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Editorial

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Dear Colleagues,

The year of 2019 is the year of fluoroscopy in minimal access surgery. This year, all the leading laparoscopic camera companies of the world have launched their new infrared-sensitive camera. Indocyanine green (ICG) is a cyanine dye used in medical diagnostics because it emits a near-infrared frequency. It is being used for a long time in determining cardiac output, hepatic function, liver, and gastric blood flow, and for ophthalmic angiography.

ICG binds tightly to plasma proteins and becomes confined to the vascular system. Even laparoscopic cholecystectomy with real-time indocyanine green fluorescence cholangiography enables better visualization and identification of biliary tree and, therefore, should be considered as a means of increasing the safety of laparoscopic cholecystectomy. It is also very beneficial for gynecological laparoscopy. You can inject it in the ureter, and the entire ureter can be visualized. In our experience, the ICG fluorescence imaging system seems to be simple, safe, and useful. The technique may well become a standard shortly because of its different diagnostic and oncologic capabilities.

In the coming issue of the World Journal of Laparoscopic Surgery, we are coming with very exciting new articles related to the use of different types of fluoroscopy in laparoscopic surgery.

We have entered the new year 2019. Arriving of new year brings new hopes, new resolutions, and new joy. Wishing you all good things on this new year! Have fun, joy, peace, love, care, luck, and success ahead!

RK Mishra
Editor-in-Chief

Chairman
World Laparoscopy Hospital
Gurugram, Haryana, India

ORIGINAL ARTICLE

A Simple and Safe Technique in Extracting Specimen after Sleeve Gastrectomy

Adem Yuksel[1], Murat Coskun[2]

Abstract

Introduction: Today, minimally invasive surgery (laparoscopic, robotic) methods are becoming increasingly common. In the procedures in which the resection was performed with a minimally invasive surgical method, specimen removal can be time-consuming and complicated. In this study, we aimed to evaluate the results of laparoscopic sleeve gastrectomy specimens removed from a 12-mm trocar area without additional tools.

Materials and methods: Between January 2016 and December 2017, 129 patients underwent a laparoscopic sleeve gastrectomy for morbid obesity. In all patients, the specimen was removed from the abdomen from a 12-mm trocar area without additional tools.

Results: The mean specimen removal time was 2.38 ± 1.9 minutes. During the follow-up period, no wound infection and trocar hernia were observed in any patient.

Conclusion: The technique applied is minimally invasive, not time-consuming, and simple when compared to other techniques reported.

Keywords: Laparoscopic sleeve gastrectomy, Port hernia, Specimen extraction.

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Introduction

Today, laparoscopic approach in gastrointestinal surgery is widely used owing to its advantages. In the procedures that the resection performed by the laparoscopic technique, different techniques such as expanding trocar incision, mini laparotomy from different regions, and removal from natural hole are used in the removal of the specimen from the abdomen.[1,2] These different incisions and methods may occasionally lead to the elimination of some advantages (early postoperative recovery, decreased surgical site infection, esthetic appearance, decreased risk of hernia, etc.) of laparoscopic surgery.[1]

Many different procedures in surgical treatment of morbid obesity can be performed with the laparoscopic technique. Among these procedures, sleeve gastrectomy, in which the stomach is resected in the vertical axis, has been applied in increasing frequency in recent years.[3] The removal of the specimen after sleeve gastrectomy can be time-consuming and complicated. There is no standard approach on this and many different techniques are applied.

In our study, it was aimed to evaluate the results of our patient group in which the sleeve gastrectomy specimen was removed from the 12-mm trocar area.

Materials and Methods

The study included patients who underwent laparoscopic sleeve gastrectomy for morbid obesity at Kocaeli Derince Training and Research Hospital between January 2016 and December 2017.

The decision was made as a result of the evaluation of the patients who were accepted according to the National Institutes of Health (NIH) consensus criteria[4] by the team consisting of surgery (gastrointestinal surgery, general surgery), endocrinology, psychiatry, gastroenterology, cardiology, chest diseases, sports medicine specialist, and dietitian team. A prophylaxis with 2 g of ceftriaxone was applied to all patients before the operation.

[1]Department of Gastrointestinal Surgery, Kocaeli Derince Training and Research Hospital, Kocaeli, Turkey

[2]Department of General Surgery, Kocaeli Derince Training and Research Hospital, Kocaeli, Turkey

Corresponding Author: Adem Yuksel, Department of Gastrointestinal Surgery, Kocaeli Derince Training and Research Hospital, Kocaeli, Turkey, Phone: +90 262 317 80 00, e-mail: ademyksel@yahoo.com

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All operations were performed by the same surgical team consisting of two persons. Pneumoperitoneum was created in such a way to reach 12–14 mm Hg by entering the abdomen with the help of a bladeless direct optical trocar (EndopathXcel; Ethicon Endo-Surgery Inc., Cincinnati, Ohio) from 19 cm below the xiphoid and 4 cm lateral from the midline. The operation was performed with 3 pieces of 5 mm and 2 pieces of 12 mm trocars, one of which was the Nathanson retractor site (Fig. 1). All 12 mm trocars were bladeless optic trocar. Starting from approximately 2 to 6 cm proximal of pylorus, until the left diaphragmatic crura is revealed, the stomach was released by the large curvature with the help of LigaSure (Valleylab, Boulder, CO) or harmonic scalpel (EthiconEndosurgery, Cincinnati, OH). The stomach was decompressed with a nasogastric or orogastric tube. The stomach was transected with the help of a 36 F bougie-guided endoscopic stapler (Ethicon Endosurgery, Cincinnati, OH). Transection was completed with 5 or 6 staplers. The gastrectomy-performed stomach was evaluated for leakage with 50–60 mL methylene blue. The resected stomach was held in the caudal end with a laparoscopic grasper and was taken 2–3 cm in a 12-mm trocar parallel to the resection axis (Fig. 2). The specimen was removed from the abdomen with a trocar. The specimen was

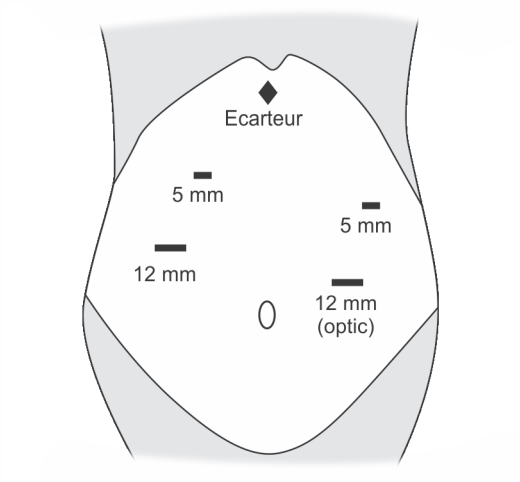

Fig. 1: Trocar locations

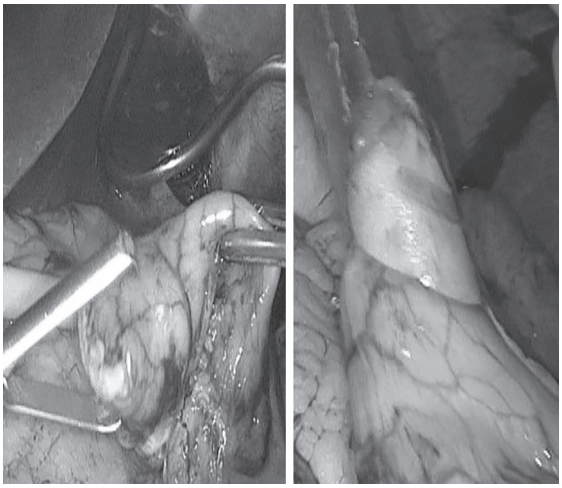

Fig. 2: Specimen grasping and pull into the 12-mm trocar

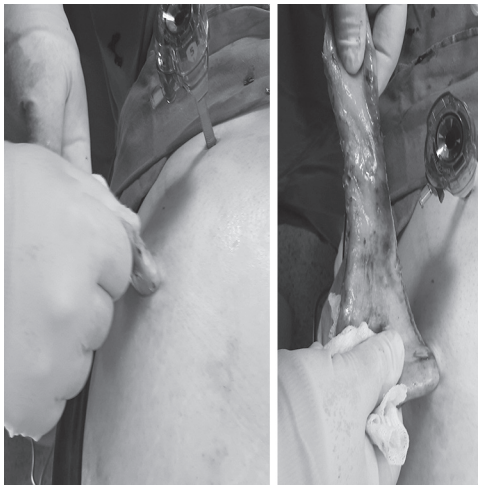

Fig. 3: Extraction of the entire specimen via the 12-mm trocar

extracted out of the abdomen by the large curvature, with the help of a gauze, by avoiding excessive traction (Fig. 3).

The patients' demographic characteristics (age, sex), body mass index (BMI), comorbid status, ASA score, intraoperative complications, specimen extraction time, and operation time were recorded. Specimen extraction time was obtained by the retrospective review of the operation video recordings in the first 55 cases, and from prospectively recorded data in subsequent cases. All patients were controlled on the 10th postoperative day, and on the 1st, 3rd, 6th, and 12th months by the surgical team. Wound-site infection status and trocar-site hernia status were recorded. Trocar site hernia status was evaluated by a clinical examination. In the statistical evaluation, a descriptive method was used.

Results

A total of 129 patients who underwent a laparoscopic sleeve gastrectomy were included in the study. Demographic characteristics (age, sex) and preoperative (body mass index, comorbidities, ASA score) characteristics of the patients are summarized in Table 1. All operations were completed laparoscopically. The sleeve gastrectomy was performed to one patient owing to gastric plication and to the other patient owing to the revision after vertical band gastroplasty. A cholecystectomy was performed in 12 (9.3%) patients in the same session. A cholecystectomy specimen was extracted from the same area. Four (3.1%) patients had leakage after the sleeve gastrectomy. One of them was spontaneously closed. Others were treated with endoscopic treatment methods. The average operative time and specimen removal time were 75.7 ± 19.4, 2.38 ± 1.9 minutes, respectively. The fundus perforation was developed in three (2.3%) patients during extraction. In addition to prophylactic antibiotherapy, antibiotic treatment was applied in the postoperative follow up of these patients. The average follow up period of the patients was 13.9 ± 6.2 months. During the follow up period, no wound site infection and trocar site hernia were seen in any patient (Table 2).

Table 1: Patient characteristics

		N: 129
Sex	Male	24 (18.6%)
	Female	105 (81.4%)
Age	Mean ± SD	38 ± 8.7
BMI	Mean ± SD	45.7 ± 6
Comorbidity	Hypertension (HT)	28 (21.7%)
	Diabetes mellitus (DM)	51 (39.5%)
	Pulmonary comorbidity	16 (12.4%)
ASA score	II	98 (76%)
	III	31 (24%)

Table 2: Intraoperative and postoperative results

		N: 129
Operation	Sleeve gastrectomy	117 (90.7%)
	Sleeve gastrectomy + cholecystectomy	12 (9.3%)
Operation time (min)	Mean ± SD	75.7 ± 19.4
Specimen extraction time (min)	Mean ± SD	2.38 ± 1.19
Specimen rupture		3 (2.3%)
Wound infection		0 (0%)
Port site hernia		0 (0%)

Discussion

Nowadays, sleeve gastrectomy is used with increasing frequency in the surgical treatment of morbid obesity owing to some advantages such as preservation of normal anatomy and absorption capacity of small intestines, technically easy applicability and short operation time.[3] In this procedure, where successful results are obtained in the resolution of weight loss and comorbid conditions, 80–90% of the stomach in vertical axis is resected.[5] Removal of the specimen outside the abdomen after this wide resection can be a complicated, and prolonged duration of operation.

In laparoscopic surgery, there are questions looked for to be answered such as from which area the specimen should be removed, from how much width the specimen should be removed, how to reduce complications related to the area the specimen removed from, and whether the integrity of the specimen should be preserved in benign procedures. The answer to these questions was not standardized also in the sleeve gastrectomy procedure.

The method frequently applied in laparoscopic procedures is the extraction of the specimen by a mini laparotomy. In a study in which the specimen was removed by a mini-laparotomy after a sleeve gastrectomy, 5% wound site infection, 3.3% hernia, and 8.3% hematoma in the site of extraction were detected.[6] These results show that the specimen removal by mini-laparotomy reduce the advantages of the laparoscopic surgery.

Different techniques have been described, in which the specimen is removed after it was disintegrated. In one of these techniques, described by Mahmood et al.,[7] the specimen was disintegrated by a tissue disintegrator and removed from a 15-mm trocar. Another technique is the technique by which Calin et al.[8] extract the specimen from the 12 mm trocar site, by cutting and making the specimen thinner in the longitudinal axis intraabdominally. The main disadvantage of both techniques is the inability of histopathological examination of the specimen due to tissue disintegrity, and the risk of intraabdominal spread of gastric content. As a matter of fact, it was shown in several studies that in the sleeve gastrectomy specimen, there was a clinically significant histopathological finding at a rate of 3.3–5.8%, and the histopathological examination of the specimen was necessary.[9,10] In addition, it has been shown that intraabdominal spread of gastric content may cause a localized inflammatory response, adhesion, and intraabdominal abscess.[11]

The most commonly used technique for removal of specimen in sleeve gastrectomy is the removal of tissue from the trocar site by preserving tissue integrity. One of the controversial points in this technique is whether the wound site is protected with different auxiliary devices (wound site retractor, organ pouch) when removing the specimen. Studies have reported that the use of organ pouches or wound site retractors does not reduce infectious complications, prolonged operation time, and increased operation costs.[12] In our technique, any auxiliary equipment was not used to protect the wound site and no wound site infection was seen in our series.

In order to reduce trocar-related complications after the sleeve gastrectomy, a technique involving a small number of patients with which the specimen was extracted transgastrically has been described.[13] However, this technique requires laparoscopic and endoscopic experience, and the risk of intraabdominal spread of stomach contents is the most important disadvantage.

In a minimally invasive surgery, the overall goal is to use a smaller number of trocars with a smaller diameter. The use of larger trocar increases the risk of postoperative pain, patient comfort, and hernia risk in the trocar site.[14] However, for the use of staplers in the sleeve gastrectomy, the minimum trocar diameter is 12 mm, and there is only one study in the literature on removal of the specimen from a 12-mm trocar site by preserving the tissue integrity. In this study by Nassif et al.,[15] the fascia was extended with a Kocher clamp and the specimen was removed with the organ pouch. In our study, this technique has been modified. Without expanding the fascia and the usage of organ pouches, the specimen was extracted. Trocar-related complications such as wound site infection or trocar site hernia were not observed. According to the extraction time of the specimen, it was observed that the specimen was extracted in a time similar to those of the other studies. In three cases, it was observed that the specimen was ruptured from fundus, owing to insufficient decompression of the stomach and the rotation of the specimen on the reverse axis during extraction. Therefore, caution should be exercised to ensure that the stomach is sufficiently decompressed and not to cause any reverse rotation during traction.

Conclusion

According to the results of our study, the specimen can be safely extracted from the 12-mm trocar site after the sleeve gastrectomy, without the use of additional tools and without expansion of fascia and without prolonging the operation time.

Ethical Committee Approval

Ethical committee approval was obtained from University of Kocaeli (GOKAEK-2017/14.37 2017/300).

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ORIGINAL ARTICLE

Follow-up Study Comparing Open Hysterectomy of Expert Surgeon and Laparoscopic Approach (Learning Curve) of the Same Surgeon

Maliheh Arab[1], Rajneesh K Mishra[2], Jatinder Sigh Chowhan[3], Shahla N Ardebili[4], Behnaz Ghavami[5], Nasrin Yousefi[6]

Abstract

Introduction: The goal of minimal access surgery is to minimize damage to the patient without impairment of immunity and the effect of treatment compared to traditional open surgical techniques. Laparoscopic hysterectomy requires more surgical skills and the learning curve is steep. The goal of this study is to compare hysterectomy in learning curve (including about 50 first surgeries) with open hysterectomy of the same surgeon, expert in open surgery, for complications, hospital stay duration, transfusion, operative time, and readmission.

Materials and methods: In a prospective cohort study, patients undergoing hysterectomy at an academic medical center located in Tehran were randomly assigned into laparoscopic (in learning curve) and laparotomy groups from 2016 to 2018. Study cases data were recorded regarding complications, hospital stay, operative time, and blood transfusion.

Results: There was no significant difference regarding intra- and postoperative transfusion, hospital stay duration, postoperative complications, and readmission in laparoscopy and laparotomy groups of hysterectomy. However, operative time was significantly different in laparoscopy and laparotomy subgroups of hysterectomy and longer in the laparoscopic group (277 minutes in laparoscopy vs 196 minutes in laparotomy).

Conclusion: This study encourages starting laparoscopy method instead of open surgery, even in the setting of expert open surgeons, and even in the advanced (level 4) surgery such as hysterectomy.

Keywords: Complications, Hysterectomy, Laparoscopy, Laparotomy, Learning curve.

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Introduction

The goal of minimal access surgery is to minimize damage to the patient without impairment of immunity and the effect of treatment compared to traditional open surgical techniques. If this goal is achieved, patients will recover faster, and hospitalization will be reduced, and their return to full activity and work will be returned in a short time.[1–3] The history of laparoscopy is still short and still no long-term results in comparison to open surgery are in our hands.[4] Today there is a lot of evidence of laparoscopic preference, and they all accept it.[5] In general, laparoscopic complications are less than open surgery.[6]

In 1999, laparoscopic hysterectomy was considered an alternative for open surgery. The first laparoscopy was reported in 1989, and then, this method continued. In the case of laparoscopic hysterectomy, compared with open surgery, the surgical time is significantly longer.[7,8] In a study, the time of postoperative recovery and the pain score in 37 patients with primary pelvic pain with diagnosis of fibroma, adenomyosis, and severe endometriosis who underwent laparoscopic assisted vaginal hysterectomy (LAVH) were recorded. The length of hospitalization was 4.5 and 2.5 days after open hysterectomy and LAVH, respectively. LAVH is more expensive than total abdominal hysterectomy (TAH). The issue is whether the benefits of shorter recovery and faster return to work, shorter hospitalization, and less need for pain relief cover the extra cost of laparoscopy. If the total healthcare costs are evaluated, the short-term recovery of laparoscopy, 2 weeks, compared to the recovery of 6–8 weeks after open surgery, makes it costly. LAVH can replace most abdominal hysterectomies due to benign disease. Laparoscopic hysterectomy requires more surgical skills, and the learning curve is steep. Studies have shown that laparoscopic advantages comparing to laparotomy include reduced postoperative pain, shorter hospitalization, faster recovery, and faster social recovery. Laparoscopic hysterectomy is longer in all studies.[1,9,10]

[1]Department of Minimal Access Surgery, Cancer Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran

[2]Department of Minimal Access Surgery, The Global Open University, Dimapur, Nagaland, India

[3]Department of Minimal Access Surgery, World Laparoscopy Hospital, Gurugram, Haryana, India

[4,6]Department of Obstetrics and Gynaecology, Shahid Beheshti University of Medical Sciences, Tehran, Iran

[5]Department of Minimal Access Surgery, Tehran University of Medical Sciences, Tehran, Iran

Corresponding Author: Maliheh Arab, Department of Minimal Access Surgery, Cancer Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran, Phone: +91 9811416838, e-mail: drmarab@yahoo.com

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Training in Laparoscopy

Besides the great interest in laparoscopy, the cost of training and instruments increase the total cost. On the other hand, less

complications and rapid recovery of laparoscopy cover these shortages.[4] Three characters of laparoscopy are as follows: instruments, trained personnel, and learning curve.[11] Nowadays, surgeons work on basic skills before real surgery.[12]

Learning curve includes 3 phases, starting, learning rate, and stabilized performance. The speed of laparoscopic learning curve at first phase is not dependent on age, number of surgeries, or hospital setting. The first phase is rapid. The main factor effective on learning curve is the supporting surgical team. Another factor is the equipment problem which is reported to occur in 87% of procedures.[5,13–15]

Learning curve is defined by the number of patients which reduce complications and time of surgery toward the same procedure in the open method. During the learning curve, complications are higher and the operative time is longer. Learning curve is defined in difficult procedures, for instance, in appendectomy, learning curve is about 30 patients.[5,6,16–18]

Levels of Gynecological Laparoscopic Surgery (HKCOG)

Level 1: Basic procedures such as diagnostic and tubal occlusion
Level 2: Minor procedures such as salpingectomy for tubal pregnancy or hydrosalpinx
Level 3: Intermediate procedures such as oophorectomy or cystectomy for ovarian cysts
Level 4: Major procedures such as hysterectomy and myomectomy
Level 5: Advanced procedures such as lymphadenectomy and radical hysterectomy

In this study, we compare hysterectomy in learning curve (including about 50 first surgeries) with open hysterectomy of the same surgeon, expert in open surgery, for complications, hospital stay duration, transfusion, operative time, and readmission.

Materials and Methods

Study Area and Study Population

In a prospective cohort study, patients undergoing hysterectomy at the Imam Hossein Medical Center located in Tehran were randomly assigned into laparoscopic and laparotomy groups from 2016 to 2018.

In this study, surgeon was the same in all operations. It should be noted that the surgeon's work experience in open surgery was about 20 years, and she was an expert, a radical gyneco-oncologist, and a referral of difficult surgical procedures. The above-mentioned surgeon began to perform laparoscopy in hysterectomy by participating in 3 laparoscopic workshops and using a trainer for a period of 6 months and clinical practice with an expert laparoscopist for 6 months, mostly in level 3 operations; finally participated in the one-month compact laparoscopy course again and started laparoscopic hysterectomy operations (level 4), independently.

From the beginning, under study information, cases were recorded regarding complications, hospital stay, operative time, and blood transfusion.

Surgical Techniques

The patient was placed in the lithotomy position with her legs open at 60°, under general anesthesia with endotracheal intubation; a Foley urinary catheter ensured the bladder was emptied during the operation.

After a CO_2 pneumoperitoneum was created, a 10-mm trocar was placed in the umbilical site by the modified Hasson technique to introduce the laparoscope and the camera. Three ancillary 5-mm trocars were also placed, two in the left side (7 cm apart to each other) and one in the right side of the patient. The surgeon operated ipsilaterally and her assistant worked in contralateral side and handled the camera at the same time.

The round ligament was sectioned at ~3 cm from the uterus, by Harmonic Ace in order to prevent bleeding from the superior uterine vessels. The areolar tissue of the broad ligament was then dissected and its posterior fold fenestrated at an avascular area above the uterine vessels. The uterine artery and the utero-ovarian ligament vs infundibulo-pelvic ligament in both sides were tied by suture and cut by Harmonic Ace.

After complete dissection of the bladder, circular monopolar colpotomy was then performed, and the uterus was removed through the vagina and sent for histological examination.

At this stage, the uterine manipulator was extremely effective in completely exposing the fornices and at the same time in avoiding CO_2 leakage from the pneumoperitoneum, thus making colpotomy easier. Finally, the vaginal vault was sutured continuously laparoscopically, and the pelvis was then checked in order to ensure hemostasis and to perform pelvic irrigation, thus removing blood clots. At the end of the surgery, only fascia site of 10 mm trochars was repaired. In the open surgery, hemostasis was performed by electrocautery and suturing, and in the case of hysterectomy, the vaginal cuff was closed.

The beginning of the operation was calculated as the moment of the umbilical incision and for laparoscopic hysterectomy and as the moment of cutaneous incision for the abdominal technique. Cutaneous suture was considered the end of the operation in both cases.

Sample Size

Cases of hysterectomy were divided into 54 laparoscopy and 57 laparotomy method. Laparoscopy cases were considered in the learning curve group. So, there were two groups of hysterectomy, including laparoscopy (learning) and laparotomy.

Data Collection

Complications during hospital stay and after discharge, blood transfusion, duration of hospitalization, readmission, and the surgical time of patients were compared between two groups.

Statistical Method

The normal distribution of quantitative data was performed using Shapiro–Wilk test. Quantitative data were displayed using mean, standard deviations, mid-range, and interquartile domains. The qualitative data were displayed using frequency and percent. Data were analyzed by ANOVA, Kruskal–Wallis, T-independent, Mann–Whitney, and Kendall–Tau coefficients for comparing quantitative responses between groups. Guerrilla *post hoc* test was used whenever necessary. Chi-square test was used to compare the qualitative responses between the studied groups, and if necessary, the exact *p* value was calculated. Covariance analysis was used to compare postoperative hemoglobin between the studied groups. The significance level for statistical tests was considered 0.05. SPSS software version 25 was used for data analysis.

Results

A total of 111 patients underwent hysterectomy. In the hysterectomy group, 111 patients, including laparoscopy in learning curve group (54) and laparotomy (57), were studied.

Medical disease, mean age, and preoperative hemoglobin level were not significantly different in patients under 2 groups of laparotomy and laparoscopy (Table 1).

There was no significant difference regarding intra- and postoperative transfusion, hospital stay duration, postoperative complications, and readmission in laparoscopy and laparotomy groups of hysterectomy. However, the operative time was significantly different in laparoscopy and laparotomy subgroups of hysterectomy, longer in the laparoscopic group (277 minutes in laparoscopy vs 196 minutes in laparotomy) (Table 2).

The type of complications during hospital stay and long-term and total complications were not significantly different in laparoscopy and laparotomy groups of hysterectomy ($p = 0.5$). No major complications happened in each of two groups.

No case of conversion to laparotomy existed in the studied laparoscopy cases.

Discussion

Transfusion and Blood Loss

In the present study, transfusion during and after surgery did not differ significantly between the laparoscopy and laparotomy groups.[19] In the other hand, in the present study, just the outcome of blood transfusion was compared in 2 groups and the volume of blood loss was not measured. Probably, if it was done, the difference of blood loss volume might be different in 2 methods. In addition to the experience of the surgeon, the staffing issues and the surgeon's assistant also play a role in the outcome of laparoscopy including blood loss.

Table 1: Comparison of demographic data, underlying medical disease, and preoperative hemoglobin level in laparoscopic and laparotomy groups of hysterectomy surgery

	Group		
Variables	*Laparoscopy*	*Laparotomy*	*p*
Mean age (SD)	46.37 (6.8)	47.7 (7)	0.318
Medical disease, *n* (%)	35/54 (64.8)	34/56 (60.7)	0.657
Mean BMI (SD)	28.18 (4.7)	28.59 (5.7)	0.712
Mean preoperative Hb (SD)	11.57 (1.76)	11.34 (1.94)	0.516

Table 2: Comparison between laparoscopy and laparotomy groups of hysterectomy surgery regarding different variables

	Group		
Variables	*Laparoscopy*	*Laparotomy*	*p*
Intraoperative transfusion, *n* (%)	3/54 (5.6)	5/57 (8.9)	0.999
Postoperative transfusion, *n* (%)	8/54 (14.9)	5/57 (8.8)	0.225
Mean operative time (SD)	277.44 (84.48)	196.75 (62.13)	0.005
Mean hospital stay (SD)	2.59 (1.22)	2.7 (1.08)	0.211
Hospital stay complications	10/54 (18.5)	4/57 (7)	0.68
Long-term complications	12/54 (22.2)	7/57 (12.3)	0.51
Total postoperative complications	17/54 (31.5)	9/57 (15.8)	0.51
Rehospitalization, *n* (%)	1/54 (1.9)	1/57 (1.8)	0.999

Operation Time

In the present study, the surgical time of the two groups had significant difference (277 minutes in laparoscopy vs 196 minutes in laparotomy). In some studies, laparoscopic and open hysterectomy were compared, and the learning curve was investigated in a prospective study and there was no difference in complications.[7,19,20] In a study, the operating time of laparoscopic history was 104 ± 26 minutes, and after passing the learning curve, it was 72–163 minutes with no significant difference with open surgery.[7] An important point is different reports of early years of laparoscopy with longer procedures in comparison to the open method.[20]

Three characters are regarded for learning curve assessment including the duration of surgery, rate of complications, and the number of conversions to open surgery. In a study, in the learning curve of laparoscopic hysterectomy, the first 10 procedures were done in a mean time of 180 minutes and decreased to 75 minutes in the 90–100th patients.[21]

In the medical center of the present study, the nursing staff, equipment, and engineering were also in training period (learning curve), and the effect of these factors was also evident in the operative time. For instance, unchecked instruments, camera, and monitoring system exhibited problems during operation which took time to solve each of them. Of course, whenever the working system develops, less problems occur during operation, and if happens, solution is rapidly done.

Complications

In the present study, complications during hospitalization and long-term (after discharge) and total complications of surgery were not significantly different between the two groups of laparoscopy and laparotomy. No serious complications occurred in two groups, and the readmission of the two groups did not differ.

Considering that the surgeon was expert in the open surgery and radical operations, the complications of her open surgery were less. The point that complications of the open surgery group with a 20-year experience of surgeon and laparoscopic surgery in her learning curve did not have a significant difference is in favor of confirming less complications of laparoscopic surgery.

Hospital Stay

In a study of laparoscopic and open hysterectomy, the mean length of the hospital stay was 2.38 ± 0.30 days in the laparoscopic hysterectomy group vs 6.23 ± 1.85 days in the abdominal hysterectomy group ($p \leq 0.001$).[7]

In the present study, the hospital stay was not different in two groups of laparoscopy and laparotomy. However, patients were not discharged, even if they wanted and were ready to leave hospital, given that the surgeon noted that she was in learning curve and was willing to closely observe postoperative period of laparoscopy patients. In this study, the need for patient pain relief, comfort, satisfaction, and quicker return to work were not considered, which might be better in the laparoscopic group.

Readmission

In the present study, readmission was not different in two groups.

Conversion Rate

In a study, readmission rate and complication rate of laparoscopic colorectal surgery were not different in comparison to expert surgeons, although decrease in operative time and conversion rate

was demonstrated. These finding might be due to more complex and high risk patients accepted by expert surgeons. Another study confirmed that the effect of change in the character of patients, tendency of complicated cases accepted by expert surgeons.[17]

The main reason for the conversion rate is usually a complication. So, conversion and complication rate are more in learning curve in the present study. There was no case of conversion to open surgery in laparoscopy patients.

Learning Curve

Transfusion

In the present study, transfusion during and after surgery did not differ significantly between the laparoscopy and laparotomy groups. In the laparoscopic surgery, blood loss is expected to be less than open surgery. A study in the laparoscopic and laparotomy hysterectomy showed that bleeding during laparoscopic surgery was less than open surgery ($p < 0.001$). The average intraoperative blood loss was lower in laparoscopic hysterectomy than in abdominal hysterectomy ($p \leq 0.001$).[17]

Conclusion

In the present study, hysterectomy patients were operated on in two groups of laparoscopy (learning curve) and open surgery of expert and radical surgeon, which did not differ in terms of complications, transfusion, duration of hospitalization, and readmission. However, the surgical time was significantly longer in the laparoscopy group. This study encourages starting laparoscopy method instead of open surgery, even in setting of expert open surgeons, and even in advanced (level 4) surgery such as hysterectomy.

In the present study, the surgeon was a gyneco-oncologist and was very familiar to pelvic anatomy and an expert in open surgery. Probably, equal complication, transfusion, hospital stay, and readmission of laparoscopic hysterectomy in her learning curve in comparison to her open surgery were due to prolonged experience in radical surgeries and might not be the case of every open surgeon.

Another point is no attention and data collection regarding patient satisfaction with her operation and work return delay after each method of surgery, laparoscopy and open, which are the main advantages of laparoscopic surgery.

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ORIGINAL ARTICLE

Role of Diagnostic Laparoscopy in Chronic Abdominal Pain with Uncertain Diagnosis: A 1-year Cross-sectional Study

Anil P Bellad[1], Amar A Murgod[2]

Abstract

Aim: Diagnosis of chronic abdominal pain is a significant clinical challenge. Laparoscopy, a minimally invasive technique, could potentially be diagnostic as well as therapeutic in patients with chronic undiagnosed abdominal pain. This study was aimed to evaluate the role of laparoscopy as an investigative modality in the diagnosis and management of patients with chronic abdominal pain.

Materials and methods: Demographics, clinical data, and medical and surgical history of the patients (55 patients) with chronic abdominal pain were noted. Details of pain such as, severity of pain based on visual analog scale (VAS) score, duration of pain, site of pain, and nature of pain were recorded. Routine along with radiological investigations were also performed. After preoperative investigations, the patients were subjected to diagnostic laparoscopy, either by open or closed technique under general anesthesia. Postoperative assessment of pain was done using VAS score.

Results: Most of the patients (65.45%) had a duration of pain between 8 weeks and 12 weeks and mean duration of pain was 10.80 ± 2.78 weeks. Fever was present in 41.82% of the patients. A history of lower segment cesarean section was observed in 5.45% patients. The most common surgical procedure performed was adhesiolysis (30.91%) followed by appendectomy (29.09%). Postoperative pain relief was statistically significant ($p < 0.001$).

Conclusion: Laparoscopy offers an effective diagnostic modality and excellent pain relief in the management of patients with chronic abdominal pain. Furthermore, adhesions and inflamed appendix are important causes of chronic abdominal pain. However, studies with a large sample size are required to validate the findings.

Clinical significance: Laparoscopy is an investigative modality in the diagnosis and management of patients with chronic abdominal pain.

Keywords: Adhesiolysis, Appendectomy, Chronic abdominal pain, Diagnostic laparoscopy.

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Introduction

Chronic abdominal pain is an intermittent or continuous pain persisting for more than 12 weeks.[1] It is the most common clinical presentation that affects the patients both physically and psychologically. In India, it is the 4th frequent chronic pain syndrome in the general population that represents about 13% of all surgical admissions.[2] Numerous etiologies ranging from organic to functional cause chronic abdominal pain. The most common organic disorders include intestinal adhesions, biliary causes, and appendicular causes, while functional disorders include irritable bowel disease, functional dyspepsia, and various motility disorders.[3] In spite of strong diagnostic workups, 40% of the patients with chronic abdominal pain did not have specific diagnosis at the end.[4] Many patients remain undiagnosed even after excluding the common disorders by meticulous investigations, and pose a significant diagnostic challenge to the physician.[5]

Biochemical, serological, and imaging techniques such as ultrasound sonography (USG), computed tomography (CT), and magnetic resonance imaging (MRI) only provide indirect evidence of underlying disorder; therefore, many of the cases remain inconclusive. Thus, it is a major challenge for the surgeon to diagnose accurately and decide an appropriate treatment modality.[6] The advent of diagnostic laparoscopy added a new tool in the diagnosis and treatment of chronic abdominal pain. It is a minimally invasive procedure and plays a significant role in the present era to diagnose chronic undiagnosed abdominal pain. It allows the direct visualization of the peritoneal cavity without the need of open exploratory laparotomy.[4] Many factors (including high diagnostic yield, its applicability and therapeutic management in both elective and emergency setups, reduced hospital stay, low morbidity, and expenditure) have made this treatment modality most popular.[7]

Although diagnostic laparoscopy is becoming acceptable in surgical practice, its role in ascertaining the diagnosis of nonspecific abdominal pain needs to be validated by an evidence base.[8] Studies that establish the definite role of diagnostic laparoscopy in patients with chronic abdominal pain are limited.[8–11] Hence, considering the burden of chronic abdominal pain and the advantages offered by laparoscopy, the present study was undertaken to identify the etiology of chronic abdominal pain. It was also aimed to assess the outcome in terms of pain relief in such patients on follow-up, after elective diagnostic laparoscopy.

[1,2]Department of General Surgery, KLE University, Dr Prabhakar Kore Hospital and Medical Research Centre, Belagavi, Karnataka, India

Corresponding Author: Amar A Murgod, Department of General Surgery, KLE University, Dr Prabhakar Kore Hospital and Medical Research Centre, Belagavi, Karnataka, India, Phone: +91 9036337275, e-mail: amarmurgod18@gmail.com

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Materials and Methods

Study Design

The present one-year hospital-based cross-sectional study was conducted from January 2016 to December 2016 at the Department of General Surgery. An approval was obtained from the Institutional Ethical review board, prior to the commencement of the study. A total of 55 patients with undiagnosed chronic abdominal pain were included in the study. The patients fulfilling selection criteria were informed in detail especially, the procedure of diagnostic laparoscopy and a written informed consent was obtained.

Selection Criteria

Patients aged ≥18 years with a history of chronic abdominal pain from ≥8 weeks and undiagnosed despite biochemical and other radiological investigations such as USG/CT/MRI were included in the study. However, the patients diagnosed with chronic abdominal pain, discontinued follow-up, pregnant women, and those not fit for general anesthesia were exempted.

Data Collection

Demographic data (including age and gender) were noted. Patients were interviewed for the medical and surgical history along with presenting complaints. Symptoms such as fever, diarrhea, constipation, burning, and micturition were recorded. The patients were subjected to clinical examination and details about severity of pain based on visual analog scale (VAS) score, duration of pain, site of pain, and nature of pain were noted. These findings were recorded on a predesigned and pretested proforma. Investigations including hemoglobin, total leucocyte counts, direct count, random blood sugar, platelet count, liver function test, urine routine and microscopy, serum creatinine, and radiological investigations such as USG, CT, and MRI were also performed.

Intervention

After the evaluation of preoperative investigations and fitness for anesthesia, the selected patients were subjected to diagnostic laparoscopy, either by the open or closed technique by a single surgeon, under general anesthesia. Patients were kept nil by mouth for 12 hours prior to surgery. Initial port placement was done at umbilical point by open technique (Figs 1A and B). In cases with scars and previous history of surgery, initial port placement was done at Palmer's point, by open technique. Additional ports were inserted as required (Fig. 1C). The abdominal cavity was examined to the possible extent in each case. Interventions such as adhesiolysis, appendectomy, peritoneal biopsy, lymph node biopsy, or aspiration of any peritoneal fluid were carried out at the discretion of the operating surgeon. Starting from the pelvis, the uterus, ovary, uterine adnexa in females, rectum and sigmoid colon, ileocecal region, cecum, appendix, ascending colon, transverse colon, stomach, duodenum, gallbladder, liver, spleen, and descending colon were serially visualized and examined. The patient was then turned in reverse Trendelenburg position for examination of the upper abdomen. With the help of bowel grasping forceps, the whole length of small bowel could be walked over for direct visualization and examination. The final diagnosis was established based on the reports of biopsy examination. Following the procedure, patients received appropriate treatment based on the findings of the laparoscopy. The general anesthesia protocol remained same for all patients, and they were followed up for assessment of pain.

Assessment of Pain

The pain was assessed using VAS score ranging from 0 to 10. VAS was explained to the patient during preoperative visit, considering zero as no pain and 10 as maximum pain points. The assessment of pain was done at enrolment and at postoperative followups, i.e., day 15, 30, 45, and 60.

Statistical Analysis

The data obtained were coded and entered in Microsoft Excel spreadsheet. The categorical data were expressed as rates, ratios, and percentages. Continuous data were expressed as mean ± standard deviation. The comparison of mean pain scores at different follow-ups was done using one-way ANOVA test. $p \leq 0.05$ at 95% confidence interval was considered as statistically significant.

Results

The mean age of the patients was 37.67 ± 14.45 years with striking female preponderance (64.45%; Table 1). Majority of the patients (38.18%) were in the age group of 18–30 years. Most of the patients were married (84.55%) and were graduates (54.55%). Fever was the clinical feature observed in most of the patients (41.82%). A history of lower segment cesarean section was observed in 5.45% patients. Tenderness over the lower abdomen was noted in 45.45% patients, while 43.6% patients had generalized tenderness (Table 1). The characteristics of the pain in the study population are given in Table 2. Most of the patients (65.45%) had a duration of pain between 8 and 12 weeks. The mean duration of pain observed in patients was 10.80 ± 2.78 weeks. Most of the patients reported generalized (49.09%), intermediate (32.73%), and progressive type of pain (65.45%).

The clinical and biochemical profile of the study population is shown in Table 3. Blood urea levels (24.51 ± 10.23 mg/dL) of the patients with chronic abdominal pain was slightly high, while the remaining clinical and biochemical parameters were within the standard limits.

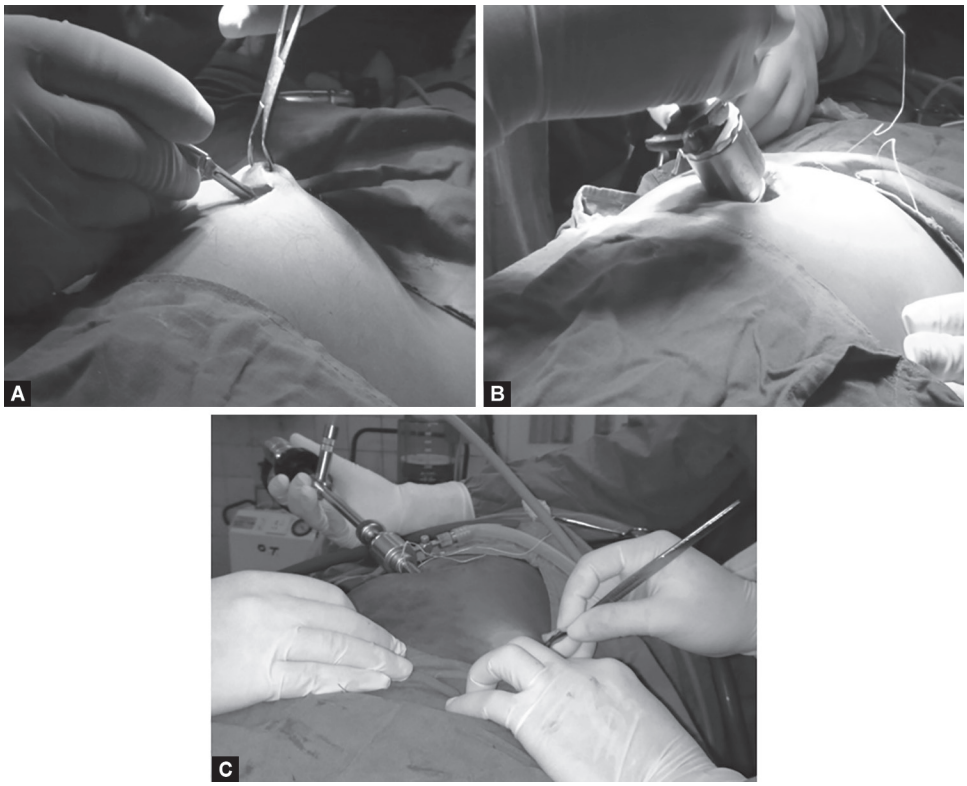
USG, CT, surgical findings, and the type of surgery performed in patients is summarized in Table 4. USG and CT findings were normal in 76.36% and 20% of the patients, respectively. The most common surgical finding was adhesions (30.91%) followed by an inflamed appendix (29.09%). The most common surgical procedure performed was adhesiolysis (30.91%) followed by appendectomy (29.09%).

Postoperative pain scores in the patients during the followup period is given in Table 5. On day 15, 47.27% patients had moderate pain and 14.55% patients had no pain. The pain was absent in 54.55%, 80%, and 89.09% patients on days 30, 40, and 60. The mean VAS score gradually reduced from 3.05 ± 1.88 on day 15 to 1.22 ± 1.54 on day 30, 0.47 ± 1.02 on day 45, and 0.25 ± 0.78 on day 60. This reduction was statistically significant ($p < 0.001$).

Discussion

Chronic abdominal pain is a persistent problem that requires immediate investigation and management. Hence, the study aimed to evaluate the role of laparoscopy as an investigative modality in the diagnosis and management of patients with chronic abdominal pain.

Male-to-female ratio in this study was 1:1.89. This suggests that chronic abdominal pain is widely prevalent among females, which could be explained by the number of gynecological procedures



Figs 1A to C: Insertion of (A) Infraumbilical port; (B) Hasson's cannula; (C) Additional ports

Table 1: Demographic details including history of patients with chronic abdominal pain

Variables	*n (%)*
Sex	
Male	19 (34.55)
Female	36 (65.45)
Age (years)	
18–30	21 (38.18)
31–40	14 (25.45)
41–50	11 (20)
51–60	3 (5.45)
61–70	6 (10.91)
Marital status	
Single	8 (14.55)
Married	47 (85.45)
Education	
Studying	12 (21.82)
Primary	2 (3.64)
Secondary	10 (18.18)
Graduate	30 (54.55)
Postgraduate	1 (1.82)
Clinical presentation	
Fever	23 (41.82)
Diarrhea	2 (3.64)
Constipation	2 (3.64)
Burning micturition	1 (1.82)
Others	1 (1.82)
History	
Previous LSCS	3 (5.45)
Hypertension	2 (3.64)
Hysterectomy	2 (3.64)
LSCS and tubectomy	2 (3.64)
Tubectomy	2 (3.64)
Laparoscopic adhesiolysis for intestinal obstruction	1 (1.82)
Open appendectomy	1 (1.82)
Right hemicolectomy	1 (1.82)
Tuberculosis	1 (1.82)
Not significant	40 (72.73)
Abdominal examination	
Lower abdominal tenderness	25 (45.45)
Generalized tenderness	24 (43.63)
Suprapubic tenderness	2 (3.64)
Upper abdominal tenderness	2 (3.64)
Umbilical tenderness	2 (3.64)

LSCS, lower segment cesarean section

they during pregnancy, such as cesarean sections, hysterectomy, and tubectomy. Similar sex-distribution pattern was observed in other studies in the literature.[2,4,12] One-third of the patients in the study were aged between 18 years and 30 years. This indicates that the occurrence of chronic abdominal pain is mostly in younger individuals.[11,12]

The physical examination in patients with chronic abdominal pain varies depending upon the location of pain and chronicity of

Table 2: Distribution of patients with chronic abdominal pain according to the characteristics of the pain

Characteristics	*n (%)*
Duration (weeks)	
8–12	36 (65.45)
13–16	18 (32.73)
>16	1 (1.82)
Site	
Generalized	27 (49.09)
Lower abdomen	22 (40.00)
Upper abdomen	3 (5.45)
Around umbilicus	3 (5.45)
Type of pain	
Moderate	1 (1.82)
Progressive	36 (65.45)
Intermediate	10 (18.18)
Dragging	5 (9.09)
Pricking	1 (1.82)
Severe	2 (3.64)
Severity	
Mild	1 (1.82)
Intermediate	18 (32.73)
Moderate	17 (30.91)
Severe	12 (21.82)
Progressive	7 (12.73)

Table 3: Clinical and biochemical profile of patients with chronic abdominal pain

Variables	*Mean ± SD*
Pain scores at enrollment (VAS score)	7.45 ± 0.74
Weight (kg)	62.65 ± 6.68
Pulse rate (per min)	76.39 ± 6.19
Systolic blood pressure (mm Hg)	121.45 ± 10.26
Diastolic blood pressure (mm Hg)	77.95 ± 8.33
Respiratory rate (per min)	17.80 ± 1.99
Temperature (°C)	97.71 ± 0.99
Hemoglobin (g%)	12.02 ± 1.76
TLC (mm^3)	8803.89 ± 3859.00
Platelet count (lakh)	2.79 ± 0.82
RBS (mg/dL)	102.29 ± 15.82
Blood urea (mg/dL)	24.51 ± 10.23
Serum creatinine (mg/dL)	0.94 ± 0.24

VAS, visual analog scale; RBS, random blood sugar; TLC, total leukocyte count

Table 4: Distribution of patients with chronic abdominal pain according to USG, CT scan, surgical findings, and type of surgery

Variables	*n (%)*
USG findings	
Normal	42 (76.36)
Mild hepatosplenomegaly, free fluid	1 (1.82)
Mild splenomegaly, mild ascites, left minimal pleural effusion	1 (1.82)
Minimal bladder distended, no obvious collection in umbilical reason	1 (1.82)
Minimal free fluid in pouch of Douglas	1 (1.82)
Not done	9 (16.36)
CT scan findings	
Normal	11 (20)
Not done	44 (80)
Surgical findings	
Adhesions	17 (30.91)
Inflamed appendix	16 (29.09)
Tubercular lymph node	6 (10.91)
Adhesions with inflamed appendix	5 (9.09)
Inflamed appendix with mobile cecum	3 (5.45)
Left-sided ovarian cyst	2 (3.64)
Liver abscess	1 (1.82)
Malrotation of gut	1 (1.82)
Omental adhere to right fimbrial end, high cecum, inflamed appendix	1 (1.82)
Right-sided ovarian cyst	1 (1.82)
Right-sided ovarian hemorrhagic cyst	1 (1.82)
Umbilicus sinus tract	1 (1.82)
Volvulus of the left hepatic flexure	1 (1.82)
Type of surgery	
Adhesiolysis	17 (30.91)
Appendectomy	16 (29.09)
Adhesiolysis with appendectomy	6 (10.91)
Lymph node biopsy	6 (10.91)
Ovarian cystectomy	4 (7.27)
Appendectomy with cecopexy	2 (3.64)
Excision of Ladd's band with ileotransverse colon anastomosis	1 (1.82)
Laparoscopic colopexy	1 (1.82)
Abscess drainage	1 (1.82)
Sinus tract excision	1 (1.82)

USG, ultrasound sonography test; CT, computed tomography

the patient's symptoms.[13] Abdominal examination revealed lower abdomen (localized) and generalized tenderness as the most common symptoms. Generalized tenderness, when compared to localized, poses a greater diagnostic challenge to the surgeons.[14] The vitals and biochemical profile of the patients were quite normal. USG and CT scans conducted in patients did not result in the diagnosis of chronic abdominal pain, whereas laparoscopic findings reported most of the patients had adhesions and inflamed appendix. Adhesions restrict the mobility or distensibility of abdominal organs, especially the bowel, and cause chronic abdominal pain.[15] Studies conducted by Salky et al.[16] and Sachin et al.[17] also reported abdominal adhesions as the frequent abdominal pathology. In contrast, study by Naniwadekar et al. reported abdominal Koch's as the most frequent cause of chronic abdominal pain, excluding gynecological cases.[2]

Adhesiolysis was the most common surgical procedure performed in the present study followed by appendectomy. Similarly, in a study by Sayed et al.,[18] 43.6% of the patients

Table 5: Distribution of patients with chronic abdominal pain according to the postoperative pain scores

	Intervals, n (%)			
VAS scores	*15 days*	*30 days*	*45 days*	*60 days*
No pain (0)	8 (14.55)	30 (54.55)	44 (80.00)	49 (89.09)
Mild (0–3)	20 (36.36)	18 (32.73)	9 (16.36)	5 (9.09)
Moderate (4–6)	26 (47.27)	7 (12.73)	2 (3.64)	1 (1.82)
Severe (>6)	1 (1.82)	0	0	0

VAS, visual analog scale

underwent adhesiolysis. In a study by Husain et al.,[6] patients with chronic abdominal pain had 19% and 17.3% cure rate with laparoscopic appendectomy and adhesiolysis, respectively, after a 6-month follow-up period. In a study by El-labban et al.,[19] laparoscopic adhesiolysis resulted in a positive outcome in more than 50% patients.

In this study, the overall pain relief was observed in 89.09% patients with chronic abdominal pain. A study by Kumar et al.[4] reported no pain or less pain in 86% of the patients after two months of laparoscopy. An excellent pain relief in the difficult patient group (i.e., patients with severe chronic pain with a duration of 10 weeks without relevant biological and radiological investigations) was observed in the present study. The mean VAS score also gradually reduced from day 15–60. At the end of the 60th day, only five patients reported mild pain and one patient had moderate pain. Patients with mild pain underwent cataplexy, appendectomy, lymph node biopsy, ovarian cystectomy, and sinus tract excision. however, the patient with moderate pain underwent excision of Ladd's band with ileotransverse colon anastomosis.

Overall, laparoscopy is a safe, quick, and effective modality of investigation for chronic abdominal pain. The ability to pin point or exclude a major cause of abdominal pain, not only avoids further investigations but also plays a significant role in reducing the fear in the minds of the patients. Laparoscopy not only determines the diagnosis, but also has the advantage of therapeutic intervention, which can be performed at the same sitting in most cases, thus avoiding another hospitalization or another exploration of the abdomen. The study also confirms that diagnostic laparoscopy aids the surgeon in directly visualizing the contents of the abdominal cavity better than any other investigative modality. It is safe to identify abnormal findings without any biological and radiological background. This can also improve the outcome in majority of the patients in the difficult group by providing a hint for the confirmation of diagnosis. Despite all its benefits, the efficiency of laparoscopy is limited by the skill, training, and coordination of the surgeons.[20]

Conclusion

Overall, laparoscopy offers a definitive diagnosis in patients presented with undiagnosed chronic abdominal pain and helps in the therapeutic intervention. Adhesions and inflamed appendix are the important causes of chronic abdominal pain. Relief of pain is obtained in many of these patients, which makes laparoscopy an excellent diagnostic modality in the management of chronic abdominal pain. However, this is a single-center study with a small sample size; hence, studies with a larger sample size are required to validate the current findings.

Clinical Significance

Laparoscopy is an investigative modality in the diagnosis and management of patients with chronic abdominal pain. Laparoscopy offers a definitive diagnosis in patients presented with undiagnosed chronic abdominal pain and helps in the therapeutic intervention.

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ORIGINAL ARTICLE

Study of Feasibility of Single Incision Laparoscopic Surgery with Conventional Instruments

Pankajkumar J Zanwar[1], Jitendra T Sankpal[2], Mukund B Tayade[3], Ajay H Bhandarwar[4], Shubham D Gupta[5], Jasmine R Agarwal[6]

Abstract

Aim: To evaluate the feasibility and safety of single incision laparoscopic surgery using conventional laparoscopy instrument set.

Materials and methods: Patients admitted in General Surgery Department of Gokuldas Tejpal Hospital, affiliated to Sir Jamshedjee Jeejeebhoy Group of Hospitals, Mumbai, during January 2015 to June 2016 for appendicitis and symptomatic gallstone disease were included in study. Forty cases were enrolled in study and prospective observational study was performed.

Results: Total 40 cases included, 21 cases of appendicitis and 19 cases of symptomatic cholelithiasis. Mean age of appendectomy group was 28.71 ± 9.69 years and mean age of cholecystectomy group was 36.71 ± 10.48 years. In our study, mean operative time for single-incision laparoscopic (SIL) appendectomy was 42.04 ± 5.74 minutes. Postoperative fever was noted in three cases (14.25%). Mean postoperative pain as per visual analog scale (VAS) score taken after 24 hours on POD 2 was 2.14. Average postoperative stay in hospital was 2.14 days, and port-site infection occurred in one case (4.17%). Patient satisfaction score obtained on the scale of 1–10 on 1-month follow-up was 7.95, while scar cosmesis score was 7.9. In our study, 19 cases underwent SIL cholecystectomy, of which 7 were male (36.8%) and 12 were female (41.2%), and mean age of patients was 36.71 years. Mean operative time in our study was 75.21 min, mean postoperative pain taken on POD 2 as per VAS score was 2.91, mean postoperative hospital stay was 2.1 days, and port-site infections occurred in 2 cases. Postoperative fever was noted in 2 cases, and postoperative patient satisfaction score obtained at 1-month follow-up was 7.73 and scar score of 7.84 on the scale of 0–10. No case required drain placement and conversion.

Conclusion: single-incision laparoscopic surgery (SILS) can be performed using conventional laparoscopic instruments, though it has more operative time, comparable postoperative hospital stay, causes less pain, and has significantly more patient satisfaction regarding postoperative scar and cosmesis.

Clinical significance: Since SILS has more patient acceptance and satisfaction, it can be offered to all patients undergoing laparoscopic surgery, irrespective of unavailability of special instruments and financial constraints, as it can be performed using conventional laparoscopic instruments.

Keywords: Laparoscopy instrument set, Single incision laparoscopic surgery, Visual analog scale.

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Introduction

Since the introduction of laparoscopy in surgical practice, it has evolved over the years from diagnostic laparoscopy to advanced form and many complicated surgeries are now being performed laparoscopically. Laparoscopic procedures are now considered as gold standard in surgical practice for common surgeries like cholecystectomy, appendectomy, and diagnostic laparoscopy, etc.

The field of minimal invasive surgery has experienced an explosive growth in the last two decades. Though the art of surgery has gone through a complete evolutionary process due to antisepsis, antibiotics, anesthesia, and concept of aseptic surgery spread over centuries, the field of laparoscopic surgery has witnessed major changes only in recent past.

The introduction of minimally invasive surgery has drastically changed the way in which surgeons treat the patients. Initially they relied on their direct senses like vision and touch to diagnose the diseases, monitor the condition of patients, and perform invasive procedures, but now minimal access surgery has changed the entire scenario. Modern surgical methods are aimed at giving cure along with using minimally invasive techniques, with the patient's safety never compromised.

During the era of laparoscopic surgery, common trend has been toward less invasive techniques and a natural extension of the trend is to perform operations without scars. The most prominent techniques representing scar less surgery are trans-umbilical single-incision laparoscopic surgery (SILS) and natural orifice transluminal endoscopic surgery (NOTES).[1]

SILS has received increasing attention in recent years. In abdominal surgery, it is an area targeted for intensive investigations. Laparoendoscopic single site surgery (LESS), one-port umbilical surgery (OPUS), and single-port access surgery (SPA) are synonymous with that of SILS.[2]

Several operations have thus been until now performed by SILS technique including cholecystectomy, appendectomy, splenectomy, and sleeve gastrectomy and many more. Many studies

[1–6]Department of General Surgery, Grant Medical College and Sir JJ Group of Hospitals, Mumbai, Maharashtra, India

Corresponding Author: Pankajkumar J Zanwar, Department of General Surgery, Grant Medical College and Sir JJ Group of Hospitals, Mumbai, Maharashtra, India, Phone: +91 9975483248, e-mail: pankaj_zanwar@yahoo.com

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are done till date to evaluate the feasibility of SILS and all these study reports have indicated that the SILS technique is safe and feasible in the population undergoing these surgeries and that the operative time with this new technique is reasonable.[1]

This study is performed in a tertiary care institute having conventional laparoscopic instrument set. Till now in our hospital, no study has been conducted to study feasibility of SILS. The purpose of our study was to present our experience with SILS and to evaluate the feasibility and safety of it prospectively.

Materials and Methods

Setting: Patients admitted in General surgical ward of Gokuldas Tejpal Hospital, affiliated to Grant Government Medical College and Sir JJ Group of hospitals, Mumbai for appendicitis and symptomatic gallstone disease.

Sample size: 40 cases, 21 cases of appendicitis and 19 cases of symptomatic cholelithiasis.

Period of study: January 2015–June 2016.

Study design: Prospective observational study.

Inclusion Criteria

Patients willing to participate in the study, patients more than 12 years of age (male and female), elective cholecystectomy and appendectomy, and fit for general anesthesia.

Exclusion Criteria

Patients not willing to participate in the study, patients less than 12 years of age, acute abdominal emergency, pregnancy, unfit for general anesthesia and/or pneumoperitoneum, multiple previous abdominal surgeries, and any mass suspicious of malignancy

Conduction of Study

Patients were selected for the study after taking careful detailed history, clinical examination, laboratory investigations, and ultrasound examination as described above. The patients eligible for the study were selected, informed, and explained regarding the above study and a proper informed, valid, and written consent taken for participation in the trial.

Patients were kept nil by mouth after 10 pm the previous day of surgery. Patients were shaved and prepared; and informed, valid, and written consent for surgery taken. All patients were informed preoperatively regarding the possibility of conversion to conventional multiport laparoscopy or open surgery depending on intraoperative findings and complications. Proper consent regarding the same was also taken.

All patients received preoperative dose of antibiotic. Patients were operated by experienced laparoscopic surgeons of the hospital with experience of >50 SILS procedures done previously. All incisions were infiltrated with local anesthetic at the end of the procedure.

Duration of surgery was measured from the time of incision to the time of closure. Patients were started on liquid diet on the evening of surgery and full diet on the next morning of surgery. All patients were encouraged to mobilize as early as possible. Inj. Diclofenac sodium 50 mg IM was given as analgesic postoperatively on demand by the patient as guided by the visual analog scale (VAS) in which the pain experienced by the patient was graded by the patient on a scale of 1–10 and recorded every 6 hours for the first 24 hours postoperatively. Analgesics were given if VAS score was >5. The mean VAS profile on day 1 postoperatively was calculated based on the scores. Time to pass flatus was noted, and patients taking >24 hours after surgery to pass flatus were noted as to have ileus.

Patients having fever more than 99°F were noted. Dressing was not changed unless there is soakage. Patients were discharged from hospital as soon as they were adequately mobilized and taking full diet with adequate pain relief.

Postoperative hospital stay was measured from the date of surgery to the date of discharge. Patients were asked to follow-up on postoperative day 7 at 1 month and 6 months postoperatively. Suture removal was on postoperative day 7 in all cases. Time to return to normal activity was noted in all patients. Patients were reassessed on all the occasions, and wound infection and port-site herniation were checked. During follow-up, all the patients in the outpatient clinic, at 1 month after surgery, answered two questions: "How much satisfied with the surgery are you?" and "How satisfied are you with the scar of the surgery?" These short questions pretended to know about the degree of satisfaction and the surgical scar cosmetic result in terms of score from 0 to 10. In this scale, 0 indicates not satisfied at all and 10 indicate excellent.

Responses given by patient were noted in case record sheets. All patients were followed up till 6 months after surgery and were assessed for development of incision related complications like port-site hernia.

Observations and Results

The following facts and figures are observed from our study (Fig. 1).

Study population included total 40 patients, out of which 21 were cases of appendicitis and 19 were cases of symptomatic cholelithiasis. Study included 14 male and 26 female patients, out of which appendicitis group consists of 7 males and 14 females while cholelithiasis group included 7 males and 12 females. A maximum number of patients in appendicitis group were from age group 21–30 years while cholelithiasis group were 6 cases each in 31–40 and 41–50 years of age group.

Mean age of patients in appendicitis group was 28.71 ± 9.69 years, while in cholelithiasis group, it was 36.71 ± 10.48 years.

Mean operative time for single-incision laparoscopic (SIL) appendectomy was 42.04 ± 5.74 minutes, while for SIL cholecystectomy, it was 75.21 ± 7.51 minutes.

Intraoperative findings were as shown in Table 1.

Intraoperative adhesions of small/large bowel or omentum were found in 12 cases out of 40 (30%). Hemorrhage was noted in 2 cases out of 40 (20%). In cholecystectomy group, one patient had bile leak due to perforation of gallbladder intraoperatively (5.26%). Common bile duct (CBD) injury did not occur in any patient. Conversion to conventional multiport laparoscopy was not needed in any cases (Tables 2 and 3).

Postoperative ileus was noted in 7 patients out of which 4 were from appendectomy group and 3 were from cholecystectomy group. Postoperative fever more than 99°F was noted in 5 patients, 3 of which belong to appendectomy group and

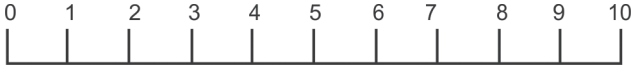

Fig. 1: Scale for scar score and patient satisfaction score

2 belong to cholecystectomy group. Postoperative pain was measured by using VAS, ranging from 0–10, every 6 hours for first 24 hours and average of the 4 scores was taken. Mean VAS score in first 24 hours was 5.38 ± 0.58 in appendectomy group while it was 6 ± 0.74 in cholecystectomy group. VAS score was obtained at a point of time, postoperative day 2 in every patient, and mean VAS score on POD 2 was 2.14 ± in appendectomy group while it was 2.21 ± 0.53 in cholecystectomy group. Patient received 50 mg of Inj. Diclofenac sodium in first 24 hours as per VAS score. One dose was given every time when VAS score was more than 5. Mean analgesic dose requirement was 2.52 ± 0.60 doses in appendectomy group while it was 2.94 ± 0.62 doses in cholecystectomy group.

Port-site infection occurred in two cases, one from appendectomy and one from cholecystectomy group. In both cases, it was cellulitis around infraumbilical port and was managed conservatively in both cases. Patients were encouraged for mobilization postoperatively as soon as they were comfortable. Patients were discharged from hospital once adequately mobilized and have good pain relief. Mean postoperative hospital stay in appendectomy group was 2.09 ± 0.30 days while it was 2.10 ± 0.31 days in cholecystectomy group. Mean time to return to normal activity found to be 7.76 ± 0.83 days in appendectomy group and 8.84 ± 0.76 days in cholecystectomy group.

Scar score given by patients on follow-up at 1 month was noted. Mean scar score in appendectomy group was 7.90 ± 0.62 and in cholecystectomy group was 7.84 ± 0.64. Patient satisfaction score taken on follow-up at 1 month was in 7.95 ± 0.58 appendectomy group and 7.73 ± 0.45 in cholecystectomy group. All patients were followed up for minimum of 6 months and no patient found to have port-site hernia.

Table 1: Intraoperative findings

Intraoperative finding	*Incidence*	*Percentage*
Adhesions	12/40	30
Bowel injury	Nil	0
Hemorrhage	2/40	5
Bile leak	1/19	5.26
CBD injury	Nil	0
Conversion	Nil	0

Table 2: Comparison with other studies of single-incision laparoscopic appendectomy (SILA)

	Name of studies					
Parameters	*Our study*	*Vilallonga et al.*[3]	*Oscar et. al.*[4]	*Ceci et al.*[5]	*Kossi et al.*[1]	*Park et al.*[6]
Total no. of cases	21	46	20	12	10	42
Age (year)	32.2	34.2	30	23.3	37	23.9
Operative time (minute)	42.04	52	40	–	40	51.7
Drain placement	0	–	4 (20%)	3 (25%)	–	–
Conversion	0	1 (2.17%)	0	0	0	0
Postoperative fever	3 (14.2%)	–	–	4 (33.3%)	–	–
Postoperative ileus	4 (19%)	–	–	5 (41%)	–	–
Postoperative pain (mean VAS on POD 2)	2.14	2.8	2	–	–	3.05
Postoperative stay (days)	2.09	–	2	–	2	2.6
Port-site infection	1 (4.76%)	–	–	–	1 (10%)	–
Patient satisfaction score	7.95	7.5	–	–	–	–
Scar score	7.9	8.6	–	–	–	–

Table 3: Comparison with other studies of SILC

	Name of study				
Parameters	*Our study*	*Culp et al.*[7]	*Sulu et al.*[8]	*Karim et al.*[9]	*Van der Linden et al.*[10]
Total no. of cases	19	62	23	45	136
Age (year)	36.71	45	48.8	46	45
Operative time (minute)	75.21	65	79.1	75	46
Conversion	0	0	5	1 + 2	1 + 7
Postoperative fever	2 (10.52%)	–	–	–	–
Postoperative ileus	3 9 (15.78%)	–	–	–	–
Postoperative pain (mean VAS on POD 2)	2.21	–	2.1	0.34 (MEWS system)	–
Analgesic doses	2.91	–	3.8	–	–
Postoperative stay (days)	2.1	2.8	2.0	1	1
Port-site infection	2	0	4	1	0
Port-site hernia	0	0	0	0	1
Patient satisfaction score	7.73	–	–	–	–
Scar score	7.84	–	–	–	–

Discussion

Scarless surgery is the Holy Grail of surgery and the main purpose of minimal access surgery was the reduction of scars and thereby pain and suffering of the patients. SILS is a very exciting new modality in the field of minimal access surgery which works for further reducing the scars of standard laparoscopy and toward scarless surgery.

In this prospective observational study, 40 patients were studied. Out of 40 patients, 21 were patients suffering from appendicitis (chronic/recurrent) and 19 were patients of symptomatic cholelithiasis. All of the patients undergone surgery for respective diseases by SILS method.

There were 14 male and 26 female patients in total out of which appendicitis group consisted of 7 males (33.3%) and 14 females (66.6%), while cholelithiasis group consisted of 7 males (36.8%) and 12 females (63.1%). The ages of patients ranged from 17 years to 53 years with a mean age of 32.2 years. Mean age of appendectomy group was 28.71 $\pm$ 9.69 years and mean age of cholecystectomy group was 36.71 $\pm$ 10.48 years.

In our study, mean operative time for SIL appendectomy was 42.04 $\pm$ 5.74 minutes (from incision to closure), drain placement was not needed in any case, and conversion to conventional multiport laparoscopic appendectomy or open method was not required in any case. Postoperative fever was noted in 3 cases (14.25%), and postoperative ileus more than 24 hours was noted in 4 cases (19%). Mean postoperative pain as per VAS score taken after 24 hours on POD 2 was 2.14, average postoperative stay in hospital was 2.14 days, and postoperative port-site infection occurred in one case (4.17%). Patient satisfaction score obtained on the scale of 1–10 on 1-month follow-up was 7.95, while scar cosmesis score was 7.9 indicating good patient satisfaction with surgery and cosmesis of scar.

Table 2 demonstrates comparison of our study findings with various studies on SILS appendectomy done previously.

In our study, 19 cases underwent SIL cholecystectomy (SILC), of which 7 were male (36.8%) and 12 were female (41.2%), and mean age of patients was 36.71 years. Mean operative time in our study was 75.21 minutes, and conversion to conventional multiport laparoscopic cholecystectomy was not needed in any case. Postoperative fever was noted in 2 cases in our study and postoperative ileus >24 hours was noted in 3 cases. All cases were managed conservatively. Mean postoperative pain taken on POD 2 as per VAS score was 2.21, average analgesic doses required were 2.91, mean postoperative hospital stay 2.1 days. Port-site infections occurred in 2 cases, which were minor and were managed on oral antibiotics. All patients were followed up for minimum of 6 months, and no case of port-site hernia was noted. In our study, postoperative patient satisfaction score obtained at 1-month follow-up was 7.73 and scar score of 7.84 on the scale of 0–10.

Table 3 demonstrates comparison of our study findings with various studies done on SILS cholecystectomy previously.

All the results in our study were comparable to studies done previously, which were performed using specialized instruments for SILS.

In this study, it was observed that it was possible to perform the procedure with conventional instruments in a timely and safe manner, provided that it be performed by experienced surgeon.

Conclusion

SILS for appendectomy and cholecystectomy can be performed using conventional laparoscopic instruments, provided surgeon has adequate expertise.

Though SILS has more operative time, it has comparable postoperative hospital stay, causes less pain, has comparable hospital stay, and has significantly more patient satisfaction regarding postoperative scar and cosmesis.

Since SILS has more patient acceptance and satisfaction, it can be offered to all patients undergoing laparoscopic surgery, irrespective of unavailability of special instruments and financial constraints, as it can be performed using conventional laparoscopic instruments.

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RESEARCH ARTICLE

Comparative Analysis of Surgical and Pathological Outcomes between Laparoscopic and Open Rectal Cancer Surgeries: Single Institution Experience

Subbiah Shanmugam[1], Jagadeesan G Mani[2]

Abstract

Background: The purpose of our review is to analyze and compare the perioperative and clinicopathologic outcomes of laparoscopic-assisted rectal surgeries (LARS) and open rectal surgeries (ORS) for rectal malignancies.

Patients and methods: A retrospective analysis of data available from June 2015 to October 2018 was performed. Patient's demographic profile, tumor characteristics, perioperative, and short-term clinicopathological outcomes were compiled and contrasted. Statistical tests used were Student's *t* test and Fischer's exact test.

Results: During the study period, 34 and 24 patients underwent laparoscopic and open rectal cancer surgeries, respectively. Of 58 patients, there were 30 men (51.7%) and 28 women (48.3%) with average age group of 51.7 years. The median tumor distance was 4 cm and 6 cm from the anal verge in the laparoscopic and open groups, respectively ($p = 0.03$). 70.1% of patients underwent preoperative chemoradiation. Conversion rate noted was 14.7%. Operative duration was prolonged for laparoscopic resection (194.7 vs 178.3 minutes, $p = 0.168$). Blood loss (395.58 vs 506.66 mL), postoperative hospital stay (8.3 vs 11.5 days: mean difference, 3.2 days), 30-day mortality (3% vs 0% $p = 0.81$), and major complications (11.8% vs 16.7%) failed to differ significantly. Negative circumferential radial margin was noticed in 98.4% of the overall group (94.1% laparoscopic resection and 95.8% open resection; $p = 0.93$).

Conclusion: There were certainly no significant differences between laparoscopic and open surgeries in operative time period, complications, and duration of hospital stay. Hence, laparoscopic surgery is oncologically safe in rectal cancer patients.

Clinical significance: Laparoscopic rectal cancer surgeries could be feasible with equivalent short-term outcomes as with open surgeries with less morbidity, even among patients treated with preoperative chemoradiation.

Keywords: Laparoscopic resections, Pathological outcomes, Perioperative outcomes, Rectal cancers, Retrospective comparative study.

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Introduction

Surgical therapy plays an integral role in the comprehensive management of rectal cancer. Total mesorectal excision (TME) done as a part of radical resection significantly improves the prognosis.[1] Though laparoscopic rectal surgeries have been associated with a steep learning curve, high conversion rate, and in need of consistent practice, it has been evolving as an alternative to open procedures.[2] However, few technical difficulties like suboptimal traction and countertraction applied during surgeries, especially in mid- to low-rectal bulky cancers, in obese patients with narrow pelvis are causing concerns for laparoscopic surgeons.[3]

There have been many studies reporting better short-term outcomes after laparoscopic surgery such as lower morbidity, reduced blood loss, reduced pain, and faster recovery.[4] Although laparoscopy may be considered the gold standard for the treatment of rectal cancers, the results of recently published well-designed randomized controlled trials, such as COLOR II, ALACART, and ACOSOG Z6051 and a meta-analysis surprisingly showed no significant differences in terms of short-term morbidity between laparoscopy and open surgery, with very narrow 95% confidence intervals.[5–9] This raised the interest and made us to compare and contrast the short-term outcomes of open and laparoscopic rectal cancer surgeries performed in our institution.

Patients and Methods

Patients Assortment

Retrospective analysis of all the patients who had been subjected to elective laparoscopy or to laparotomy for rectal malignancy between June 2015 and October 2018 was conducted on the basis of a prospectively recorded database. Records pertaining to age group, gender, comorbidities, tumor site and stage, neoadjuvant treatment, operative time period, surgical and pathologic data, complications, postoperative intestinal activity, and time period of stay were investigated; almost all patients underwent curative resection. Exclusion criterion comprised tumors with complications like obstruction, perforation, recurrence and patients who underwent synchronous colectomies. A series of 24 patients who underwent standard open rectal surgeries and operated prior to the laparoscopic aided rectal procedures were commenced and was compared to a group of 34 consecutive

[1,2]Department of Surgical Oncology, Government Royapettah Hospital, Kilpauk Medical College, Chennai, Tamil Nadu, India

Corresponding Author: Jagadeesan G Mani, Department of Surgical Oncology, Government Royapettah Hospital, Kilpauk Medical College, Chennai, Tamil Nadu, India, Phone: +91 9941019742, e-mail: jagusurgun@gmail.com

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patients who underwent laparoscopic TME for rectal cancer. Patients from laparoscopic groups were operated on by the exact same surgical personnel. Tumors situated within 17 cm of the anal verge were considered as: lower rectum (<7 cm from anal verge); mid-rectum (7.1–12 cm from anal verge); higher rectum (>12 cm from anal verge). Patients with T3 and or T1 or T2 N1 tumors in the middle or lower third of the rectum underwent neoadjuvant chemoradiation (50.4 Gy given over 5 weeks in combination with 5-fluorouracil or with oral capecitabine at a dosage of 1000–1500 mg per m^2 every day for the entire timeframe of radiotherapy-based chemotherapy) and after that surgical procedures 6–8 weeks eventually. Preoperative planning was exactly the same in both categories.

Surgical Technique

Oncological concepts adopted were (1) ligation of the inferior mesenteric artery and the inferior mesenteric vein to offer sufficient colon extent for a tension-free anastomosis, (2) sharp TME for middle and lower rectal cancer, (3) preservation of the autonomic pelvic nerves, and (4) appropriate distal and radial surgical margins. All patients were operated under general anesthesia. A 10-mm camera port was placed 0.5 cm above the umbilicus. Another 10 mm port was introduced one-third of the distance from the right anterior superior iliac spine to the navel. Two 5-mm trocars positioned at the level of umbilicus on either side, lateral to rectus sheath, and an additional 5-mm port positioned in the left iliac fossa. After inspecting for the presence of peritoneal diseases, the peritoneum was incised from the level of the sacral promontory posterior to the rectum down to the summit of the coccyx. Anterior dissection started in the retrovesical septum in males and in the rectovaginal space in females. The rectosacral ligament and anococcygeal ligament were divided and incised at the level of the fourth sacral vertebra. The intact mesorectum was circumferentially mobilized. For tumors in the higher rectum, a higher TME or partial mesorectal excision was performed laparoscopically with transection of the mesorectum 5-cm distal of the tumor, followed by a stapled anastomosis. For tumors situated in the mid and distal rectum, a complete TME was done laparoscopically. The rectum was transected with an endoscopic or traditional stapler with the use of a Pfannenstiel incision. A coloanal anastomosis was performed if at least 1 cm from the dentate line often is spared with an adequate oncological distal margin of 2 cm. Typical lateral-to-medial mobilization was attempted of the sigmoid colon, descending colon, and the splenic flexure. After scoring the mesentery and separating the mesenteric fat with small vessels by applying harmonic scalpel, the inferior mesenteric vessels were identified, clipped, and transected with harmonic scalpel. A transverse incision of 3–4 cm was made to remove the specimen with the aid of a wound shield. Colorectal anastomoses were performed using circular staplers. Proximal and distal tissue donuts produced by the circular stapler were checked for integrity. The distal donut was sent for pathological assessment as the circumferential margin. Covering loop ileostomy or transverse colostomy was created for diversion of feces.

Open TME

Open cases were performed through a midline incision. Open TME was performed as outlined by earlier explained techniques.

Conversions was defined as operating any procedure using an open method, except the removal of the specimen or transection of rectal cancer through the anus.

Pathological Assessment

All specimens were analyzed by the same experienced pathologist who examined the involvement of the circumferential margin (distance of 1 mm and or less from the tumor to the mesorectal fascia), involvement of the distal margin (tumor approaching the distal portion), and the number of isolated lymph nodes.

Statistical Analysis

The statistical analysis was performed employing the SPSS software program version 22.0 (Chicago, IL, United States) and Windows. Parametric variables were expressed as mean ± SD. The Student's *t* test was used to analyze variations between the LARS and ORS groups. The χ^2 test (or Fisher's exact test where appropriate) and exact tests were performed to compare variables between the two groups. A *p* value less than 0.05 was considered statistically significant.

Results

A total of 58 patients participated in this study, including 34 in the LARS (15 males and 19 females, mean age 52.41 years) and 24 in the ORS (15 males and 9 females, mean age 50.62 years) (Table 1). There were no significant differences in baseline characteristics between the two groups. 23 patients (67.6%) in the LARS and 18 patients (75%) in the ORS underwent neoadjuvant chemoradiotherapy before surgery. Majority of patients in both the groups had TNM stage III disease (61.8% in LARS vs 70.8% in ORS). Surgery was not successfully completed by laparoscopy (converted to laparotomy) in 5 of 34 (14.7%) patients. The most frequently performed procedure was APR (52.9%) in LARS group and LAR (45.38%) in ORS group. The ORS included 5 patients, 11 patients, and 4 patients underwent APR, LAR, and anterior resection, respectively. 5.9% and 8.3% of patients underwent posterior pelvic exenteration in LARS and ORS groups, respectively (Table 2).

Though statistically borderline significant, laparoscopic group patients (LARS) had decreased length of hospital stay ($p = 0.0511$) and decreased blood loss ($p = 0.0491$). Mean operating time was 16 minutes longer for laparoscopic than open surgery. Return to oral diet was longer by a mean of 1.4 days in the open group. But these differences were not significant. Common procedure-related complications included anastomotic leakage, pelvic abscess, ileus, and urinary tract problems (Table 3).

The overall morbidity rate was 29.4% in the LARS as compared with 45.8% in the ORS. However, this difference was not statistically significant ($p = 0.1999$). Only one patient from the laparoscopic group had mortality within 30 days. 4.2% and 8.3% patients of open group had intestinal obstruction and wound dehiscence, respectively. 11.8% patients and 12.5% patients of LARS and ORS group had anastomotic leakage, respectively. The rate of wound infection and rate of delay in bladder emptying were more in ORS and LARS group, respectively.

Regarding oncologic adequacy of resection, a total of 21.9% (9/41) of patients showed a complete degree of response to NCRT; the proximal and distal resection margins did not differ significantly between the groups. A total of 2.9% of patients in the LARS group showed circumferential resection margin (CRM) involvement; however, none of the patients in the ORS group showed this involvement, although the difference was not significant. The distribution of pathological tumor and nodal stages was similar between the groups (Table 4).

The mean numbers of lymph nodes harvested were 10.8 in the LARS group (range: 8–13) and 12.6 (range: 8–19) in the ORS group.

Table 1: Patient's baseline characteristics

S. no.	*Parameters*	*Group*	*Laparoscopic-assisted rectal surgeries (LARS) N (%)*	*Open rectal surgeries (ORS) N (%)*	*p value*
1	No. of patients		34 (58.6%)	24 (41.4%)	–
2	Age (years)	Mean ± SD	52.41 ± 13.01	50.62 ± 13.01	0.6086
3	Sex	Male	15 (44.1%)	15 (62.5%)	0.1676
		Female	19 (55.9%)	9 (37.5%)	
4	Serum albumin (g/dL)	Mean ± SD	4.27 ± 0.55	3.76 ± 0.42	0.1171
5	Serum CEA* (ng/mL)	Median	9.85	22.25	0.9773
6	Distance from anal verge (cm)	Median	4	6	0.3369
7	Location of tumor	Upper third	8 (23.5%)	5 (20.8%)	0.6215
		(12–17 cm from AV)	4 (11.8%)	9 (37.5%)	
		Middle third	22 (64.7%)	10 (41.7%)	
		(7–12 cm from AV**)			
		Lower third (<7 cm from AV)			
8	Neoadjuvant chemo RT	Given	23 (67.6%)	18 (75%)	0.5445
		Not given	11 (32.4%)	6 (25%)	
9	Clinical T stage	cT2–T3	29 (85.3%)	20 (83.3%)	0.8390
		cT4	5 (14.7%)	416.7%)	
10	Clinical N stage	Negative	12 (35.3%)	7 (29.2%)	0.6243
		Positive	22 (64.7%)	17 (70.8%)	
11	Distant metastasis	Present	0 (0%)	0 (0%)	0.8011
		Absent	34 (100%)	24 (100%)	
12	Clinical stage group	Stage I–II	13 (38.2%)	7 (20.6%)	0.4742
		Stage III	21 (61.8%)	17 (70.8%)	

*CEA, carcinoembryonic antigen
**AV, anal verge

Table 2: Surgical data

Parameters	*Group*	*Laparoscopic-assisted rectal surgeries (LARS)*	*Open rectal surgeries (ORS)*	*p value*
Type of surgery	Anterior resection	7 (20.6%)	4 (16.7%)	
	Low anterior resection	6 (17.6%)	11 (45.8%)	0.0749
	Abdominoperineal resection	18 (52.9%)	5 (20.8%)	
	Posterior pelvic exenteration	2 (5.9%)	2 (8.3%)	
	Total pelvic exenteration	1 (2.9%)	2 (8.3%)	
Operative time	Mean ± SD (in minutes)	194.7 ± 40.43	178.3 ± 48.51	0.1676
Intraoperative blood loss	Mean ± SD (in mL)	295.58 ± 83.55	406.66 ± 137.97	0.0491
Intraoperative complications	Present	0 (0%)	2 (8.3%)	0.3611
	Absent	34 (100%)	22 (91.7%)	
Incidence	Bladder injury	Nil	1	
	Ureteric injury	Nil	1	

Although the number of lymph nodes harvested tended to be more in the ORS group, the difference did not reach statistical significance.

Discussion

Three randomized controlled trials have demonstrated that the oncological outcomes of laparoscopic surgery for the rectal cancer are comparable to those of open surgery.[7,10,11]

In the first study, the COLOR II trial, Van der Pas et al. prospectively randomized 1,103 patients with rectal cancer to either laparoscopic or open proctectomy.[12] Although laparoscopic procedures took longer time (240 vs 188 minutes), the patients in that group had significantly less blood loss (200 vs 400 mL), earlier return of bowel (2 vs 3 days), and shorter hospital length of stay (LOS) (8 vs 9 days). The 28-day morbidity and mortality were similar in both groups. Similarly, our study cohorts also showed that patients treated with laparoscopic-assisted rectal resection though statistically not significant took longer operating time (195 vs 175 minutes) with minimal blood loss (295 vs 405 mL), 0.95 day earlier return of bowel movements, and shorter hospital day by 3 days. The morbidity and mortality patterns of our study cohorts are in concordance with COLOR II trial population.

Table 3: Postoperative outcomes

Parameters	*Group*	*Laparoscopic-assisted rectal surgeries (LARS)*	*Open rectal surgeries (ORS)*	*p value*
Morbidity incidence	Yes	10 (29.4%)	11 (45.8%)	0.1999
	No	24 (70.6%)	13 (54.2%)	
Major complications	Anastomotic leakage			
	Yes	4 (11.8%)	3 (12.5%)	0.9325
	No	30 (88.2%)	21 (87.5%)	0.8011
	Intestinal obstruction			
	Yes	0 (0%)	1 (4.2%)	0.3611
	No	34 (100%)	23 (95.8%)	
	Wound dehiscence			
	Yes	0 (0%)	2 (8.3%)	
	No	34 (100%)	22 (91.7%)	
Minor complications	Wound infections			
	Yes	6 (17.6%)	9 (37.5%)	0.0890
	No	28 (82.4%)	15 (62.5%)	0.9224
	Delayed urinary bladder emptying			
	Yes	6 (17.6%)	4 (16.7%)	
	No	28 (82.4%)	20 (83.3%)	
Time to first bowel movement	Days (range)	1.5 (1–2.5)	2.4 (1.5–3)	0.3625
Length of hospital stay	Mean ± SD (in days)	7.3 ± 2.13	11.5 ± 2.12	0.0511
Mortality before 30 days of surgery	Yes	1 (2.9%)	0 (0%)	0.8011
	No	33 (97.1%)	24 (100%)	

Table 4: Pathological outcomes

Parameters	*Group*	*Laparoscopic-assisted rectal surgeries (LARS)*	*Open rectal surgeries (ORS)*	*p value*
Histologic type	Adenocarcinoma	32 (94.1%)	24 (100%)	0.9363
	Adeno-squamous	1 (2.9%)	0 (0%)	
	Melanoma	1 (2.9%)	0 (0%)	
Grade	Grade 1	19 (55.9%)	10 (41.7%)	0.2860
	Grade 2	14 (41.2%)	11 (45.8%)	
	Grade 3	1 (2.9%)	3 (12.5%)	
Effect of NACT	Residual disease present absent	(23)	(18)	0.9704
		18 (78.2%)	14 (77.8%)	
		5 (21.8%)	4 (22.2%)	
Circumferential resection margins (cm)	Positive (<1 mm)	1 (2.9%)	0 (0%)	0.9363
	Negative (>1 mm)	33 (97.1%)	24 (100%)	
Proximal resection margins (cm)	Positive	0 (0%)	0 (0%)	0.8011
	Negative	34 (100%)	24 (100%)	
Distal resection margins (cm)	Positive	0 (0%)	1 (4.1%)	0.8011
	Negative	34 (100%)	23 (95.8%)	
Number of lymph nodes harvested	Median (range)	10.8 (8–13)	12.6 (8–19)	0.1206
Completeness of TME	In percentage	100%	100%	–

In CLASICC trial, Guillou et al. randomized 794 patients with colorectal cancers.[13] Of these patients, 381 had rectal cancer and underwent a low anterior resection or an abdominoperineal resection. Although laparoscopic procedures took longer time (180 vs 135 minutes), the patients in that group had earlier return of bowel (5 vs 6 days) and shorter hospital LOS (11 vs 13 days). The open and laparoscopic groups had no statistically significant difference in the perioperative morbidity. These results are in concordance with our results. In contrast to the CLASICC trial where both groups had a high rate of positive CRM (14% for open surgery and 16% for laparoscopic surgery), among our study population, only one patient of the laparoscopic group of patients had positive CRM when comparing open group patients.[14,15]

In the COREAN trial, Kang et al. enrolled 340 patients with locally advanced (T3N0-2) rectal cancer.[10] All patients had undergone neoadjuvant chemoradiation therapy and were randomized to

open vs laparoscopic resection. Although laparoscopic procedures took longer time (244.9 vs 197 minutes), the patients in that group had earlier return of bowel movements (38.6 vs 60 hours) and shorter hospital LOS (8 vs 9 days). The results of our study correlate with this randomized control trial (RCT).

With regard to operative morbidity, COLOR II trial documented equal complication rates in both laparoscopic and open surgeries (40% in lap vs 37% in open). CLASSIC trial documented intraoperative complications such as bowel injury (1% in lap vs 1% in open), bladder injury (2% in lap vs 0% in open), ureteric injury (0% in lap vs 3% in open) and postoperative complications (40% in lap vs 37% in open) such as anastomotic leakage rate (10% in lap vs 7% in open) and wound infection (5% in lap vs 5% in open). COREAN trial documented wound infection rate (1.2% in lap vs 6.5% in open), anastomotic leakage rate (2% in lap vs 0% in open), and pelvic abscess (0% in lap vs 0.6% in open). Our study reports revealed intraoperative complications such as bladder injury (0% in lap vs 4.5% in open) and ureteric injury (0% in lap vs 4.5% in open) and postoperative complications (29.5% in lap vs 45.8% in open) such as anastomotic leakage rate (11.8% in lap vs 12.5% in open) and wound infection (17.6% in lap vs 37.5% in open) with no statistical significant differences made between laparoscopic and open surgeries. Our results are therefore comparable with the existing international RCTs.

With regard to 30-day mortality, CLASSIC trial and COLOR II trial reported a mortality rate of 4% in laparoscopy, 5% in open, 1% in laparoscopy, and 2% in open surgeries, respectively. Our results showed a 30-day mortality of 0%. A meta-analysis of prospective trials was conducted by Arezzo et al. and included 23 studies, 8 of which were randomized, representing a total of 4,539 patients.[16] A mortality incidence of 1.0% was observed in the laparoscopic group compared with 2.4% in the open group ($p = 0.048$). A significant difference was also seen in the morbidity rate between the two groups (31.8% in the laparoscopic group vs 35.4% in the open group; $p < 0.001$).

Boutros et al. retrospectively compared 234 patients undergoing open or laparoscopic TME for rectal cancer.[17] Laparoscopy was associated with longer operative time (245 vs 213 minutes) but with less blood loss (284 vs 388 mL), shorter LOS (7 vs 8 days), and lower rates of 30-day morbidity (25 vs 43%) and surgical site infections (9 vs 20%). Similarly, Lee et al. included 160 patients in their retrospective study; however, all these patients had stage I rectal cancer.[18] Overall, morbidity and mortality were similar in both the laparoscopic and open groups. The laparoscopic group had longer operative time (221 vs 184 minutes) but significantly less blood loss (150 vs 200 mL), time to first bowel movement (2.44 vs 3.54 days), rate of superficial surgical-site infection (0 vs 7.5%), and LOS (8 vs 11 days).

Pathological Outcomes

Local recurrence is related to several oncological parameters that can be objectively measured. These include completeness of the TME, involvement of the CRM, and number of harvested lymph nodes.[19]

In fact, in three large randomized controlled trials (COLOR II, CLASICC, and COREAN) and in a large-scale multicenter prospective review by Lujan et al., there were no statistical differences in those parameters when laparoscopic and open approaches were compared.[7,10,13–15] However, different standards for pathological evaluation were applied to each study, and an overall comparison was difficult to make. Likewise, Lujan et al. included 4,970 patients with rectal cancer.[20] They found that laparoscopic surgery resulted in decreased blood loss, lower 28-day morbidity, increased completeness of TME, and a 3-day decrease in the hospital LOS. In contrast to the CLASICC trial, the rate of CRM positivity was significantly lower, prompting the authors' conclusions that laparoscopic resection is the preferred approach for patients with rectal cancer.

On the other hand, the American ACOSOG Z6051 trial comparing laparoscopic to open resection of stage IIA, IIIA, or IIIB rectal cancer originating within 12 cm from the anal verge[6] showed the quality of TME specimen in 462 operated patients. They reported surgeries as complete (77%) and nearly complete (16.5%) TME in 93.5% of the cases. Negative circumferential radial margin was observed in 90% of the overall group (87.9% laparoscopic resection and 92.3% open resection; $p = 0.11$). Distal margin result was negative in more than 98%of patients irrespective of the type of surgery ($p = 0.91$). The authors of ACOSOG Z6051 trial demonstrated that laparoscopic resection did not meet the criteria for noninferiority of pathologic outcomes compared with open surgery. Only one patient of LARS group had positive circumferential resected margin and one patient in ORS group had positive distal resected margin.

Stevenson et al. randomized 475 patients with T1–T3 low rectal cancer (<15 cm from the anal verge) to undergo laparoscopic or open resections.[8] The circumferential resection margin was clear in 222 patients (93%) in the laparoscopic surgery group and in 228 patients (97%) in the open surgery group (risk difference of −3.7%; $p = 0.06$), the distal margin was clear in 236 patients (99%) in the laparoscopic surgery group and in 234 patients (99%) in the open surgery group (risk difference of −0.4% $p = 0.67$), and TME was complete in 206 patients (87%) in the laparoscopic surgery group and 216 patients (92%) in the open surgery group (risk difference of −5.4%, $p = 0.06$). This study also failed to establish noninferiority of laparoscopic surgery compared with open surgery, especially in patients with larger T3 tumors. The authors concluded that there is not enough evidence supporting the routine use of laparoscopy in the management of rectal cancer.

The number of lymph nodes harvested is another parameter frequently adopted to evaluate the oncological quality of the surgical procedures. In our study, the mean number in the LARS group was slightly lower than ORS group. The requirement for accurate pathological staging was comparable to the reported numbers of 11–23 for the laparoscopic groups in other studies. Considering that the number of lymph nodes may decrease after neoadjuvant chemoradiation, the present findings were even more favorably comparable with previous findings in patients undergoing neoadjuvant chemoradiation as in COREAN trial (17 in lap vs 18 in open), CLASSIC trial (12 in lap vs 13.5 in open), and ACOSOG Z6051 trial (17.9 in lap vs 16.5 in open).

The analysis of long-term outcomes is necessary for establishing the value of laparoscopic surgery in the treatment of rectal cancer. None of the short-term advantages would be important if the incidence of local recurrence and survival was compromised.

Conclusion

Our study demonstrated that laparoscopic TME is safe and feasible, with an oncological adequacy comparable to the open approach. During surgery, it seems that the operating time is longer in the laparoscopic group with less blood loss. Important short-term advantages will be the quicker recovery of the bowel function and

decreased median length of hospital stay with similar morbidity and mortality. Further studies and trials are required before more conclusive arguments can be made to support the universal use of laparoscopy in the surgical management of rectal cancer.

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RESEARCH ARTICLE

Laparoscopic Cholecystectomy at Cesarean Section

Majid Mushtaque[1], Samina A Khanday[2], Junaid Sheikh[3], Arshad R Kema[4], Ibrahim R Guru[5], Tajamul N Malik[6]

Abstract

Objective: To study the outcome of laparoscopic cholecystectomy at the time of cesarean section.

Materials and methods: Eight patients were subjected to laparoscopic cholecystectomy at the time of cesarean section. All of them were diagnosed with cholelithiasis at the first antenatal scan. Laparoscopic cholecystectomy was performed by a standard technique, after assessing the anatomy via the cesarean wound.

Results: Laparoscopic cholecystectomy was combined with lower segment cesarean section (LSCS) under general anesthesia in all patients. Surgeries were completed in a mean operating time of 82 minutes. There were no intraoperative or major postoperative complications. No extra antibiotics or analgesics doses were needed. Patients were discharged on the third and the fourth postoperative day.

Conclusion: A combination approach of laparoscopic cholecystectomy at the time of LSCS confers the benefits of minimal access for gallstone disease apart from being safe, effective, and well accepted. With an additional small port site incision, single anesthesia, and single hospital stay, the combined procedure confers valuable advantages in terms of time, hospital stay, cost, and convenience. It also prevents the possibility of developing acute cholecystitis while the patient is waiting for cholecystectomy apart from avoiding the separation of mother from newborn entailed by reoperation.

Keywords: Combined approach, Gallbladder disease, Laparoscopic cholecystectomy, Lower segment cesarean section, Pregnancy.

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Introduction

Lower segment cesarean section (LSCS) is one of the most common operative procedures in women of reproductive age. Gallstones are three times more common in women than men and cholecystectomy is the most common major operation worldwide. While 2–4% of pregnant women are found to have gallstones by obstetric ultrasound, symptomatic cholelithiasis and cholecystitis during pregnancy occur in only 5–10 of every 10,000 births. Most patients are effectively managed with conservative, nonoperative therapy. In some patients, however, surgery is required for refractory symptoms or complications.[1] The incidental finding of gallstones has increased considerably as so many patients undergo ultrasound imaging of abdomen for a variety of conditions.[2] It has been shown that cholecystectomy for gallstones during laparotomy for the unrelated condition may sometimes be appropriate because such patients are at a greater risk of developing symptoms.[3] Many women undergoing gynecological surgery ask for cholecystectomy to avoid future hospitalization and another operation. One appropriate approach could be to perform combined cesarean section and cholecystectomy in one sitting. Different varieties of procedures have been done at the time of cesarean section, including gynecological procedures, hernia repair, appendectomy, and cholecystectomy.[4–7] The combination of cholecystectomy with cesarean section is virtually undocumented outside of a case report.[8–10] The authors of the present article have reported the feasibility and safety of combined LSCS and open cholecystectomy in a single sitting,[11] and the present study is a further a step ahead by approaching the patient with the laparoscopic technique for gallbladder removal immediately after cesarean section.

Materials and Methods

The study was conducted from July 2014 to August 2018 at Sopore Nursing Home and New City Hospital in Kashmir, Jammu and Kashmir, India. A total of 20 pregnant women with concurrent gallstone disease were identified at their first antenatal sonography, out of which, 12 were scheduled for laparoscopic cholecystectomy at the time of cesarean section. All the patients had gallstones. The selection criteria for the combined procedure were the same as that of the previous study by the authors. Patients who refused a combined procedure or had associated cardiovascular or pulmonary illnesses, acute cholecystitis in the third trimester, gallbladder mass, and symptoms or investigations suggestive of common bile duct stones were not included in the study. In our study group, one patient underwent open cholecystectomy for her intractable recurrent biliary colics in the second trimester of her pregnancy and was excluded from the study. Three more patients lost the antenatal follow-up. The remaining eight patients were either managed conservatively for their symptomatic gallbladder disease or were asymptomatic during their pregnancy. Indications for cesarean section included cephalopelvic disproportion (CPD),

[1]Department of Health and Family Welfare, Sub-District Hospital, Chadoora, Jammu and Kashmir, India

[2]Department of Pathology, Government Medical College, Srinagar, India

[3,4,6]Department of Health and Family Welfare, District Hospital, Badgam, Jammu and Kashmir, India

[5]Department of Health, Guru Superspeciality Hospital, Jammu and Kashmir, India

Corresponding Author: Majid Mushtaque, Department of Health and Family Welfare, Sub-District Hospital, Chadoora, Jammu and Kashmir, India, Phone: +91 9419010280, e-mail: drmajidmushtaque@gmail.com

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previous cesarean section, transverse lie, twin pregnancy, and placenta previa. Written informed consent was obtained for combined procedures at the time of admission. All patients received prophylactic intravenous antibiotics. Under general anesthesia, LSCS was done first by making a Pfannenstiel or lower midline abdominal incision. Upper abdominal anatomy was assessed via the cesarean wound after the uterus was closed. A telescope was also used through the cesarean incision to have a closure look at the target site. The lax abdominal wall was easily retracted allowing the assessment of the upper abdomen. After closing the uterus, the first 10 mm trocar was placed at the umbilicus under direct vision and was controlled by surgeons' left hand, before closing the cesarean wound. The abdominal cavity was insufflated with carbon dioxide after closing the laparotomy incision and the insufflation pressure was preset at 12–13 mm Hg. Continuous $ETCO_2$ monitoring was done. Three additional trocars were placed at conventional sites (epigastric 10 mm, right subcostal 5 mm, and right lumbar 5 mm) under laparoscopic vision (Fig. 1). Laparoscopic cholecystectomy was completed in all the patients by the duct first method after defining the critical view of safety. The gallbladder was extracted via the epigastric port. A small 14 Fr tube drain was placed in the subhepatic region in all the patients. Ports were removed under the vision and port sites closed. All the patients were encouraged to be ambulatory 18 hours after the operation. Data recorded included age, parity, associated illnesses, biliary symptoms, laboratory and radiological investigations, conversion rate, operative findings, intraoperative complications, the time taken for laparoscopic cholecystectomy after completion of cesarean section, postoperative complications, length of hospital stay from the day of operation, mortality, and pathological findings of gallbladder.

Results

The age of the patients ranged between 24 and 37 years (mean 29.7 years). All except one patient were multigravida. Ultrasonographic findings included multiple gallbladder (GB) calculi in 7 (87.5%) patients, and a solitary large stone of 30 mm diameter in one (12.5%) patient. Clinical presentation included a history of biliary symptoms like episodic upper abdominal pain and/or dyspepsia in four (50%) and acute cholecystitis in the first trimester in one (12.5%), while three (37.5%) women had silent gallstones. One patient who was excluded from the study developed recurrent acute biliary colic requiring frequent admissions and was operated at a referral center for her gallstone disease in her second trimester of pregnancy. Other three patients lost their follow-up in their last trimester of pregnancy. All symptomatic patients were managed conservatively during their pregnancy, including one who developed acute calculous cholecystitis in her first trimester. The indications of LSCS in our study group were CPD in two, previous LSCS in five, and placenta previa in one of the patients. All the patients were operated at term. Under general anesthesia, LSCS was first done using either Pfannenstiel incision (five patients) or lower midline incision (three patients). Anatomy in the upper abdomen was assessed via the cesarean wound after closing the uterus. Direct visual assessment was somewhat easier via the lower midline incision as compared to Pfannenstiel incision. All the patients had favorable anatomy and laparoscopic cholecystectomy was completed in them. A small tube drain was placed via the right flank port site as routine which was removed in all patients on the first or the second postoperative day.

Intraoperative findings included flimsy omental adhesions in four (50%) patients, and dense adhesions in calots, distended gallbladder, short cystic duct, and mucocele in each (12.5% each) of the patients. None of the patients had pericholecystic edema/abscess, empyema, or dilated cystic duct. Opened specimen revealed gallstones with or without sludge in seven patients, and gallstones with clear mucus in one patient.

Surgeries were completed in a mean operating time of 82 minutes and the mean extra time taken after LSCS, placement of primary optical supraumbilical trocar, and closure of the cesarean wound was 24 minutes (15–40 minutes). There were no conversions to open cholecystectomy. There were no intraoperative or postoperative complications except for one woman who developed postoperative cesarean wound infection (mild) which was treated with additional daily dressings. All newborn were healthy with a mean birth weight of 2.9 kg. There were no deaths in our series. No extra antibiotics or analgesic doses were needed. Patients were discharged on the third and the fourth postoperative day. Histopathology of the gallbladder specimen revealed features consistent with chronic cholecystitis in five, acute inflammation in one, cholesterolosis in one, and a normal gallbladder in one of the specimens.

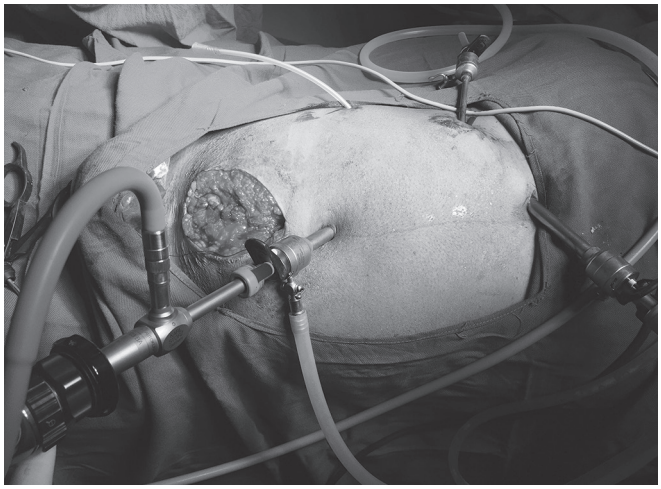

Fig. 1: Lower segment cesarean section wound with sheath closed and standard port sites for laparoscopic cholecystectomy

Discussion

Gallstones are more common during pregnancy due to decreased gallbladder motility and increased cholesterol saturation of bile. Gallstone disease during pregnancy has been associated with increased risk of preterm birth, maternal morbidity, and readmission, as well as neonatal morbidity.[12] The prevalence of biliary sludge, gallstones, and biliary pancreatitis in pregnancy ranges from 5 to 36%, 2 to 11%, and 1/1,000 to 3/10,000, respectively.[13–16] However, the need for cholecystectomy occurs in 1 in 1.6–1 in 10,000 pregnancies and most of the patients with symptomatic gallbladder disease in pregnancy are effectively managed conservatively, and cholecystectomy is performed selectively during the postpartum period.[14] Many patients require cholecystectomy during pregnancy, and the laparoscopic approach seems to be a safe alternative to open surgery during pregnancy.[17] For pancreaticobiliary diseases in pregnancy, endoscopic retrograde cholangiopancreatography (ERCP) has been suggested as an effective alternative to surgery.[18] Although gallstone disease in pregnancy is uncommon, the potential maternal and fetal morbidities from both the disease and its surgical therapy are significant. Pregnant women who

develop symptomatic gallstone disease have a high rate of recurrent symptoms.[19]

After open or laparoscopic cholecystectomy in pregnant women, the rate of preterm labor is 5–7% overall and up to 40% in the third trimester.[17–20] The rate of spontaneous abortion is 0–18%, and the rate of preterm delivery is 0–22%, depending on the severity of the underlying disease and gestational age.[21] In a large retrospective population-based study, fetal outcome following laparoscopy did not differ from that following laparotomy.[22] Decision between operative and nonoperative management regarding the gallstone disease in pregnancy must balance the operative risks against those of the disease itself. The main operative risks include fetal teratogenicity and spontaneous abortion for patients treated early in pregnancy and preterm labor or delivery in those treated in the third trimester. With nonoperative management, the main concern relates to the severity of nausea and/or pain and the potential development of complications of gallstones, including acute cholecystitis, obstructive jaundice, and pancreatitis.[19] Five of our patients (62.5%) were treated nonoperatively for their symptoms before delivery.

If a pregnant womanrequires abdominal surgery, the major issues are the optimal perioperative management and the best surgical approach. In the past, laparotomy was the only option. In recent years, more and more laparoscopic procedures are being done during pregnancy.[23] Any abdominal operation during pregnancy may adversely affect the fetus and/or mother by several mechanisms. These include direct uterine trauma, altered uteroplacental blood flow, teratogenic effects of anesthetic drugs and altered homeostasis in fetus and mother, increased risk of thromboembolic disease, effects of postoperative medications, and increased risk of incisional hernias.[24] Laparoscopic surgery has potential advantages compared to open abdominal surgery. These include reduced exposure of the uterus to trauma and air, more rapid maternal recovery and mobilization, decreased pain, better cosmesis, improved operative exposure in some conditions, and decreased risk of incisional hernias.[19]

In an era when the cost of surgery has become increasingly important, a new approach is combined procedures in laparoscopic surgery as well as open general and gynecological surgery.[25,26] The authors of this article have already demonstrated the safety and efficacy of combined LSCS and open cholecystectomy earlier,[11] and the present study is a further a step ahead by approaching the patient with the laparoscopic technique for gallbladder removal. In our present series, a combined procedure was completed in all the patients and it was observed that laparoscopic cholecystectomy can be safely performed at the time of cesarean section in properly selected low-risk patients with a negligible rate of complications. A healthy young patient with no comorbid conditions and uncomplicated cesarean section is a good candidate. However, the safety needs to be further established with further studies, especially in obese patients with comorbid medical conditions, acute cholecystitis in the early third trimester, associated or suspected CBD stones, and those encountering complications of LSCS. Till date, these patients would be better served by delayed laparoscopic cholecystectomy.

The disadvantages of combined surgeries include longer duration of anesthesia and operative time, possible complications of multiple incisions, and increased blood loss. However, in the present study, laparoscopic cholecystectomy was completed in a mean operating time of 24 minutes (15–40 minutes) after LSCS. Additional port site wounds did not significantly increase the analgesia requirements or morbidity and all patients were ambulatory after 18 hours after surgery. The duration of hospital stay was 3–4 days. No additional antibiotics were required.

Laparoscopic cholecystectomy at the time of cesarean section in selected patients is a cost-effective method of treatment for gallstone disease, especially in developing countries like India. A combined procedure avoids rehospitalization for separate cholecystectomy. With an additional benefit of minimal access surgery, single anesthesia, and single hospital stay, the combined procedure confers valuable advantages for both patient and hospital in time, cost, and convenience, including avoiding the separation of mother from newborn entailed by reoperation. It also prevents the possibility of developing acute cholecystitis while the patient is waiting for cholecystectomy. Our results indicate that the combination approach of laparoscopic cholecystectomy at the time of LSCS confers the benefits of minimal access for gallstone disease apart from being safe, effective, and well accepted.

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REVIEW ARTICLE

Comparison between Roux-en-Y Gastric Bypass and Mini-gastric Bypass in Patients of Developing Countries

George C Obonna[1], Martin C Obonna[2], Rajneesh K Mishra[3]

Abstract

Background: The disease of obesity mostly common in the developed countries is also predominantly seen in the developing countries in recent times. This is therefore a cause to worry.

Aim: To review literature comparing Roux-en-Y gastric bypass (RYGB) and mini-gastric bypass (MGB) to ascertain the more effective and safe bariatric and metabolic operation.

Materials and methods: Detailed literature review online was perfected via Springer Link, International Bariatric Club, and the World Health Organization. Of immense use was a database of 1,000 bariatric surgeries collated from multiple hospitals in the developing countries.

Conclusion: Both bariatric procedures are effective in the treatment of morbid obesity by restriction and malabsorption. They resolve obesity-related metabolic complications and hence increase quality of life for morbidly obese patients. However, in their comparison, MGB take lesser time to perform than RYGB. Also, MGB has shown to be simpler and safer surgery than RYGB. Thus, in the developing country, with its high population and increasing prevalence of morbidly obese individuals, MGB procedure can be used to treat more patients and also reduce the time and energy taken to manage the patient because of its technical ease, efficacy, revisibility, and reversibility. Overall, a zero mortality in MGB makes it the gold standard in bariatric surgery.

Keywords: Laparoscopy, Mini-gastric bypass, Roux-en-Y gastric bypass.

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Introduction

Obesity has become a problem worldwide and currently severely ravaging the developing countries. The developing countries include the recently industrialized countries such as India, China, and many South and Central American countries.

The developed countries such as the Western Europe, Japan, South Korea, Australia, United States, Canada, Israel, and New Zealand have been living in affluence which is highly associated with endemic obesity. The diffusion of western cultural norms has fuelled widespread trends of obesity in developing countries in recent times. Increasing adiposity, improved hygiene and public health services, vaccination and basic amenities, such as safe drinking water, have led to better lifespan long enough to develop problems linked to obesity which included cardiovascular disease and metabolic disorders such as diabetes mellitus, osteoarthritis, and liver cirrhosis. A BMI of 37.5 is classified as severe obesity and surgery remains the weight-reducing gold standard in the treatment of such individuals. Follow-up of these patient is the Achilles' heel of every bariatric program, because in the absence of continuous contact with the patient, the surgeon loses feedback from the patient. Even though some comorbidities of obesity, such as essential hypertension and type 2 diabetes, have been considered in the health bill of the developing countries, obesity itself has not. A few hospitals are trying to perform bariatric surgery in the developing countries; however, this procedure is in direct competition with other digestive system surgeries such as gastric cancer and cholelithiasis, both of which are highly prevalent diseases in the developing country.

This situation means that there are extensive waiting lists for bariatric surgery in the developing countries. The mini-gastric bypass (MGB) which subserves a lesser operating time than Roux-en-Y gastric bypass (RYGB) is thus preferred in this circumstance. Being technically simpler, MGB is a safe and effective alternative to the previous gold standard RYGB with equal results plus the advantage of being technically simpler with lower complication rates and impact more on the quality of life of the patients.[1]

Surgery has become the best treatment for morbid obesity as has been universally accepted.[2] Both open and minimally invasive laparoscopic surgeries are effective in the management of morbid obesity.[3–5] Laparoscopy is associated with postoperative complications and requires more operative time and an almost vertical learning curve.[6,7] Apart from the occurrence of marginal ulcers and reflux bilious gastritis, mini-gastric bypass also known as one anastomosis gastric bypass is easier and adequate enough than Roux-en-Y gastric bypass in the treatment of morbid obesity.

Aim

The aim is to compare RYGB with MGB with the view of drawing inference on which is best in the treatment of morbid obesity.

[1]Department of Surgery, University of Medical Science UNIMED Ondo State, Nigeria

[2]College of Medicine, Abia State University, Uturu, Nigeria

[3]World Laparoscopy Hospital, Gurugram, Haryana, India; Department Chair, Minimal Access Surgery, TGO University, India

Corresponding Author: George C Obonna, Department of Surgery, University of Medical Science UNIMED Ondo State, Nigeria, Phone: +234 8120206423, e-mail: obogeo2009@yahoo.com

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A specified number of bariatric surgeries of RYGB and MGB done were analyzed over several variables.

Materials and Methods

This a multicenter survey in which there is a detailed review of cases done in specialized hospitals in developing countries assisted by search engines such as MSN, etc., using Springer Link and the Journal of Minimal Access Surgery (MAS). Bariatric-specific longitudinal data analyzed for complication and benefits formed the bedrock of assessment in the comparison of MGB and RYGB.

Operative Techniques

The MGB (one anastomosis gastric bypass) is a mal-absorption procedure but is also minimally restrictive. Figure 1 depicts the contour of the operation. Robert Rutledge first performed this surgery in 1997.[8]

In laparoscopy, the procedure is done using a five-trocar technique, with the first stapler firing perpendicular to the lesser curvature distal to the crow's foot using a 45-mm green or gold cartridge. Then, a vertical gastric division starting proximally to the left of the angle of His which is not dissected thereby establishing a long gastric tube carved out snugly on a 38-fr bougie. The ostracized part of the stomach remains in situ and extends into a biliopancreatic limb. In the next phase of the procedure, an estimated 200 cm of the jejunum distal to the ligament of Treitz is where a wide antecolic gastrojejunostomy is done using a 45-mm blue cartridge and closed. The gastrojejunostomy anastomosis may be placed more proximally or distally, depending on the need for weight loss.[9]

Roux-en-Y gastric bypass is principled on restriction and malabsorption. Laparoscopic RYGB was first reported in 1994 by Wittgroove. A small gastric pouch is created by firing the stapler at the level of the second short gastric vessel, straight to the lesser curvature, creating a 30–50 mL gastric pouch. The jejunum is then transected 50 cm distal to the ligament of Treitz. The proximal divided end of the jejunum is anastomosed 75 cm distally (or 150 cm distally for the superobese), where a stapled side-to-side enteral–enteral anastomosis is done using a 60 cm white cartridge, with subsequent enterotomy closure. The gastrojejunostomy (Roux limb) is done from end-to-end or from end-to-side. This is as shown in Figure 2.[10]

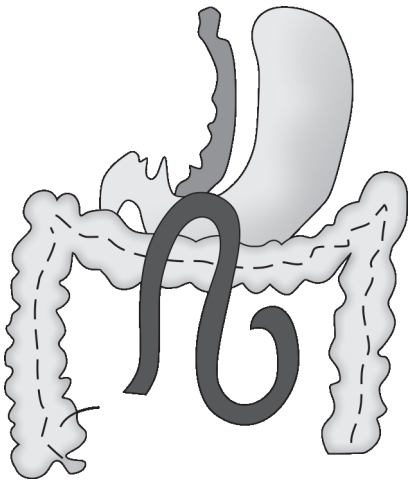

Fig. 1: Showing MGB[11]

Result

The result was on the parameters of operation time, operative morbidities follow-up, and Quality of Life Assessment survey. A multicenter study of 500 MGBs and 500 RYGB done in 5 years in the developing country revealed the mortality rate to be 0.3% in RYGB and zero in MGB. A comparative analysis of results is as indicated in Table 1.

Bile reflux was <1% in the MGB series and nil in RYGB.

In both, there was no persistent vomiting, and the weight regain was 8.5% in RYGB but 0% in MGB.

Hypoalbuminemia was 2% in RYGB and 13.17 in MGB.

Hypertension, type 2 diabetes, dyslipidemia, and percent excess weight loss had maximum resolution in MGB.

The most common complication of RYGB is leakage which is not seen in MGB. Conversion rate from laparoscopy to open surgery in RYGB ranged 0.8–11.8%. No conversion was recorded after laparoscopic MGB.

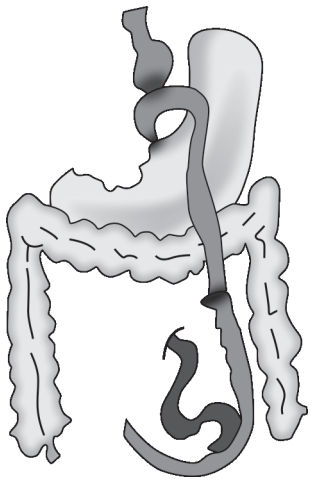

Fig. 2: Showing RYGB[11]

Table 1: Comparative analysis between procedures ($p < 0.05$)

Characteristics	*RYGB*	*MGB*
Mortality rate	0.3%	0
Bile reflux	Nil	<1%
Persistent vomiting	Nil	Nil
Weight regain	8.5%	0%
Hypoalbuminemia	2%	13.1%
Duration of operation	123–198 minutes	42–75 minutes
Minor complication • Wound infection • Gastrointestinal bleeding • Ileus	7.5–15%	0–5%
Early anastomotic leakage	3.3–15%	Nil
Late anastomotic leakage	2.2–27%	Nil
Reoperation rate	5–10%	<1%
Marginal ulcers	<2%	3%
Resolution of hypertension	72.3%	85.4%
Resolution of dyslipidemia	74%	93.3%
Resolution of type 2 diabetes	75.8%	95.1%
Excess weight loss	72.3%	92.2%

Discussion

It is pertinent to note that previously the more commonly recognized bariatric surgeries are RYGB and vertically banded gastroplasty (VBG). This was enunciated in 1999 by the National Institute of Health Consensus Conference NIH. In 2004, a consensus conference emanated from the American Society for Bariatric Surgery (ASBS), which updated the evidence and the conclusions of the NIH. At this time, RYGB was considered as the most commonly performed bariatric surgery. As the preoperative complications continue to soar, experience became a necessity in the performance of this procedure. Leakage was significant and proved to be the most common complication.[11] As weight reduction is more in RYGB than in VBG, RYGB became the more popular procedure. Laparoscopic sleeve gastrectomy (LSG) is also another popular technique and has its drawback. The incidence of leaks was even higher in LSG because the intraluminal pressure in the sleeve is very high making the stomach to give way at its weakest point, near the esophagogastric junction.

Mini-gastric bypass is low antecolic and one less anastomosis, and given a better blood supply, it decreases the danger of leakage. High anastomosis near the gastroesophageal junction and the earlier retrocolic method complexes, this procedure and the antecolic approach with a bivalve of the omentum to reduce tension on the mesentery are currently being carried out.

Either way, the technical difficultly and the postoperative complications of leakage, hospital stay, pain, and time taken are more for RYGB compared to MGB. The operative time for RYGB is more than MGB. In laparoscopy, even though five-port technique is used for both, more dissection and anastomosis make RYGB a more time-consuming procedure.

Reflux gastritis does occur in MGB; however, this might require long-term follow-up with endoscopy. The other problem with MGB is the formation of marginal ulcers. Here, the incidence is more compared to RYGB. This is possible because of the volume of gastric tube in MGB. Weight loss and reduction in BM1 is more with MGB compared to RYGB as a result of the long bypass limb of the bowel. This may be associated with nutritional deficiency in folate, hypoalbuminemia, iron, and vitamin.[12] However, in both, iron deficiency anemia was the only culprit.[12–14] A long period of follow-up is required to detect the occurrence of micronutrients deficiency and bone diseases. To balance weight reduction with micronutrient deficiency, it is better to adopt the following precautions: use a bypass limb of 150 cm in those with BM1 less than 40 and add a 10-cm increase in the bypass limb with every BM1 category related to obesity instead of applying a particular 200 cm limb for all the cases. This will give a better result.

Overall, MGB has a better safety profile than RYGB and is thus preferred. Indications for operation in morbidly obese patients include a BM1 more than 40 or more than 35 if comorbidities are associated.

Note that for patients with moderate obesity BMI 30–35 but suffering with metabolic syndrome, the decreased risk of laparoscopic gastric bypass surgery suggests its inclusion in the options of management.

Maximum resolution of type 2 diabetes, hypertension, and dyslipidemia in the MGB were as a result of the cummulative effect of some restriction of intake, significant rapid transit (incretin effect), and more fat malabsorption.[15–20] Mini-gastric bypass is proven to be reliable in developing countries like India, as India is only second to China in the population with type 2 diabetes.[21,22]

Conclusion

In comparing MGB to RYGB in the developing countries, we conclude that MGB is an effective alternative to RYGB. With the increasing burden of obesity in these countries, MGB is a simpler and safer approach toward weight reduction and control of obesity associated metabolic syndrome. With MGB, there is a differential reduction in the short- and long-term complications associated with most other bariatric techniques. It will thus proffer quality treatment to majority of the populace in these recently industrialized developing countries.

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REVIEW ARTICLE

Local Anesthetic Use for Pain Relief Following Laparoscopic Ventral Hernia Repair: A Systematic Review

Vaaiga Autagavaia[1], Jamie-Lee Rahiri[2], Melanie Lauti[3], Lydia Poole[4], Garth Poole[5], Andrew G Hill[6]

Abstract

Aim: To assess the effectiveness of the addition of local anesthetic (LA) techniques in reducing pain and morphine consumption in the first 24 hours following laparoscopic ventral hernia repair (LVHR) in adults.

Background: Ventral hernias (VH) are a common condition; with risk factors (including obesity), the incidence of VH is projected to increase. Surgical VH repair is required for symptom relief and to prevent related complications. LVHR has significant advantages over open repair, with reduced infectious complications, shorter hospital stays, and more favorable outcomes in obese patients. However, in comparisonto open repair LVHR patients often experience severe pain post-LVHR. LA is an important part of multimodal analgesia regimes and their use in the context of post-operative LVHR pain management is growing in importance.

Review results: A systematic review was performed according to PRISMA using search terms related to LA, LVHR post-operative pain, and morphine consumption; studies were limited to adults (>18 years) and randomized control trials (RCT). Four RCT met the inclusion criteria. All studies compared bupivacaine with normal saline, one also used bupivacaine with epinephrine; varying LA interventions were used. One study showed a statistically significant, but small (0.08 mg) reduction in pain scores at 24 hours, which is likely to be clinically insignificant. Three studies showed an overall reduction in morphine consumption at 24 hours, with only one reaching statistical and clinical significance.

Conclusion: Bupivicaine LA interventions post-LVHR did not reduce pain scores at 24 hours, but morphine consumption appeared to have been reduced.

Clinical significance: Despite some evidence of reduction in morphine consumption in the first 24 hours post-LVHR, further investigation is required regarding post-operative LVHR pain management using LA, including agent and mode of delivery.

Keywords: Analgesia, Laparoscopy, Outcomes, Ventral hernia.

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Background

A ventral hernia (VH) is a fascial defect in the anterior abdominal wall. Primary VH includes epigastric, umbilical, and spigelian hernias. A secondary defect, or incisional hernia, is one that develops at a previous surgical incision site.[1] VH are a common condition and risk factors include obesity, previous abdominal surgery, and chronic elevated intra-abdominal pressure.[2] With the current obesity epidemic, the incidence of VH formation is projected to increase.[3,4] Consequently, the optimization of postoperative care following VH repair is critical to the effective management of this increasingly significant issue.

VH require surgical repair to relieve symptoms and prevent complications, such as uncontrolled pain and hernia strangulation.[5,6] Open mesh repair has been the gold standard since it has been provedto be superior to open suture repair owing to significantly lower recurrence rates.[7] However, LVHR has grown in popularity since its introduction in 1993.[8] Multiple studies have demonstrated a number of advantages of LVHR over open repair, including decreased infectious complications and shorter hospital admissions.[9–12] Furthermore, LVHR appears to be favorable in obese patients owing to lower complication rates.[13–16]

Laparoscopic surgery has long been considered less painful in comparison with open surgery, yet trials have reported no difference in acute or chronic pain between open and LVHR.[17–19] In fact, patients often experience severe pain following LVHR and this remains a significant clinical problem. It is hypothesized that this severe pain is attributable to techniques of mesh fixation during ventral herniorrhaphy.[20–22] Mesh may be secured with sutures or tacks, which pass through the peritoneum, fascia, and muscle of the anterior abdominal wall. Both techniques are associated with significant abdominal wall pain impacting on short- and long-term patient wellbeing, recovery, and satisfaction.[23]

Local anesthesia has become an important addition to multimodal analgesia regimens for postoperative pain. Local anesthesia prevents afferent nociceptive nerve transmission from the surgical site to the spinal cord, reducing the local inflammatory response and pain perception. This is clinically achieved by neuraxial blockade with epidural anesthesia, wound instillation, or compartment blocks.[24] The objective of this systematic review was to assess the effectiveness of the addition of LA techniques in reducing pain and morphine consumption in the first 24 hours following LVHR in adults.

Methods

A systematic review was performed in accordance with the preferred reporting items for systematic reviews and meta-analyses (PRISMA)

[1–6]Department of Surgery, South Auckland Clinical Campus, The University of Auckland, Auckland, New Zealand

Corresponding Author: Vaaiga Autagavaia, Department of Surgery, South Auckland Clinical Campus, The University of Auckland, Auckland, New Zealand, Phone: +64 92760000, e-mail: v.autagavaia@auckland.ac.nz

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statement where possible.[25] Two authors (JR and VA) independently performed electronic searches of four databases (MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials, and Google Scholar). With the assistance of a subject librarian, the first author (JR) collated a list of keywords and search terms to incorporate them into the strategies adapted for each database. The search terms combined the concepts of LA, LVHR, post-operative pain, and morphine consumption (Table 1). Results were limited to adults (>18 years) and randomized controlled trials (RCT). No other limitations were applied. Search results were downloaded and managed with RefWorks citation management software (ProQuest LLC, USA).

Study Selection

Abstracts were screened and full-text papers obtained to identify primary research studies reporting the effectiveness of the addition of LA techniques in reducing pain scores and morphine consumption in the first 24 hours following LVHR. All published studies comparing LA modalities for post-operative pain relief following LVHR by randomized trial were included. The primary outcomes of interest were pain scores at rest and total morphine consumption in the first 24 hours following LVHR. Exclusion criteria included nonrandomized studies, pediatric studies, and those articles for which full-text publications were not available (e.g., conference abstracts). Three reviewers (JR, LP, and VA) independently performed the searches and examined titles and abstracts to exclude irrelevant reports and produce a list of studies for full-text review in an iterative process. Any disagreement over inclusion or exclusion was discussed with the senior author (AGH) and a consensus reached. Additional articles and abstracts were retrieved by manually examining reference lists of relevant publications. The last search was performed on June 19, 2018.

Data Extraction

Data extraction for morphine consumption and pain scores in the first 24 hours was performed independently by two reviewers (JR and VA) and entered into predesigned electronic tables. Data were reported as mean ± standard deviation (SD) where possible. Morphine consumption within the first 24 hours following surgery was reported as morphine equivalents where possible and as reported by individual trials. The median score was used as an estimate of the mean where the latter was not reported.

Table 1: Search strategy used in OVID Medline® in-process and other non-indexed citations (search strategy was modified as required for each database used. exp. exploded MeSH term, mp key word, mt methods)

Search terms
(postoperat* or post-operat* or postoperative pain or postoperative pain or pain*).mp
and
exp. analgesics, opioid/or placebo.mp or morphine.mp or opiate*.mp or opioid*.mp or analg*.mp
and
Anesthesia, local/mt or local anesth*.mp or local anesth* or ropivacaine.mp or bupivacaine.mp or lidocaine.mp or lignocaine.mp or procaine.mp
and
"laparoscopic ventral hernia repair".mp or exp. hernia, ventral/mt OR ventral hernia.mp.
and
exp. laparoscopy/mt or laparoscop*.mp or endoscop*.mp

SD measures were attempted based on the methods described in the Cochrane Handbook of Systematic Reviews of Interventions, where attempts to contact authors for clarification were unsuccessful (up to two emails).[26]

Risk of Bias Assessment

The Cochrane Collaboration tool for assessing risk of bias was implemented and generated by RevMan 5.1.[27] Two reviewers (JR and LP) independently assessed the methodological quality of trials for sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, lost to follow-up, intention-to-treat, and financial conflicts.[28]

Review Results

The literature search identified 637 records in the initial database search. A PRISMA flow diagram for the systematic review is presented in Flowchart 1. Four RCT met the inclusion criteria and were included in the review.[29–32] All four studies compared bupivacaine with normal saline and only one of these studies used bupivacaine with epinephrine (Table 2). All studies were classified as having a low risk of bias (Fig. 1). Variations in the timing of outcome measures, the duration and type of the intervention and the study cohorts limited meaningful synthesis of the data. The data are therefore presented as a narrative review.

Pain Scores

There was variation in the types of post-operative pain-scoring questionnaires used in the included studies. Two studies utilized visual analog scores (VAS),[29,30] one study used a numerical rating scale (NRS),[31] and the remaining study used VAS and present pain intensity (PPI) scores.[32] Only one trial, the largest of the included studies, demonstrated a statistically significant difference in pain scores at 24 hours.[30] This trial was assessed as having a low risk of bias and bupivacaine was comparedwith saline using a laparoscopic transverse abdominis plane (TAP) block and only a very small difference (0.08 mg) was noted in pain scores, which is unlikely to be clinically significant. However, a statistically and clinically significant difference in morphine consumption clearly favored the TAP block with bupivacaine (see below). Three trials showed a significant reduction in the reported pain scores at the one-hour mark, of which two reached statistical significance in favor of the intervention group at one hour post-surgery.[29–31]

Morphine Consumption

Three of the four included studies demonstrated decreased morphine consumption in the intervention group at 24 hours, of which only one reached statistical and clinical significance.[30] The remaining study reported a statistically insignificant increase in morphine use in the intervention group at 24 hours following LVHR and did not provide a measure of variance.[32]

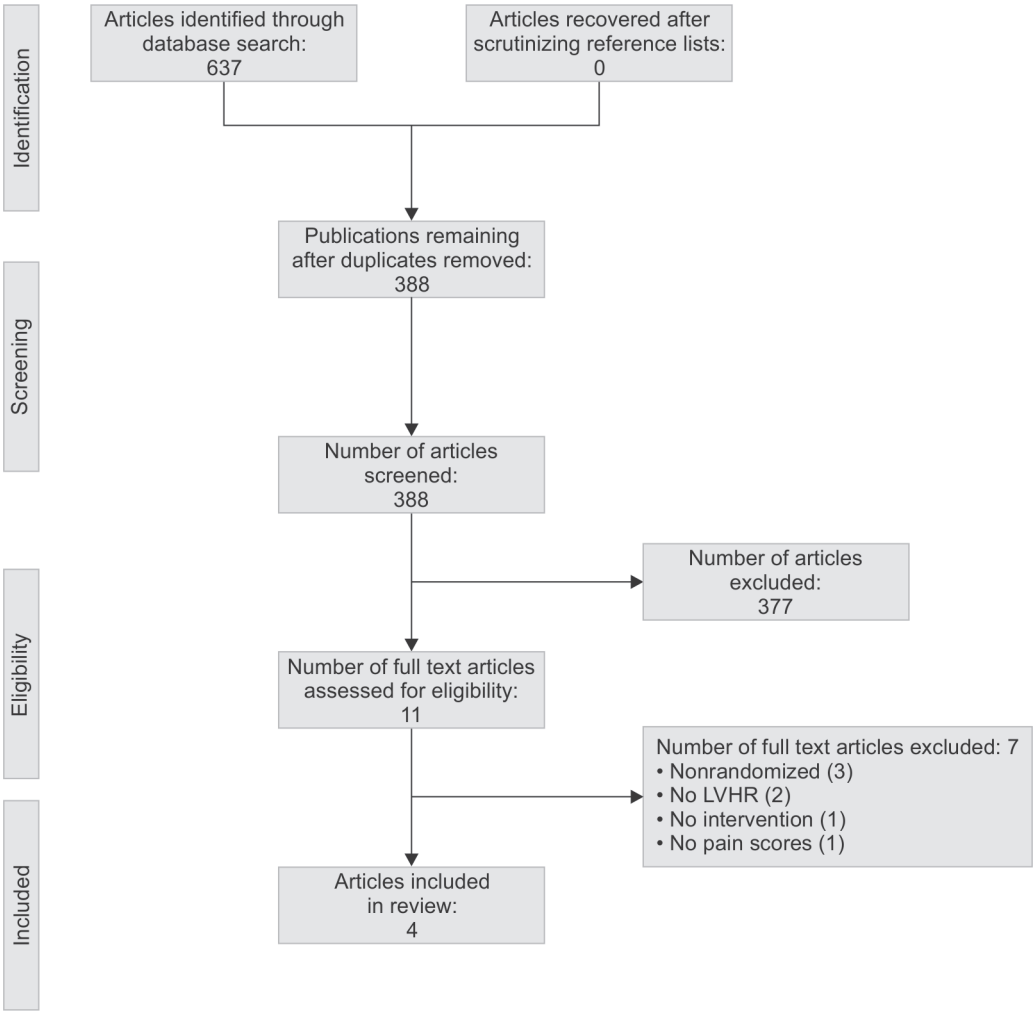
Complications and Adverse Effects

There were no reports of adverse events following the application of LA interventions. None of the trials reported plasma levels of LA agents. Only one study reported a major complication: a single case of mesh infection with methicillin-resistant *Staphylococcus aureus*.[32]

Discussion

This systematic review includes four trials comparing various bupivacaine interventions to usual/standard care or a saline control

Flowchart 1: PRISMA flow diagram of study selection



for improving postoperative pain and morphine consumption following LVHR.[29–32] These interventions included peripheral nerve blockade, continuous intraperitoneal LA infusion, and single-shot intraperitoneal LA instillation techniques. Although the use of bupivacaine did not seem to significantly improve pain score measures, it did seem to reduce morphine consumption at 24 hours.

Although all included trials compared different interventions, bupivacaine was consistently the chosen LA agent. Bupivacaine is a long-acting LA agent that is easily used with minimal side effects.[33] Among other factors, the analgesic efficacy of bupivacaine depends on the method of delivery and the desired effect site. In addition, it has a rapid onset of action and, depending on dosage and concentration, an elimination half-life ranging from 1.5 to 8 hours.[34–36] Interestingly, the single trial that used bupivacaine with epinephrine did not show a prolonged analgesic effect as would be expected. Given these pharmacokinetic properties, it is unsurprising that patients experienced less pain in the early postoperative phase within the three trials that compared single-injection LA analgesic interventions.[29–31] These findings suggest that single-bolus LA analgesic interventions with bupivacaine may be limited principally by the short duration of the analgesic agent.

Previous studies have shown successful prolongation of LA analgesic effects with continuous LA infusions via perineural catheters and mechanical pain pump devices.[37,38] Despite this, Rosen et al. were unable to demonstrate a difference in post-operative pain scores and morphine consumption following LVHR, using this technique.[32] A possible reason for the negative findings in this trial may lie with the technical aspects of catheter placement. With the successful implementation of LA infusions in other procedures, the development of this technique should be explored further with attention to the insertion technique and LA effect site.

The administration of LA agents to wound sites improves pain and morphine use after laparoscopic surgery owing to ease of application, effective afferent nociceptive blockade, and reduction in the local inflammatory response.[39–41] While opioid analgesics are the mainstay of postoperative analgesia following LVHR and cannot be eliminated from multimodal regimens of analgesia, there are many unwanted adverse effects associated with their use which can hinder recovery.[42] Despite no significant difference in pain scores in the included trials, an overall reduction in total morphine consumption was observed in the intervention group in three of the trials.[29–31] While there are multiple factors at play during postoperative recovery, an observation between all interventions compared was that patients were less likely to ask for additional analgesia in the early post-operative phase following LA application. Bellows and colleagues noticed that patients requested the majority of pain relief in the first four hours post-surgery in the control group.[29] The opposite was seen in the intervention group.

Table 2: Study characteristics of included trials comparing LA interventions for postoperative pain up to 24 hours following LVHR

Study	*Design, N [intervention/ control]*	*Intervention*	*LA agent, control*	*Mean morphine consumption in 24 hours (mg) [intervention/ control]*	*Pain score measure (0–10)†*	*Mean pain scores at rest [intervention/ control]*	*Main findings of intervention*
Bellows[29]	RCT, 9/9	Trans-abdominal LA injected at suture sites prior to suture placement	10 mL 0.25% bupivacaine with epinephrine, no control	24.1 ± 7.2/ 26.3 ± 9.2	VAS	1 hours: 2.2 ± 0.8/ 6.4 ± 0.9* 2 hours: 3.1 ± 0.9/ 3.9 ± 1.1 4 hours: 1.1 ± 0.4/ 2.6 ± 0.9 24 hours: 2.3 ± 0.8/2.3 ± 1.0	Significant reduction in pain scores at one hour after surgery
Fields[30]	RCT, 52/48	Laparoscopic assisted TAP block	50–60 mL 0.25% bupivacaine, 0.9% normal saline	25.64/42.56*	VAS	1 hours: 5.19 ± 0.39/ 6.46 ± 0.38* 24 hours: 4.60 ± 0.39/4.52 ± 0.31*	Significant reduction in pain scores and total morphine consumption in 24 hours
Gough[31]	RCT, 42/38	Peri-prosthetic LA injection, with all patients receiving LA port site injections	0.5% bupivacaine, 0.9% normal saline	4.8 ± 17.3/ 6.7 ± 15.4	NRS	<1.5 hours: 4.4 ± 2.4/ 4.8 ± 2.2 22.5–24.5 hours: 3.6 ± 2.5/2.7 ± 1.4	Reduced pain scores and total morphine consumption (not significant)
Rosen[32]	RCT, 37/36	Continuous elastomeric pain pump infusion of LA for 48 hours above the mesh in the hernia sac	0.5% bupivacaine, 0.9% normal saline	52.2/44.5	VAS	0:1.7/2.3 8 hours: 5.7/5.5 16 hours: 5.4/5.6 24 hours: 5.0/6.0	No advantage in reduction pain scores and total morphine consumption in 24 hours

VAS, visual analog scale; LA, local anesthetic; LVHR, laparoscopic ventral hernia repair; TAP, transverse abdominis plane; NRS, numerical rating scale; VRS, verbal rating score; PPI, present pain intensity; RCT, randomized controlled trial.
†All pain scores use a 0–10 point scale with a score of 10 signifying the worst possible pain.
*p <0.05.

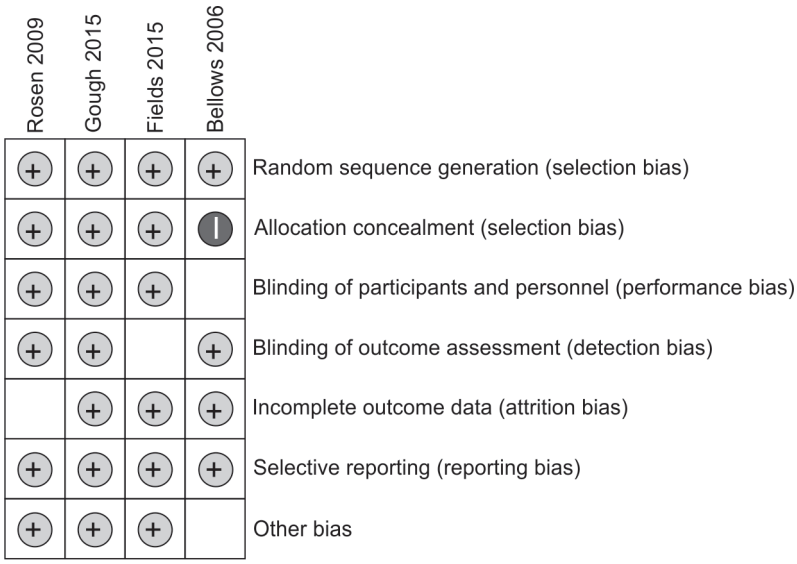


Fig. 1: Cochrane risk of bias figure

This particular study demonstrates that the early postoperative phase serves as the best time for single-shot LA interventions to be effective.

Limitations

The present review was limited by the lack of available trials. All included studies were heterogeneous comparing different interventions; hence, no quantitative analysis or meta-analysis was possible.

Conclusion

While bupivacaine interventions did not improve early post-operative pain scores, they appeared to reduce the amount of morphine consumed in the first 24 hours following LVHR. Further definitive conclusions cannot be made owing to the limited and heterogeneous nature of the available evidence. The management of pain following LVHR would benefit from further good quality trials investigating LA agents and their mode of delivery.

Clinical Significance

Despite some evidence of reduction in morphine consumption in the first 24 hours post-LVHR, further investigation is required regarding postoperative LVHR pain management using LA, including agent and mode of delivery.

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CASE REPORT

Laparoscopic Management of Median Arcuate Ligament Syndrome: Single Center Experience

Eppa Vimalakar Reddy[1], Gourang Shroff[2], Vemula Bala Reddy[3], Akella V Phanendra Somayajulu[4]

Abstract

Median arcuate ligament syndrome (MALS) is a rare disease caused as a result of extrinsic compression by diaphragmatic fibers arching on the celiac artery at its point of origin from the abdominal aorta. Patients suffering from MALS presented with weight loss, nausea, vomiting, and postprandial epigastric pain. Often misdiagnosed with dyspepsia or acid peptic disease, this syndrome is a diagnosis by exclusion, after excluding commoner causes of the upper abdomen pain. It is diagnosed with computed tomographic (CT) angiography and treated with various modalities, including laparoscopic or open division of fibers of MAL, which cause extrinsic pressure. We report a series of three cases of MALS diagnosed and managed at our center, using laparoscopic division of the fibers and release of the celiac artery.

Keywords: Celiac artery compression syndrome, Dunbar syndrome, Laparoscopy, Median arcuate ligament syndrome, Minimal invasive.

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Introduction

The median arcuate ligament (MAL) is an arch of diaphragmatic fibers crossing the aorta, superior to the celiac artery origin and at the level of diaphragmatic insertion.[1–3] Its lower insertion crosses the proximal part of the celiac artery.[1–5]

MALS is a rare disease caused by the extrinsic compression on the celiac artery by inferior insertion of the median arcuate ligament fibers (Fig. 1).[1–5] This leads to ischemia to the bowel supplied by the celiac artery. It is also known as celiac artery compression syndrome (CACS) or dunbar syndrome.

An estimated 10–24% of people may have indentation of celiac artery caused by an abnormally low placed ligament.[6] But only a minor fraction will have a clinically significant disease.

The clinical presentation of celiac artery compression include weight loss, nausea, vomiting, and abdominal pain, which are particularly aggravated after a meal.[3–5] The condition may sometimes present atypically with exercise-related abdominal pain/diarrhea[12] (more in athletes), or rupture of a pancreaticoduodenal artery pseudo-aneurysm (due to post-stenotic dilatation of celiac trunk).[7,8]

MALS is a diagnosis of exclusion. A strong clinical suspicion is required in making the diagnosis of this syndrome. The diagnosis of significant celiac axis compression was previously made with conventional angiography. However now, it can be very well diagnosed with the three-dimensional computed tomographic (CT) angiography.[2] Convensional angiography/plasty of the celiac artery is now only used either as a primary treatment modality[9,10] or for postoperative stenosis.[11]

The primary treatment options for management of this syndrome are either open or laparoscopic division of fibers of MAL, or angiographic stenting of the celiac artery in resistant cases. Robotic surgery has also been projected as a treatment option in recent days.

Materials and Methods

We report a case series of three cases of MALS diagnosed and managed with the laparoscopic approach at our center.

[1–4]Department of Surgical Gastroenterology, Sunshine Hospitals, Secunderabad, Telangana, India

Corresponding Author: Eppa Vimalakar Reddy, Department of Surgical Gastroenterology, Sunshine Hospitals, Secunderabad, Telangana, India, Phone: +91 9573201103, e-mail: vimalakarreddy@gmail.com

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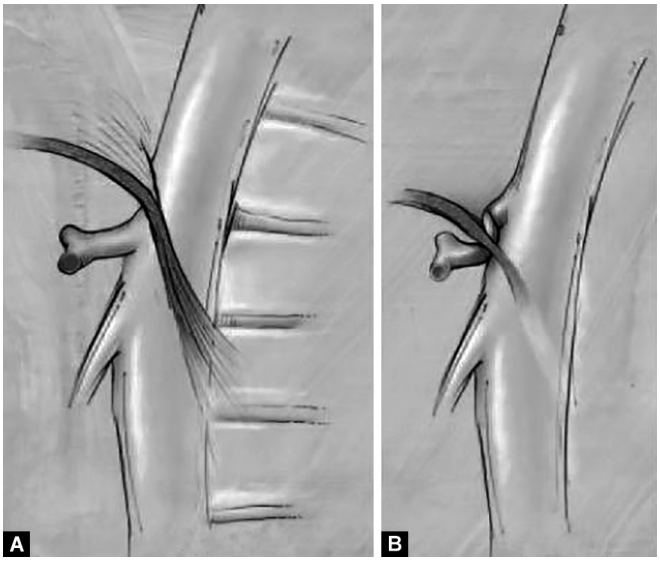

Figs 1A and B: (A) Normal anatomy of ligament crossing anterior to aorta; (B) In MALS, it crosses the proximal portion of the celiac trunk, causing indentation

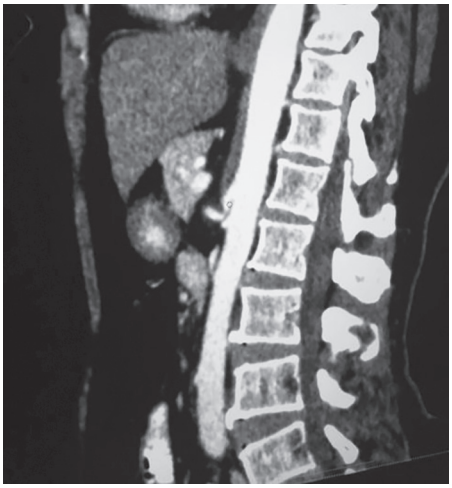

Fig. 2: A CT angiography image of the patient (sagittal view) showing compression of the celiac trunk with post stenotic dilatation

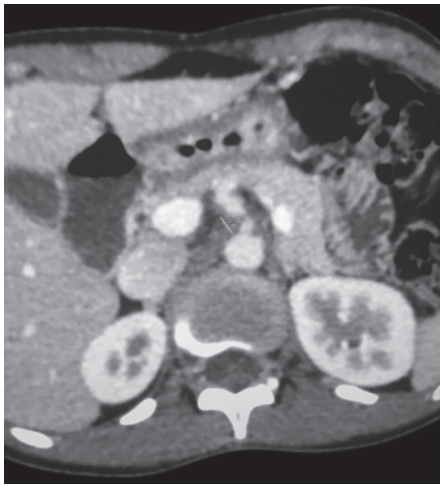

Fig. 3: A CT angiography image (axial view) showing compression of the celiac trunk with post stenotic dilatation

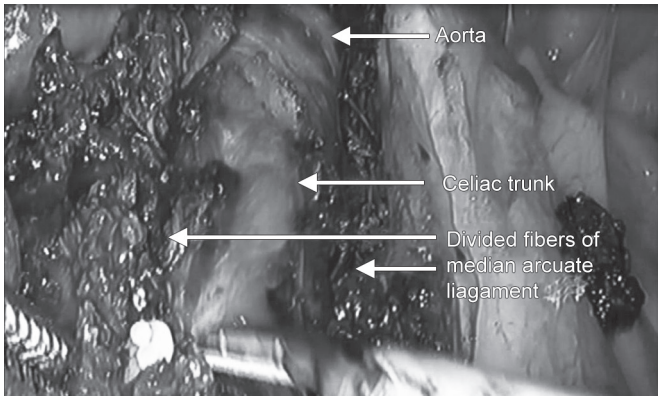

Fig. 4: An intraoperative image of the celiac trunk after division of the fibers of median arcuate ligament

Surgical Technique Employed

The patient is placed in a supine position with leg split and in a head-up position. The aorta and diaphragmatic arches identified and dissected until the origin of celiac artery. Any external compression on the artery is released and the artery is completely skeletonized.

Case Description

Case 1

A 52-year-old gentleman came with the complaints of severe postprandial abdominal pain for 6 months, a history of vomiting since 1 month and a history of approx 15 kg loss of weight in last 6 months.

Upper GI endoscopy shows grosive gastropathy and colonoscopy was normal. CT angiography of the abdomen showed a high-grade stenosis at the origin of the celiac trunk without any significant intraluminal plaque or calcification (Figs 2 and 3).

After trial of conservative management for erosive gastropathy, as the patient was refractory, diagnosis of MALS was made and taken up for surgery.

Postoperatively, liquids were started on 2nd POD, a soft diet on 4th POD, and then the patient was discharged. On a serial followup up to 2 years, the patient is significantly pain free, tolerating the diet well.

Case 2

A 22-year-old lady came with chief complaints of severe epigastric abdominal pain aggravated for 5 days, with a history of similar complaints for the last 2 years, and moderate severity aggravated by food intake. A history of nausea was present on and off. No history of vomiting or fever was found to be associated with the symptoms. A history of approx 10 kg loss of weight was present in the last 6 months.

Upper GI endoscopy and colonoscopy normal. CECT abdomen revealed significant compression on the proximal part of the celiac artery by median arcuate ligament—suggestive of MALS.

The patient underwent laparoscopic release of median arcuate ligament impingement on the celiac artery (Fig. 4).

Postoperatively, liquids were started on 2nd POD, a soft diet on 4th POD, and then the patient was discharged. On serial follow-up up to 1 year, the patient's post prandial abdominal pain has significantly resolved. She is tolerating oral diet well.

Case 3

A 44-year-old female with chief complaints of severe pain abdomen with anxiety and insomnia since 6 months. No history of vomiting or nausea. History of approx. 12 kg weight loss in the last 6 months.

Upper GI endoscopy and colonoscopy were normal. CECT abdomen revealed significant compression of the proximal part of the celiac artery by fibers from diaphragmatic crura—suggestive of MALS.

The patient underwent laparoscopic release of the fibers causing compression. Postoperative liquids were started on 1st POD, a soft diet on 3rd POD, and then the patient was discharged. On serial follow-up upto 9 months, the patient was significantly asymptomatic.

Results

In this study, three patients were evaluated, diagnosed, and treated by laparoscopic division of diaphragmatic fibers.

Two of the three were females. The mean age at presentation was 39.3 years (22–52). All 3 patients presented with upper

abdominal pain, which was not responding to conventional PPI therapy. The mean weight loss of 12.33 kg was reported (10–15 kg). The length of symptoms at presentation was a mean of 12 months (6–24).

On evaluation with CT angiography, all 3 revealed significant compression of the celiac trunk at its origin from aorta. All three patients underwent laparoscopic division of MAL fibers. None of the patients required conversions to open.

The length of the postoperative stay ranged from 3 to 4 days, with all patients being discharged with no postoperative complications or morbidity. On average, followup of 15 months (9–24) showed that all three patients remained symptom free and tolerated diet well.

Discussion

Since the first description of MALS in 1961, there are several debates on the diagnosis and treatment of this rare clinical entity.

The mean age of presentation in our study is around 39.3 years, which correlates with the literature quoted age of 47 years.[4] However, many studies quote a younger age of presentation, around 2nd or 3rd decade of life. Two of the three patients were females, in accordance with most cited literature mentioning more prevalence among female population.

Our study demonstrates successful management of MALS with a multidisciplinary approach. This condition is diagnosed mostly on initial duplex ultrasound imaging followed by UGI endoscopy and contrast CT angiography of the abdomen and is managed with laparoscopic division of median arcuate ligament fibers.

Selecting patients for laparoscopic treatment of MALS is a clinical challenge. Most cases are misdiagnosed and managed for a long time with PPIs and other supportive treatment. Diagnosis of MALS requires a high degree of clinical suspicion along with appropriate investigative workup. It is further complicated owing to a high prevalence of asymptomatic anatomic compression of celiac artery on CT overlapped with pain abdomen. Hence, probably, the diagnosis of MALS can only be confirmed postoperatively if the patient is significantly relieved of the symptoms after release of MAL fibers.

Once the diagnosis of MALS is made, the next challenge is to select the approach to divide the MAL fibers. Various methods have been proposed, including open approach, laparoscopic, robotic, and retroperitoneal endoscopic. Van Petersen et al.[21] demonstrated a retroperitoneal endoscopic MAL release and Relles et al.[22] reported a robotic-assisted MAL release technique. A minimally invasive approach has obvious advantages in this group of relatively young cohort. Laparoscopic approach has gained significant popularity over time, surpassing open approach in most cases, as an initial treatment approach.

We, at our center, recommend laparoscopic management owing to the basic advantages of minimal invasive approach clubbed with acceptable learning curve and ease along with excellent visualization of the celiac trunk origin and the MAL. In our study, a laparoscopic approach was associated with no perioperative morbidity, a short hospital stay, and minimal blood loss, with acceptable results and patient satisfaction, consistent with other reports.[13–20] Patients were followed up at 1 month and then every 3 months till 2 years. All the patients were asymptomatic at follow-up.

Despite the acceptable satisfaction rates, a subset of MALS patients may remain refractory with partial or no relief of symptoms or may have recurrent symptoms, requiring further intervention like angioplasty or stenting.

Limitations of our study is the small number of cases, owing to rarity of the disease.

Conclusion

MALS is a rare clinical disease, requiring high clinical suspicion for diagnosis. Management includes surgical division of MAL fibers. Laparoscopic management is gaining popularity and recommended owing to the basic advantages of minimal invasive approach clubbed with acceptable learning curve and ease of performing, along with excellent visualization of the celiac trunk origin and the MAL.

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CASE REPORT

Review of Outcome of Laparoscopic Cholecystectomy Done by Consultants vs Surgery Residents at Tertiary Care Teaching Hospital

Jasmine R Agarwal[1], Jitendra T Sankpal[2], Ratnaprabha P Jadhav[3], Shubham D Gupta[4], Supriya S Bhondve[5], Ruchira R Bhattacharya[6]

Abstract

Objective: The aim of this study was to assess morbidity, mortality, and outcome in selected patients after laparoscopic cholecystectomy (LC) performed by consultants or by surgical residents at Gokuldas Tejpal Hospital affiliated to Grant Government Medical College and Sir JJ group of Government Hospitals in Mumbai, India

Materials and methods: Between January 1, 2013 and December 31, 2016, 342 laparoscopic cholecystectomies were performed, 111 by residents and 231 by consultants. The routine blood investigations of all the patients were sent and they all had electrocardiography, chest X-ray, and abdominal ultrasound scan done preoperatively. All patients were induced with general anesthesia.

Results: Six conversions were required to an open procedure (four in the resident group and two in the group of consultants) because of impossible recognition of anatomy around Calot's triangle. The mean operative time was 59 minutes for the residents while for the consultants it was 47 minutes. Mortality rate was 0% in both groups. There were 27 major complications, 12 in the resident group and 15 in the consultant group. The mean hospital stay was 3.5 days and 2.3 days for patients operated by the residents and the consultants, respectively, while all the patients resumed their normal activities after 16.7 days and 15.1 days respectively.

Conclusion: Supervised LC performed by surgical residents does not increase surgical morbidity and does not compromise patient outcome.

Keywords: Cholecystecomy, Cholelithiasis, Complications, Laparoscopy, Outcome, Surgical training.

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Introduction

The discipline of surgery has become even more complex with the rapid introduction of revolutionary technologies. Laparoscopic surgery is the simplest and first of those new directions. Several authors have described the establishment of laparoscopic cholecystectomy (LC) as a standard method and the associated learning curves.[1–3]

As the new technologies are introduced into our hospitals, our operative tables must be evaluated on multiple levels. Laparoscopic and robotic surgeries have created a need for advanced and different skills and abilities that both practicing surgeons and trainees should be familiar with. Training of future surgeons is a task of vital importance to the society. Since the introduction of the laparoscopic technique in 1985, LC has become the preferred procedure.[4] Some authors emphasize on the importance of LC because junior residents are performing a number of laparoscopic procedures under direct supervision, and an increasing number of LCs.[5]

This is a retrospective study aiming to compare the outcome, efficacy, and morbidity rates between patients who underwent LC by consultants and surgical trainees.

Materials and Methods

Between January 1, 2013 and December 31, 2016, 342 patients underwent LC at Gokuldas Tejpal Hospital, affiliated to Grant Government Medical College and Sir JJ group of Government Hospitals in Mumbai, India. Of these 342, 111 patients were operated on by three surgical residents, and the other 231 patients by three consultants.

In India, surgical residents begin to assist and operate under close supervision in the second or third year of their residency as per Medical Council of India. LC was done with the patient under general anesthesia.

[1]Department of General Surgery, Sir JJ Group of Hospitals, New Delhi, India

[2]Department of General Surgery, Sir JJ Group of Hospitals, Mumbai, Maharashtra, India

[3]Department of General Surgery, Sir JJ Group of Hospitals, Nanded, Maharashtra, India

[4]Department of General Surgery, Sir JJ Group of Hospitals, Datia, Madhya Pradesh, India

[5]Department of General Surgery, Sir JJ Group of Hospitals, Ahmednagar, Maharashtra, India

[6]Department of General Surgery, Sir JJ Group of Hospitals, Kolkata, West Bengal, India

Corresponding Author: Jasmine R Agarwal, Department of General Surgery, Sir JJ Group of Hospitals, New Delhi, India, Phone: +91 8510010756, e-mail: jasmineagarwal2810@gmail.com

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Source of support: Nil

Conflict of interest: None

Surgical Technique

After an infraumbilical incision, open method of creating pneumoperitoneum was used. Four ports were then inserted: two 10-mm ports in the subumbilical and subxiphoid regions, and two 5-mm trocars in the right hypochondrium. Meticulous dissection was carried out at Calot's triangle and around gallbladder using bipolar electrocautery and dissection hook, respectively. The cystic duct and cystic artery were clipped separately with metallic clips and then divided. One operator and two assistants complete an operation. In our study, the one who identified and dissected the structures in Calot's triangle was considered the principle surgeon.

Residents were introduced to laparoscopic techniques by lectures, seminars, and demonstrations. Subsequently, surgical residents assisted in operations as camera operators, and then progressed to being first assistants, and then operated as the first surgeons after acquiring appropriate skills.

All operations by surgical trainees were performed under the instruction and supervision of an experienced laparoscopic surgeon.

The routine blood investigations of all the patients were sent (like complete hemogram, liver function tests, and renal function tests) and they all had electrocardiography, chest X-ray, and abdominal ultrasound scan done preoperatively.

Statistical Analysis

The Statistical Package for the Social Sciences was used to collect all the data. An unpaired *t* test was used, and the mean duration of the surgery, the mean duration of hospital stay, and the number of days needed for resuming daily activities were compared. To compare the complication rates, conversions to open surgery, and mortality rates, a X^2 test was used. A probability of <0.05 was accepted as significant. An independent researcher reviewed the results.

Results

The data comparing patients who underwent LC by surgeons and residents are in Table 1.

The mean duration of the operation was 49 minutes for the surgeons and 57 minutes for residents ($p = 0.12$). Neither conversion rate to laparotomy ($p = 0.17$) nor complication rate ($p = 0.06$) was significantly different between surgeons and residents. Finally, the mean hospital stay was 2.3 days and 3.5 days, respectively ($p = 0.33$).

Table 1: Comparison of laparoscopic cholecystectomies performed by surgeons and residents

	Surgeons (n = 231)	*Residents (n = 111)*	*p value*
Mean duration of operation (minutes)	49 (27–78)	57 (33–97)	0.12
Major complications	15	12	0.06
• Intraoperative			
Bowel thermal injury	1	0	
Bile duct injury	0	0	
Bile leak	4	3	
Hemorrhage	3	2	
Hematomas at trocar site	0	0	
• Postoperative			
Inflammation at port site	4	4	
Paralytic ileus	1	2	
Jaundice	2	1	
Conversion to laparotomy	2	4	0.17
Mortality rate (%)	0	0	0.22
Mean hospital stay (days)	2.3	3.5	0.33
Return to normal activity	15.1	16.7	0.27

Discussion

Considerable concerns exist that shortening the time period of training will compromise the competence of new surgeons. The surgical trainees must obtain adequate operative experience without any unfavorable outcomes to the patient. This retrospective study has shown that the level of the principle operating surgeon does not predict the mortality or morbidity in patients undergoing LC.

Several authors have criticized that the laparoscopic generation of surgeons start their training in biliary surgery with less experience with the open technique;[6] however, studies have shown that less experience in open cholecystectomy does not influence the safety of LC.[7] Instead, surgeons who started LC after their residency encountered more biliary complications than did their colleagues who learned LC during their residency.[5]

All similar studies' results indicate that with proper training and guidance, surgical residents can achieve a satisfactory level of competence in this procedure.[3]

After LC, two patients operated on by a surgeon and one by a resident became jaundiced, and endoscopic retrograde cholangiopancreatography was performed. These patients underwent a papillotomy because of common bile duct stones, which were successfully removed.

Conclusion

We conclude that when surgical residents perform LC after sufficient training in laparoscopy and under proper supervision and guidance, favorable outcomes are achieved. The learning and experienced surgeons must be aware of the possible complications and the necessary prerequisites that should be taken for their prevention.

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CASE REPORT

Minimal Invasive Management of Gallbladder Perforation

Jalbaji P More[1], Shirish R Bhagvat[2], Prachiti Gokhe[3], Amol Wagh[4], Ajay H Bhandarwar[5]

Abstract

Background: Gallbladder perforation (GBP) is a rare clinical entity but life-threatening complication of cholecystitis with or without stones and associated with increased rate of mortality and morbidity due to late diagnosis.

Case description: We describe the case of a 51-year-old male patient who presented with abdominal pain and a Niemeier type II GBP. CT scan revealed a GBP with subhepatic collection and surrounding inflammatory changes. It was communicating through a thin hypodense band with the cystic duct, distal to an impacted stone. Through laparoscopy, the collection was confirmed to be a subhepatic secondary to GBP. The cholecystectomy and the abscess cavity treatment were completely handled via laparoscopic approach.

Discussion and conclusion: The case report demonstrates that laparoscopic approach can be a safe and feasible method in order to treat both the cause and the complication in this situation. Early diagnosis and appropriate minimally invasive approach are the key to manage this condition.

Keywords: Gallbladder perforation, Laparoscopic cholecystectomy, Niemeier classification.

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Introduction

In retrospective studies, acute cholecystitis may result in 2–12% of gallbladder perforation (GBP). The most important risk factor is gallbladder stones.[1]

According to the inflammation progress and type of perforation, Niemeier is subdivided GBP into three types.[1,5–7] Type I (acute) is associated with free perforation into the peritoneal cavity. Type II (subacute) perforation consists in the localization of the fluid at the perforation site, pericholecystic abscess, and localized peritonitis. If the perforation site is covered by the omentum, the intestines, or the visceral surface of the liver, the infection remains limited in the supra mesocolic space with formation of a plastron, pericholecystic fluid, or an intrahepatic abscess.[1–3] Therefore, the GBP can cause a cholecystohepatic communication with consequent spreading of the infection into the liver. The type III (chronic) perforation consists of internal or external fistula formation.[1,3,5]

[1–4]Department of General Surgery, Grant Government Medical College and Sir JJ Group of Hospitals, Mumbai, Maharashtra, India

[5]Department of General, Bariatric, GI, HPB, Endocrine MIS, Grant Government Medical College and Sir JJ Group of Hospitals, Mumbai, Maharashtra, India

Corresponding Author: Jalbaji P More, Department of General Surgery, Grant Government Medical College and Sir JJ Group of Hospitals, Mumbai, Maharashtra, India, Phone: +91 9960672080, e-mail: morejalbaji97@gmail.com

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Conflict of interest: None

Case Description

A 51-year-old male presented to us with complaints of low-grade fever, pain in right hypochondrium since14 days and h/o weight loss. On physical examination, the patient was icteric and Murphy's sign was positive. His white blood cell count was 15,400/µL and total bilirubin was 5.1 mg% with the direct component being 3.4 mg%. Alkaline phosphatase level was 812 IU/L. Ultrasound is ultrasonography report of abdomen which was suggestive of thickened GB wall with pericholecystic collection gallbladder perforation (GBP). This was further investigated with a triphasic CT scan which showed GBP over posterior wall with subhepatic collection. Patient was prepared for early elective laparoscopic cholecystectomy the following day.

The umbilical port was inserted by Hasson's method. The intraoperative findings revealed liver adhesions between inferior edge of right lobe of liver and omentum. There were omental adhesions to gallbladder with increased vascularity. Around 50 cc pus mixed with bile was there, aspirated, and sent for culture. After initial adhesiolysis, calots was found to be frozen. Significant inflammation was encountered in Calot's triangle with a short and wide cystic duct. So antegrade dissection of gallbladder approach is preferred, and while separating the gallbladder off the gallbladder fossa, the posterior (hepatic) surface of gallbladder at fundus found to be ruptured. The gallbladder fossa was irrigated with saline and mopped using a gauze piece. The frozen calots was meticulously dissected using standard laparoscopic instruments (suction cannula) and electrocautery. The critical view of safety was achieved. Cystic artery and cystic duct were clipped and divided, and total cholecystectomy was performed. Hemostasis was achieved and tube drain was placed in Morrison's pouch.

The postoperative course was uneventful, the drain was removed on day 2, and patient discharged on day 4. The histopathology report was chronic eosinophilic cholecystitis with GBP.

Discussion

GBP is a rare complication of acute cholecystitis and cholelithiasis and still remains a diagnostic challenge to surgeons. Of all the patients with cholelithiasis, approximately 10% have asymptomatic cholelithiasis of which 2% may present with a GBP, and mortality in patients with a perforation is 12–16%.[4] GBP was classified and described by Neimeier in three types (Table 1).[5]

There are several mechanisms behind GBP. The most common is cystic duct obstruction, gallbladder distension, altered vascularization, ischemia, and necrosis followed by perforation.

Fundus of the gallbladder is the most common site of perforation secondary to its poor blood supply. GBP can represent in a number of sign and symptoms including generalized or right upper quadrant pain, fever, and jaundice.

Patients can also present with generalized peritonitis and septic shock.

Gore et al. suggested that GBP should be suspected in patients of acute cholecystitis who suddenly deteriorated and become toxic.[8]

Ultrasonography is the initial radiological investigation done in most of the cases, but it has its own limitations in suspected cases of GBP due to gaseous distension of bowel and pain; sonography is compromised and unable to locate the perforation. CT scan is considered the gold standard for the diagnosis of complicated biliary pathology.[10] Signs of GBP on CT scan include a defect, thickening, and enhancement in gallbladder wall and gall stones in common bile duct and cystic duct. Pericholecystic changes include fat stranding, fluid collection, abscess, or bilioma formation (Figs 1 and 2).

Kim et al. in their study compared sensitivity of CT and ultrasound in detecting the perforation found that in 50% of patients, and site of perforation was seen on CT but not a single perforation was identified on sonography.[9]

MRI examination, by its superior soft tissue resolution and multiplanar capability, can be a possible diagnostic option in order to demonstrate the defects of the gallbladder wall; however, cost is the limiting factor.

In our case, we did a thorough routine and radiological workup to establish a definite diagnosis. Considering the safety and feasibility of laparoscopic cholecystectomy, it was preferred. Early laparoscopic cholecystectomy is a safe option in acute cholecystitis patient. Hussain et al. in their study of GBP have concluded that initial management can be conservative followed by interval cholecystectomy.[11] Donati et al. in a case report of GBP suggest that early intervention or open cholecystectomy should be performed.[12]

Table 1: Neimeier classification of gallbladder perforation

Type	*State*	*Description*
Type I	Acute	Is associated with generalized biliary peritonitis
Type II	Subacute	Consists of fluid localization at perforation site, pericholecystic abscess
Type III	Chronic	Includes the formation of internal or external fistulas

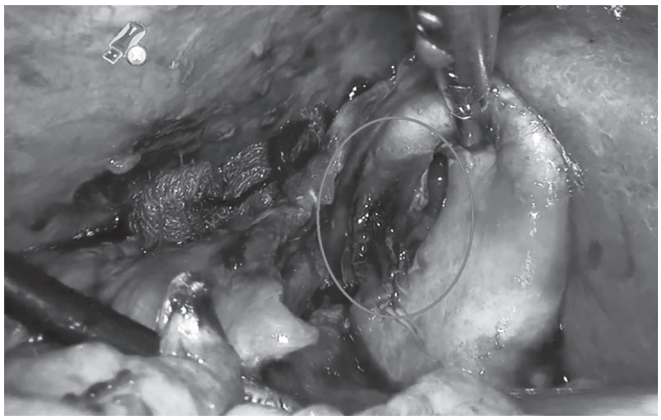

Fig. 1: Perforation in gallbladder at fundus

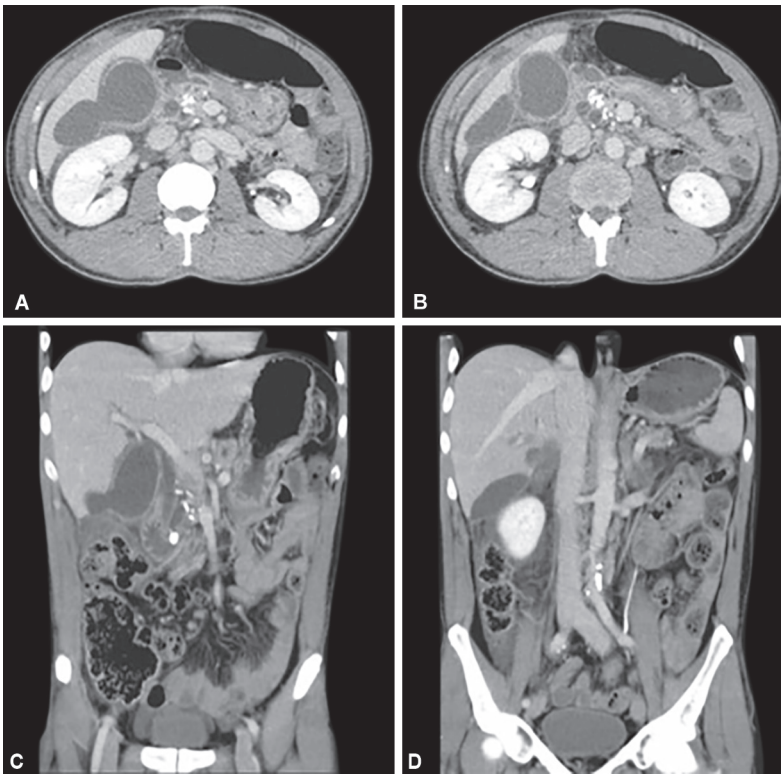

Fig. 2: CT scan images; coronal view showing gallbladder perforation

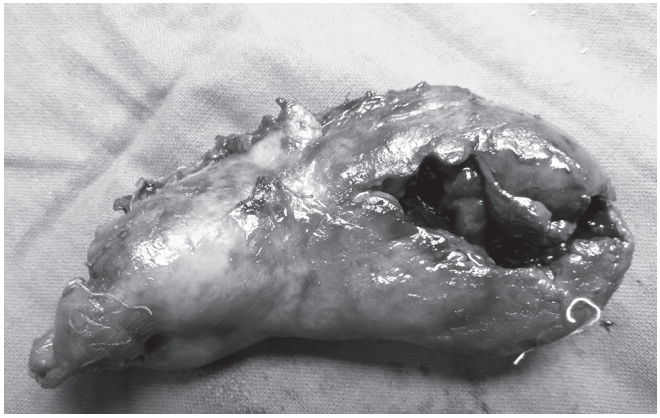

Fig. 3: Perforated gallbladder specimen

Our case report successfully demonstrates the utility of laparoscopy in GBP and its ability to treat the disease as well as complication in the same setting.

Considering the technically demanding nature of laparoscopic surgery in such situations, it is advisable that it should be performed by an experienced laparoscopic surgeon. After cholecystectomy, gallbladder fossa is irrigated with normal saline and an abdominal drain tube is placed under laparoscopic guidance. The postoperative hospital stay in our case was only 4 days (Fig. 3).

Conclusion

A rapid, multimodal diagnostic workup and accurate identification of the type of GBP will help clinicians in identifying the best effective means of managing patients with such pathology. An appropriate minimally invasive approach is the key to manage this rare complication. Early laparoscopic cholecystectomy can be a definitive management option in GBP patient.

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