	16 (38.1%)
	Breathing difficulty	14 (33.33%)
	Palpitation	18 (42.86%)
Type of plication	Nissen's	37 (88.1%)
	Toupet's	4 (9.52%)
	Gastropexy	1 (2.38%)
Crural closure	Suture repair	25 (59.52%)
	Mesh repair	17 (40.48%)

Table 3: Intraoperative parameters

Mesh	*Blood loss*	*Operative time*	*Hospital stay*
No	60.00 SD 14.142 mL	122.00 SD 10.00 minutes	4.20 SD 0.816 days
Yes	65.29 SD 21.828 mL	134.12 SD 13.257 minutes	5.18 SD 1.286 days
Total	62.14 SD 17.605 mL	126.90 SD 12.781 minutes	4.60 SD 1.127 days

Table 4: Complications

	Mesh		
Complications	*No*	*Yes*	*Total*
Diarrhea	1 (2.4%)	0 (0.0%)	1 (2.4%)
Dysphagia	4 (9.5%)	6 (14.3%)	10 (23.8%)
Gas bloat	4 (9.5%)	6 (14.3%)	10 (23.8%)
Pulmonary complication	1 (2.4%)	2 (4.8%)	3 (7.1%)
Total	10 (23.8%)	14 (33.33%)	24 (57.14%)

In 24 (57.14%) patients, minor, manageable complications were observed in intra- and postoperative follow-up of 2 years. Dysphagia and gas bloat being the most common, and each was observed in 10 (23.8%) patients. Pulmonary complication was observed in three (7.1%) patients owing to the mediastinal dissection. Out of three, pneumothorax was detected in one (2.4%) of the patients, which was managed by putting chest tube and thereafter patient was managed conservatively. Complication profile of the patients is shown in Table 4.

There was no mortality in 30 days postoperatively. This procedure was satisfactory (defined as symptom relief and with no hiatus hernia in postoperative barium meal) in 39 (92.9%) patients. Recurrence occurred in three (7.1%) patients of type III hernia in whom only fundoplication was done without mesh placement. These patients were re explored, and mesh was placed after crural repair. They had an uneventful postoperative period.

Discussion

Laparoscopic surgery provides the advantages of a minimally invasive approach, which consist of shorter hospital stays, faster time of recovery, reduced postoperative pain, and reduced pulmonary complications.[11,12]

The standard surgical technique include stomach reposition, crural repair, and antireflux procedure. Hernia sac dissection and complete detachment from the mediastinal pleura are mandatory. After doing so, it is possible to return the stomach and GEJ to its usual infradiaphragmatic position in a tension-free manner.[13] At the completion of hiatal dissection, the intraabdominal esophagus should measure at least 2–3 cm in length to decrease the chance of recurrence. The goals of the surgery as described by Stein and DeMeester should be construction of a short, loose 360-degree fundoplication.[14] In our series, we performed a total of 25 (59.52%) posterior cruroraphies. In the cases of large hiatal defect and friable crura, the crura repair should be reinforced. Some authors suggest routine use of pledgets to lessen the pressure on the suture line.[15] Some authors recommend the use of a synthetic mesh inpatients with the hiatal defect larger than 8 cm in cruralseparation.[16] In 17 (40.48%) cases with the hiatal defect larger than 8 cm, we reinforced the primary crural repair with an only application of "U"-shaped synthetic mesh fixed by tacks.[17] Zaman and Lidor have found a decrease in recurrence after laparoscopic paraesophageal hernia repair and mesh reinforcement, with similar results in both synthetic and biologic mesh.[18] Zhang et al., Huddy et al., and Tam et al. have found a reduced rate of hernia recurrence after mesh reinforcement compared to primary suture repair at short-term follow-up (up to 12 months).[19–21] Recent studies have indicated that the fundoplication is the necessary step in all hiatal hernia repairs due to the incompetent lower esophageal sphincter and extensive hiatal dissection, which may also potentiate reflux.[25]

In our series, we performed a total of 37 (88.1%) 360° Nissen floppy fundoplications. In four (9.52%) patients, we performed partial posterior fundoplication according to Toupet. One patient (2.38%) underwent gastropexy. The conversion rate to open procedure was 4.8% (two patients), mainly because of technical difficulties in very obese patients. The average length of hospitalization was 4.6 (SD 1.12 days). The 30-day death rate was zero. Similar results were obtained in other series.[22,13]

Although chances of recurrence are more with PTFE mesh, but with least adhesions, vice versa holds true for polypropylene mesh. In our study, mixed mesh was used to have least adhesions and recurrences. Our study showed recurrence rate of 7.1%, and all the recurrences occurred in the type III hernia in which mesh was not used similar to the study done by Morino et al. in which the recurrences decreased by using a mixed mesh.[23] In hiatal hernia, Nissen fundoplication is a time-proven procedure with various modifications. In a 1,340 case series, 1,248 (93.1%) patients had satisfactory outcome over a period of 5 years.[24] Out of 42 patients in our study, 39 (92.9%) patients had satisfactory results. Multiple studies have reported that complications occur rarely after mesh fixation.[25]

Dysphagia is the most common complaint in first week after Nissen fundoplication.[26] Although resolving spontaneously, endoscopic dilatation is required in patients who had persistent dysphagia over the long term. In a 50 case series, three (6%) patients were operated with repeat laparoscopic surgery for dysphagia.[27] Some studies have reported the rate of dysphagia in excess of 13% after mesh placement.[28] In the study done by Soricelli et al., the recurrence rate dropped from 1.8% with the tension-free technique to 1.1% with the use of cruroplasty and mesh placement.[29] In our technique, U-shaped mesh was used to decrease the dysphagia rate. Our study showed dysphagia in 10 (23.8%) patients (mesh: 6, 14.3%; nonmesh: 4, 9.5%) who were managed conservatively without any surgical intervention for dysphagia.

Conclusion

This study concluded that laparoscopic management of hiatus hernia is a feasible and safe option, with a very low morbidity and mortality rate. The patient satisfaction rate was excellent, and postoperative complications were minimum and manageable.

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RESEARCH ARTICLE

Effects of Intraperitoneal Instillation of Ropivacaine on Postoperative Bowel Movements

MV Ramya[1], Sudheesh Kannan[2], Mallikarjuna Manangi[3], Athish B Shetty[4], Santhosh Kumar CS[5]

Abstract

Background: Gallstone disease represents a significant burden for healthcare systems making laparoscopic cholecystectomy one of the most common surgical procedures performed in the world.

Aims and objectives: Numerous studies have shown intraperitoneal ropivacaine instillation to have good analgesic effect thus enhancing postoperative recovery. In this study, we aim to evaluate the effect of intraperitoneal instillation of ropivacaine on postoperative bowel movements.

Methods: A prospective study was conducted on 28 patients undergoing laparoscopic cholecystectomy in the Victoria Hospital, affiliated to Bengaluru Medical College and Research Institute, Bengaluru, from October 2019 to December 2019. Laparoscopic cholecystectomy was performed electively on patients diagnosed with symptomatic cholelithiasis. Group A were instilled with ropivacaine intraperitoneally (40 mg of ropivacaine in 100 mL of normal saline) during laparoscopic cholecystectomy, after the removal of the gallbladder but prior to the removal of the ports into the gallbladder bed and over the liver surface. Group B were not instilled with any drug. Patients were then monitored postoperatively, treated with intravenous analgesics, and other supportive care was given. Postoperative bowel movements were then recorded in terms of mean time for appearance of bowel sounds, passage of flatus, and passage of stools. Patients were then discharged after being deemed fit for discharge.

Results: There was no significant improvement in the return of bowel sounds or in the time to passage of flatus/stools as a result of intraperitoneal ropivacaine instillation. Further, it did not seem to have a positive effect on the early discharge of patients.

Conclusion: Early recovery from surgery has been a major concern. In this regard, the effect of intraperitoneal instillation of ropivacaine on postoperative analgesia has been well documented. However, its effect on postoperative bowel movements does not seem to be significant.

Keywords: Cholecystectomy, Enhanced recovery after surgery, Laparoscopic cholecystectomy, Postoperative care.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1481

Introduction

Gallstone disease represents a significant burden for healthcare systems worldwide and is one of the most common disorders among patients presenting to the general surgery outpatient department and emergency with abdominal discomfort. In India, the prevalence of gallstones ranges from 6 to 9% in the adult population.[1] Autopsy reports have shown a prevalence of gallstones from 11 to 36%.[2]

Globally, laparoscopic cholecystectomy is one of the most common surgical procedures performed. Elective laparoscopic cholecystectomy is performed as a day-care procedure in a few hospitals but in most, the hospital stay spans a few days. Several factors play a role in this, the primary causes being pain and delayed return of bowel movements. Several measures including enhanced recovery after surgery (ERAS®) protocols have been implemented for this purpose to hasten the recovery and promote early discharge of the patient. One of the components of the ERAS protocols includes the intraperitoneal instillation of ropivacaine in laparoscopic surgeries.[3]

Clinical trials indicate that ropivacaine is an effective regional anesthetic when administered intraperitoneally, providing good analgesia and thus early postoperative recovery. Ropivacaine is a long-acting amide local anesthetic agent. It is known to produce effects via reversible inhibition of sodium ion influx in nerve fibers.[4]

Boddy et al., in their meta-analysis involving 24 randomized controlled trials showed there was a significant postoperative pain relief after instillation of ropivacaine intraperitoneally in patients who had undergone laparoscopic cholecystectomy.[5]

Chundriger et al. conducted a randomized controlled trial including 60 patients, who underwent laparoscopic cholecystectomy, divided into two groups. One group received bupivacaine intraperitoneally whereas the other received normal saline. Lesser pain was observed in the postoperative period in the group that received bupivacaine.[6]

Duffield et al. concluded that intraperitoneal instillation of ropivacaine in patients undergoing laparoscopic colectomy decreases postoperative pain and improves functional recovery thus promoting early discharge.[7]

Numerous studies have shown that intraperitoneal ropivacaine instillation has good analgesic effect thus enhancing postoperative recovery. In this study, we aim to evaluate the effect of intraperitoneal instillation of ropivacaine on postoperative bowel movements.

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How to cite this article: Ramya MV, Kannan S, Manangi M, *et al.* Effects of Intraperitoneal Instillation of Ropivacaine on Postoperative Bowel Movements. World J Lap Surg 2021;14(3):212–214.

Source of support: Nil

Conflict of interest: None

Methodology

A prospective study was conducted on 28 patients undergoing laparoscopic cholecystectomy in Victoria Hospital, affiliated to Bengaluru Medical College and Research Institute, Bengaluru, from October 2019 to December 2019.

After taking informed written consent, patients were randomly divided into Group A and Group B based on a randomization sequence obtained from www.randomisation.org.

Group A were instilled with ropivacaine intraperitoneally (40 mg of ropivacaine in 100 mL of normal saline) during laparoscopic cholecystectomy, after the removal of gallbladder but prior to the removal of the ports into the gallbladder bed and over the liver surface.

Group B were not instilled with any drug.

Laparoscopic cholecystectomy was performed electively on patients diagnosed with symptomatic cholelithiasis. Diagnosis of symptomatic cholelithiasis was made in patients with dyspepsia, right hypochondrium/epigastric pain, and ultrasonographic evidence of cholelithiasis. Acid peptic disease was ruled out by esophagogastroduodenoscopy.

Laparoscopic cholecystectomy was performed in both groups by a team that included a surgeon, two assistants, and a scrub nurse with anesthesiologists and operation theater technicians. One dose of second-generation cephalosporins was given preoperatively, half an hour prior to surgery. The four-port technique was used (10 mm umbilical, 10 mm subxiphoid, 5 mm right subcostal in midclavicular line, and 5 mm in the right anterior axillary line). Critical view of safety was always identified, and Calot's triangle dissected. Cystic artery and cystic duct were delineated, clipped, and then cut. Gallbladder specimens were removed through the subxiphoid port and sent for histopathological examination. Ropivacaine 40 mg diluted in 100 mL of normal saline was instilled intraperitoneally in Group A patients, whereas no drug was instilled in Group B patients. Patients were given postoperative intravenous second-generation cephalosporins. Patients were then monitored postoperatively, treated with intravenous analgesics, and other supportive care was given. Patients were then discharged after being deemed fit for discharge.

Data about the demographics, clinical findings, ultrasonogram reports, biochemical reports, intraoperative findings, operative time, postoperative bowel movements (time to appearance of bowel sounds, time to passage of flatus, and time to passage of stools), time to oral intake, and time to be deemed fit for discharge were collected and analyzed.

Statistical Analysis

Data were analyzed by descriptive statistics, such as mean and standard deviation. Independent *t*-test was used to determine significant difference between the two groups. The software SPSS version 20.0 was used for data analysis.

Results

The study included 28 patients who underwent laparoscopic cholecystectomy during the study period. Group A consisted of 11 patients, and Group B comprised 17 patients (Fig. 1). Among the study population, females constituted 60.7% and males constituted 39.3%. The mean age of the study group was 45.6 years. The mean body mass index of the study group was 23.9.

The mean time taken for surgery was 76 minutes. There were no conversions to open surgery.

There were no ICU admission or readmission in either of the groups. There was no mortality.

As shown in Table 1, the time to appearance of bowel sounds and time to passage of stools were marginally lower in the group that received ropivacaine; however, the *p*-value being >0.05 makes the result statistically insignificant.

Oral intake was also started slightly earlier in the group that received ropivacaine as shown in Figure 2.

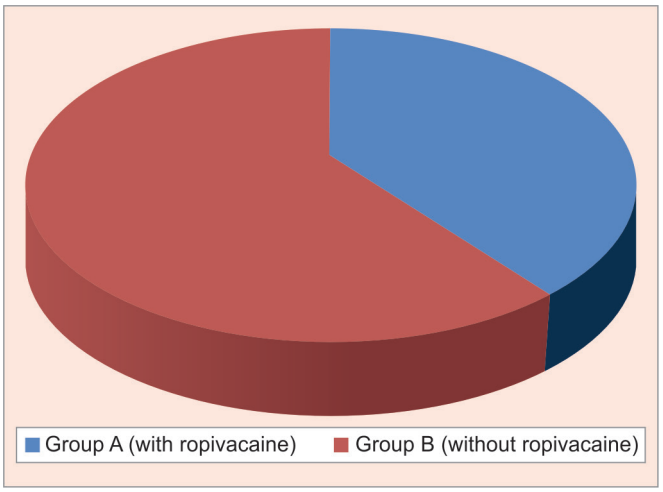

Fig. 1: Composition of the study group

Table 1: Time parameters for Group A and Group B

Parameter	*Group A*	*Group B*	*p value*
Mean time to appearance of bowel sounds	13.7 hours	14.5 hours	0.7
Mean time to first passage of flatus	24.1 hours	21.2 hours	0.18
Mean time to passage of stools	49.6 hours	50.7 hours	0.79
Mean time to oral intake	21.3 hours	22.7 hours	0.57
Mean time to discharge	57.5 hours	58.7 hours	0.85

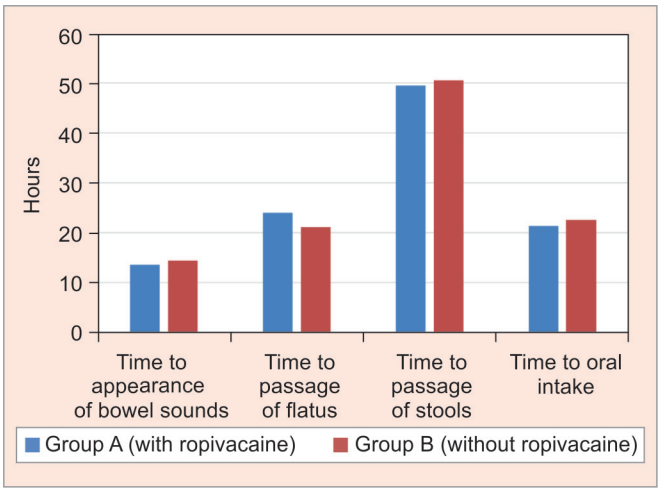

Fig. 2: Comparison of postoperative bowel movements in Group A and Group B

It is also clear from Figure 2 that passage of flatus was early in the group that did not receive ropivacaine. The *p*-value, however, was again >0.05 and hence requiring more studies to show a statistically significant result.

Discussion

Laparoscopic cholecystectomy is one of the most common surgeries performed worldwide. In this era, when people wish to resume work as early as possible following a surgery, new steps are being taken to enhance postoperative recovery.[3]

Enhanced recovery after surgery (ERAS) protocols are being implemented in this regard. One of the components of the ERAS protocol for laparoscopic surgeries includes intraperitoneal instillation of ropivacaine for its regional anesthetic effect, thus reducing postoperative pain and promoting early discharge of the patient.[3]

Several studies have shown the positive effects of intraperitoneal instillation of ropivacaine on postoperative pain with barely any side effects.

A prospective randomized control study conducted by Shivhare et al. concluded that 0.5% of 30 mL (150 mg) of ropivacaine instilled intraperitoneally in patients undergoing laparoscopic cholecystectomy significantly reduced the shoulder tip pain during the first postoperative day compared with 30 mL of normal saline instilled in the gallbladder fossa.[8]

Wu et al. conducted a study in 2005 in which they concluded that perioperative cotreatment with dextromethorphan and intravenous lidocaine had better analgesic effect and promotes early recovery of bowel function after laparoscopic cholecystectomy.[9]

Elhakim et al. concluded in their study that a combination of intraperitoneal instillation of lidocaine and tenoxicam provided better analgesia and faster return of bowel function.[10]

However in our study, it was noted that intraperitoneal instillation of ropivacaine had no significant effect on bowel movements.

Though there are studies observing the analgesic effect there is a lack of literature studying the effects of intraperitoneal instillation of ropivacaine on bowel movements.

In our study, this hypothesis was studied to know the possible effects of intraperitoneal instillation of ropivacaine on bowel movements. It was noted that there was no significant improvement in the return of bowel sounds or in the time to passage of flatus/stools. It also did not seem to have a positive effect on the early discharge of patients.

Limitations of the Study

As the study was conducted on a smaller population, generalizing these results to a bigger population might not be appropriate and further studies would be needed to have a definite picture of the effect of ropivacaine on postoperative bowel movements.

Conclusion

Early recovery from surgery has been a major concern. In this regard, the effect of intraperitoneal instillation of ropivacaine on postoperative analgesia has been well documented. However, the effect of the same on postoperative bowel movements does not seem to be significant. Hence, further studies are needed to validate our results.

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RESEARCH ARTICLE

Laparoscopic Extended Hemicolectomy vs Laparoscopic Transverse Colectomy for Management of Mid-transverse Colon Cancer—Which is the Optimal Surgical Approach?

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Abstract

Background: Laparoscopic-assisted surgical approach performing either extended right or left hemicolectomy or performing only conservative approach by transverse colectomy could be considered as various management approaches of cancer of the transverse colon but a consensus of which technique is the best is still lacking. So the choice of surgical approach depends on the preference and experience of the operating surgeon.

Aim: The aim of this study was to compare performing laparoscopic extended right or left hemicolectomy and performing transverse colectomy for management of transverse colon cancer located in the middle part of the transverse colon regarding surgical and oncological findings and patients' outcomes to prove which surgical approach is the best.

Patients and methods: We analyzed collected data of 120 patients with mid-transverse colon cancer. We divided them into two groups: the first group included 80 patients who were managed by right or left hemicolectomy and the second group included 40 patients who were managed by transverse colectomy. We evaluated operative, postoperative, and follow-up data of all included patients.

Results: The length of specimens was longer in the hemicolectomy group than that in the transverse colectomy group ($p = 0.007$). The numbers of dissected lymph nodes were significantly higher in the hemicolectomy group than in the transverse colectomy group ($p < 0.001$). The duration of operative time was longer in the hemicolectomy group than in the transverse colectomy group ($p = 0.014$). The group of patients in the hemicolectomy group experienced a higher rate of recovery findings than the transverse colectomy group. The group of patients in the hemicolectomy group experienced lower rates of intraoperative and perioperative complications than the transverse colectomy group ($p = 0.002$). Five years of overall survival (OS), progression-free survival (PFS), and disease-free survival (DFS) rates were slightly longer in the hemicolectomy groups than those in the transverse colectomy group, but results were not statistically significant.

Conclusion: We concluded that hemicolectomy is a better surgical approach of management of cancer located in the mid-transverse colon regarding operative and short-term outcomes than transverse colectomy, but regarding oncological outcomes, both techniques are considered safe and feasible.

Keywords: Hemicolectomy, Laparoscopic, Mid-transverse colon cancer, Transverse colectomy.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1478

Introduction

Carcinoma which is located in the transverse colon forms about 10% of all colorectal cancers.[1] The survival rates and patients' outcomes were found to be worse than cancers located elsewhere in the colon and rectum.[2] This dismal outcome might be due to, late discovery and diagnosis, dual lymphatic metastases along both branches of mesenteric vessels, and proximity to vital abdominal organs.[3]

Laparoscopic-assisted surgical management of cancer of the transverse colon is recently gaining acceptance to be an optimal management procedure. But the optimal approach for the management of cancer located in the mid-transverse colon is still controversial.[4]

Previous reports stated that performing either extended right or left hemicolectomy or only conservative approach by transverse colectomy could be considered various management approaches, but a consensus of which technique is the best is still lacking. So the choice of surgical approach depends on the preference and experience of the operating surgeon.[1]

The aim of this study was to compare performing laparoscopic extended right or hemicolectomy and performing transverse colectomy for the management of transverse colon cancer located in the middle part of the transverse colon regarding surgical and oncological findings and patients' outcomes to prove which surgical approach is the best.

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How to cite this article: Almoregy AS, Osman G, Sharafedeen M, *et al*. Laparoscopic Extended Hemicolectomy vs Laparoscopic Transverse Colectomy for Management of Mid-transverse Colon Cancer—Which is the Optimal Surgical Approach? World J Lap Surg 2021;14(3):215–220.

Source of support: Nil

Conflict of interest: None

Patients and Methods

Patients

This prospective study was approved by the local ethics committee of Faculty of Medicine, Zagazig University Institutional Review Board.

We analyzed the collected data of mid-transverse colon cancer patients who were surgically managed by either laparoscopic-

assisted, transverse colectomy, extended right hemicolectomy, or extended left hemicolectomy. All patients were admitted and operated in the General Surgery Department, Zagazig University Hospitals, in the period between January 2015 and April 2020.

Mid-transverse colon cancer is the term used when the cancer is determined during surgical exploration to be found in the middle part of the transverse colon, about 10 from each of the splenic or hepatic flexures.

Inclusion Criteria

Patients aged from 20–70 years with clinical, radiological, and histopathological diagnoses of adenocarcinoma of the transverse colon stages from I to III are included for the research.

Exclusion Criteria

We excluded patients with stage IV colon cancer who primarily presented with distant metastases; patients with multiple foci of colon cancer; patients with concomitant cancer in other organs; patients with emergent surgical intervention for the management of cancer-related intestinal obstruction, severe bleeding, or perforation; and patients with inflammatory bowel diseases or familial adenomatous polyposis.

After the application of inclusion and exclusion criteria of the current study, we included 120 cases with mid-transverse colon cancer. We divided them into two groups: the first group included 80 patients who were managed by right or left hemicolectomy and the second group included 40 patients who were managed by transverse colectomy.

Patients selected to perform transverse colectomy, right or left hemicolectomy, were made according to the choice and evaluation of the surgeon.

Surgical Techniques[5]

We performed surgery by using five ports, and we performed lymphadenectomy in a caudal-to-cranial or cranial-to-caudal manner along the superior mesenteric vein. We pulled out the intestine from a minute incision and then transected it by linear staplers in all included patients.

For cases that underwent hemicolectomy whether right or left, we ligated that middle colic vessels at their origin for right hemicolectomy and ligated the left colic and the left branch of the middle colic pedicles at their origins for left hemicolectomy with D2 or D3 lymphadenectomy.

For cases that underwent transverse colectomy, we have resected the bowel segment located between both hepatic flexure and splenic flexure, in addition to its lymphatic and vascular supply that is located along the pedicle of middle colic vessel with its ligation at its origin with D2 or D3 lymphadenectomy. Then, restoration of the bowel was done by side-to-side or end-to-end anastomoses.

We recorded all demographic patients' data such as age, sex, and BMI; pathological findings such as tumor histopathological subtype, grade, stage, number of dissected and positive lymph nodes, specimen length, and distances from both proximal and distal resected margins; operative findings such as operative time, complications, bleeding, and conversion rate; and postoperative data such as postoperative pain, bleeding, surgical wound infection, intestinal obstruction, and anastomotic leakage.

Postoperative complications were defined as any adverse findings that happened during 30 days from surgery. Bleeding was considered as a complication if the bleeding patient needs a blood transfusion. Pain is considered a severe complication if the patient needs high dose of analgesia. We defined anastomotic leakage as any clinical or radiological evidence of dehiscence which needs or not surgical intervention.

Patients were allowed to exit from the hospitals in the case of absence of symptoms, regular stool passage, and meals' tolerance.

Oncological and Follow-up Findings

We followed our patients at the outpatient clinic during the first 2 years after operation every 3 months; then, we followed them every 6 months for the remaining 3 years.

During the follow-up period, we regularly measured carcino-embryonic antigen (CEA) and cancer antigen (CA19-9), we performed computed tomography of the abdomen and chest every 6 months, and we performed total colonoscopy every 2 years. We assessed and analyzed overall survival (OS), progression-free survival (PFS), and disease-free survival (DFS) rates during the follow-up.

We performed a separate analysis for comparison between both hemicolectomy and transverse colectomy groups.

Data Analysis

Clinical data, demographic data, pathological findings, operative, postoperative, and follow-up data were collected, tabulated, and statistically analyzed. We compared continuous data using Student's *t-test* or Mann–Whitney *U*-test whenever needed. We analyzed categorical data using either Chi-square or Fisher's exact tests. For estimation of survival rates such as OS, PFS, and DFS rates, we used Kaplan–Meier curves and the log-rank test for comparison between survival curves. Statistical analyses were two sided, and we considered *p* value of less than 0.05 as a significant value. We used the statistical program Advanced Statistics (IBM SPSS Statistics v20.0, IBM Corporation, Armonk, New York).

Results

Demographic and Clinical Results

Table 1 denoted that there were no statistically significant differences in both groups regarding all demographic patients' data such as age, sex, and BMI and pathological findings such as tumor histopathological subtype, grade, and stage.

There was a statistically significant difference in the length of specimens, lengths of proximal and distal margins between both groups; they were longer in the hemicolectomy group than in the transverse colectomy group ($p = 0.007$). The numbers of dissected lymph nodes were significantly higher in the hemicolectomy group than in the transverse colectomy group ($p < 0.001$). The numbers of positive lymph nodes were higher in the hemicolectomy group than in the transverse colectomy group, but this was not statistically significant (Tables 2 to 4).

Operative and Perioperative Results

The duration of operative time was longer in the hemicolectomy group than in the transverse colectomy group ($p < 0.001$). There were no statistically significant differences in both groups regarding conversion rates.

The group of patients in the hemicolectomy group experienced a higher rate of recovery findings such as shorter time to first flatus, time to first mobilization, and shorter time to first meal, and shorter duration of hospital stay than those in the transverse colectomy group (0.014).

Table 1: Demographic, clinicopathological, operative, postoperative, and outcome findings of all included patients

		All population	
Patients' clinical characteristics and outcomes		*N*	*%*
Age (years)		55 (29–80)	
Sex	Female	42	35.0%
	Male	78	65.0%
Size	≤5 cm	75	62.5%
	>5 cm	45	37.5%
Histopathological subtype	Conventional adenocarcinoma	105	85%
	Mucoid carcinoma	15	15%
DUKE stage	A	36	30.0%
	B	33	27.5%
	C	51	42.5%
Stage	I	36	30.0%
	II	43	35.8%
	III	41	34.2%
LN metastases	No	79	65.8%
	Yes	41	34.2%
Number of lymph nodes harvested		20 (9–28)	
Grade	I	33	27.5%
	II	78	65.0%
	III	9	7.5%
Length of the specimen		50 (20–100)	
Margin status	R0	114	95.0%
	R1	6	5.0%
Duration of hospital stay	5	16	13.3%
	6	28	23.3%
	7	31	25.8%
	8	26	21.7%
	9	19	15.8%
30-day morbidity	No	114	95.0%
	Yes	6	5.0%
30-day mortality	No	117	97.5%
	Yes	3	2.5%
Operative time minute		110 (90–150)	
Operative complications	0	114	95.0%
	1	6	5.0%
Postoperative complications	0	107	89.2%
	1	13	10.8%
Relapse	No	96	80.0%
	Yes	24	20.0%
Death	No	107	89.2%
	Yes	13	10.8%

The group of patients in the hemicolectomy group experienced lower rates of intraoperative and perioperative complications than the transverse colectomy group ($p = 0.002$, $p = 0.017$).

There were no statistically significant differences in both groups regarding 30-day postoperative outcomes.

Survival and Patients' Outcome Results

There were no statistically significant differences between both groups, regarding disease, local or systemic recurrence, progression, and the use of or response to chemotherapy.

Five years of OS, PFS, and DFS rates were slightly longer in the hemicolectomy groups than in the transverse colectomy group, but the results were not statistically significant.

All these data analyses confirm the advantages of hemicolectomy over transverse colectomy.

Discussion

Although transverse colon cancer forms about 10th of all colon cancer cases, a consensus about the best management strategy for such cancer is still lacking.[6] Survival rates of cancer located in the transverse colon are lower than survival rates of cancer located in other parts of the colon.[7] This dismal outcome is mostly due to sending lymph node metastases to lymph nodes located around both superior and inferior mesenteric vessels in addition to proximity to vital abdominal organs that made surgical management is difficult with a higher incidence of postoperative complications.[3]

Previous studies compared both conservative approaches by surgical removal of only the transverse colon, while others prefer the extended right or left hemicolectomy to achieve more treatment that is radical and removal of more lymph nodes.[8]

Moreover, laparoscopic-assisted surgery is now considered the best management approach for colon and rectal cancers.[9,10]

Most previous studies compared laparoscopic and open surgical management of colon cancer,[11,12] but only a few studies compared laparoscopic-assisted conservative transverse colectomy and extended hemicolectomy for management of transverse colon cancer.

In the present study, we included cases with mid-transverse colon cancer that was managed by either right or left hemicolectomy compared them by cases managed by transverse colectomy.

We showed that both laparoscopic-assisted right or hemicolectomy or laparoscopic-assisted transverse colectomy could be proper management options for cancer located in the mid-transverse colon, as we showed that operative, clinical, and oncological outcomes were nearly the same for both groups, but the incidence of postoperative complications was higher in patients underwent transverse in comparison with patients underwent hemicolectomy which is similar to the results of Matsuda et al.[4] and Milone et al.[1]

We showed that as the number of dissected lymph nodes is more in the hemicolectomy group than that in the transverse colectomy group, hemicolectomy leads to more radical management than conservative transverse colectomy.

Leijssen et al.[13] and van Rongen et al.[14] showed that despite fewer harvested lymph nodes in the transverse colectomy group, they showed that no differences between transverse colectomy and hemicolectomy regarding operative and postoperative complications concluded that performing transverse colectomy is an oncologically safe and suitable management approach for cancer of the mid-transverse colon stages from I to III, but the limitation of both studies is the small number of included patients made their results need further modifications.

Matsuda et al.[4,5] showed that both transverse colectomy and hemicolectomy have similar advantages and oncological outcomes, but their study was retrospective and included a small number of patients.

We showed that the duration of operative time was longer in the hemicolectomy group than that in the transverse colectomy group, but we showed that the group of patients

Table 2: Correlations between both included groups of patients underwent both surgical techniques regarding demographic and clinicopathological findings

		Management surgical technique						
		Extended right and left hemicolectomy		*Transverse colectomy*		*Total*		
Patients' clinical characteristics		*N*	*%*	*N*	*%*	*N*	*%*	*p*
Age (years)*		55 (29–80)		55 (29–80)		55 (29–80)		1
Sex	Female	28		14	35.0%	42	35.0%	1
	Male	52		26	65.0%	78	65.0%	
Size	≤5 cm	50		25	62.5%	75	62.5%	1
	>5 cm	30	37.5%	15	37.5%	45	37.5%	
Histopathological subtype	Conventional adenocarcinoma	70	85%	35	85%	105	85%	0.958
	Mucoid carcinoma	10	15%	5	15%	15	15%	
DUKE stage	A	24	30.0%	12	30.0%	36	30.0%	1
	B	22	27.5%	11	27.5%	33	27.5%	
	C	35	42.5%	17	42.5%	51	42.5%	
Stage	I	24	30.0%	12	30.0%	36	30.0%	0.771
	II	28	35.0%	12	30.0%	43	35.8%	
	III	28	35.0%	16	40.0%	41	34.2%	
LN metastasis	No	52	65.0%	24	60.0%	79	65.8%	0.495
	Yes	28	35.0%	16	40.0%	41	34.2%	
Number of lymph nodes harvested*		24 (10–28)		20 (10–27)		20 (9–28)		<0.001£
Grade	I	22	27.5%	11	27.5%	33	27.5%	1
	II	52	65.0%	26	65.0%	78	65.0%	
	III	6	7.5%	3	7.5%	9	7.5%	
Length of the specimen		70–100	30–60					0.007
Margin status	R0	38	95.0%	38	95.0%	114	95.0%	1
	R1	2	5.0%	2	5.0%	6	5.0%	

All variables were compared using Chi-square test except (*) Mann–Whitney *U*-test

in the hemicolectomy group experienced a higher rate of recovery findings and experienced lower rates of intraoperative and perioperative complications than those in the transverse colectomy group. Our results were slightly different from the results of Chong et al.,[3] who reported no significant differences in operative time or incidence of postoperative complications between both transverse and hemicolectomy groups that suggest safety and feasibility of the conservative approach; moreover, they showed that the extent of lymphadenectomy in the transverse colectomy was sufficient for adequate radicalism and accurate cancer staging.

We showed that there were no statistically significant differences between both groups regarding 5-year OS and DFS rates in each group which is similar to the results of Guan et al.[15] Matsuda et al.[9,10] reported that in their group of patients the 5-year OS was worse than the 5-year DFS and explained their results by that most patients who died were from diseases other than cancer.

We showed that although dissected lymph nodes were higher in the lymphadenectomy group, the incidence of positivity was similar in both groups; similarly, Milone et al.[16] and Guan et al.[15] concluded safety and feasibility of transverse colectomy as a less aggressive and a more advisable approach of surgical management of mid-transverse colon cancer.

Milone et al.[1] showed similar results to ours that hemicolectomy is a better management procedure that has fewer complications than the transverse colectomy group; additionally, they showed that the hemicolectomy group experienced higher recovery, less bleeding, less anastomotic leakage, and better survival rates.

The fewer number of dissected lymph nodes in the transverse colectomy group is due to shorted size of the sample in addition to technical difficulty of performing adequate lymphadenectomy in the transverse colectomy approach.

Guan et al.[15] showed that a number of harvested lymph nodes were higher in the hemicolectomy group than those in the transverse colectomy group, but they stated that both procedures yielded sufficient lymph nodes for adequate staging.

Milone et al.[1] explained the higher complication rates after transverse colectomy is that it required both splenic and hepatic flexures mobilization which is considered a technically difficult step in any colon resection, and in transverse colectomy we required to make double mobilization of both flexures which increased risks of complications.

Regarding the follow-up, patients' outcomes, and survival rates, we showed similar results to all previous studies that both OS and DFS rates were comparable between the both procedures, suggesting that both surgical approaches were adequate, safe, and feasible for selected patients.

Table 3: Correlations between both included groups of patients underwent both surgical techniques regarding operative, postoperative, and outcome findings

		Management surgical technique						
		Extended right and left hemicolectomy		*Transverse colectomy*		*Total*		
Postoperative data		*N*	*%*	*N*	*%*	*N*	*%*	*p*
Duration of hospital stay, days*		5 (4–8)		7 (5–9)		6 (4–9)		0.014
		10	12.5%	4	10.0%	16	13.3%	0.963
		18	22.5%	8	20.0%	28	23.3%	
		20	25.0%	12	30.0%	31	25.8%	
		9	22.5%	10	25.0%	26	21.7%	
		7	17.5%	6	15.0%	19	15.8%	
30-day morbidity	No	76	95.0%	38	95.0%	114	95.0%	1
	Yes	4	5.0%	2	5.0%	6	5.0%	
30-day mortality	No	78	97.5%	39	97.5%	117	97.5%	1
	Yes	2	2.5%	1	2.5%	3	2.5%	
Operative time minute*		125 (100–150)		105 (100–150)		110 (90–150)		<0.001[£]
Operative complications	0	78	98.0%	36	90.0%	114	95.0%	0.002
	1	2	2.0%	4	10.0%	6	5.0%	
Postoperative complications	0	76	95.0%	34	85.0%	107	89.2%	0.017
	1	4	5.0%	6	15.0%	13	10.8%	
Relapse	No	64	80.0%	32	80.0%	96	80.0%	1
	Yes	16	20.0%	8	20.0%	24	20.0%	
Death	No	70	87.5%	36	90.0%	107	89.2%	0.917
	Yes	10	12.5%	4	10.0%	13	10.8%	

All variables were compared using Chi-square test except (*) Mann–Whitney *U*-test

Table 4: Correlations between both included groups of patients underwent both surgical techniques regarding survival rates

			Censored		*Survival rate, %*		*Survival time, months*		*95% confidence interval*	
Survival analysis	*Total N*	*N of events*	*N*	*Percent*		*Sig.*	*Mean*	*Std. error*	*Lower bound*	*Upper bound*
Relapse-free survival										
Extended right and left hemicolectomy	80	16	32	80.00%	0.8	0.587	31.15	1.537	28.137	34.163
Transverse colectomy	40	8	32	80.00%	0.8		31.15	1.537	28.137	34.163
Overall	120	24	96	80.00%	0.8		31.383	0.851	29.715	33.051
Progression-free survival										
Extended right and left hemicolectomy	80	16	32	80.00%	0.8	0.957	31.15	1.537	28.137	34.163
Transverse colectomy	40	8	32	80.00%	0.8		31.15	1.537	28.137	34.163
Overall	120	24	96	80.00%	0.8		31.383	0.851	29.715	33.051
Overall survival										
Extended right and left hemicolectomy	80	10	35	87.50%	0.875	0.984	33.325	1.128	31.115	35.535
Transverse colectomy	40	4	36	90.00%	0.895		34	0.947	32.143	35.857
Overall	120	13	107	89.20%	0.89		33.842	0.571	32.723	34.961

Summary and Conclusion

In the current study, we correlate transverse colectomy and hemicolectomy whether right or left aiming at detecting the best management surgical approach and we showed that hemicolectomy is better regarding radicalism of management, better recovery, and less incidence of complications. We showed that survival outcomes are similar between both procedures so we concluded that hemicolectomy is a better surgical approach for the management of cancer located in the mid-transverse colon regarding operative and short-term outcomes than transverse colectomy, but regarding oncological, survival, and long-term outcomes, both techniques are considered technically and oncologically safe and feasible.

Recommendations

We highlighted the liability of considering transverse colectomy in certain cases of cancer in the mid-transverse colon as a safe and curative approach of managing curable transverse colon cancer rather than considering it a palliative procedure. A large study included that a large number of patients are needed to prove and strengthen our findings.

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RESEARCH ARTICLE

Laparoscopic Cholecystectomy: Single-port vs Traditional Procedure: Our Experience

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Abstract

Background: Laparoscopic surgery is widely accepted as a reliable alternative to the open approach across surgical disciplines. Benefits of single-incision laparoscopic surgery (SILS), as exemplified here by single-port laparoscopic cholecystectomy (SPLC), have yet to be formally proved. However, the hypothesized benefits of SILS would include those of standard traditional laparoscopic surgery plus improved esthetic outcomes, with surgery being performed through a single hidden incision.

Methods: All patients who had chronic calcular cholecystitis at the General Surgery Department at Mansoura University Hospital between May 2014 and May 2018 were eligible for this study to compare SPLC with multiport laparoscopic cholecystectomy (MPLC). Operative and perioperative outcomes, including cosmesis, were analyzed.

Results: SPLC had been performed in Group A (40 patients), mean age was 37.35 ± 10.72, 80% were females, and mean BMI was 30.15 ± 4.53. MPLC was performed in Group B (40 patients), mean age was 40.70 ± 9.71, 75% were females, and mean BMI was 28.35 ± 2.83. The average duration of postoperative hospital stay in SPLC cases was 24 hours and in MPLC group was 25.20 hours, with $p = 0.330$, which was insignificant. In the SPLC group, the mean operative time was 95.75 minutes whereas in the MPLC group the mean operative time was 42.10 minutes. Therefore, the mean operative time in the SPLC group was significantly higher than in the MPLC group ($p < 0.01$). Esthetic results were better in the SPLC group than in the MPLC group.

Conclusion: Based on the current findings, SPLC seems to be a safe procedure in uncomplicated cholecystitis with rapid recovery, less postoperative pain, less wound infection, and better cosmesis. The operative time was long. However, patients should be aware of the risks of port-site incisional hernia and instructed to avoid heavy work and exercises during the first three postoperative months.

Keywords: Laparoscopic cholecystectomy, Single-port, Traditional.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1482

Introduction

Laparoscopic surgeries are special techniques by which surgeons perform the operations via several tiny holes in the abdomen with the help of a camera. It is known also as minimally invasive surgery (MIS). These incisions are much smaller than traditional surgical techniques.[1]

Diminished postoperative pain, fast recovery, improved esthetic outcomes, and short hospital stay are the documented benefits across a spectrum of surgical procedures. Many procedures have been done safely with laparoscopy. These include laparoscopic cholecystectomy that has supplanted open cholecystectomy for most gallbladder pathologies.[2,3]

Laparoscopic cholecystectomy is a widely accepted procedure that causes less postoperative pain and a shorter postoperative length of stay (LoS) than open surgery.[4–8] Traditional laparoscopic cholecystectomy is done in >90% of elective cholecystectomies and 70% of urgent cholecystectomies.[9,10]

The concept of SILS is to do the procedure through a single skin incision, usually the umbilicus through multichannel (trocar) ports. The umbilicus is the common site for basic procedures such as laparoscopic cholecystectomy and appendectomy. The incision can be periumbilical or transumbilical.[11,12]

SILS is a quickly growing procedure as a union between traditional laparoscopic techniques and Natural orifice transluminal endoscopic surgery (NOTES). The current trend has been about the development of SILS to further reduce the invasiveness of laparoscopic surgeries by minimizing the number of skin violations.[13,14]

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How to cite this article: Awad SM, Dawoud I, Althobiti W, *et al.* Laparoscopic Cholecystectomy: Single-port vs Traditional Procedure: Our Experience. World J Lap Surg 2021;14(3):221–226.

Source of support: Nil

Conflict of interest: None

Since 1985, many efforts have been on in the laparoscopy field to reduce the invasiveness of laparoscopic approaches, with operators developing new technology and techniques to minimize postoperative pain and improve esthetic outcome by small-sized ports or smaller numbers. At present, SILS has gained tremendous focus for the treatment of many surgical diseases.[5,15–17]

The difficulties of SILS include limited triangulation between straight instruments, restricted movements, close proximity between the instruments, and narrow visual axis and operative field.[18–20]

However, there are no clear indications for SILS until now, and its applicability and feasibility have grown throughout many of the surgical fields. The applicability of this approach has been

observed in gynecologic, urologic, pediatric, gastrointestinal, and bariatric surgery.[13]

Patients and Methods

All patients who had chronic calcular cholecystitis at the General Surgery department 7 at Mansoura University Hospital between May 2014 and May 2018 were eligible for this study to compare between SPLC and MPLC. Operative and perioperative outcomes, including cosmesis and quality of life, were analyzed. Candidates were randomly assigned into two groups: Group A consisted of 40 cases (single-port laparoscopic cholecystectomy) and Group B consisted of 40 cases (traditional multiport laparoscopic cholecystectomy).

Inclusion criteria: (1) age: ≥15 years, (2) sex: male and female, (3) ultrasound finding of gallbladder stones, (4) biliary colic, and (5) BMI <40.

Exclusion criteria: (1) age: <15 years, (2) acute pancreatitis, (3) common bile duct stones, (4) contraindications for single-port cholecystectomy, namely, ASA classification of 3 or 4 indicating pregnancy, and (5) BMI >40.

All candidates underwent proper history taking, thorough clinical examination, radiological, and full laboratory investigation stressing on liver status.

Follow-up of the patients: Follow-up of the patients included operative time, periprocedural operative complications (bleeding, bile leak, visceral injury, conversion to MPLC or open cholecystectomy). Postoperative follow-up included postoperative bleeding, bile leak, hospital stay, wound infection, incisional hernia, and cosmesis for one year. All of these data were collected, tabulated, and analyzed carefully using SPSS version 26.

Results

This comparative prospective research was performed on all eligible candidates who were classified into two groups: Group A consisted of patients who underwent single-port laparoscopic cholecystectomy and Group B consisted of patients who underwent multiport laparoscopic cholecystectomy.

Demographic Criteria and Clinical Characteristics of the Patients

Demographic and clinical characteristics of the patients are shown in Table 1. Patients in both groups had same abdominal sonography finding, such as normal liver, gallbladder stones, normal common bile duct diameter with no stones impacted, and so on. Laboratory investigations for patients in both groups were normal including serum bilirubin, serum alkaline phosphatase, liver enzymes, bleeding profile, and hemoglobin level. All cases with symptomatic cholelithiasis and all surgeries were elective.

Operative time: In Group A, the mean operative time in minutes was 95.75 ± 18.37 (Table 2) whereas in the MPLC group, it was 42.10 ± 5.04, so that the mean operating time in Group B was significantly lower than in the SPLC group (p <0.01).

Operative times and learning curve: The operative time was significantly higher in Group A (Fig. 1). An important reduction in the operative time was achieved as the number of cases undergoing SPLC had increased. In the first 20 cases, the average operative time was 100 minutes whereas in the second 20 patients, it was 80 minutes (Fig. 2).

Intraoperative complications: In the SPLC group, we encountered intraoperative bleeding in one case. The source of bleeding was a cystic artery, and we had to convert to MPLC to control the bleeding whereas in the MPLC group there was no intraoperative bleeding (p = 0.311) which is insignificant (Fig. 3). There was no intraoperative viscus injury or bile leakage in both groups.

Conversion to MPLC: In the SPLC group (Fig. 4), the conversion to MPLC was mandated in five patients. In one patient, it was due to uncontrolled bleeding from a cystic artery. In two patients, conversion was due to a tense gallbladder with pericholecystic adhesions and exposure of Calot's triangle was difficult. Both patients were male and had a history of recent attack of acute cholecystitis. In one patient, there was a caterpillar hump anomaly of the right hepatic artery occupying most of the cholecystohepatic triangle and so we had to convert for better delineation of Calot's triangle and safe cholecystectomy. In one patient, we converted to MPLC then to open procedure due to a thick gallbladder with an impacted large stone at the cystic duct.

Postoperative complications (bleeding, bile leak): In both groups, we did not have postoperative bleeding or bile leak.

Postoperative pain and need for additional analgesia: All patients in both groups received the same postoperative analgesia (paracetamol injection 8 hourly). In the SPLC group, the number of patients requiring additional analgesia in the form of NSAIDS was 16 (40%) whereas in the MPLC group, the number of patients requiring additional analgesia was 30 (75%) (p = 0.025), indicating

Table 1: Demographic and clinical characteristics of the patients

	SPLC group (n = 40)		*MPLC group (n = 40)*		*t*	*p*
Age (mean ± SD), years	37.35 ± 10.72		40.70 ± 9.71		1.036	0.307
BMI (mean ± SD)	30.15 ± 4.53		28.35 ± 2.83		1.506	0.140
Sex	*No.*	*%*	*No.*	*%*		
Male	8	20%	10	25%	0.143[#]	0.705
Female	32	80%	30	75%		
Recent attack of acute cholecystitis or pancreatitis	6	15%	4	10%	0.229	0.633

Table 2: Operative time in SPLC group and MPLC group

	Group A (n = 40)	*Group B (n = 40)*	*t*	*p*
Operative time (mean ± SD)	95.75 ± 18.37	42.10 ± 5.04	12.594	<0.01*

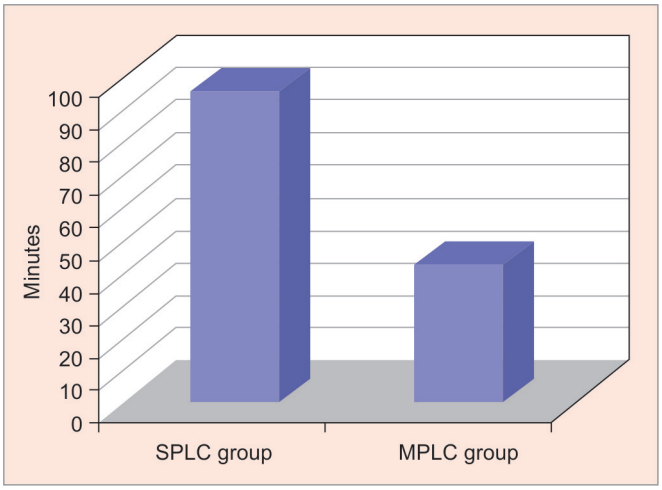


Fig. 1: postoperative time in SPLC and MPLC groups

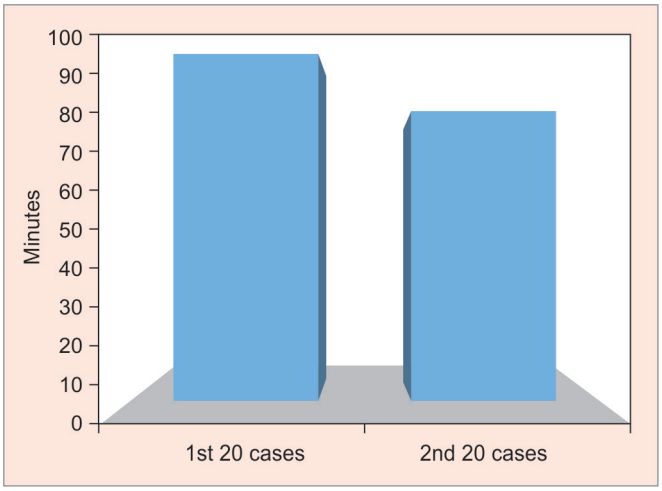


Fig. 2: Operative time and learning curve in SPLC group

that postoperative pain in SPLC is not significantly less than in the MPLC group. The data are shown in Table 3.

Postoperative of LoS: The mean duration of *LoS* in Group A was 24 hours whereas in Group B it was 25.20 hours (Table 4); *p* was 0.330 which is insignificant.

Postoperative wound infection: In the SPLC group, we observed wound infection in two patients (5%) whereas in the MPLC group wound infection occurred in eight patients ($p = 0.151$). In the SPLC group, the wound infection was mild and managed by oral antibiotics whereas in the MPLC group wound infection was at the site of the epigastric port (Fig. 5). In the eight patients, port-site wound infections were observed because the gallbladder had been perforated during specimen extraction and it was resolved with oral antibiotics.

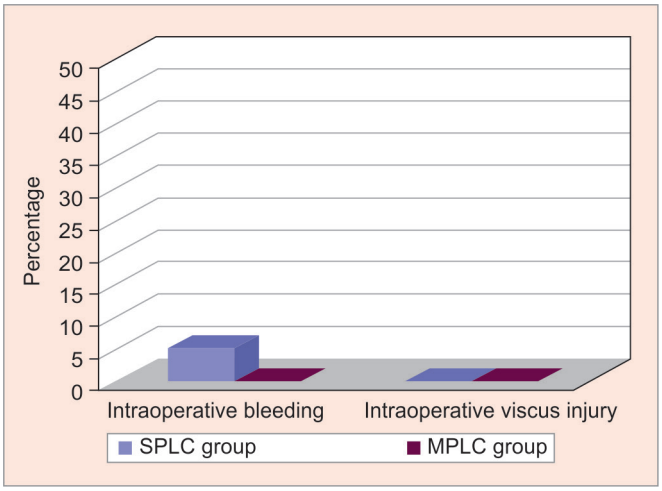


Fig. 3: Intraoperative complications of both groups

Table 3: Post-procedural pain in the two groups

	SPLC group (n = 40)		*MPLC group (n = 40)*			
	No.	*%*	*No.*	*%*	x^2	*p*
Need for NSAIDS	16	40%	30	75%	5.013	0.025

Table 4: Postoperative LoS in SPLC and MPLC groups

	SPLC group (n = 40)	*MPLC group (n = 40)*	*t*	*p*
Hospital stay (mean ± SD)	24.00 ± 0.00	25.20 ± 5.37	1.000	0.330

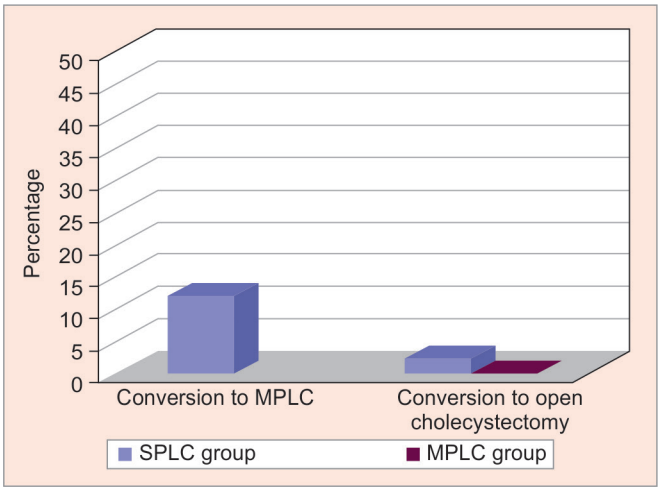


Fig. 4: Conversion to MPLC in SPLC group

Port-site incisional hernia: In the SPLC group, port-site incisional hernia developed in two patients whereas in the MPLC group no patient developed port-site incisional hernia within the six-month follow-up period ($p = 0.147$). Two patients had port-site incisional hernia within the first six months postoperatively (Table 5), so patients should be informed to avoid heavy exertion and exercises during the first three months postoperatively.

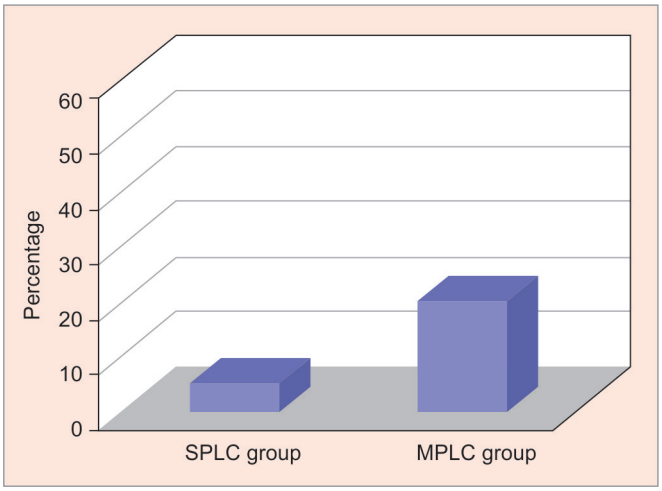
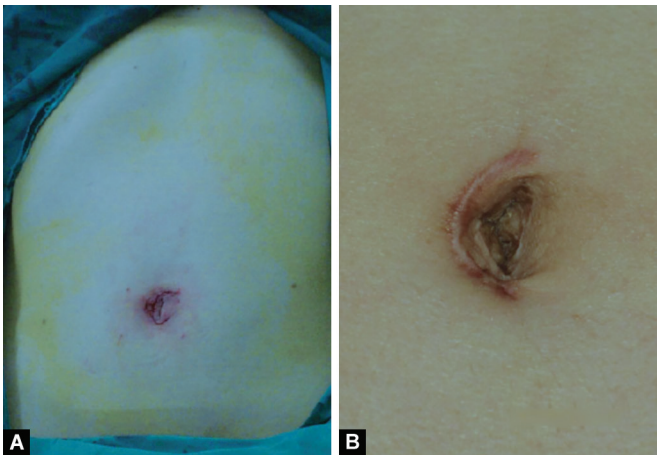


Fig. 5: Postoperative wound infection in SPLC and MPLC groups

Table 5: Incidence of postoperative port-site incisional hernia in both groups

	SPLC group (n = 40)		*MPLC group (n = 40)*			
	No.	*%*	*No.*	*%*	X^2	*p*
Port-site incisional hernia	2	5%	0	0%	2.105	0.147



Figs 6A and B: (A) The transumbilical incision immediately after surgery; (B) The transumbilical incision 6 months postoperatively

Cosmetic results: Esthetic outcomes were higher in the first group having one incision concealed in the umbilicus rather than having four separate incisions as in the MPLC group (Fig. 6).

Discussion

SILS is one of the most advanced innovation in the field of MIS. The collaboration between the biomedical industry, technology research, and surgical experts is the guiding force to add more patient-friendly techniques to the field of surgery. The target of SILS is to minimize surgical invasiveness of port access and provide surgery with no scar as the slit of port access is most often concealed within the umbilicus.[21–24]

The latest invention in SILS is use of the single-access device. This technique accommodated the introduction of three or four instruments through a single access device via an opening in the umbilicus. The latest devices that are available let the surgeon to insert more than two instruments and an optic with or without trocars through one port. Triangulation can be gained through articulating prebent instruments.[25–28]

We will now discuss the advantages, disadvantages, and difficulties that we faced during our own experience of SPLC at the General Surgery department at Mansoura University Hospital.

A recent revolution in MIS for the majority of surgical specialties has been the rapid recovery times with shorter hospitalization, fewer wound-related complications post-operatively, and better esthetic results. However, MPLC is still associated with more tissue trauma due to the size and number of ports utilized.[18,29–31]

In our study, the postoperative pain in both groups was compared using the number of patients who required additional analgesia for breakthrough pain (NSAIDS). Analysis of these two items showed that postoperative pain was more in the MPLC group. According to Prasad A et al., Group A patients experienced less postoperative pain than those of the other group.[12,32]

SILS is a maneuver to minimize multiple incisions by using a small hidden intraumbilical slit, thereby making SPLC seems like a scarless operation to the candidate.[33–36] According to the patients' own assessment in our study, those who underwent SPLC had better esthetic outcome and more candidate satisfaction than those in the MPLC group.

According to a study, SPLC patients were cosmetically superior than MPLC cases and were also higher in the same group in terms of patient satisfaction scores; thus cases in Group A were more satisfied with the overall outcomes of the technique.[37]

According to a study of SPLC conducted in 107 cases of which 81 (76%) were done successfully, the LoS of the SPLC group vs that for the MPLC group was statistically different. The successful SPLC cases had a mean LoS of 1.1 ± 0.35 days compared with 1.4 ± 1.3 days for the MPLC group.[38] In our current research, the average postoperative LoS for successful SPLC was 24 hours and for the MPLC group (25 ± 5.37 hours) there was insignificant difference between the two groups.

In our study, port-site wound infection occurred in two patients of the SPLC group whereas in the MPLC group it occurred in eight cases. According to Lee et al.'s study, the incidence of postoperative port-site wound infection was less in the SPLC group.[37] In the current research, the average operative time was 100 minutes in the first 10 patients in the SPLC group and it decreased to 80 minutes in the second 10 patients denoting that the operative time reduces with an improved learning curve.

The experience with SPLC is manifest in the cholecystectomy trial of Tacchino et al. as the operative time reduced from 180 minutes for the first patient to 105 minutes for the second patient and remained at an average of 50 minutes finally. Some researchers concluded no learning curve for this technique when transabdominal sutures were used for clear exposure from the start. To enhance the learning curve, laboratory training on dry porcine models was advised.[31]

SPLC is an advanced laparoscopic technique, and it should be done basically by surgeons with enough experience in traditional laparoscopy. Surgeons face a learning curve in using the instruments with a limited range of motion. The operators also are in need of frequent adjustment of the vision due to simultaneous movement of both the laparoscope and instruments. This mandates skilled laparoscopists with superior coordination and harmony between the surgeon and the assistant, which increases with experience.[31,34–36,39]

SPLC can be done safely with standard straight laparoscopic instruments. In our study 10 patients out of 40 were operated by the standard laparoscopic instruments and all were completed successfully. According to Cantore et al.'s study of 20 candidates (16 women, 4 men) of SILC, 4 (20%) had had previous abdominal surgery (appendectomy in all patients). Traditional straight laparoscopic instruments were used. All patients were successfully operated without additional skin slits. This study concluded that SILC with traditional straight laparoscopic instruments is feasible and safe.[40]

In recent years, SILS and NOTES have received attention for both clinical and industrial aspects. The key advantages in favor of these two techniques are the esthetic outcome, fast recovery of patients, and reduced need for analgesia.[18–20] SILS is considered superior to other NOTES because it does not involve manipulation of instruments through internal hollow organs such as the stomach or vagina.[31,32,37]

In our present research, the mean operative time in the first group as a new procedure was 95.75 minutes, which was significantly higher than in the MPLC group (42.10 minutes). According to one research, which was carried out on 60 patients divided into two equal groups of 30 candidates each, Group I was offered MPLC and in Group II, SILC was done. Length of stay, pain score, operative time, and wound infection rates were compared between the two groups. Operative times in Group I and Group II were 38.50 ± 8.92 minutes and 80.17 ± 30.16 minutes, respectively. p value was 0.0001, which indicates an important difference between the two groups.[41]

As the number of cases undergoing SPLC increased, there was an important reduction in the operative time with improvement of the learning curve. In our current study, operative time after first 20 SPLC techniques showed a significant reduction. This correlates with the recorded "learning curve" in other research studies.[24]

In one study, the postoperative incidence of port-site incisional hernia in the 1st group was higher postoperatively (2 cases out of 20). An issue that many operators expressed about SILS is the probability of a high occurrence of port-site incisional umbilical hernias postoperatively. The concern behind this query was that SILS requires a bigger fascial incision (20–30 mm) to accept a multichannel port device. So careful closure of the fascial defect and postoperative instructions to avoid heavy work and exercises within the first three months post-operatively are obligatory.[24,39,42]

In our study, the instrumental cost of the SPLC using a commercial port and curved instruments was significantly higher than the cost for MPLC. According to a previous experience, two consecutive series of cases with SILC were assessed and revealed that the instrumental cost of SILC using a commercial port was significantly higher (median $1123) than the cost for MPLC (median $441, $p = 0005$).[43] SPLC has secondary advantages including improved esthetic outcomes, LoS, and a rapid return to work Therefore, the cost of the SPLC procedure should not be the reason to reject the technique.

Major technical difficulties with this novel procedure are the sacrifice that have to be made in terms of ergonomics and comfort. Because all camera and instruments are accommodated through the same slit, the triangulation of instruments around the target was lost. In our current research, this resulted in an initial significant increase in the operative time. However, in our study with an improvement of the learning curve of the technique, operative times have been minimized significantly and are now very near to the mean time taken for traditional laparoscopy. Future technical improvements in instrumental technology may guide minimizing of the operative times further.[41,43,44]

Another issue that must be understood with SILS is cross-handedness. Early in our current study, we struggled with hand placement outside the abdomen as the sphere of space that the external components of the instrumentation and the surgeons' hands inhabit is decidedly smaller.[45,46]

In general aspects, case results and safety from any operative technique may be affected by three various, but equally significant, items: the patients' health (or disease); surgeons (expertise, training, and his/her surgical team); and technology used.[47] In our current research, simple cases with straightforward diseases are the most proper cases for this procedure. Thus, one might think that patients who are morbidly obese, those with previous abdominal surgeries (especially ventral hernia repairs with mesh), very tall candidates, or cases with multiple comorbidities may be excluded (at least at an early time of experience with an operator's single-port use).

In general, all periprocedural complications linked to laparoscopy will also be potential concerns in SILS. At present, most clinical research studies have not reported a higher complication rate, or more serious entities of complications, after SILS. In fact, the available experience has revealed the same results with SILS as compared to conventional laparoscopic approach, with the addition of many of its proposed and unique benefits, such as improved esthetic outcomes from virtually hidden scars.[45,46]

There may be a subset of potential complications, which may prove to be more common with SILS as compared with other traditional procedures. Of particular concern is that electrical injuries could be more prone to occur, at least in theory. These may occur as a result of the near proximity of laparoscopic instruments, with close contact, to each other. However, it did not occur in our study.[46]

Conclusion

SILS allowed for better cosmesis, less pain and faster recovery, less wound infections, ease of tissue retrieval, combination procedure, and patient acceptance. Standard instruments can be used, and natural orifices need not be violated. SPLC can be done safely with standard straight laparoscopic instruments. With improvement of the learning curve of the technique, operative times have been minimized significantly.

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CASE REPORT

Endoscopic Management of Two Sites of Stenosis Post-laparoscopic Re-sleeve Gastrectomy and Acute Pancreatitis

Mohammad A Alhaijawi[1], Ibrahim Alonazi[2], Khatoon Alakrawi[3], Fatima Ali[4], Wassim A Yassine[5], Mohammed Alaqeel[6]

Abstract

Sleeve gastrectomy is a commonly performed bariatric procedure that is complicated by stricture formation in approximately 0.5% of cases. Gastric sleeve surgery adverse events, which can result in strictures and leaks, are increasingly managed through a minimally invasive endoscopic approach. Endoscopic treatment with pneumatic balloon dilation and stent insertion has repeatedly proven to be effective and safe as the first line of management for this complication as in our case with two sites of stenosis and twisting because of severe adhesions due to previous scar tissue and acute pancreatitis. Surgical intervention should be considered only after the failure of endoscopic treatment.

Keywords: Adhesions, Endoscopic pneumatic balloon dilation, Morbid obesity, Pancreatitis post-sleeve gastrectomy, Two sites of stenosis post-sleeve gastrectomy.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1463

Introduction

Obesity has been a major public health problem worldwide,[1] and it has reached epidemic levels in the past few decades. Surgical therapy is effective and proven therapy for patients with severe obesity. Sleeve gastrectomy is a frequently performed procedure worldwide. Sleeve gastrectomy is a commonly performed bariatric procedure that is complicated by stricture formation in approximately 0.5% of cases. Gastric sleeve surgery adverse events, which can result in strictures and leaks, are increasingly managed through a minimally invasive endoscopic approach. Surgical revision of sleeve gastrectomy is associated with significant morbidity even when performed laparoscopically. Therefore, endoscopic management is the preferred option.[2]

History and Examination

We report a case of a 37-year-old female who presented with infertility for years, most likely attributed to her morbid obesity. After several unsuccessful trials of losing weight, the patient was advised to seek bariatric surgery to help her with conceiving. In 2012, she underwent laparoscopic sleeve gastrectomy (LSG) with weight of 174 kg, height of 169 cm, and body mass index (BMI) of 60.9 kg/m^2. Fortunately, after losing 74 kg, the patient went through *in vitro* fertilization, got pregnant with her first child, and was delivered by cesarean section in 2016, but since after giving birth, she started gaining weight again.

The patient was planning for a second pregnancy, and as she did not successfully achieve significant weight loss from her initial surgery, she decided to undergo a revisional bariatric surgery with a weight of 115 kg, height of 169 cm, and BMI of 40.3 kg/m^2.

Laparoscopic re-sleeve gastrectomy was done on May 12, 2019. After the operation and while still at the hospital, the patient was well, not in pain, tolerating orally with no nausea or vomiting, passed flatus, and so was discharged home with instructions. Two days later, the patient started vomiting every mL of fluid she drank, was not passing stool, ignored her symptoms, and was only receiving intravenous fluids and vitamin injections at home by her nurse sister. One month later, she was presented to the emergency room (ER) at our hospital at King Saud Medical City (KSMC), complaining of persistent vomiting, epigastric pain radiating to the back, history of on\off fever, and acute kidney injury due to dehydration.

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How to cite this article: Alhaijawi MA, Alonazi I, Alakrawi K, *et al*. Endoscopic Management of Two Sites of Stenosis Post-laparoscopic Re-sleeve Gastrectomy and Acute Pancreatitis. World J Lap Surg 2021;14(3): 227–229.

Source of support: Nil

Conflict of interest: None

ER Presentation

The patient weighed 93 kg with BMI of 32.6 kg/m^2. Her major complaint was persistent vomiting. She looked sick and severely dehydrated. Vitals were: Temperature, 37; blood pressure, 89/65; and pulse, 60 bpm. On examination of the abdomen, it revealed properly healed surgical wounds and soft and lax abdomen on palpation. She has no tenderness and distension. Guarding and rebound signs were both negative.

Laboratory Investigations

The patient presented with hypokalemia and a significantly high lipase level of 335 U/L. The lipase level was fluctuating throughout the admission.

Imaging

A series of imaging studies have been undertaken to rule out obstruction and stenosis. Computed tomography (CT) of abdomen with contrast was done and showed no evidence of small or large bowel obstruction. In addition, gastrografin study revealed re-sleeved stomach with complete obstruction. There was no proof of contrast leak. Furthermore, upper gastrointestinal endoscopy

(UGIE) came out with LA grade C reflux esophagitis, stenosis, and twisting (Fig. 1).

As CT, gastrografin, and UGIE were all inconclusive, the patient was posted for laparoscopic exploration on June 10, 2019. Endoscopy procedure for upper GI was done intraoperatively and broke out re-sleeved stomach and two areas of moderate stenosis at 42 to 44 cm from the teeth line and small ulceration at the proximal part of the stomach.

Postoperative/Bariatric Surgery Team Decision

The decision of completing the conservative treatment had been made on June 13, 2019. Dilatation with 18 to 20 mm pyloric balloon dilator was performed (Fig. 2) and a 22 mm × 140 mm double Niti-S stent was placed (Fig. 3); all performed under fluoroscopic guidance. The patient stayed at the hospital under our care for monitoring for about 3 days post-stent placement. After her general condition improved, she was discharged home on June 18, 2019, giving all the instructions for 1-month follow-up appointment with the bariatric surgery team at the outpatient clinic. As per instructions, a month later, on July 16, the patient presented to the outpatient clinic. She was only complaining of mild abdominal bloating but was doing well and tolerating orally with no more vomiting. She was admitted to the hospital through outpatient department (OPD) for stent removal, which was done on July 16, 2019, after UGIE showed no more evidence of significant stenosis at the stomach. The patient was discharged home again with instructions and follow-up appointments at the OPD. Two months later, the patient came to the clinic and she was doing well with no nausea or vomiting or other complaints and tolerating.

Discussion

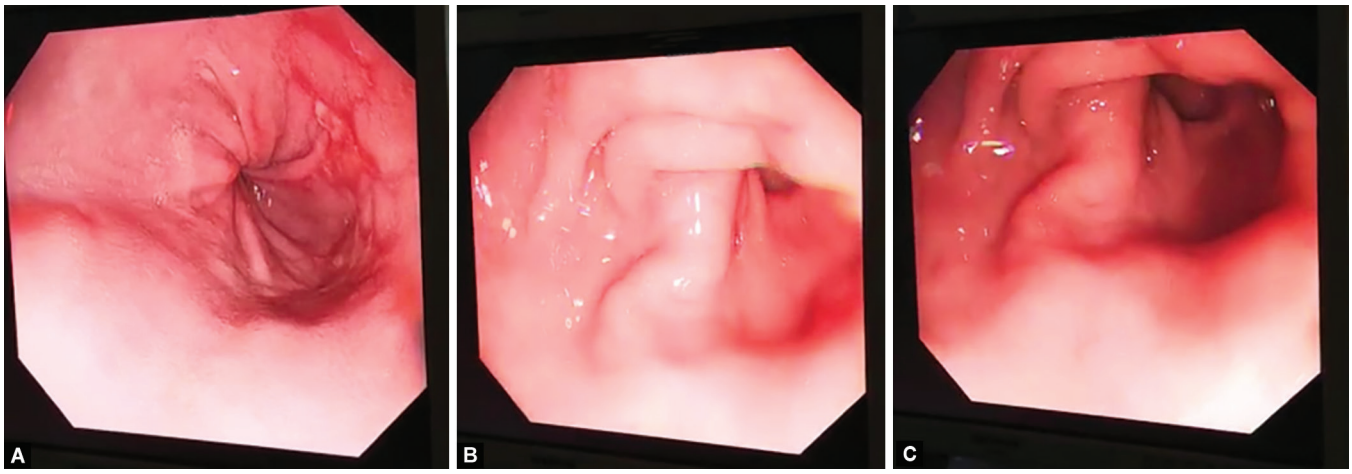
Sleeve gastrectomy is a left "parietal cell" gastrectomy of the fundus, body, and proximal antrum, which creates a longitudinal, partly vertical, cylindrical gastric conduit constructed along the lesser curve of the stomach.[3] The stomach is reduced in volume (by an almost tenfold reduction, i.e., 1000 mL to less than 100 mL) but tends to function normally, so most of the nutritional items can be consumed, in small amounts.[4] As in any other surgery, sleeve gastrectomy has its risks and complications, and those complications may include hemorrhage, leaks, thromboembolism events, reflux, and strictures. Strictures are usually divided into early strictures and late strictures

Patients with early strictures, which occur <1 month from the time of surgery, are often affected by pseudo-strictures caused either as a result of postoperative edema or hematoma formation.

Late strictures, which occur >1 month from the time of surgery, are usually true strictures. They are usually caused by ischemia, retraction due to scarring, or misalignment during stapling. Treatment of LSG strictures is controversial. When we can manage the patient by noninvasive methods, and when we can manage him by surgical methods, all lack consensus.

In order to confirm the diagnosis of gastric sleeve stenosis, endoscopic and fluoroscopic investigations are essential.[5] In this case report, we share a case of LSG strictures treated with pneumatic balloon dilation as a primary modality of treatment.

Two types of stenosis are usually documented. The first and most frequently encountered is an axial deviation commonly located at the incisura angularis. It can be visualized endoscopically



Figs 1A to C: UGIE photos. (A) Reflux; (B) Sites of stenosis; (C) Site of twisting

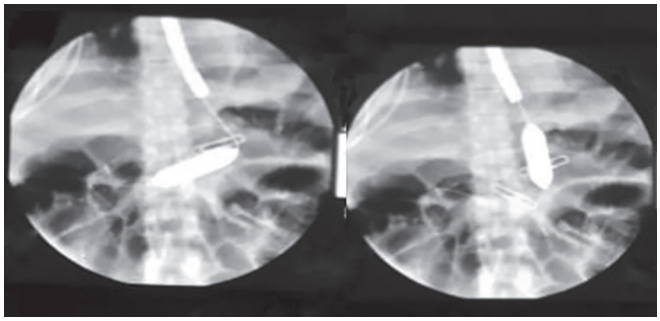


Fig. 2: UGIE: Balloon dilatation and stent insertion

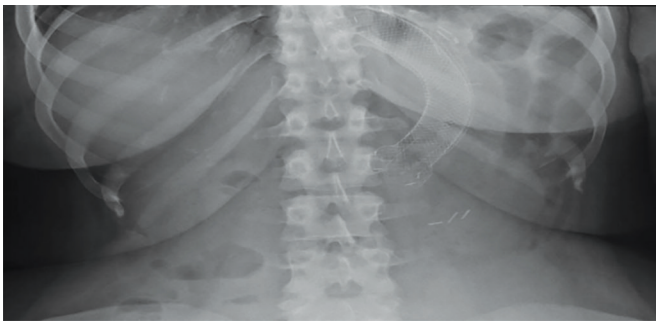


Fig. 3: X-ray abdomen after stent placement

as a sharp angulation even though the scope passes into the antrum. Less frequently encountered is mechanical stenosis, presenting as an anatomical obstruction. It can be found anywhere along the proximal gastric conduit and is usually described on endoscopy as a mucosal narrowing.[4]

In order to confirm the diagnosis of gastric sleeve stenosis, endoscopic and fluoroscopic investigations are essential.[6]

Causes of stenosis may include reinforcement of the staple line with a running suture on a tight sleeve, aggressive or unequal traction on the greater curvature during gastric stapling, or insufficient posterior dissection of the posterior stomach off the retroperitoneum.[4]

On the contrary, complications of acute pancreatitis, such as paralytic ileus, ischemic necrosis, perforation, and mechanical obstruction, are relatively infrequent. Mechanical bowel obstruction as a result of acute pancreatitis has been described in the literature and is more likely to occur in the splenic flexure and transverse colon. This is believed to be due to severe inflammation of the body and tail of the pancreas causing extrinsic compression or due to retroperitoneal extravasation of pancreatic enzymes causing pericolitis and/or pericolic fibrosis.[7]

In case of **revisional LSG** like our patient, complete posterior dissection is usually more challenging, and together with developing acute pancreatitis with severe adhesions and previous scar tissue, it may contribute to a higher stenosis rate.[6]

Endoscopic intervention, including pneumatic dilation, and endoscopic stent placement are first-line therapies for stenosis discovered after the immediate perioperative period. Success rates for endoscopic therapy for sleeve stenosis have been reported as high as 88 to 94%. Conversion to RYGB is considered a definitive therapy for stenosis of the mid-body of the gastric sleeve and is likely the most common revisional operation performed in the setting of sleeve stenosis. In some severe cases of stenosis, total gastrectomy may be necessary.[4]

Conclusion

The earlier detection of post-sleeve gastrectomy stricture with effective management significantly reduces patient morbidity. Endoscopic treatment with pneumatic balloon dilation and stent insertion has repeatedly proven to be effective and safe as the first line of management for this complication[5] as in our case with two sites of stenosis and twisting because of severe adhesions due to previous scar tissue and acute pancreatitis. Surgical intervention should be considered only after the failure of endoscopic treatment.

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