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EDITORIAL

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As the latest volume of the *World Journal of Laparoscopic Surgery* reveals, the field of minimally invasive surgery continues to push the boundaries of medical science, demonstrating both innovation and an ongoing commitment to improving patient outcomes. This issue, spanning May to August 2024, encapsulates a broad spectrum of original research, novel surgical techniques, and insightful reviews that highlight significant advances and ongoing challenges in laparoscopic surgery.

Among the notable original articles, Ghodratollah Maddah and colleagues propose a groundbreaking technique for the management of malignant vaginal fistulas, a condition that poses significant challenges in surgical treatment. This innovation not only paves the way for more effective treatments but also exemplifies the kind of pioneering work that can lead to substantial improvements in patient care.

Similarly, the study on Enhanced Recovery after Surgery (ERAS) Protocols for total laparoscopic hysterectomy by Aashritha Mukka and her team offers compelling evidence on the advantages of ERAS over conventional postoperative care. Such studies are crucial as they provide robust data to support shifts in clinical practice, ultimately enhancing recovery rates and patient satisfaction.

The issue also addresses the practical aspects of surgical training and technique modification, such as the adaptation of Maryland forceps presented by Gursev Sandlas and colleagues, and the insightful analysis of the learning curve associated with the enhanced-view totally extraperitoneal repair (e-TEP) technique for inguinal hernia. These articles reflect a keen focus on not only advancing surgical methods but also ensuring these advancements are accessible and teachable within the surgical community.

The clinical technique section highlights an innovative approach for managing cervical insufficiency and uterovaginal prolapse, introduced by B Ramesh and his team. This technique, which involves laparoscopic transabdominal cerclage with sacrocervicopexy using a single polyester tape, could potentially set a new standard for the treatment of these conditions, emphasizing the journal's role in disseminating transformative surgical strategies.

Furthermore, the review articles, particularly the systematic review by Saburi O Oyewale on the challenges and adaptations of laparoscopy in Nigeria, offer a broader context of how laparoscopic techniques are being adapted globally, underscoring the importance of contextual and cultural considerations in the global dissemination of medical innovations.

Each article in this issue contributes to a composite view of a field that is dynamically evolving, driven by both technological advancements and a deep commitment to patient-centered care. It is a reminder to the medical community that the pursuit of knowledge and refinement in laparoscopic surgery is not just about technological triumphs, but also about the practical application of these innovations in ways that are meaningful to the patient outcomes.

As we reflect on the contributions of this issue, let us also look forward to the future, inspired by the knowledge that our collective efforts will continue to enhance the quality and effectiveness of healthcare worldwide.

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ORIGINAL ARTICLE

Management of Malignant Vaginal Fistulas: Suggestion of a Novel Technique

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Abstract

Objective: This study was performed with the aim to evaluate the results of the treatment of vaginal fistulas caused by pelvic malignancy and to present a new surgical technique.

Materials and methods: In this retrospective study, patients with vaginal fistula who have been treated in Ghaem and Omid Hospitals of Mashhad University of Medical Sciences from 2004 to 2020 were studied. The inclusion criteria were the patients whose fistulas were caused by malignant neoplasia with pelvic organ origin. The patients with fistulas caused by other causes were excluded from the study. Patients' information was collected from the electronic records and the hospital archives and also the information recorded by the surgeon.

Results: Out of 26 patients with vaginal fistula caused by pelvic malignancies, 18 cases had enterovaginal fistula. Cancer of cervix (11 cases) was the most prevalent cancer. Time interval between the incidence of fistula and the onset of the disease was 43.5 months. About 16 patients had a history of radiotherapy before the onset of the fistula, and 23 cases had undergone surgery before the onset of fistula. About 11 patients were treated with resection, 8 patients with ostomy, and 5 with fistulized loop bypass.

Discussion and conclusion: In cases of extensive pelvic involvement with a tumor, it is recommended to use intestinal bypass in fistula site with the technique provided in this article, since it controls the symptoms of the patient and has limited complications.

Keywords: New technique, Outcomes, Pelvic malignancy, Vaginal fistula.

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Introduction

Vaginal fistulas caused by pelvic malignancies often result in the excretion of gastrointestinal secretions from the vagina, which is referred to as vaginal fistula. Vaginal fistulas cause distressing symptoms. These symptoms, which depend somewhat on the type of fistula, include vaginitis, feeling of gas passing from vagina, stool and urine excretion of the vagina, and some degree of incontinence and severe itching.[1] The types of vaginal fistulas include rectovaginal, anovaginal, colovaginal, enterovaginal, vesicovaginal, ureterovaginal, and uterovaginal.[2] Several causes have been reported for these fistulas, the most common of which are obstetrics complications, bowel inflammatory disease, postoperative complications, pelvic malignancies, infections, trauma, and radiotherapy.[3]

In patients with gynecologic malignancies, vesicovaginal and enterovaginal fistulas are more common. In these patients, a fistula can be the result of a primary tumor invasion or recurrence of the tumor or a complication after surgery or radiotherapy.[4]

In order to diagnose fistula, in addition to clinical history and examination, different methods based on the location of fistula are used. Anoscopy, vaginography, ureterography, cystoscopy, and endoluminal ultrasound are of the methods, but the diagnostic method for complex fistulas is MRI and for those who do not tolerate it is CT scan.[5]

Since the spontaneous repair of these fistulas is very rare,[6] several surgical and nonsurgical treatments have been used. Treatment of vaginal fistulas also varies according to the type, size, and location of fistula. Different surgical procedures have been used, from simple resection to pelvic exenteration, depending on the case.[7] The new percutaneous methods with successful short-term results are also presented.[8] In patients who do not tolerate general anesthesia or have multiple associated diseases, or have delayed complications of radiotherapy, palliative therapy with diversion of bowel contents may be the only possible treatment for the fistula.[9] However, evidence-based randomized clinical trials which determine appropriate treatment for vaginal fistula are not still performed.[10]

The aim of this study was to investigate the surgical procedures performed and their results in patients with fistula in the field of gynecologic malignancies. Meanwhile, a new method has been proposed in cases of complicated fistula in end-stage patients.

Materials and Methods

In this retrospective study, patients with vaginal fistula who have been treated in Ghaem and Omid Hospitals of Mashhad University of Medical Sciences from 2004 to 2020 were studied. The inclusion criteria were the patients whose fistulas were caused

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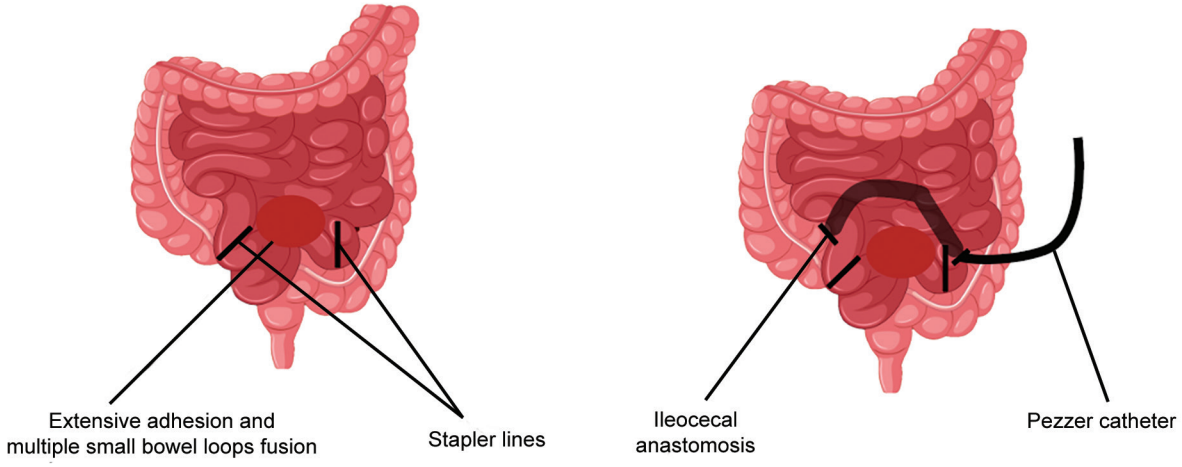

Fig. 1: Schematic design of novel intestinal fistula bypass technique. Note the location of the Pezzer drain

by malignant neoplasia with pelvic organ origin. The patients with fistulas caused by other causes were excluded from the study. Patients' information was collected from the electronic records and the hospital archives and also the information recorded by the surgeon. This information includes demographic data, diagnosis of primary tumor, tumor pathology, time of fistula symptoms occurrence, type of fistula, and type of treatment and treatment outcome.

Patients were admitted to a single surgeon for performing diagnostic and therapeutic procedures, and all surgical procedures were performed by the same surgeon.

All patients have undergone clinical examination and additional diagnostic tests were performed including simple graphy, graphy with contrast, ultrasound, and CT scan.

Medical treatment was performed for patients with undesirable conditions who had no possibility to do surgery, and laparotomy was performed in cases leading to surgery. During surgery, general examination of the abdomen and pelvis was done, the location of fistula was assessed, and the type of operation was decided according to the findings. The surgical procedures performed consisted of the initial anastomosis of the fistulized loop, resection with Hartmann colostomy, enterostomy or deviant colostomy, and fistulized loop bypass. In patients who had extensive invasion of tumor to the intestines, it was not possible to do dissection and releasing, so an ostomy was done in the most distal part of the gastrointestinal tract before the fistula.

There was extensive adhesion and actually multiple small-bowel loops fusion in the pelvic cavity between the intestine and pelvic organs in 4 cases. Our new surgical technique was employed in these cases. In this circumstance, it was impossible to dissect tissues without inadvertent enterotomies. So, a small bowel was cut proximal to the fusion site with a linear cutter stapler. The proximal end reanastomosed distal to fistula (ileoileal or ileocecal). A Pezzer drain was inserted into the small bowel distal to fusion and brought out through a stab wound in the abdominal wall. If there was uncertainty about distal obstruction in the rectum, a diversion colostomy was created (Fig. 1).

Results

Twenty-six patients with vaginal fistula from pelvic malignancies were identified. The underlying malignancies included 10 cases of ovarian cancer, 11 cases of cervical cancer, 3 cases of endometrial cancer, 1 rectal cancer, and 1 urinary bladder carcinoma (Table 1). Patients were referred immediately or with delay after fistula. The interval between the incidence of fistula and the onset of the disease, which was defined as the time of the first therapeutic intervention, was 1–204 months (mean of 43.5 months). In one patient, the first presentation of tumor was vaginal fistula. The presentation of fistula was before surgical operation in 17 cases and was followed by surgery in 8 cases: 5 of these cases were after the surgery of ovarian cancer recurrence and 3 after hysterectomy of endometrial cancer.

Table 1: Underlying malignancy and patient's age

Underlying malignancy	*Mean age (year)*	*Age range (year)*	*N (%)*
Ovarian cancer	49.5	30–70	10 (38.4)
Cervical cancer	57.5	42–63	11 (42.30)
Endometrial cancer			3 (11.53)
Rectal adenocarcinoma	57.3	55–62	1 (3.84)
Bladder cancer			1 (3.84)
Total	53.8	30–70	26 (100)

The symptoms of the patients were fecal excretion from the vagina in 17 cases, excretion in the urine in 5 cases, and urine excretion from the vagina in 1 case. There were also 3 cases of percutaneous fistulas. The underlying malignancy and age of the patients are presented in Table 2. The type of fistula based on the underlying malignancy is presented in Table 2. The complex ileorectovaginal fistula was observed in one patient and also complex ileovesicovaginal fistula in one case. In 22 cases, before the presentation of fistula, there was a history of bilateral hysterectomy and/or oophorectomy, and only 3 cases of cervical cancer patients have received initial treatment with radiotherapy. In 14 patients, radiotherapy was performed prior to the onset of fistula, including 9 patients with cervical cancer and 3 with ovarian cancer, and 2 with endometrial cancer.

In terms of pathology results, in patients with ovarian cancer, the results of pathology were cystadenocarcinoma in 8 cases, granulosa cell tumor in 1 case, and Sertoli–Leydig cell tumor in 1 case. The interval between onset of the disease and presentation of fistula in the case of granulosa cell tumor was 17 years and

Table 2: Types of fistulas based on underlying malignancy

		Vesicovaginal	*Ileovesicovaginal*	*Enterocutaneous*	*Ileovesical*	*Rectovaginal*	*Ileovaginal*
Ovarian cancer	10	–	1	2	2	2	3
Cervical cancer	11	–	1	–	2	3	5
Uterine cancer	3	–	–	1	–	1	1
Rectal cancer	1	–	–	–	–	1	–
Bladder cancer	1	1	–	–	–	–	–
Total	26	1	2	3	4	7	9

Table 3: Type of surgery based on the type of fistula

Type of fistula	*Medical treatment*	*Bypass*	*Diverting ostomy*	*Resection*	*N (%)*
Ileovaginal	1	3	2	2	9 (34.6)
Rectovaginal	–	–	3	4	7 (26.9)
Ileovesical	–	1	3	1	4 (15.3)
Enterocutaneous	1	–	–	2	3 (11.5)
Ileovesicovaginal	–	1	–	1	2 (7.6)
Vesicovaginal				1	1 (3.8)
Total	2	5	8	11	26

in the case of the Sertoli–Leydig cell tumor was 8.5 years. If we exclude these two cases, the mean time interval between onset of the disease and presentation of fistula in ovarian cancer was 38.2 months (7–120 months), in cervical cancer was 22.1 months (1–44 months), and in endometrial cancer was 39 months (36–42 months).

Three cases had gastrointestinal fistula as iatrogenic. The first case was a 52-year-old woman who had undergone uterine cancer surgery at another center and was referred to the center due to a colon fistula at the incision. Laparotomy was performed for the patient that multiple lacerations were observed in the rectosigmoid region. According to the report of the first surgeon, the surgery has been associated with adhesion and difficulty of dissection. Partial colectomy, Hartmann's colostomy, as well as Bogota bag in the abdominal wall were performed for the patient. Finally, the colostomy was closed, and the patient's general condition is good up to 6 years after the operation. The second case was a 64-year-old woman with a history of Sertoli–Leydig cell tumor, in which laparotomy was done in another center due to the recurrence of the tumor, and because of severe adhesion of the intestines, no special procedure was performed. Following this, the patient was referred to our center with a complaint of a narrow intestinal fistula to the abdomen wall. Laparotomy was again performed, resection of fistulized loop anastomosis was done, and the patient had good general condition after 7 months of operation. The third case was a 62-year-old woman with ovarian cancer recurrence that laparotomy was performed in another center, and no special procedure was performed due to utmost adhesion. She was referred to this center with an enterocutaneous fistula. The patient received medical treatment until she died after 2 months due to sepsis.

Laparotomy and surgery were used to treat the fistula in 24 patients, and the type of operation is presented in Table 3, and only 2 patients received medical treatment: one had no consent to surgical therapy and the other was unable to tolerate general anesthesia. Bypass was decided for 4 patients who had advanced disease or severe adhesion, and there was no possibility for bowel dissection and fistulized loop resection. Of these, there were two cases of ovarian cancer recurrence and two cases of cervical cancer recurrence. The type of fistula was ileovaginal in 2 patients, ileovesical in one case, and ileovesicovaginal in one case. Of these patients, one case is still alive after about 4 years, and three died 4, 7, and 12 months after the operation.

In the follow-up of patients until doing the study, 11 cases died, 10 were alive, and follow-up was not possible in 5 cases. The average follow-up period for those who survived was 44 months (7–96 months), and the average survival time for those who died was 5.7 months (1–12 months).

Discussion and Conclusion

Vaginal fistula is not actually a disease, it is a symptom of a variety of diseases that cause very unpleasant conditions for patients and affects different aspects of the patient's life. Since the accurate prevalence of the causes of vaginal fistula in scientific papers is not clear, and also the prevalence of vaginal fistulas in pelvic malignancies is not clearly determined, pelvic tumors account for less than 5% of the causes of vaginal fistulas.[11]

In patients with gynecologic malignancy, fistula is caused by primary tumor invasion or recurrence of the tumor or can be a complication of surgery or radiotherapy.[12] In this study, 14 patients received radiotherapy before fistula was presented, of which the cause of the fistula was only due to radiotherapy in 4 cases and was associated with tumor recurrence in 10 cases. The factors that are included in the development of fistula following radiotherapy are: more advanced stage of the primary tumor, higher dose of radiotherapy, and associated cardiovascular diseases and cigarette smoking.[13]

Radiotherapy causes progressive obliterating endarteritis that leads to necrosis and degradation of mucosal surfaces.[14] Some patients receive both external radiotherapy and vaginal brachytherapy, and thus vaginal fistula is more common in cervical cancer patients.[15] In a retrospective study on 2,096 patients with cervical cancer during a 10-year period, 1.8% of patients complicated by fistula, all of them had already received radiotherapy.[16] In this study, 22 patients had a history of surgery prior to the presentation of fistula, which had been caused by tissue damage, radiotherapy, and tumor recurrence. It is not clear that which factor was the exact cause of fistula in these patients, but the accumulation effects of these cases have contributed to the formation of fistula. The most common technical error in the literature, accidental inclusion of the posterior vaginal wall in colorectal anastomosis, was not observed in this study.[17] A retrospective study of Berek et al. on 75 patients who had undergone pelvic drainage surgery for gynecologic cancer recurrence and gastrointestinal or urinary fistulas after surgery was reported in 17 cases.[4]

Vesicovaginal and enterovaginal fistulas are the most common types of fistulas associated with gynecologic malignancies.[18] In this

study, enterovaginal fistulas, including ileovaginal and rectovaginal fistulas, included 61.5% of cases (16/26).

Given the low possibility of successful conservative treatment in vaginal fistulas, especially in the field of gynecologic malignancies,[19] surgery is the definitive treatment for these fistulas. Of course, this treatment is performed not only due to removing the potential side effects of fistulas, such as recurrent[20] urinary tract infections, but also due to eliminating its destructive effects on patients' self-esteem and quality of life.[21]

There are several surgical methods for the treatment of vaginal fistula, and choosing the suitable methods, especially in patients with gynecologic malignancies, depends on the condition of fistula (simple or complex), the health status of the underlying tissues (history of radiotherapy and surgery), and the recurrence of tumor.[21]

Although most fistulas in this study were vaginal (ileovaginal and rectovaginal), but due to the complexity of the fistula or tumor recurrence, vaginal surgery was not possible, so laparotomy with abdominal approach was performed for all patients. According to the findings during surgery, resection of the involved area was performed in 11 cases. Resection with anastomosis was performed in 5 cases, partial colectomy with Hartmann's colostomy was performed in 2 cases, and also posterior exenteration without tumoral residue was done in 2 cases. One case was treated by anterior exenteration because of bladder cancer, and finally, a recurrency of rectal cancer underwent abdominoperineal resection.

In five patients with severe adhesions in the pelvic region, it was not possible to do dissection, so a bypass was performed in the manner previously described. The fistulas created in these patients are often created in the ileum terminal region. This is probably due to the proximity of this part of the intestine to the pelvic cavity. In cases of gynecologic malignancies, that generally surgery is performed on the pelvis, adhesion between the ileum and the surfaces without pelvic peritoneum, and also vaginal cuff leading to bowel entrapment in the pelvic cavity. Additionally, radiotherapy causes more damage to this fixed part of the intestine. In the same manner, tumor recurrence entraps the bowel and predisposes it to radiation. So, access to this fistula located within such a complex of viscera needs a hazardous dissection. Inevitably multiple enterotomies occur. Spillage of bowel contents contaminates the operation field and alongside with irradiated tissues results in surgical infections and abscesses.

According to the abovementioned, narrow intestinal bypass is an effective method to relieve the symptoms of the patient without causing risk or a special complication for patients. In this study, in the cases of bypass, cases of postoperative death (death within 30 days after surgery) or fistula recurrence were not observed.

Our new approach to treat complicated fistulas caused by gynecologic malignancies is simple and safe and has no significant complication for patients; we suggest this method to surgeons for treatment of this group of patients.

Author's Contributions

GM, AA, and MEP carried out data collection. AA and AM– writing: review and editing and investigation. MTRM – writing. All authors read and approved final manuscript.

Ethical Statement

The study was approved by the Ethics Committee of Mashhad University of Medical Sciences, Mashhad, Iran (ID: 8032363).

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ORIGINAL ARTICLE

A Randomized Control Study on the Effectiveness of Enhanced Recovery after Surgery (ERAS) Protocol with Conventional Protocol in Total Laparoscopic Hysterectomy

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Abstract

Aim: The present study was aimed to evaluate the effectiveness of enhanced recovery after surgery protocol (ERAS) vs conventional protocol in decreasing the duration of hospital stay after total laparoscopic hysterectomy. It also aims to assess the postoperative complications, compliance, patient comfort, and surgeon satisfaction among the ERAS and conventional protocol in total laparoscopic hysterectomy.

Materials and methods: The present randomized controlled study was conducted by the Department of Obstetrics and Gynaecology at JSS Hospital, Mysuru, over a period of 1 year 18 months. A total of 120 patients scheduled for a laparoscopic hysterectomy with salpingectomy or salpingo-oophorectomy for a benign disease were included in the research and were randomized into ERAS ($n = 60$) and conventional protocol groups ($n = 60$). Both the ERAS protocol and the control group received care in accordance with accepted protocol.

Results: In the present study, the mean VAS score in the ERAS study group was found to be 2.4 ± 0.6, and in the control group, is 4.6 ± 0.8 with a mean difference of 2.1 and *p*-value of less than 0.05. The mean total duration of hospital stay (in days) among the patients in the ERAS group is 1.6 ± 0.3 days. In the control group, is 4.4 ± 0.5 days with a mean difference of 2.8 days and a *p*-value of less than 0.05. None of the ERAS group patients had been readmitted to the EMD.100% of the patients in both the groups, are satisfied with the outcome of the surgery.

Conclusion: The ERAS protocol implementation in laparoscopic hysterectomy procedures has resulted in decreased length of total duration of hospital stay and high patient satisfaction with no change in postoperative complications and readmission rates.

Keywords: Conventional protocol, Duration of hospital stay, ERAS protocol, Gynecology, Laparoscopic hysterectomy.

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Introduction

Enhanced recovery after surgery (ERAS) is a multidisciplinary strategy with a broad focus on enhancing postoperative results. The purpose of ERAS pathways is to preserve normal physiology during surgery in order to improve patient outcomes while reducing postoperative problems and readmissions.

In the past few years, the focus has been on aiming for shorter hospital stay following surgery so as to reduce the economic burden and improve the experience of patients which helps patients to recover sooner and return to normal life as early as possible.[1,2]

Enhanced recovery after surgery is often termed as "rapid recovery program," "multimodal perioperative management," or "fast-track program." The primary pathologic factor causing postoperative morbidity and organ dysfunction is surgical stress.[3] The comprehensive feature of the ERAS protocol was intended to incorporate the patient's whole journey throughout the perioperative period by integrating a number of modalities and therapies using an evidence-based methodology.[2]

Preoperative fasting time reduction, nausea and vomiting control, optimal fluid management, reduced nasogastric tube use, opioid-sparing analgesia, early mobilization, early enteral nutrition, antithrombotic and antimicrobial prophylaxis, and patient counseling about surgery and postoperative recovery are all ERAS components.[4]

Traditional methods support the use of catheters, nasogastric tubes, drains, oral intake restrictions, and ambulation. These are gradually declining in favor because there is no evidence from science to back up the practice.

Every year, more than 234 million major surgical procedures are performed worldwide, and despite improvements in anesthesia and surgical care, the morbidity rate following abdominal surgery is still high. With the intention of reducing the loss of functional ability and hastening the healing process, the ERAS clinical pathways have been developed to enhance the standard of perioperative care.[5]

The ERAS protocol aims to minimize surgery-related morbidities, lower the risk of complications and readmissions, lessen

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postoperative pain and painkiller use, raise patient satisfaction, and shorten hospital stays. There has been a desire for research into ERAS in gynecological procedures due to its successful use in colorectal surgery and other disciplines. Additionally, revised recommendations have been made for postoperative care for those who underwent gynecologic surgery.[6,7]

Data on the success of the ERAS program in gynecological operations, particularly benign surgery, are few. In order to assess the postoperative result in ERAS against traditional procedure in complete laparoscopic hysterectomy, we undertook this study as an institutional experience.

Objectives

To determine the effectiveness of ERAS protocol in decreasing the length of hospital stay after laparoscopic hysterectomy.

Materials and Methods

The present randomized control trail was conducted by the Department of OBG at JSS Medical College Hospital from November 2020 to June 2022 among the subjects who were scheduled for laparoscopic hysterectomy with salpingectomy or salpingo-oophorectomy for benign condition.

A total of 120 study subjects were selected for the purpose of the study with 60 subjects in each group. The sample size was estimated considering SD of post-op hospital stay as 3 hours in each group, and study to be sensitive enough to detect at least 1 hour difference in hospital stay with 5% alpha error and 95% power, as 58 in each group, considering the dropouts the sample size included was 60 in each group.

The sample size was calculated as follows:

$$= \frac{2S_p^2\left[Z_{1-\alpha/2} + Z_{1-\beta}\right]^2}{\mu_d^2}$$

$$S_p^2 = \frac{S_1^2 + S_2^2}{2}$$

where S_1 = SD in the first group, S_2 = SD in the second group, $Z\alpha$ = Mean difference between the groups, Z_β = Significance level, p = Power

Inclusion Criteria

- Patients undergoing total laparoscopic hysterectomy for benign gynecological disorder operated by same surgeon, who fall under ASA grade I and grade II categories.

Exclusion Criteria

- Infected masses
- Immunocompromised patients
- Gynecological malignancies
- Age > 70 years

Methodology

Women planned for laparoscopic hysterectomy for benign conditions at JSS Mysuru, Gynecology OPD were told about the research.

Which includes two types of protocols: ERAS and conventional

Those willing and consenting to be a part of the study are selected

The patients are randomly allocated into two groups via the sealed opaque envelope technique

Study group are those that follow the ERAS protocol

Control group are those that follow the conventional protocol

The patients were explained about the study which included two types of protocols:

1. ERAS protocol for laparoscopic hysterectomy
2. Conventional protocol for laparoscopic hysterectomy

Before starting the study the informed consent was taken from all the study subjects. The patients were randomly allocated into two groups using sealed opaque envelope technique.

a) Study group (S) $n = 60$
b) Control group (C) $n = 60$

Prior to surgery, preoperative interviews and physical and gynecological tests were conducted with women who had their eligibility examined. Women in the study group (S) get care in accordance with ERAS procedure, whereas those in the control group (C) receive care in accordance with standard practice.

Assessment of postoperative complications is done within 1 week of surgery in both the groups. Patient and surgeon satisfaction questionnaire is taken after the surgery in both the groups

Data were gathered and entered into the MS Excel spreadsheet that was already developed. The Windows version 21.0 of the SPSS application was used to conduct the statistical analysis. Bar charts were used to graphically express qualitative data, which was displayed as proportions and pie diagrams. Mean and standard deviation were used to display quantitative data. For the significance of qualitative data, the Chi-square test/test Fisher's was employed, while the student's t test was utilized to determine the degree of significance for quantitative data. Statistics were judged significant-values are considered significant at $p < 0.05$.

Results

The age-group ranged from 35 to 68 years with a standard deviation of ± 7.8. In study group, most patients were aged between 41 and 45 years (25%) and the least in 66–70 years (3.3%). Similarly, in Control group, most patients lie in the age-group of 51–55 years (33.3%) and least in 61–65 years (3.3%) (Table 1).

The mean BMI in Study group is 25.35 ± 2.763, and in Control group is 25.1 ± 2.141 with a mean difference of 0.1 and p-value of 0.704 there does not exist significant difference in mean BMI between two groups.

In the ERAS group, the average preoperative hospital stay is 7.8 ± 2.0. hours. In the control group, the patients' mean duration (hours) is 30.07 ± 4.41 with the mean difference of 22.17 and a p-value was found to be less than 0.05. Among the control group,

the mean fluid administration of the study subjects was found to be 968.33 ± 133.393 mL with the mean difference value of 489.167 mL and a *p*-value was found to be less than 0.05. The mean fluid requirement (in mL) during the postoperative period among the study subjects in the ERAS group was found to be 471.67 ± 150.808 mL. In the control group, the mean fluid requirement of the patients is 1328.33 ± 324.738 mL with a mean difference of 856.667 mL and a *p*-value was found to be less than 0.05.

The mean CO_2 pressure (mm Hg) during the intraoperative period among the study subjects in the ERAS study group was found to be 12.37 ± 0.66 mm Hg. The mean CO_2 pressure in the control was found to be around 14.0 ± 0 mm Hg with a mean difference of 1.6 mm of Hg and *p*-value was found to be less than 0.05 (Table 2).

The mean doses of postoperative rescue analgesia among the participants in the study group is 1 ± 0.2. In the control group, mean doses of postoperative rescue analgesia is 2 ± 0.3, with a mean difference of 1 and a *p*-value was found to be less than 0.05. The mean VAS score among the patients in the ERAS group is 2.4 ± 0.6, and in the control group, the mean VAS score is 4.6 ± 0.8 with the mean difference of 2.1 and *p*-value was found to be less than 0.05. The mean fluid requirement (in mL) during the postoperative period among the study subjects in the ERAS group was found to be 471.67 ± 150.808 mL. In the control group, the mean fluid requirement of the patients is 1328.33 ± 324.738 mL with a mean difference of 856.667 mL and a *p*-value was found to be less than 0.05. The mean duration of post-op catheter removal (in hours) among the patients in the ERAS group is 6.70 ± 1.02 hours. In the control group, the duration of post-op catheter removal is 10.45 ± 1.04 hours with the mean difference of 3.7 hours and a *p*-value was found to be less than 0.05. The mean duration of post-op time for ambulation (in hours) among the patients in the ERAS group is 5.80 ± 1.05 hours. In the control group, the post-op time to ambulation duration is 9.80 ± 1.3 hours with the mean difference of 4 hours and a *p*-value was found to be less than 0.05. Patients in the ERAS group had an average postoperative hospital stay of 1.1 days with a standard deviation of 0.3 days. The length of the post-op hospital stay in the control group was 3.1 ± 0.3 days, with the mean difference of 1.9 days and a p-value was found to be less than 0.05. The patients in the ERAS group had an average hospital stay of 1.6 ± 0.3 days. The duration of hospital stay is 4.4 ± 0.5 days in the control group with the mean difference of 2.8 days and a *p*-value was also found to be less than 0.05. The mean postoperative analgesia requirement (days) in the study group is 2.5 ± 0.8. In the control group, the mean post-op analgesia requirement of the patients is 5 ± 0 days with a mean difference of 2.4 days and the *p*-value was found to be less than 0.05 (Table 3).

In the study group, most participants had no shoulder pain (86.7%), and 13.3% had shoulder pain. Similarly, 81.7% of the participants had no shoulder pain in the control group, while 13.3% had shoulder pain.

In the ERAS group, most patients had no vault infection (98.3%), and 1.7% had vault infection. Similarly, 96.7% of the patients had no vault infection in the control group, while 3.3% had. In the study group, most participants had no abdominal wall wound infection (100%). Similarly, in the control group, none of the participants had

Table 1: Intergroup comparison of baseline characteristics among the groups

	ERAS group (n = 60)		*Control group (n = 60)*		
Age (years)	*Frequency*	*%*	*Frequency*	*%*	*p-value*
35–40	9	15.0	17	28.3	0.06
41–45	15	25.0	5	8.3	
46–50	12	20.0	12	20.0	
51–55	14	23.3	20	33.3	
56–60	6	10.0	3	5.0	
61–65	2	3.3	3	5.0	
66–70	2	3.3	0	0.0	

Table 2: Intergroup comparison of clinical parameters in pre- and intraoperative period

	Study group (n = 60)		*Control group (n = 60)*				*Mann–Whitney U-test*
	Mean	*Std dev*	*Mean*	*Std dev*	*Mean difference*	*t-value*	*p-value*
Preoperative hospital stay (hours)	7.85	2.007	30.07	4.437	22.17	35.36	<0.001*
Fluid administered intraoperative (mL)	479.17	101.80	968.33	133.39	–489.167	–22.5	<0.001*
Intraoperative CO_2 pressure (mm Hg)	12.37	0.663	14.00	0.000	–1.633	–19.08	<0.001*

*$p < 0.05$

Table 3: Intergroup comparison of clinical parameters in postoperative period

	Study group (n = 60)		*Control group (n = 60)*		*Mean*		*Mann–Whitney U-test*
	Mean	*Std dev*	*Mean*	*Std dev*	*difference*	*t-value*	*p-value*
Postoperative rescue analgesia	1	0.2	2	0.3	1.0	39	0.002*
Post-op pain (VAS)	2.43	0.647	4.60	0.807	–2.167	–16.224	<0.001*
Fluid requirement postoperatively in mL	471.67	150.808	1328.33	324.738	–856.667	–18.5	<0.001*
Postoperative removal of catheter in hours	6.70	1.062	10.45	1.048	–3.750	–19.46	<0.001*
Postoperative time for ambulation in hours	5.80	1.054	9.80	1.312	–4.000	–18.40	<0.001*
Postoperative hospital stay in days	1.142	0.3201	3.125	0.3973	–1.9833	–30.11	<0.001*
Total duration of hospital stay	1.617	0.3836	4.417	0.5381	–2.80	–32.81	<0.001*
Requirement of postoperative analgesia (days)	2.57	0.890	5.00	0.000	–2.433	–21.17	<0.001*

*$p < 0.05$

Table 4: Comparison of complication among the study subjects in both the groups

	Study group (n = 60)		*Control group (n = 60)*		
	N	*%*	*N*	*%*	*p-value*
Shoulder pain					
Yes	8	13.3	11	18.3	0.453
No	49	86.7	52	81.7	
Vault infection					
Yes	1	1.7	2	3.3	0.559
No	59	98.3	58	96.7	
Abdominal wall wound infection					
Yes	0	0.0	0	0.0	0.559
No	60	100.0	60	100.0	
Readmission to EMD					
Yes	0	0.0	2	3.3	0.559
No	60	100.0	58	96.7	

abdominal wall wound infection. None of the ERAS group patients had been readmitted to the EMD. Similarly, in the control group, most patients were not readmitted to the EMD (96.7%), and 3.3% had been readmitted to the EMD (Table 4).

In the ERAS group, 98.3% of patients thought the material was of high quality, while only 1.7% did not. Similarly, 98.3% of the patients liked the quality of the information provided in the control group, while 1.7% did not like it. In the ERAS group, most patients liked staying in the gynecological ward (98.3%), and 1.7% did not. Similarly, 95% of the patients liked staying in the gynecological ward in the control group, while 5% did not like it. In the study group, most patients did not have additional visits to a doctor (96.7%), and 3.3% had additional visits. Similarly, 96.7% of the patients did not have additional doctor visits in the control group, while 3.3% had additional visits. And 100% of the patients in both the groups, that is, study and control groups are satisfied with the outcome of the surgery. In the study group, the surgeon was comfortable with anesthesia given to patients. Similarly, 96.7% of the time surgeon was comfortable with anesthesia given to patients in the control group, while 3.3% were uncomfortable (Table 5).

In the study group, surgeon felt abdominal distension was sufficient (98.3%), and 1.7% did not feel sufficient abdominal distension. the surgeon felt abdominal distension was sufficient during surgery in the control group. The surgeon in both the groups, that is, study and control groups was satisfied with the relaxation during the surgery (Table 6).

Table 5: Distribution of the study subjects based on the patient satisfaction score

	Study group (n = 60)		*Control group (n = 60)*		
	N	*%*	*N*	*%*	*p-value*
Do you like the quality of the information?					
Yes	59	98.3	59	98.3	1
No	1	1.7	1	1.7	
Do you like staying in the gynec ward?					
Yes	59	98.3	57	95.0	0.309
No	1	1.7	3	5.0	
Did you have additional visits to a doctor?					
Yes	2	3.3	2	3.3	1
No	58	96.7	58	96.7	
Are you satisfied with the outcome of your surgery?					
Yes	60	100.0	60	100.0	
No	0	0.0	0	0.0	
Were you comfortable with the anesthesia?					
Yes	60	100.0	58	96.7	0.154
No	0	0.0	2	3.3	

Table 6: Distribution of the study subjects based on the doctor satisfaction

	Study group (n = 60)		*Control group (n = 60)*		
	N	*%*	*N*	*%*	*p-value*
Was the abdominal distension sufficient during surgery?					
Yes	59	98.3	60	100.0	0.315
No	1	1.7	0	0.0	
Was there sufficient relaxation during the surgery					
Yes	60	100.0	60	100.0	
No	0	0.0	0	0.0	

Discussion

The traditional method of postoperative treatment has likely been in use for many years out of habit and without any scientific support. As shown in other specialty procedures, the ERAS process is said to be superior to the traditional method. With regard to a total laparoscopic hysterectomy, our goal was to determine the cause of this outcome. The discussion is based on the fact that identical findings have been made in research using a number of different samples.[8]

The age range in the current research was 35–68 years with a standard deviation of 7.8. In the study group, patients range in age from 41 to 45 years old (25% of patients) to 66 to 70 years old (3.3% of patients). Similarly, in the Control group, most patients lie in the age-group of 51–55 years (33.3%) and least in 61–65 years (3.3%). Jimenez et al.[9] reported that the mean age of the study subjects was found to be 42.97 ± 7.88 in ERAS group and in control group it was 43.07 ± 9.51. Age-groups were insignificant between both the groups.

The study found that the mean hospital stay preoperatively (hours) in the ERAS group was 7.8 ± 2.0 and in control group was 30.07 ± 4.41 with a *p*-value less than 0.05. There was a decreased length of preoperative hospital stay in the study group as those patients were admitted on the day of surgery, which did not affect postoperative complications and readmission rates.

The mean BMI in study group is 25.35 ± 2.763, and in the control group is 25.1 ± 2.141 with a mean difference of 0.1 and *p*-value of 0.704, which is in accordance with the study of Jimenez et al. The mean BMI of ERAS group was 25.83 ± 3.66, and in the control group, it was 26.60 ± 5.14.[6]

The mean doses of postoperative rescue analgesia among the participants in the study group is 1 ± 0.2 hours. In the control group, mean doses of postoperative rescue analgesia is 2 ± 0.3, with the mean difference of 1 and a *p*-value of less than 0.05, the study shows that there were more rescue analgesic doses in control group than the study group this may be due to addition of regional anesthesia in the study group which demanded fewer rescue analgesia doses and aided in faster recovery and early ambulation.

All the ERAS and control group patients were given intraoperative analgesia. The mean VAS score among the patients in the ERAS group is 2.4 ± 0.6, and in the control group is 4.6 ± 0.8 with the mean difference of 2.1 and *p*-value of less than 0.05, which shows the statistical significance. The visual analog score (VAS) was lower in patients handled with ERAS protocols than in patients managed with traditional protocols following both laparotomy and laparoscopic procedures, which is comparable to the research by Abdelrazik and Sanad.[10]

The mean duration of post-op catheter removal (in hours) among the patients in the ERAS group is 6.70 ± 1.02 hours. In the control group, it is 10.45 ± 1.04 hours with the mean difference of 3.7 hours and a *p*-value of less than 0.05, which shows statistical significance, which aid in early ambulation postoperatively and decreases the chance of urinary tract infections, which is in line with the study of Han-Geurts IJ et al.[11] where the ED group subjects had significant correlation with shorter duration for urinary catheter required (1 vs 39 days, $p < 0.001$).

The mean duration of post-op time to ambulation (in hours) among the patients in the ERAS group is 5.80 ± 1.05 hours. In the control group, it is 9.80 ± 1.3 hours with the mean difference of 4 hours and the *p*-value was found to be less than 0.05. Early catheter removal decreased postoperative fluid administration, low pain scores aid in early ambulation of patient in the study group, In 2008, during the early stages of ERAS, Chase et al.[12] examined their ERAS program in 880 laparoscopically operated gynecologic cancer patients, which included early eating, early ambulation, and quick conversion to oral analgesics. According to their findings, ERAS decreased postoperative hospitalization without raising the risk of serious consequences.

The patients in the ERAS group had an average hospital stay of 1.6 ± 0.3 days. Among the study subjects in the control group, the mean duration of hospitalization was 4.4 ± 0.5 days with the mean difference of 2.8 days and the *p*-value was found to be less than 0.05. Factors like admission on the day of surgery, no bowel preparation preoperatively, zero fluid balance therapy, decreased administration of postoperative fluids, early removal of catheter, early ambulation all of these contribute to decreased length of hospital stay in the study group. It is true that there have been clinical trials to test these methods, but they have mostly been utilized for oncological surgery, and the outcomes have been mixed.

Similar to our study, Ferrari et al. found that the ERAS procedure resulted in a shorter hospital stay than the usual protocol. A clinical experiment was conducted by Yilmaz et al. to assess abdominal hysterectomy with a shorter hospital stay.[13] A clinical trial by the Olga Kilpios group investigated laparoscopic hysterectomy in the ERAS group; however, it only looked at how long patients stayed in the hospital and how often they used opioids. Compliance is not evaluated, and other ERAS components are not considered.[8] Seven of the eight studies that included length of hospital stay (LOHS) found that LOHS was lower in the ERAS group.[14,15]

In the study group, most participants had no shoulder pain (86.7%), and 13.3% had shoulder pain. Similarly, 81.7% of the participants had no shoulder pain in the control group, while 13.3% had shoulder pain. This finding may be due to reduced intraoperative carbon dioxide pressure in study group compared with control group.

Postoperative complications like vault infection, abdominal wall wound infection, perioperative bleeding did not show any statistical significance between the two groups, suggesting implementation ERAS protocol showed no change in postoperative complications between the two groups. Even while Jimenez et al. found no statistically significant difference in the number of complications, there did seem to be a trend toward less problems in the ERAS group (6% vs 20%, $p = 0.1$).[9]

Nilsson et al. focused on the risk variables for complications after hysterectomy using an ERAS approach. Their research revealed that while postoperative infections and complications were frequent, serious problems were very few. Strong risk factors for postoperative complications were obesity and prior laparotomy, which is in line with the results of other research on benign hysterectomy.

None of the ERAS group patients had been readmitted to the EMD. Similarly, in the control group, most patients were not readmitted to the EMD (96.7%), and 3.3% had been readmitted to the EMD. No discernible difference in readmission rates was seen between the two groups was identified in the study by Bahadur et al. which was comparable to our study findings.[15]

The majority of the data and methods are obtained from studies and protocols carried out in other surgical specialties, despite the fact that ERAS protocols are quickly becoming the new standard for the treatment of gynecological surgery. Additionally, research comparing these techniques in gynecological surgery is often observational in nature and/or contrasts the ERAS group with backward control groups.[16,17] The use of observational studies, which have a significant risk of bias, is the major issue in gynecological surgery, as stated by de Groot et al. in their review and meta-analysis of published publications.

In our study, Majority of the study subjects (60%) in ERAS group and (59%) in control group were satisfied with the protocols and 100% of the patients in both the groups are satisfied with the outcome of the surgery. According to Bahadur et al.[15] 65% of patients in the group ERAS reported satisfaction ratings of higher than 9/10, while the median score for both groups was 8/10. Philp et al. employed the in-patient satisfaction with care measure using the questionaries' INPATSAT-32, which was mailed out one month after surgery, to assess patient satisfaction in a fast-track setting in 2014. Overall, 96% of patients rated good to outstanding in coordination of care from diagnosis to discharge and 92% said the nursing care was efficient.[18]

In the present study in the ERAS group, all the surgeons were comfortable with anesthesia given to patients in the study group and similarly, 96.7% of the surgeons were comfortable with anesthesia given to patients in the control group, while 3.3% were uncomfortable. Overall in both the groups surgeons were satisfied with the abdominal wall distension and relaxation during the surgery.

Conclusion

The efficacy of ERAS depends on its capacity to end the stress cascade and, to the greatest extent feasible, preserve normal physiology both before and after surgery. Early ambulation, early initiation of feeds, early removal of the Foley catheter, use of antiemetics, and multimodal analgesia used during the course of therapy help patients leave the hospital sooner.

The current study adds to the body of research showing that the ERAS program, when used effectively, promotes earlier release and quicker recovery, which ultimately results in better patient satisfaction and quality of life. Although there are many studies evaluating its impact in gynecologic surgery, further research is needed, particularly less invasive gynecological surgeries.

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ORIGINAL ARTICLE

Modification to the Maryland Forceps

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Abstract

All laparoscopic surgeons, adult or pediatric, would be familiar with the ubiquitous Maryland forceps, a dissector used as an indispensable tool in various day-to-day laparoscopic procedures. However, it is limited in its use because it has a smooth surface on the outer surface of the jaws, which causes it to slip during dissection. Thus, it not only takes longer but also makes it more difficult to dissect tissues during the procedure. To tackle this problem, we came up with a modification of our own which would make it easier to use this instrument by reducing the slippage that occurs during the procedure.

Keywords: Dissection, Laparoscopy, Laparoscopic surgery, Maryland dissector, Technical modification.

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Introduction

All laparoscopic surgeons, adult or pediatric, would be familiar with the ubiquitous Maryland forceps, which is an indispensable instrument in laparoscopic surgery.

It is a pair of dissecting forceps that may have a curved or a straight end with serrations on the inner surface of the jaws. It is used for dissection in various planes of different tissues during a laparoscopic procedure. However, a pertinent problem with the Maryland dissecting forceps is that it has a smooth surface on the outer surface of the jaws, which causes them to slip during dissection. Thus, it takes longer and also makes it more difficult to dissect tissues during the procedure.

To tackle this problem, we came up with a modification of our own which would make it easier to use this instrument by reducing the slippage that occurs during the procedure.

Aims and Objectives

- To make a modification to the widely used Maryland laparoscopic dissector forceps enabling better use in pediatric surgery.
- To minimize tissue slippage.

Materials and Methods

Our modification to Maryland's forceps involves having serrations on the outer surface of the blades, close to the tip of the forceps, along with the inner surface, which will provide a better grip and thus reduce tissue slippage, therefore making it easier to perform dissections during the procedure.

The following are the design changes that we made to the original design of Maryland forceps (Figs 1 to 4):

- The forceps will have two blades which may be straight or may be curved.
- The blades will have vertical serrations on the inner surface and also have serrations on the outer surface close to the tip of the blades to provide a better grip to the blade while dissecting through the tissues.
- The internal serrations shall provide a grip for holding the tissues while the external serrations shall provide a grip while dissecting through the tissue.

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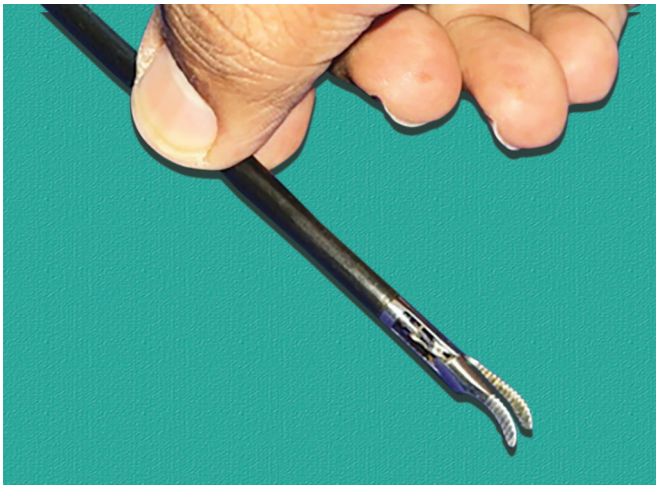

Fig. 1: Curved forceps blade

- The forceps shall be available in three diameters, namely, 3, 5, and 10 mm.

Fig. 2: Vertical serrations on the inner surface and on the outer surface close to the tip of the blades to provide better grip

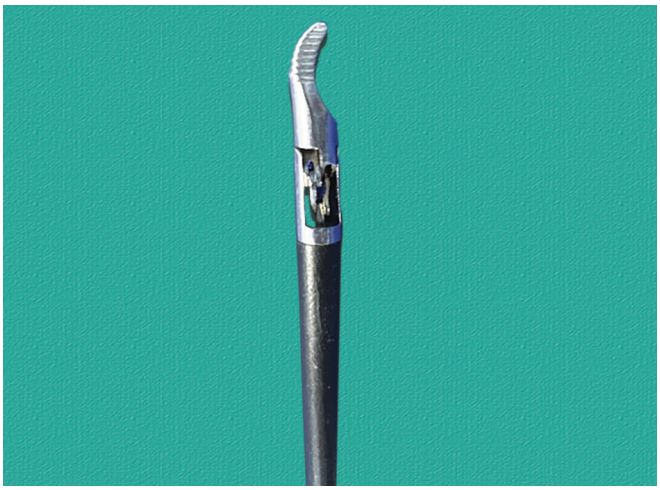

Fig. 3: External serrations provide grip while dissecting through the tissue

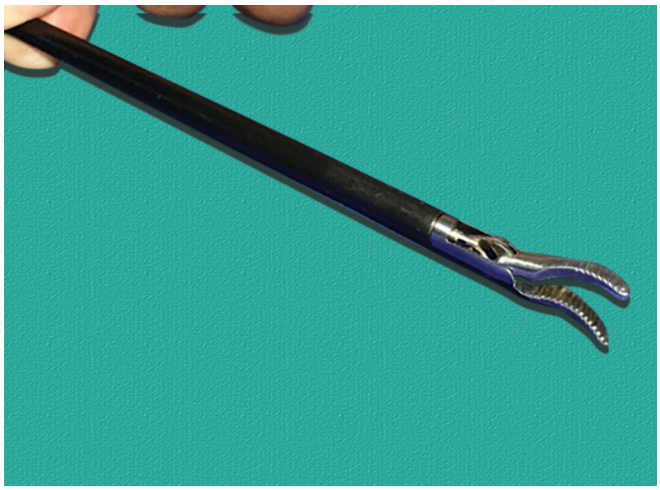

Fig. 4: The internal serrations provide a grip for holding the tissues

- The forceps shall be available in two lengths, namely, 20 and 25 cm.
- Various combinations of diameter and length shall be available.

Most laparoscopic surgeries make use of Maryland dissector for tissue dissection and space creation. Different designers and researchers have contributed to the evolving design of the Maryland forceps starting from the early 90s. In 1992, it was Smith[1] who patented the disposable Maryland dissectors which are widely used nowadays. At the turn of the century, the following two modified designs came into vogue: The first by Moran et al.[2] in 2008 and the second by Batchelor et al.[3] in 2015. Lee et al.[4] proposed a modification aiding in better tactile and pressure-sensing feedback in 2016.

These forceps are available as both unipolar and bipolar instruments.[5–7]

One of the drawbacks of the Maryland dissector has been that tissue tends to slip out between its jaws surface during laparoscopic dissection, owing to its smooth outer surface. This is especially of note in pediatric surgeries when one is dealing with limited available space within the body cavity. Therefore, sometimes it becomes difficult to dissect tissues and the operating time increases.

The proposed modifications to the universally available Maryland forceps aim to reduce some of its flaws.

Conclusion

This modification to the jaws of the Maryland dissector helps lessen chances of major injury to vital structures by negating the need for many laparoscopic instruments, need for frequent readjustments, especially in pediatric surgeries. Major organ injuries due to instrument slippage and the amount of intraoperative blood loss, are hence reduced, and postoperative comfort is improved with the need for lower analgesic doses for postoperative pain relief.

This instrument is designed in such a way that it can be completely taken apart and put together, as the modification only entails changes to the jaws of the forceps. This ensures that each individual component can be sterilized optimally and thoroughly without compromise. Also, the design allows for multiple uses of the instrument thereby reducing costs further.

The manufacturing cost too is negligible since minimal changes need to be made to the existing jaw design which can be easily accomplished.

Wider usage and adoption of this modification may prove helpful in reducing operative times and tissue injury due to slippage, especially in pediatric surgery.

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ORIGINAL ARTICLE

Negotiating Learning Curve in Enhanced-view Totally Extraperitoneal Repair (e-TEP) for Inguinal Hernia

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Abstract

Introduction: Inguinal hernia repair is one of the most frequent surgeries performed by a general surgeon. The novel laparoscopic modification of totally extraperitoneal (TEP) hernioplasty to enhanced-view totally extraperitoneal (e-TEP) hernioplasty was pioneered by J Daes in 2012. The e-TEP technique ensures that the extraperitoneal space can be reached from almost anywhere in the anterior abdominal wall. The e-TEP approach can quickly and easily create an extraperitoneal space, provide a flexible port setup adaptable to many situations, ease the management of the distal sac, and improve tolerance of pneumoperitoneum. (e-TEP) is now gaining popularity because of the lesser learning curve (LC). The aim of this study was to see the LC for laparoscopic e-TEP repair for inguinal hernia. The primary objective of this study was to evaluate the mean operating time (OT) and secondary objectives were to assess the complications and the rate of early discharge.

Methodology: A retrospective analysis of the medical records of 42 patients scheduled for laparoscopic e-TEP repair for inguinal hernia was done from July 2018 to Feb 2023 in Dr. RMLIMS Lucknow India, a government medical Institute. Patients with complete or incomplete unilateral inguinal hernia and recurrences were included, complicated hernia and bilateral hernia were excluded from this study. Standard e-TEP access was created as described by Jorge D. All the procedures were carried out by a single surgeon under general anesthesia. Besides, demographic data such as age, sex, body mass index (BMI), umbilicus to pubic symphysis distance, Direct/indirect inguinal hernia, complete/incomplete hernia, and size of defect were collected. In addition to that OT, postoperative duration of hospital stay, and complications such as bleeding and peritoneal rents were also collected. The surgeon's competency was evaluated by the OT [moving average curve and LC by cumulative sum (CUSUM)] frequency of complications and length of hospital stay.

Results: Reducing trend of the mean OT with the passage of phases I–III was observed. The curve is steep and first increases rapidly with a small plateau phase followed by a decreasing phase. Phase I had patients from 1 to 13, phase II had patients from 14 to 28, and phase III had patients from 29 to 42.

Conclusion: In this study, the LC for e-TEP using CUSUM analysis for operative time and surgical failure was evaluated. For an experienced laparoscopic surgeon, we estimated that a minimum of 42 cases were needed to overcome the LC for e-TEP with an operative time of 78.71 ± 10.02 minutes.

Keywords: Laparoscopic, Laparoscopic hernia repair, Learning curves, Inguinal hernia.

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Introduction

Repair of inguinal hernia is considered to be among the most frequent general surgical procedures. Until laparoscopic repairs (where mesh is placed in a more anatomic site) came into the picture, the technique of hernia surgery remained almost unchanged for a century.[1] The novel laparoscopic modification of totally extraperitoneal (TEP) hernioplasty to enhanced-view totally extraperitoneal repair (e-TEP) hernioplasty was pioneered by J Daes in 2012.[2] In the e-TEP technique, the extraperitoneal space can be reached from multiple sites in the anterior abdominal wall. Moreover, in this technique, creation of extra- or pre-peritoneal space is much quicker and easier. This technique widens the surgical field with provision of a flexible port setup adaptable to many situations. It eases dissection of spermatic cord structures with sac and peritoneum and improves tolerance of pneumoperitoneum; e-TEP is now gaining popularity because of lesser learning curve (LC). It offers better vision of the operative field and better ergonomics for surgeons;[3] e-TEP is increasingly becoming a preferred technique because of the ease of using a larger size mesh for huge defects and the fact that it is a comparatively better technique for patients with difficult body habitus, having short umbilicus-pubis distance and with history of previous pelvic surgery. As the number of studies increases, the armamentarium of e-TEP will increase and will supersede or replace TEP soon. Various researchers have tried to find out whether the relative advantages achieved could help formulate the criteria by which one can determine which type of procedure is suitable for a particular patient.[4,5]

Although this method is easier for surgeons having experience in laparoscopic hernia surgeries, but it carries few concerns for beginners, such as lengthier LC, as compared to open surgery increased risk of intraoperative complications which may eventually turn out to be harmful to patients during the learning process.

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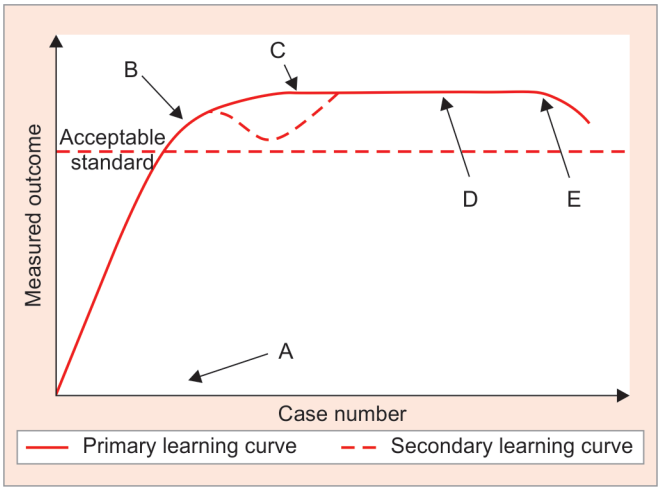

Fig. 1: The idealized surgical learning curve (LC)

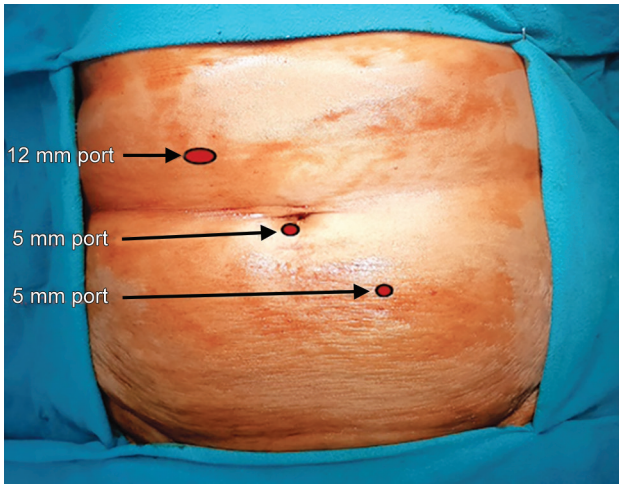

Fig. 2: Ports set up for right inguinal hernia

Initial work on LC was done by TP Wright 1936, an aeronautical engineer, who first described the LC.[6] He found out that there was an increase in the efficiency of airplane component production and decrease in the cost as the experience of workers increased. However, assessment of a clinicians' performance is a difficult task as compared to a machine.

Nevertheless, LCs can be used to evaluate a surgeon's performance. A German psychologist Hermann Ebbinghaus told about the concept of LC in medical science for the first time after the famous Bristol Royal Infirmary Inquiry in 1998. It evaluated the reasons of deaths of 30 infants in cardiac surgery unit.

The concept of LC states that a procedure is safer and more efficient if the surgeon performs in higher numbers and this progress can be plotted on a graph.[7]

The relevance of this study is to find out that at what point in the LC a surgeon can do a procedure efficiently, safely, and independently within a standard acceptable operative duration.

Our aim of this study was to observe the LC for laparoscopic e-TEP repair for inguinal hernia.

The primary objective of this study was to determine the mean operating time (OT) whereas secondary objectives were to assess the complications and the rate of early discharge along with the progressing LC (Fig. 1).

Methodology

Medical records of 42 patients scheduled for laparoscopic e-TEP repair for inguinal hernia were retrospectively analyzed from July 2018 to Feb 2023 in a tertiary care teaching and training government medical institute of North India. The surgeon had basic laparoscopic surgery experience of 10 years and a fellowship of laparoscopic hernia surgery.

Inclusion and Exclusion Criteria

After clinicoradiological confirmation of inguinal hernia, patients with complete or incomplete unilateral inguinal hernia and recurrences were included, complicated hernia and bilateral hernia were excluded.

Method and Data Collection

A 15 × 15 cm sized light-weight Proline mesh was used in all cases and were operated by single surgeon with same team. Standard

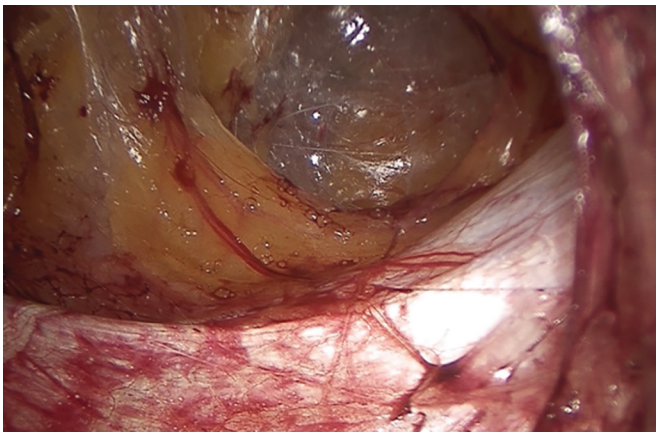

Fig. 3: Preperitoneal (starting with retrorectus) space creation

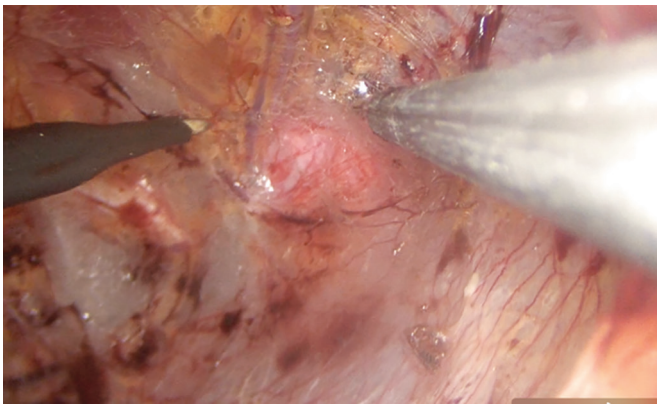

Fig. 4: Dissection in preperitoneal space

e-TEP access was created via an approximately 12 mm incision, placed high in the upper lateral quadrant of the abdomen, about 5 cm cephalad and 4 cm lateral to the umbilicus on the ipsilateral side, as described by Jorge D. Other two working ports placement was done as per convenience (Figs 2 to 5). All the procedures were carried out under general anesthesia by the same surgeon. Informed consent was taken; data were collected from previous

medical records of patients operated using the eTEP method from the same surgeon. Besides, various demographic data were collected such as age, sex, body mass index (BMI), umbilicus to pubic symphysis distance, Direct/indirect inguinal hernia, complete/incomplete hernia, and size of defect [ultrasonography (USG) measurement]. In addition to that OT, postoperative duration of stay, and complications such as bleeding and peritoneal rents were also noted. The surgeon's competency was evaluated by the OT (moving average curve and LC by cumulative sum (CUSUM) frequency of complications and length of hospital stay.

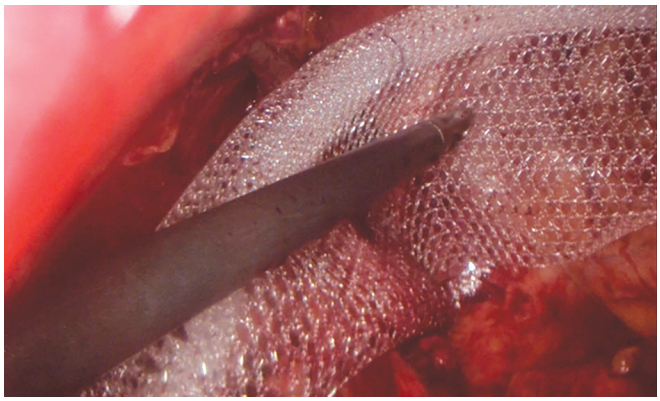

Fig. 5: Mesh fixation

Learning Curve and Cumulative Sum Analysis

Evaluation of the LC for OT was done by the moving average curve (Fig. 6) method and CUSUM analysis (Fig. 7).[8] The moving average curve was constructed for the OT for all the 42 patients. CUSUM analysis was the cumulative mean difference of the OT, and the gradient of this ascent indicates that individuals' performance improves at a great pace and this part of the curve may show stepwise ascent as individuals learn and master stages of a complex procedure. The points where the curve changes its course indicates the next phase of learning. Based on Figures 6 and 7, there are a total of three phases of the surgeon. Phase I is from 1 to 13, phase II from 14 to 28, and phase III from 29 to 42.

Data Analysis

The data was analyzed using statistical package for the social sciences (SPSS), version 24.0. Descriptive parameters such as

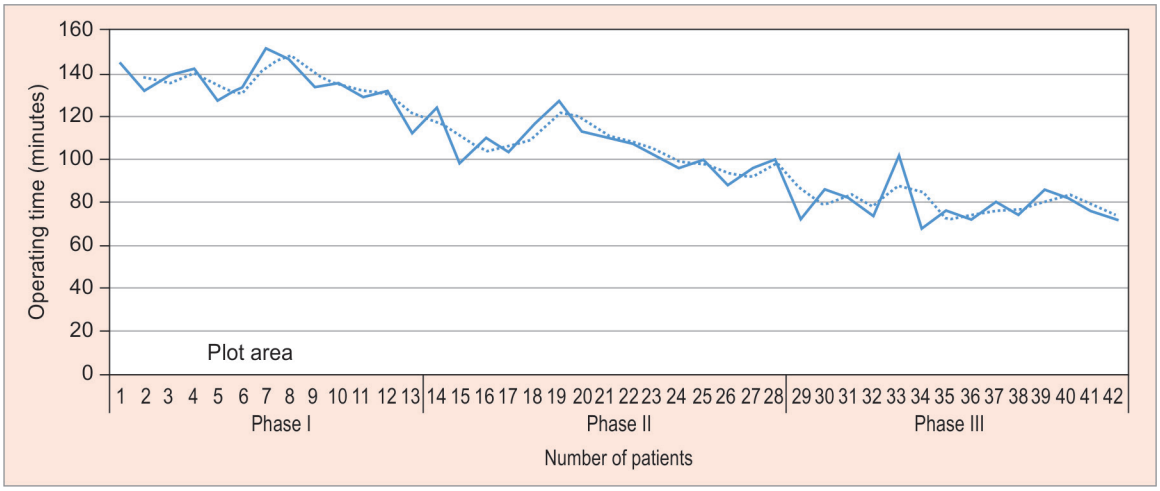

Fig. 6: Moving average curve for operating time (OT)

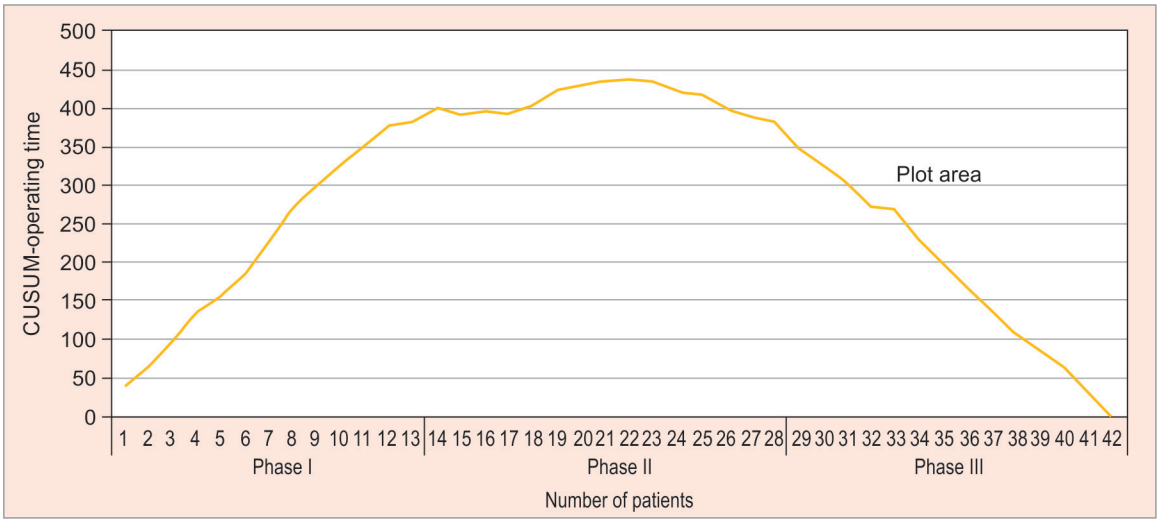

Fig. 7: Cumulative sum–OT of e-TEP

Table 1: Sociodemographic profile of the study participants

	Total (n = 42)	*Phase I (n = 13)*	*Phase II (n = 15)*	*Phase III (n = 14)*	*p-value*
Age (mean ± SD) years	45.32 ± 7.61	44.78 ± 6.73	46.12 ± 4.35	45.01 ± 7.45	0.830
Sex					
Female (*n*, %)	2 (4.76)	1 (7.7)	0 (0)	1 (7.14)	0.557
Male (*n*, %)	40 (95.24)	12 (92.3)	15 (100)	13 (92.86)	
BMI (mean ± SD)	23.6 ± 3.02	24.5 ± 1.86	23.8 ± 2.76	23.4 ± 2.92	0.540
Comorbidities*					
DM (*n*, %)	9 (21.4)	3 (23.1)	6 (40)	0	–
HT (*n*, %)	9 (21.4)	5 (38.5)	3 (20)	3 (2.4)	
COPD (*n*, %)	7 (16.6)	2 (15.4)	3 (20)	2 (14.2)	
None (*n*, %)	19 (42.5)	4 (30.7)	7 (46.6)	9 (64.2)	
Socioeconomic status					
Lower	17 (40.4)	8 (61.5)	4 (26.7)	5 (35.7)	0.326
Middle	20 (47.6)	4 (30.8)	8 (53.3)	8 (57.1)	
Upper	5 (12)	1 (7.7)	3 (20)	1 (7.2)	
Umbilicus to pubic symphysis distance (cm)	17.23 ± 2.56	17.35 ± 2.23	17.68 ± 2.13	17.03 ± 1.38	0.671

*Multiple comorbidities

frequencies, mean, standard deviation, and graphs were used. Probability (p) was calculated to test statistical significance at the 5% level of significance. The categorical variables were analyzed by Chi-square test whereas the continuous variables were analyzed across the three phases using one-way ANOVA.

Results

Figure 6 depicts the reducing trend of the mean OT with passage of phase I–III. Figure 7 depicts the LC of the surgeon performing e-TEP which is based on the CUSUM analysis. The curve is steep and first increased rapidly with a small plateau phase followed by decreasing phase. Phase I had patients from 1 to 13, phase II had patients from 14 to 28, and phase III had patients from 29 to 42.

There was no statistically significant difference in the mean age, gender distribution and socio-economic status of the study participants in the three phases. The mean BMI of the study participants in the three phases was 24.5 ± 1.86, 23.8 ± 2.76, and 23.4 ± 2.92 kg/m^2 which was statistically insignificant. The umbilicus to pubic symphysis distance was also comparable in the three phases and was non-significant (Table 1).

There was no statistically significant difference in the distribution of the study participants in the three phases according to the type of hernia, sidedness, scrotal descent, repair of recurrent hernia, history of previous abdominal surgery, peritoneal rents, conversion to open, Ileus, hematoma, and early occurrence. Of the 42 patients, 11 required additional port insert, that is, 6, 4, and 1 in phases I–III, respectively, and this was significant. The hernia defect size also varied significantly in the three phases. In phases I–III, it was 1.78 ± 0.98, 2.06 ± 1.47, and 2.98 ± 1.23 cm^2, respectively. The mean OT also decreased significantly with passage of each phase. In phases I–III, the mean OT was 135.38 ± 17.26, 105.06 ± 12.68, and 78.71 ± 10.02 minute, respectively. There was a statistically significant difference in the proportion of patients having estimated blood loss of above 10 mL who underwent e-TEP in the three phases. Maximum duration of hospital stay was observed in the first phase which reduced with passage of each phase and this decrease was statistically significant (Table 2).

Discussion

The minimum number of surgeries required to acquire requisite proficiency of drawbacks and pitfalls that lead to a steady OT and cutback on complication rates is defined as a LC.[3,5,9,10] So, precisely the time essentially needed for the surgeon to grasp a technique or to have complete authority or command of this technique is considered here as LC. In the past few years, with extensive usage of laparoscopic methods in surgery, the window of opportunity to estimate the clinical outcomes based on surgical experience in laparoscopic procedures has opened.[11,12]

Despite there has been a progress from open to laparoscopic procedures, repairing the hernia laparoscopically is challenging, especially who have started this technique recently which is because of the complex anatomy of the site and confined operating field. Therefore, every surgeon starts with a period where they acquire skills and learning. So, a LC is safe, precise and important, as that period of being unskilled is highly related to complications and recurrences.[13,14]

Reduction in OT alone does not add to the experience or mastering of the technique, but non conversion to open repair, usage of no extra ports, no intraoperative or postoperative complications faced, minimal blood loss and no recurrences post-surgery. All these together add on the skill and mastering the technique for a surgeon. So, in this study significant reduction in the OT along with decrease in the complications and failure rates was considered as the main factor to determine the LC and phases of a surgeon performing e-TEP.

Early literature has shown a varied range of patients from 80–400, for a surgeon to become an experienced and skilled in TEP.[5,10,15] In a Cochrane review, it was suggested that at least 30–100 TEP operations were needed as critical threshold to master the technique for inguinal hernia.[16,17]

Table 2: Comparison of perioperative data of the study participants in the three phases

Parameters	*Total (n = 42)*	*Phase I (n = 13)*	*Phase II (n = 15)*	*Phase III (n = 14)*	*p-value*
Hernia type					
Direct	13 (30.9%)	4 (30.7%)	5 (33.3%)	4 (28.5%)	0.975
Indirect	29 (69.1%)	9 (69.3%)	10 (66.6%)	10 (71.5%)	
Sidedness					
Right	23 (54.7%)	9 (69.3%)	8 (53.3%)	6 (42.8%)	0.385
Left	19 (45.3%)	4 (30.7%)	7 (46.6%)	8 (57.2%)	
Scrotal descent present	7 (16.6%)	3 (23.8%)	2 (13.3%)	2 (14.3%)	0.755
Repair of recurrent hernia	4 (9.5%)	1 (7.6%)	0	3 (21.4%)	0.140
History of previous abdominal surgery	2 (4.8%)	1 (7.6%)	1 (6.6%)	0	0.587
Additional port insertion	11 (26.2%)	6 (46.2%)	4 (28.6%)	1 (7.1%)	**0.049**
Hernia defect size (cm^2)	2.45 ± 1.98	1.78 ± 0.98	2.06 ±1.47	2.98 ± 1.23	**0.042**
Peritoneal rents	10 (23.8%)	5 (38.4%)	4 (28.6%)	1 (7.1%)	0.153
Conversion to open	1 (2.4%)	1 (7.6%)	0	0	0.319
Mean OT (minutes)	106.02 ± 38.96	135.38 ± 17.26	105.06 ± 12.68	78.71 ± 10.02	**0.0001**
Estimated blood loss (>10 mL)	8 (19.4%)	6 (46.2%)	2 (13.3%)	0	**0.004**
Length of hospital stay (hours)	32.63 ± 10.65	36.03 ± 4.28	32.12 ± 6.24	27.57 ± 5.39	**0.001**
Ileus	2 (4.7%)	1 (7.6%)	1 (6.6%)	0	0.587
Hematoma	4 (9.5%)	3 (23%)	1 (6.6%)	0	0.111
Early recurrence	1 (2.4%)	1 (7.6%)	0	0	0.319

Bold values indicates statistically significant of *p*-value

On observing the LC obtained in our study, learning was divided in three phases. Phase I had 13 patients, phase II had 15 patients, and phase III had 14 patients. The mean OT in our study was 135.38 ± 17.26, 105.06 ± 12.68, and 78.71 ± 10.02 minutes in phases I–III of the LC. This difference in mean OT was highly significant among the 3 phases ($p = 0.0001$). Similarly in another study, gaining experience gradually decreased the mean duration of surgery significantly ($p < 0.001$); there was plateau obtained after 60 cases of mean time of 28 minutes. The mean duration of stay in hospital was 0.97 days, plateau phase after 20 cases.[3]

Park YY et al., divided the study period in three phases from CUSUM learning graphs: Operating time-phases I (from the first to 32nd), II (from 33rd to 83rd), whereas the third phase comprised from 84th to 172nd patients. The mean OT time was statistically reduced in the three OT phases (64.6 vs 50.8 vs 35.2 minutes; $p < 0.001$). This study calculated the LC on a special surgery, that is, single-incision laparoscopic totally extraperitoneal repair (SILTEP) which is another complex laparoscopic technique.[18] Similarly, significant reduction in mean OT was seen in other studies as well, with the progress in the learning phases.[3,9,19] The total skin to skin time duration of initial cases was significantly improved in the later part of our study due to expansion in the confidence and enhanced familiarity with the regional anatomy.

The intricate complications in the peri operative time seen in our early phase were same as published by other authors with difference in proportions may be due to the minute difference laparoscopic procedure dealt with and difference in the sample size.[3,9] The reduction in the complications in the later phases were seen in all the studies including ours. Conversion rates 2.3% and early recurrence were also not significant in our study ($p = 0.319$) as only one patient had recurrence and one conversion to open and that too in the initial phase.

In an another research, Mathur and Lin concluded that there was a stability in the mean operative time after 18 cases with a repeat increase in between 51 and 61 cases, falling there on.[20] The conversion rate shown was about 1.3% whereas the recurrence rate was 2%. Contrary to ours they included bilateral hernias and only irreducible ones were excluded. Another study by Cjhoi YY et al. evaluated the performance of a single inexperienced surgeon (the surgeries were carried out without any supervision). He reported that after 60 cases, there was a stability in the operative time, with a 0.8% conversion to open rate and 0.4% recurrence rate.[3] In this study, only bilateral cases were excluded whereas patients who had abdominal surgery and those having recurrent hernia were included in the study like ours but all operations were TEP.

One more study speculated that there was a safe outcome in TEP procedure after 40 cases when comparing experiences of different surgeons.[10] They concluded that highly significant reduction in conversion rates were seen after 40 cases. The difference in inclusion criteria and technique of surgery creates a void in comparing these studies objectively as per the LC as in our study, cases were performed by a single surgeon, who was already experienced in TEP which made advancing to e-TEP a little easier.

This study had some limitations which includes its generalizability to variation in expertise of surgeons and backgrounds. Since the data were collected retrospectively by review of the medical records, postoperative pain evaluation was not possible and also as the surgeon had experience in TAPP and few cases of TEP before starting of e-TEP which may not be generalizable to all.

Conclusion

This study showed the LC (for operative time and surgical failure) for e-TEP using CUSUM analysis. It is estimated that for a surgeon already having experience in laparoscopic inguinal hernia surgery, minimum 42 cases are needed to overcome the LC for e-TEP with average operative time of 78.71 ± 10.02 minutes.

Clinical Significance

For inguinal hernia, because of easy port setup, wider view, easy maneuverability, easy intracorporeal suturing and short LC, e-TEP can be mastered by every surgeon who deals with inguinal hernia.

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ORIGINAL ARTICLE

Study of Complications of Laparoscopic Cholecystectomy at Teaching Institute

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Abstract

Introduction: The gold standard surgical procedure for treating cholelithiasis has been cholecystectomy. The situation with regard to surgical management of gallstones (GS) has significantly changed with the advent of laparoscopic cholecystectomy. This laparoscopic approach has several theoretical advantages, such as lower hospitalization and recovery costs, pain reduction, avoiding large incisions for better cosmetic results, and quicker return to work following surgery. Recent trials indicate a rise in occurrence of operative complications, particularly common bile duct (CBD) injury, despite early promising results. Laparoscopy use is further restricted by costly equipment, specialized training requirements, and a protracted learning curve.

Materials and methods: This study was done at MGM medical college and Hospital, Navi Mumbai, from August 2010 and September 2012. Fifty patients admitted in OPD and emergency department from the Department of Surgery fulfilling the inclusion and exclusion criteria were included in the study. After complete investigations and with written informed valid consent, patients were subjected to laparoscopic cholecystectomy. The duration of postoperative pain from the day of surgery including mild pain to severe pain and the number of postoperative days with postoperative pain and number of days of analgesia required were noted and documented for further comparison.

Results: Time taken for operation was significantly longer in the laparoscopic cholecystectomy group ($p < 0.001$). Postoperative stay is less and faster recovery requirement of analgesics is also less in laparoscopic cholecystectomy group of patients.

Conclusion: Laparoscopic procedure can be feasible in patients with acute cholecystitis with steep learning curve. Biliary duct injury is a common complication in laparoscopic procedure. Operating time is more in case of laparoscopic cholecystectomy group.

Keywords: Cholecystectomy, Cholelithiasis, Complications, Laparoscopic, Surgery.

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Introduction

In northern India, gallstones (GS) are a common occurrence. Gallstones were present in up to 16 and 29% of women over the ages of 40–49 and 50–59, respectively.[1] There are many more patients with asymptomatic GS than those with symptomatic gallstone disease (GSD). According to a number of studies done on dead people, the majority of GS are asymptomatic. Merely 14% of the individuals with GS had undergone cholecystectomy over a 10-year period in a study of 9,332 postmortem reports, suggesting that as many as 86% were asymptomatic.[2] Although, many different approaches of treating GS have been developed, they have not proven to be effective. Cholecystectomy has long been the preferred surgical procedure for treating cholelithiasis. The situation regarding the surgical care of cholelithiasis has significantly changed with the introduction of laparoscopic cholecystectomy. It has created new opportunities for gallstone management. The laparoscopic technique has several theoretical advantages, such as lower hospitalization and recovery costs, pain reduction, avoiding major incisions for better cosmetic results, and quicker return to work following surgery. Recent trials indicate a rise in the prevalence of operational complications, particularly common bile duct (CBD) damage, despite early positive outcomes. Laparoscopy utilization is further restricted by costly equipment, specialized training requirements, and a protracted learning curve. This has caused many people to reflect deeply and make multiple attempts to weigh the benefits and drawbacks of laparoscopic cholecystectomy.[3] Laparoscopic removal of the gallbladder has been reported to be somewhat contraindicated by prior abdominal surgery. The reason of this study was to precisely check how prior intra-abdominal surgery affected the safety and viability of laparoscopic cholecystectomy. The open conversion rates, duration of hospital stay, intraoperative and postoperative complications, and operating timeframes of 1,638 patients undergoing laparoscopic GB removal data were all analyzed. Of the 1,638 study participants, 473 (28.9%) had 58 upper and 415 lower abdominal surgeries in the past. The 262 individuals who had only had an appendectomy in the past were not included in the analysis. In patients who had undergone upper, lower, or no prior abdominal surgery, adhesions were discovered in 70.7, 58.8, and 2.1% of instances, respectively. Adhesiolysis was necessary in 78, 30,

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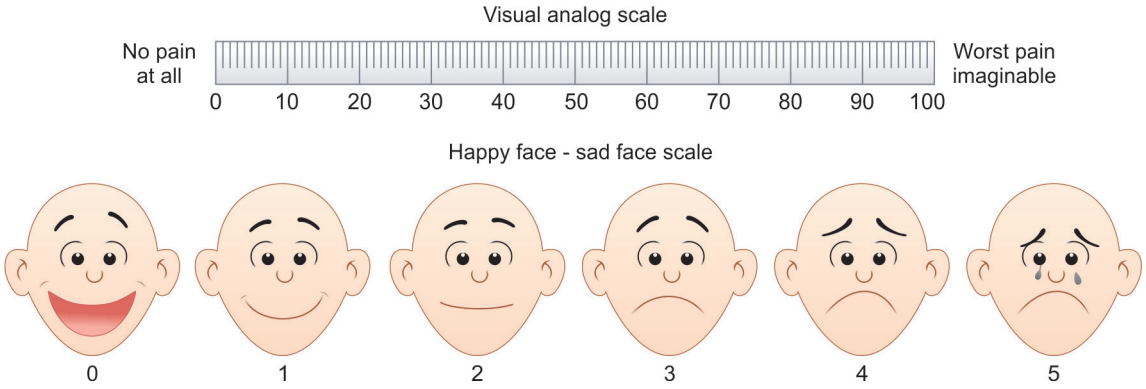

Fig. 1: Visual analog scale

and 0% of these cases, adhesiolysis was not the direct cause of any complications. Patients who had underwent lower abdominal surgery in the past and those who had not previously undergone abdominal surgery had shorter operating times, higher open conversion rates (19%), higher incidences of postoperative wound infections (5.2%), and longer postoperative stays (3.4 ± 2.1 days). The study's withdrawn conclusions indicated that a prior upper abdominal surgery has been associated with longer duration of stay following surgery, a higher open conversion rate, a longer need for adhesiolysis, a longer operating time, and a higher incidence of wound infection. Some studies also show that, upper abdominal surgery is also linked with characteristic changes in lung function which adds the risk of collapse of lower lobe. According to published research, the conversion rate for laparoscopic gallbladder removal in skilled hands can range from 3 to 15%. Generally, conversion rate is common in patients with acute cholecystitis because of dense adhesions and unclear or aberrant anatomy. Some investigators conducted studies to investigate the causes of conversion of laparoscopic cholecystectomy to open cholecystectomy procedure and found that inflammation was to be the main factor influencing conversion rate. In 7.8% of cases, intraoperative bile duct stones that had not been suspected were found. The most significant potential predisposing factor for the 401 bile leaks (BL) and 561 major bile duct injuries (BDI) that were documented was acute or chronic inflammation.

A new era of surgical treatment has begun with the recent surge in the use of laparoscopic and other minimal access surgeries, which is having a significant impact on surgical management.

Hence, the above study was conducted to study the complications of laparoscopic cholecystectomy at teaching institute.

Materials and Methods

Fifty patients with GS who got admitted to Hospital Navi Mumbai and MGM Medical College between August 2010 and September 2012 are included in the study. Before starting the study, the Institutional Ethical Committee granted all the required ethical permissions.

Inclusion Criteria

Patients with acute and chronic cholecystitis, asymptomatic GS, and asymptomatic GS in particular situations, such as diabetes and hemolytic anemia, who were willing to provide written consent for the procedure after being fully informed about the cost, the patient's co-morbidities, etc., were included in the inclusion criteria. Patients had were between the ages of 25 and 65.

Exclusion Criteria

Exclusions from the study included being <25 years old or >65 years old, having choledocholithiasis, or not being prepared to provide written consent for the procedure.

Several patients who had come to the hospital's EM Department complaining of severe abdominal pain were admitted. Patients with acute abdominal pain and a variety of dyspeptic symptoms from the emergency room and surgical outpatient department participated in a hospital-based study. A complete medical history was taken, along with an examination to rule out other possible causes of the patient's dyspepsia and acute abdominal pain. Basic blood investigations were also performed, including CBC, BSL, LFT, urine, blood urea, serum creatinine, chest X-ray, ECG, and USG. After the diagnosis of GSD was confirmed, the patients were chosen for the laparoscopic cholecystectomy procedure based on inclusion and exclusion criteria. Laparoscopic cholecystectomy cases that suffered intraoperative hemorrhage or damage to the CBD were turned into open surgery cases. The length of the procedure, the use of postoperative analgesics, intraoperative complications (such as CBD injury and intraoperative bleeding), and postoperative complications (such as surgical wound infection, surgical wound dehiscence, postoperative intra-abdominal infection, postoperative ileus, and postoperative pancreatitis pulmonary complications, such as lower lobe atelectasis, cardiac issues, and death) were all examined in relation to each patient. The visual analog scale (VAS) is used to measure and record the degree of postoperative pain (Fig. 1).

The day of surgery is considered as zero and the day of discharge is considered as last day of postoperative hospital stay. Data were collected and documented in Microsoft Excel worksheet for further reference of the study.

Results

Eight (16%) of the 50 patients had acute cholecystitis when they first arrived, but the majority of them had chronic cholecystitis when histopathology confirmed the diagnosis. Thirty-five patients (70%) had no symptoms and an ultrasonography revealed one or more gall bladder calculi. Seven patients, or 14%, had chronic cholecystitis. Under general anesthesia, all patients underwent elective surgeries (Table 1).

Table 1: Clinical presentation

Clinical presentation	*No. of patients*	*% of patients*
Asymptomatic	35	70
Acute cholecystitis	8	16
Chronic cholecystitis	7	14

Table 2: Operation duration

Type of operation	*Time duration (range) (Min)*	*Mean-operation time (Min)*	*Std deviation*
Laparoscopic gall bladder removal	50–175	103.98	34.8756

Table 3: Pain duration

Type of operation	*Pain duration in days (range)*	*Pain duration in days (mean)*	*Std deviation*
Laparoscopic GB removal	0–4	1.49	1.443

Table 4: Use of analgesics

Nature of surgery	*No. of days of analgesia required (Range)*	*Mean no of days analgesia required*	*Standard deviation*
Laparoscopic GB removal	0–4	1.49	1.443

Table 5: Postoperative hospital stay

Nature of operation	*Minimum postoperative hosp. stay (days)*	*Maximum postoperative hosp. stay (days)*	*Mean postoperative hospital stay (days)*	*Standard deviation*
Laparoscopic cholecystectomy	2	6	3.7	1.2495

The median (range) operating time for laparoscopic gallbladder removal was 50–175 minutes (mean = 103.98 min) (Table 2).

The pain duration for laparoscopic cholecystectomy was 0–4 days (mean = 1.5 days) (Table 3).

Number of days of analgesia required were 0–4 days (mean = 1.5 days) (Table 4).

The duration for postoperative hospital stay was, minimum for 2 days and maximum for 6 days (mean = 3.7) (Table 5).

"Unnecessary risks are avoided and laparotomy is performed in all cases in which the anatomy is unclear and complications which cannot be controlled laparoscopically," states the institutes policy with respect to indication for conversion. Out of the 50 patients who were initially scheduled for a laparoscopic cholecystectomy, three underwent an open cholecystectomy instead of a laparoscopic procedure (Table 6). One case of intraoperative hemorrhage and two cases of CBD injury resulted in the conversion of laparoscopic GB removal to open surgery. The remaining laparoscopic cholecystectomies went without incident.

Discussion

Fifty patients underwent laparoscopic surgery for our study. Due to CBD damage, 2 of the 50 lap cholecystectomies were changed to open procedures, and one case was altered due to intraoperative hemorrhage. Bile duct damage is rarely the cause of death in patients who undergo laparoscopic cholecystectomy, according to observations. The mortality rate in our series is zero.

In skilled hands, laparoscopic cholecystectomy conversion rates can range from 3 to 15%. With a 6% conversion rate in our series, only 2 cases—1 from intraoperative hemorrhage and 1 from CBD injury—were converted to open procedures. For open cholecystectomy, the incidence of bile duct damage ranges from 0.1 to 0.2%, while for laparoscopic cholecystectomy,[4–7] it ranges from 0.3 to 0.6%.[4,7–10] Dense adhesions in the upper abdomen and GB wall necrosis, which prohibits holding and retracting with a grasper, are the two most common causes of conversion. Most common factors for risk for conversion are males, obese pts, cholecystitis (after 48–72 hours of beginning of symptoms), and CBD stones. Complications including cystic artery injury, intraoperative bleeding, CBD injury, bowel injury, and others (such as gall bladder perforation, intraoperative bile leakage, trocar injury, cautery injury) are the main causes of the switch from laparoscopic to open surgery. Acute cholecystitis with adhesions, gangrenous gall bladder, empyema gall bladder, gall bladder cancer, liver tumors, choledochoduodenal fistula, intrahepatic gall bladder, and acute pancreatitis are among the operational findings. Most open conversions take place after a simple examination or a minimal dissection, and rather than being seen as a failure, the decision to convert should be seen as an indication of surgical maturity. Six Vecchio et al.[8] (1998) reported that the conversion rate was 2%.

According to Butt et al.,[9] Guraya et al.,[10] Southern Surgeons Club[11] and others, the conversion rate of the patients was discovered to be 4, 2.9, and 4.7%, respectively, in their respective studies. The conversion rate in our study was 6%.

The mean operative time for laparoscopic surgery in our study was 103.98 minutes, which is a significantly longer period of time. Laparoscopic surgery has a lengthy learning curve, which could account for this noticeable discrepancy. The above table shows the comparison of laparoscopic cholecystectomy times between the investigators' studies. Between 0 and 4 days following a laparoscopic cholecystectomy, analgesics were found to be required (mean number of days: 1.5 days). For the purpose of relieving shoulder tip pain resulting from diaphragmatic irritation brought on by C02 pneumoperitoneum, the pts in the lap group needed analgesic medication after operation (Table 7).

The decreased hospital stay associated with laparoscopic cholecystectomy shows one of its main benefits. In this series, we encounter a mean postoperative hospital stay for laparoscopic cholecystectomy which is of 3.7 days. The data can be compared with those of other published series in Table 8. Faster recovery and decreased postoperative stay decreased the cost but higher OT expenses and costly equipment's raised overall total cost.

Complications

The current series found that the rate of complications following laparoscopic cholecystectomy was 24% (with 3% occurring intraoperatively and 9% occurring postoperatively). In a Toronto

Table 6: Complication encountered during procedure

Complications	*Laparoscopic cholecystectomy*
Wound infection	3
Bleeding intraoperatively	1
Burst abdomen	0
Abdominal infection	0
CBD injury	2
Acute pancreatitis	1
Post-op ileus	3
Respiratory problems	2
Heart problems	0
Death	0

Table 7: Operative times between various series

Series	*Mean operative time open cholecystectomy (min)*	*Mean operative time laparoscopic cholecystectomy (min)*
CH Chau et al.[12]	84.8	92.2
Lujan et al.[13]	77	88
Gupta et al.[14]	41.89	66.28
Our study	70	103.98

Table 8: Compares hospitalization period of different published studies

Series	*Laparoscopic cholecystectomy*
CH Chau et al.[12]	7.1 days
Lujan et al.[13]	3.3 days

group study, Barkun JS et al.[15] also noted that there were noticeably fewer complications with laparoscopic cholecystectomy than with open cholecystectomy. Laparoscopic surgery may have a higher risk of morbidity and death for older patients, most of them have decreased cardiopulmonary reserves.[16] Theoretically, lap cholecystectomy may exacerbate cardiac issues because of the intra-abdominal pressure and head-up position, which can cause blood to pool in the legs, decreased venous return, hypotension, and a higher risk of venous thrombosis.

When inhaled gas pressure is increased, carbon dioxide (CO_2) can directly affect the heart and lungs. Desmet reported that the blood's absorption of the injected CO_2 resulted in elevated arterial pCO_2 and decreased pH: Arrhythmia was caused by the elevated pCO_2, usually in patients having laparoscopic surgery. Longer recovery times are one potential drawback of laparoscopic cholecystectomy acute cholecystitis cases.[14] The question of whether the extended operating and anesthetic times have any effects has been raised. First, the availability of cutting-edge laparoscopic instruments and the surgeon's experience determine how long a procedure takes. The second factor is the surgeons' growing laparoscopic surgical experience.[17]

Bleeding at the trocar site, bleeding from the liver bed, spilled GS, biliary leaks, bile duct injury, late postoperative strictures, and bowel injury are a few of the frequent side effects of laparoscopic cholecystectomy. Two cases in the group undergoing laparoscopic cholecystectomy were linked to bile duct damage, which was discovered during the procedure and required open surgery to perform a biliary bypass. Another issue with laparoscopic cholecystectomy in acute cholecystitis cases is bile duct damage. Injuries to the bile duct occur 0.3–0.6% of the time following laparoscopic cholecystectomy.[16–19] Early studies reported a higher incidence of CBD injury in cases of acute cholecystitis.[5,20] Mistaking the CBD for the cystic duct is the very frequent cause of significant bile duct damage. The CBD is put at risk when the cystic duct becomes edematous, shortened, and occurs in close proximity to it due to acute cholecystitis. But with more understanding and practice, the risk of serious bile duct damage during a laparoscopic cholecystectomy for acute cholecystitis is not significantly higher than it is for elective surgery.[21]

Conclusion

Although laparoscopic procedures have a high learning curve, they can be useful for patients with acute cholecystitis. Therefore, in order to lower the number of complications, all residents in a teaching institute are recommended to undergo specialized training in laparoscopic surgery, which includes simulation training. Biliary duct injury is a common side effect of laparoscopic procedures, primarily due to misidentification of the CBD as the cystic duct. Because of their high learning curve, the group having laparoscopic cholecystectomy had longer operating times.

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ORIGINAL ARTICLE

Diagnostic Laparoscopy for Chronic Pelvic Pain after Hysterectomy: A Nonrandomized Control Study from North India

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Abstract

Background: Chronic pelvic pain (CPP) following a surgical procedure has been reported to affect a significant number of patients and is associated with a decreased quality of life.

Objective: To evaluate CCP laparoscopically in patients who had previously undergone hysterectomy for benign lesions.

Materials and methods: A multicentric study conducted over a period of 8 years. The study group included 88 females with posthysterectomy CPP of more than 8 months in whom a definitive diagnosis was either not reached or was in doubt despite thorough clinical and radiological investigations. Fifty-four patients agreed to the procedure while 34 patients were treated conservatively. Baseline characteristics, subjective pain relief, and overall patient satisfaction were compared between the two groups.

Results: The mean age of the patients, body mass index (BMI), duration of symptoms, preoperative visual analog scale (VAS) for pain, and primary approach for hysterectomy were found to be statistically insignificant between the operative and conservative groups ($p > 0.05$). The most common indications for previous hysterectomy in both groups were dysfunctional uterine bleeding and leiomyoma. The most frequent findings at diagnostic laparoscopy were adhesions (53.70%), cystic lesions of preserved functional ovary (22.22%), and hydro/pyosalpinx (9.25%). Ten (18.51%) patients did not reveal any obvious positive finding. Adhesiolysis and ovarian cystectomy were the most frequently done procedures. Laparoscopic diagnosis was confirmed by histopathology in most of the patients. Improvement in VAS score was more significant in the operated group than in the conservative group.

Conclusion: Diagnostic laparoscopy is an effective and accurate tool to evaluate CPP after gynecological surgery apart from being an excellent approach for therapeutic interventions.

Keywords: Chronic pelvic pain, Diagnostic laparoscopy, Hysterectomy.

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Introduction

Chronic pelvic pain (CPP) can be defined as constant or intermittent lower abdominal or pelvic pain, not related to the menstrual cycle lasting for a duration of at least 6 months and is severe enough to cause functional disability which may require medical or surgical treatment.[1] The prevalence of CPP varies between 12 and 39% of the reproductive age group women.[2] Several studies have demonstrated that a number of surgical procedures like amputations, thoracotomy, mastectomy, and inguinal herniorrhaphy per se may cause chronic or long-lasting pain in about 6–7% of cases. Various risk factors suggested as a cause of chronic postsurgical pain include the type of surgery, initial preoperative pain, acute postoperative pain, psychological factors as well as genetic factors.[3]

About 10% of gynecological patients attending outpatient departments (OPDs) have CCP as their primary symptom, out of which exploratory laparoscopy is indicated in 40% of these women, but to what extent specifically a gynecologic surgery in itself is responsible for chronic pain has been barely studied.[1,4–6] Chronic postoperative pain of varying degrees has been reported to affect 4.7–31.9% of women following hysterectomy. Chronic pelvic pain is associated with a decreased quality of life in them as well as poses a significant clinical challenge to be managed adequately.[4,7] The objective evaluation of chronic abdominal or pelvic pain is a difficult task as the clinical signs are either inconclusive or even completely absent. Most of the patients are treated symptomatically without sufficient assessment and many are referred to as a somatoform disorder by a psychiatrist.[8]

Laparoscopy has been proven to have a crucial role in diagnosis as well as for treatment in selected patients with chronic abdominal

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Table 1: Basic demographic data, primary indication and previous procedures

Baseline characteristics	*Diagnostic laparoscopy group (n = 54)*	*Conservative group (n = 34)*	*p-value*
Mean age in years (range)	45 (31–63)	47 (34–71)	0.8771
Mean BMI (kg/m^2) (range)	24.7 (17.1–36.2)	23.9 (16.9–37.6)	0.6792
Mean duration of CPP in months (range)	16 (8–38)	18 (8–36)	0.3423
Mean VAS and SD (range)	6 ± 0.355 (4–9)	5.05 ± 0.63 (3–9)	0.4135
Mean follow-up period in months (range)	8 (6–10)	9 (6–12)	0.5616
Primary indication for hysterectomy			
Dysfunctional uterine bleeding	20 (37.03%)	12 (35.29%)	0.8197
Leiomyoma (fibroids)	15 (27.77%)	9 (26.47%)	0.7870
Adenomyosis	9 (16.66%)	7 (20.58%)	0.1251
Endometriosis	6 (11.11%)	4 (11.76%)	0.9915
Uterine prolapse	2 (3.70%)	1 (2.94%)	0.7694
Cervical dysplasia	1 (1.85%)	1 (2.94%)	0.1416
Emergency cesarean hysterectomy	1 (1.85%)	0 (0.00%)	0.0000
Primary approach for hysterectomy			
Conventional open hysterectomy	31 (57.40%)	19 (55.88%)	0.7549
Vaginal hysterectomy	10 (18.51%)	6 (17.64%)	0.9897
Laparoscope-assisted vaginal hysterectomy	8 (14.81%)	6 (17.64%)	0.3628
Total laparoscopic hysterectomy	5 (9.25%)	3 (8.82%)	0.7960

disorders, whose diagnosis remains uncertain, despite exploring the requisite laboratory and imaging modalities. Presently, less than 20% of population in the developing countries have access to ultrasound, computerized tomography (CT), magnetic resonance imaging, Doppler, or other imaging modalities. Paradoxically, at present, vast areas of the developing world have access to a laparoscope, which currently remains true at most private as well as at the government district and subdistrict level hospitals in Kashmir, India.[9]

The current study is aimed at laparoscopic diagnostic evaluation of CCP in patients who had undergone hysterectomy for benign lesions. The outcome of concurrent laparoscopic therapeutic interventions is also evaluated.

Materials and Methods

This multicentric study was conducted from June 2011 to March 2019 at three hospitals (Government Subdistrict Hospital, Guru Multispecialty Hospital, and Government SKIMS-MC Hospital) in Kashmir, India. The study group included a total of 88 females who had previously undergone hysterectomy for proven benign lesions and had a history of postsurgical CPP of more than 8 months duration. Basic demographic data, primary indication, and previous procedures were noted. Despite thorough general physical and systemic examinations, routine laboratory investigations, abdominal and transvaginal ultrasonography and in some cases, CT-scan, a definitive diagnosis was either not reached or was in doubt. All these patients with uncertain diagnoses were advised diagnostic laparoscopy for clarification and possibly treatment for their CPP. While fifty-four patients agreed to the procedure, the other 34 patients either refused or were unfit for surgery and were given conservative treatment and were followed regularly.

Diagnostic laparoscopy was performed using a high-definition camera, connected to a Hopkins II 30° telescope. High-definition 32″ monitor was used for video display. The pneumoperitoneum was created by the open method by a supraumbilical or subumbilical incision using the umbilical cicatrix tube. An umbilical port (10 mm) was used for the camera while two working ports (5 mm) were placed according to the base-ball diamond configuration for exploration of the target area and therapeutic intervention. An additional 5-mm port was used for retraction whenever required.

The details of intraoperative findings and therapeutic procedures done were recorded. Three patients had concurrent ultrasound-documented gallstone disease which was taken care of at the same surgical setting. All the patients were followed for a minimum period of 6 months and the primary outcome of subjective pain relief as per VAS score (0–10) was compared at 1, 3, and 6 months with the patients who were treated conservatively. Other parameters studied were overall patient satisfaction, recurrence or worsening of pain, recurrence of the disease process after laparoscopic management, and histopathological analysis of the surgical specimen.

Written and informed consent for publication of the identifiable details if any was obtained from the patient/study participant/parent/guardian. To calculate the *p*-value, Fisher's exact test, and Pearson's Chi-square test were applied to compare the frequencies for categorical parameters, and the unpaired *t*-test was used to compare the means (two tailed) among continuous variables. The results were calculated on a 95% confidence interval. A *p*-value below 0.05 was considered statistically significant.

Results

In the study group of 88 patients with CPP, 54 of them were subjected to diagnostic laparoscopy, while the other 34 patients were treated conservatively. The mean age of the patients, BMI, duration of symptoms, the preoperative VAS for pain, and follow-up period are depicted in Table 1, which were found to be statistically insignificant between the operative and conservative groups ($p > 0.05$). The most common indication for hysterectomy in both groups was dysfunctional uterine bleeding and leiomyoma (fibroids) in a total of 32 (36.36%) and 24 (27.27%) patients, respectively. Also, no significant difference in the primary approach for hysterectomy was noticed between the laparoscopy and conservative groups (Table 1). The initial procedures, irrespective of the approach,

Table 2: Findings at diagnostic laparoscopy and therapeutic interventions done

Laparoscopic findings	*Number of patients (N = 54)*	*Laparoscopic procedures done*
Ovarian cyst of preserved functional ovary	12 (22.22%)	Ovarian cystectomy/salpingo-oophorectomy*
Endometriosis		
Peritoneal	1 (1.85%)	Excision of endometriosis*
Ovarian	3 (5.55%)	Ovarian cystectomy*
Retention cyst due to adhesions	2 (3.70%)	Deroofing and drainage*
Hydrosalpinx/pyosalpinx	5 (9.25%)	Salpingo-oophorectomy*
Isolated adhesions		
Omental	13 (24.07%)	Adhesiolysis
Ileal	1 (1.85%)	Adhesiolysis
Tubal	1 (1.85%)	Salpingectomy
Band	1 (1.85%)	Division
Chronic/recurrent appendicitis (dense adhesions in the RIF and/or thickened appendix)	3 (5.55%)	Appendectomy*
Tuberculosis	1 (1.85%)	Biopsy of lesion and ATT
Inguinal hernia (indirect)	1 (1.85%)	TAPP
No abnormality detected	10 (18.51%)	Nil

ATT, antitubercular treatment; TAPP, transabdominal preperitoneal repair; *Procedures requiring adhesiolysis in some cases

included hysterectomy with bilateral salpingo-oophorectomy in 47 (53.40%) patients who were either above 40 years of age, and/or had a bilateral diseased ovary. Hysterectomy with bilateral or unilateral ovarian preservation was the initial procedure in 41 (46.59%) patients who were less than 40 years of age with one or both ovaries being healthy.

At diagnostic laparoscopy in 54 women, the most frequent finding noted was adhesions in 29 (53.70%) patients which were either isolated (29.62%) or in combination with other pathologies. Cystic lesions of preserved functional ovary were diagnosed in 12 (22.22%), and hydro/pyosalpinx in another 5 (9.25%) patients (Table 2). No obvious abnormality could be detected in 10 (18.51%) patients. Other positive findings included endometriosis, chronic appendicitis, and retention cysts due to adhesions in 4 (7.40%), 3 (5.55%), and 2 (3.70%) patients, respectively. Tuberculosis and unilateral indirect inguinal hernia were diagnosed in each of the patients. Concurrent surgical procedures done were according to the findings at laparoscopy and are shown in Table 2. No complications or conversions to an open approach were needed. All the patients were discharged on the first or the second postoperative days and were regularly followed for at least 6 months.

The VAS scores for pain were compared between the operative and conservative groups at 1, 3, and 6 months after surgery which were found to be statistically significant (Table 3). None of the patients in the laparoscopy group complained of worsening pain, but seven (20.58%) of the patients treated conservatively complained about the same at 6 months. There was no recurrence of the disease process in the operative group with a better overall patient satisfaction rate of 83.33% as compared with the conservative group (23.5%).

Histopathological analysis of ovarian specimens of 20 patients revealed simple cysts in 11, normal ovaries in 4, hemorrhagic cysts in 2, and endometriotic cysts in another 3 patients. Two patients with peritoneal deposits revealed peritoneal endometriosis in one and tuberculosis in another on histopathology. Pseudocyst lining was seen in the cyst wall specimen of two patients confirming a retention cyst. The salpingectomy specimen of 11 patients revealed normal tubes in 2, features of chronic or acute chronic salpingitis in 4, and hydro/pyosalpinx in 5 patients. Histopathological features of chronic appendicitis were noted in an appendicular specimen of all three patients.

Table 3: The VAS score for pain on follow-up

	Mean VAS score with SD		
Postoperative period	*Operated group (n = 54)*	*Conservative group (n = 34)*	*p-value*
1 month	3.96 ± 0.556	4.91 ± 0.593	0.0031
3 months	2.53 ± 0.482	5.08 ± 0.593	0.0006
6 months	2.46 ± 0.482	5.35 ± 0.640	0.0001

Discussion

Accurately diagnosing a CPP is sometimes one of the baffling problems faced by surgeons and gynecologists despite a thorough clinical evaluation. Also detailed biochemical, serological, and imaging techniques may only provide indirect evidence of underlying disorder and therefore, many of the cases remain inconclusive. Laparoscopy is an excellent diagnostic modality that is often underutilized due to risks inherent to surgical procedures. The safety of diagnostic laparoscopy and concurrent therapeutic procedures is well established beyond doubt and with advances in technology and increasing experience, it is being used in diagnosing chronic abdominal or pelvic pain where all other methods have failed.[10] In the current study, the reason for posthysterectomy CPP could be established in 44 (81.48%) patients confirming the previous reports of laparoscopy being a valuable method of evaluation of undiagnosed CPP in women.[11,12] The causes of CCP could not be ascertained in 10 (18.51%) of our patients, which is in accordance with the incidence of negative laparoscopy reported by various authors irrespective of previous surgeries and ranges between 12 and 44%[11] This reflects that even after excluding uterine causes for CPP in our study, the incidence of failure to establish a conclusive diagnosis laparoscopically does not seem to be significantly different from some studies.[10–12]

Intra-abdominal adhesions of variable degrees have been reported as a common cause of chronic pelvic/abdominal pain in a number of studies as was the case in the present study.[11,13–15] Intra-abdominal adhesions can cause chronic abdominal pain by restricting the mobility or the distensibility of the bowel. Omental adhesions to the viscera or parties can also be responsible for varying degrees of chronic abdominal pain. Laparoscopic adhesiolysis significantly reduces chronic abdominal/pelvic pain in nearly 70% of patients with improvement in their VAS scores at follow-up. However, long-term efficacy needs to be proved as the results of previous randomized trials seem to be equivocal.[16]

Excluding gynecological cases, studies from third-world countries report abdominal tuberculosis as the most frequent cause of chronic abdominal pain, but in our study, only one patient was diagnosed with abdominal tuberculosis.[17,18] Pelvic congestion was found to be the cause of CCP in 18.6% of patients in a study by Hebbar S and Chawla C who diagnosed it laparoscopically. The findings included a bulky/boggy uterus with varicosities in the surrounding supporting ligaments of the uterus, the etiology that was already excluded in view of previous hysterectomy in our study group.[11]

Ovarian cysts (follicular/polycystic) of preserved functional ovary/s found in 22.2% of the operative group of this study could at least theoretically explain the origin of pelvic pain. Other possibilities for CCP could be ovarian remnant syndrome and residual ovary syndrome.[19] The former is defined as pelvic pain or dyspareunia associated with the regrowth of residual ovarian tissue after salpingo-oophorectomy, while the latter is described as the presence of persistent pelvic pain or dyspareunia or a pelvic mass after conservation of one or both ovaries at hysterectomy, both of which can be effectively managed by an experienced laparoscopic surgeon.[19,20]

Endometriosis is a growing healthcare problem all around the world commonly affecting women of reproductive age with a very diverse range of presentations including CPP. Pelvic endometriosis is a common laparoscopic finding in patients with CPP.[18,21,22] In the present study, the indication for initial hysterectomy was endometriosis in a total of 10 patients. Six of these patients were subjected to diagnostic laparoscopy which revealed the presence of recurrent endometriotic lesions (ovarian/peritoneal) in 4 (66%) of them. Advanced stages of endometriosis have high recurrence rates where the ovaries were conserved with 6–8-fold risk of recurrent pain and reoperation respectively. The decision between the conservative or operative treatment of these cases largely depends upon taking into consideration the age of the patient and the impact of early menopause on their lifestyle. The recurrence of endometriosis and related symptoms are directly correlated to the surgical precision and complete removal of peritoneal and deeply infiltrating endometriotic lesions so as to keep the risk of recurrence as low as possible.[23]

In the present study, hydrosalpinx/pyosalpinx was diagnosed laparoscopically in 5 (9.25%) patients, the incidence of which probably could have been higher as all patients in our study did not have conserved adnexa at the time of their previous surgery. Chronic recurrent appendicitis has been reported as a cause of chronic abdominal/pelvic pain in 0–40.67% of cases.[10–12,15–18,24] Dense adhesions in the right iliac fossa (RIF) and/or thickened appendix were found in three of our patients which was dealt with appropriately.

Although the VAS scores for pain in our study were significantly better in the operative than in conservative groups at 1, 3, and 6 months after surgery, it did not reach zero-score in all patients (Table 3). It is possible that at times, multiple reasons can be associated with chronic abdominal pain in a single patient and the pelvic pathology seen at laparoscopy may not be the only reason for patient discomfort/pain.[25] Our study also revealed no apparent recurrence of the disease process in the operative group with better overall patient satisfaction rate up to 6 months. More randomized studies with larger sample size and prolonged follow-up is required to further validate the benefits of therapeutic laparoscopy in patients with chronic abdominal/pelvic pain.

Conclusion

The current study suggests that diagnostic laparoscopy is a fairly accurate tool in evaluating patients with posthysterectomy CPP with uncertain diagnosis, as well as has the added advantage of a therapeutic intervention in the same setting in most cases. Diagnostic laparoscopy can be especially useful in evaluating and treating postsurgical chronic abdominal/pelvic pain in patients from the developing nations who may not have access to sophisticated and expensive imaging devices. However, the possible benefits and risks associated with laparoscopy need to be assessed for each woman individually.

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ORIGINAL ARTICLE

Outcomes of a Low-cost, Outpatient Laparoscopic Appendectomy Protocol Performed by First- and Second-year General Surgery Residents in Cases of Uncomplicated Appendicitis

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Abstract

Introduction: Appendicitis is one of the most frequent surgical diseases. In uncomplicated appendicitis, outpatient protocols have been shown to significantly reduce costs and can be replicated by residents. In Colombia, this type of protocol has never been evaluated. The aim of this study was to evaluate the outcomes of a low-cost, outpatient laparoscopic appendectomy protocol performed by first- and second-year general surgery residents in uncomplicated appendicitis.

Materials and methods: A prospective longitudinal study of outpatient management after laparoscopic appendectomy was conducted in Bogotá, Colombia. It included patients with uncomplicated acute appendicitis and excluded those with evidence of perforation, abscess, or gangrenous appendicitis. The frequency of complications, readmissions, and postoperative pain were evaluated as outcomes.

Results: 285 patients were included, with a median age of 28 years and 52.3% ($n = 149$) were female. All patients had modulated pain and tolerance of the oral route during the postoperative period. There were only 10 (3.5%) readmissions and 12 (4.2%) complications, of which 80% ($n = 8$) and 58.3% ($n = 7$) corresponded to the laparoscopic group. On bivariate analysis, no association was found between the frequency of complications and the surgical approach (open vs laparoscopic surgery, $p = 0.10$), the stage of appendicitis (edematous vs fibrinopurulent, $p = 0.14$), or the American Society of Anesthesiologists classification (I vs II, $p = 0.44$).

Conclusions: This study demonstrated that the low-cost outpatient management protocol for uncomplicated appendicitis by laparoscopic appendectomy performed by first- and second-year residents had a low frequency of complications and readmission, with no significant differences compared with open surgery or appendicular phase.

Clinical significance: The findings of this study have important implications for clinical practice. Outpatient postoperative management can reduce healthcare costs and improve patient satisfaction by reducing hospital stays and facilitating earlier recovery. This alternative should be considered for selected patients who meet the criteria for safe and effective care.

Keywords: Ambulatory surgical procedures, Appendicitis, Appendectomy, General surgery, Laparoscopy, Operative surgical procedures.

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Introduction

Acute abdominal pain is the main cause of general surgery consultations in the emergency department (ED). Acute appendicitis stands out as the most prevalent gastrointestinal surgical emergency globally, affecting approximately 6–7% of the global population and comprising 1% of all surgical procedures.[1,2] Laparoscopic appendectomy represents the optimal surgical approach for treating acute appendicitis. It is linked to fewer perioperative complications in comparison to the open technique, offering advantages, such as reduced postoperative pain, lower incidence of surgical site infections (SSI), a shorter hospital stay, and a quicker resumption of normal daily activities.[2,3] Previously, an American surgical program (National Surgical Quality Improvement Program; NSQIP) reviewed 32,000 patients from 2008, showing that hospitalization for uncomplicated acute appendicitis ranged from 1.8 to 2.2 days.[4,5] Today, uncomplicated acute appendicitis treated with laparoscopic appendectomy requires minimal length of hospital stay, allowing for postoperative monitoring in an outpatient setting.[4]

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The treatment of acute appendicitis has evolved in the last 20 years with the introduction and development of minimally invasive surgery allowing many laparoscopic procedures to be performed on an outpatient setting.[6] In the US, a confirmed outpatient protocol for laparoscopic appendectomy in uncomplicated acute appendicitis has shown a relevant increase in the rate of outpatient management without raising the morbidity-mortality among patients.[4] The percentage of appendectomy procedures performed in outpatient settings, as reported in the literature, ranged from 20 to 88%.[6] This type of protocols allows a better flow of patients with a higher hospital bed availability, discharging those with favorable evolution and low risk of postoperative complications. In Colombia and Latin America, evidence on this topic is very scarce or non-existent. Considering the relevance of improving the dynamics of the care of one of the most frequent surgical diseases in our region, guaranteeing adequate outcomes as well as the establishment of a program that can be replicated by first-year residents, facilitating their early exposure to laparoscopy and improving their learning curve and surgical performance, the aim of this study was to evaluate the outcomes of a low-cost, outpatient laparoscopic appendectomy protocol performed by the first- and second-year general surgery residents in uncomplicated appendicitis.

Materials and Methods

Study Design and Population

A prospective longitudinal study was executed in Bogotá, Colombia, spanning from January 2018 to January 2020, to assess the outpatient management following laparoscopic appendectomy. The procedure was executed by the first- and second-year general surgery residents under the supervision of a faculty surgeon, exclusively for cases of uncomplicated appendicitis. Inclusion criteria comprised individuals meeting the following conditions: (1) patients diagnosed with uncomplicated acute appendicitis (non-perforated edematous/fibrinopurulent) categorized as American Society of Anesthesiologists Physical Status Classification System[7] (ASA) 1 or 2; (2) Residing in the Bogotá metropolitan area or having the ability to travel to the hospital; (3) Exhibiting normal vital signs postoperatively; (4) Managing postoperative pain within a visual analogue scale of 4 or less; (5) Demonstrating the capacity to tolerate liquid intake, ambulate, and exhibit spontaneous urine output.[6]

Uncomplicated appendicitis was determined by the senior surgeon. Patients displaying signs of complications (perforation, abscess, or gangrenous appendicitis) were excluded.[6] Additionally, exclusion criteria encompassed pregnancy, conversion to open surgery, age below 15, intraoperative findings of perforation or abscess, and inadequate comprehension of postoperative care, warning signs, and indications for ED consultation.[6] The study assessed outcomes such as the frequency of complications, readmissions, postoperative pain, and mortality. Extensive preoperative counseling was administered to all patients regarding dismissal plans from the postoperative recovery unit after surgery.

Surgical Technique

A standardized laparoscopic appendectomy technique utilizing three ports was employed across all patients. The procedure commenced with the introduction of a 10-mm steel reusable port at the umbilicus, employing a Hasson open technique to establish a 12 mm Hg pneumoperitoneum.[8] Subsequently, two additional steel reusable ports were inserted under direct laparoscopic visualization using a 30° laparoscope: A 12-mm port in the suprapubic region and a 5-mm port in the left iliac fossa. The mesoappendix underwent dissection and sectioning from the apex to the base, employing electrocoagulation with a monopolar laparoscopic hook device. The tip of the appendix was grasped and secured using two endoloops or Hem-o-lok clips, size XL. The appendix was transected between the two ligatures, leaving one loop or clip on the cecum end. Post-resection, a cost-effective specimen retrieval bag was introduced into the abdomen through the 12-mm suprapubic port, enclosing the excised appendix. At the conclusion of the surgery, it was administered Ropivacaine (40 mL, 200 mg) through infiltration at each port site.[6]

General anesthesia adhered to the recommendations of the Enhanced Recovery After Surgery Society.[9] During induction, a single intravenous dose of cefazolin (2 gm), along with intravenous injections of metoclopramide (10 mg) and dexamethasone (8 mg) was administered to enhance rehabilitation and prevent postoperative nausea and vomiting.[6,9] Multimodal analgesics were implemented from the initiation of surgery, encompassing an anti-hyperalgesic agent (ketamine 20 mg) and a step 1 analgesic (paracetamol plus non-steroidal anti-inflammatory drugs, unless contraindicated).[6,10]

Outpatient procedures in appendectomy studies are defined as surgeries with a hospital stay of less than 24 hours, with or without an overnight stay. In this investigation, the definition from the International Association for Ambulatory Surgery (IAAS) was adopted, characterizing ambulatory surgery as a procedure where the patient is discharged on the same working day.[6] Patients eligible for the cost-effective and outpatient laparoscopic protocol provided informed consent, incorporating comprehensive information about appendicitis, the surgical procedure, and their commitment to report any postoperative complications to the clinic. Monitoring persisted until full awakening, with patients retained until meeting clinical discharge criteria for outpatient procedures. Each patient was invited to a follow-up consultation at 8 days.

Data collected for each patient encompassed age, gender, length of stay, operating time, complications within 30 days of discharge, unexpected return consultations, unexpected readmissions, and unexpected reoperations. Complications were categorized using the modified Clavien system.[11] Information was gathered during routine postoperative follow-up, with all patients granting informed consent for the research use of their data.

Outpatient Management Protocol

Once the patients were selected, education was provided to them and their families during the immediate postoperative period. An instruction manual with simple, patient-friendly, and standardized graphical instructions for postoperative care was designed. The manual included general care (position, rest, exercise, and feeding), wound and dressing management, use of painkillers (acetaminophen-naproxen scheme, except in cases of hypersensitivity), and warning signs and indications for ED readmission. A week after discharge, patients were required to attend an outpatient check-up to rule out postoperative complications and review the histopathology report. Finally, after 30 days, a telephone communication was made with all patients to complete the postoperative follow-up.

Statistical Analysis

It was assessed the normality of quantitative variables using the Kolmogorov–Smirnov test. Skewed variables were expressed as the median (interquartile range, IQR, or range). Qualitative variables were concisely presented as frequency and percentages. Comparative analysis utilized Pearson's Chi-square test or Fisher's exact test for categorical variables, and Student *t*-test or Mann–Whitney test for quantitative variables. Statistical significance was established at a p-value < 0.05. We conducted all analyses using the Statistical Package for the Social Sciences (SPSS) version 28.0 software.

Ethical Statements

Approval for this study was granted by the ethics review board of the institution. The protocol adhered to the principles outlined in the Declaration of Helsinki and the guidelines of Good Clinical Practice.[12,13]

Results

A total of 285 patients, with a median age of 28 years, participated in the study, and 52.3% ($n = 149$) were female. Among them, 237 (83.1%) were classified as ASA type I, while 16.9% ($n = 48$) fell into type II. Regarding the appendicular phase, 45.6% ($n = 130$) were in the edematous phase, and 54.4% ($n = 155$) were in the fibrinopurulent phase. The laparoscopic group exhibited a median operative time of 50 (17–120) minutes, slightly longer than the 47.5 (15–90) minutes observed in the open surgery group (Table 1).

The rate of readmission to the ED for this cohort was 3.5% ($n = 10/285$). The primary cause for readmission in 5 patients was uncontrolled postoperative pain, occurring between the third and eighth postoperative day, and was managed through in-hospital analgesic treatment. Additionally, one patient was readmitted due to postoperative vomiting, treated with in-hospital symptomatic management. The remaining four readmissions were attributed to superficial SSI in one patient requiring wound management, and organ/space SSI in three patients necessitating percutaneous drainage and intravenous antibiotics (Table 1).

The overall frequency of complications in the study was 4.2% ($n = 12/285$), slightly exceeding the rate of readmissions (3.5%). This discrepancy was attributed to complications being identified not only through readmissions but also through postoperative control consultations and a 30-day postoperative telephone follow-up. The range of complications included four cases of seroma, three cases of organ/space SSI, three cases of superficial SSI, one case of surgical wound dehiscence, and one case of perilesional ecchymosis.

Bivariate analyses revealed no significant association between unexpected readmissions and complications with any of the preoperative or perioperative variables (Table 2). Out of the 285 patients meeting the criteria for outpatient postoperative management, 95.7% ($n = 273$) completed the follow-up without associated morbidity, and 96.5% ($n = 275$) completed the follow-up without requiring readmission to the ED.

Discussion

In the U.S. alone, 357,000 appendectomies are performed each year. Specific data regarding this issue in Latin America is unavailable.

Table 1: Sociodemographic, clinical, and surgical characteristics, and postoperative outcomes of the studied population, according to the surgical approach

		Open	*Laparoscopic*
Variable	*N*	*n (%)*	
Age			
Years, median (range)		24.5 (15–73)	29 (15–77)
Gender			
Female	149	3 (2%)	146 (98%)
Male	136	61 (44.9%)	75 (55.1%)
ASA			
I	237	56 (23.6%)	181 (76.4%)
II	48	8 (16.7%)	40 (83.3%)
Appendicitis phase			
Edematous	130	22 (16.9%)	108 (83.1%)
Fibrinopurulent	155	42 (27.1%)	113 (72.9%)
Surgical time			
Minutes, median (range)		47.5 (15–90)	50 (17–120)
Modulated pain			
Yes	285	64 (22.5%)	221 (77.5%)
Tolerates the oral route			
Yes	285	64 (22.5%)	221 (77.5%)
Readmission			
Yes	10	2 (20%)	8 (80%)
No	275	62 (22.5%)	213 (77.5%)
Complication			
Yes	12	5 (41.7%)	7 (58.3%)
No	273	59 (21.7%)	214 (78.3%)

*ASA, American society of anesthesiologists physical status classification system

Table 2: Association between gender, clinical variables and type of surgical approach with the frequency of complications

		Complication	*Non-complication*	
Variable	*N*	*n (%)*		*p-value*
Gender				
Male	136	7 (5.1%)	129 (94.9%)	0.452
Female	149	5 (3.4%)	144 (96.6%)	
ASA				
I	237	9 (3.8%)	228 (96.2%)	0.440
II	48	3 (6.2%)	45 (93.8%)	
Appendicitis phase				
Edematous	130	3 (2.3%)	127 (97.7%)	0.143
Fibrinopurulent	155	9 (5.8%)	146 (94.2%)	
Surgical approach				
Open	64	5 (7.8%)	59 (92.2%)	0.103
Laparoscopic	221	7 (3.2%)	214 (96.8%)	

*ASA, American society of anesthesiologists physical status classification system

However, the implementation of an outpatient laparoscopic appendectomy protocol could potentially eliminate the need for an average of 485,000 inpatient days annually, resulting in healthcare savings of almost $1,000,000,000.[4] This study indicates that the protocol for outpatient laparoscopic appendectomy performed by first and second-year general surgery residents for uncomplicated appendicitis is safe and feasible with a very low postoperative morbidity and no need for surgical reinterventions.

The Jerusalem guidelines for diagnosing and treating acute appendicitis indicates that laparoscopic appendectomy is now the gold standard technique to treat acute appendicitis.[14] An analysis of NSQIP data by Page et al.,[15] shows that over 80% of appendectomies in the US are performed using a laparoscopic approach.[4,15] Our cohort showed that 77.54% of patients underwent a laparoscopic procedure. Although laparoscopic appendectomy has advantages, such as less pain, quicker return to work, better cosmetic result and shorter length of hospital stay. Many studies comparing open vs laparoscopic appendectomy have not shown significant differences in length of Hospital stay. Guller et al.[16] found that hospital stay was 2.06 days for laparoscopic vs 2.88 days for open appendectomy in 43,757 patients.[16] Our results show no differences in the length of hospital stay (<24 hours) for outpatient open vs laparoscopic appendectomy in uncomplicated cases performed by first and second-year general surgery residents. Our results also showed no difference in readmission rates (2 vs 8 patients) for open vs laparoscopic appendectomy, nor significant differences in the rate of postoperative complications (5 vs 7 patients). Our results are similar to those shown by Cash et al.,[4] but we reported a lower postoperative complications rate (4.2 vs 5.2%).

Previous studies[4,17,18] have demonstrated that discharging patients with uncomplicated acute appendicitis within 24 hours of surgery resulted in an outpatient rate ranging from 65 to 88%, in contrast to the 100% observed in our study. No readmissions occurred in the outpatient group, leading to the conclusion that performing it safely for acute non-perforated appendicitis is feasible. Nevertheless, studies by various authors,[19–21] involving mixed populations of patients with complicated and uncomplicated appendicitis, reported outpatient surgery rates of only 18, 20, and 32, respectively.[19–21]

No national data regarding appendectomy procedures and their outpatient rates in Colombia are available. In comparison to France, only 1.3% of appendectomy procedures were conducted in outpatient settings in 2015.[22] Most surgeons in our country view conventional hospitalization as the standard of postoperative care for laparoscopic appendectomy. As Gignoux et al.,[6] we consider all patients with uncomplicated appendicitis to be eligible for outpatient postoperative care, unless they have severe comorbidities that require monitoring, who do not meet early discharge criteria or have severe infections or intraoperative complications. Dubois et al.[23] estimated a cost savings of $323 per every outpatient laparoscopic appendectomy. These data support the implementation of protocols for low-cost and outpatient laparoscopic appendectomy for patients with uncomplicated appendicitis in low- to middle-income countries such as Colombia.

A scoring system to select patients with acute appendicitis for outpatient surgery was developed by Lefrancois et al.,[21] based on five preoperative criteria: body mass index (BMI) < 28 kg/m^2, preoperative C-reactive protein (CRP) levels < 30 mg/dL, preoperative white blood cell (WBC) counts < 15,000/mm^3, diameters of the appendix ≤10 mm, and no radiological signs of perforation.[6,21] In our analysis, no associated factors with failure in the outpatient protocol for patients with uncomplicated appendicitis were identified.

In 2017, a cohort study involving 1,649 emergency appendectomies[24] revealed that outcomes of appendectomies executed by senior surgeons were compared with those performed by general surgery residents. The study showed no significant differences in postoperative complication rates, length of hospital stay, and overall duration of antibiotic treatment. Nevertheless, the surgery duration in the senior surgeon's group was significantly shorter compared with the resident's group (39.9 vs 48.6 minutes; $p < 0.001$). This study demonstrates that laparoscopic appendectomies can be safely performed by surgical residents, as evidenced in our series.

Also, our analysis showed that none of the variables were significantly associated with postoperative complications or readmission. A previous study[4] showed no increase in the incidence of complications/readmissions for the outpatient group, but 72 patients required a 24-hour hospitalization postoperatively, and the authors could not identify a clinical indication for the postoperative admission.[4] These findings drive us to continue to apply our outpatient treatment protocol to improve the success of discharge in less than 24 hours after laparoscopic appendectomy for uncomplicated appendicitis and become the norm rather than the exception. However, it should be clarified that the protocol should not be used as a substitute for clinical judgment in the treatment of acute appendicitis patients.

As limitations, this was a single-center, non-randomized study, and complicated acute appendicitis patients were not included. Then, our results should be interpreted within the context of its design. However, it is necessary to recognize as a strength that this is the first study in Colombia and probably in Latin America that evaluates this type of protocol, demonstrating that it can be applied by residents, guaranteeing favorable and cost-effective outcomes, due to the low rate of complications and readmissions.

Conclusions

This study demonstrated that the low-cost outpatient management protocol for uncomplicated appendicitis by laparoscopic appendectomy performed by the first- and second-year residents had a low frequency of complications and readmission, with no significant differences compared with open surgery or appendicular phase.

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ORIGINAL ARTICLE

The Trend in Laparoscopic Surgical Practice in the Riverine Ondo, Southwestern Nigeria

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Abstract

Background: Laparoscopic surgery is a minimally invasive surgical practice which is of diagnostic and therapeutic value.

Aim: To determine the indications, operative findings and interventions at laparoscopy in our resource challenged settings.

Methods: This was a two-year prospective study in the university of medical science teaching hospital Ondo and a private laparoscopy George and Martin laparoscopy center, Ore, Ondo State, Nigeria, between January 2020 and January 2022 which included 51 patients. Both diagnostic and therapeutic procedures were followed up during this period. Data on patients' age, gender, indications for surgery, duration of hospital stay, outcome of surgery were analyzed. Data analysis was by the SPSS version 23 (IBM incorporated, Chicago, USA).

Results: Fifty one patients were put under study. The median age was 42 years (mean = 41.73; age range of 8–75years). There were more females 29 (56.9%) than males 22 (43.1%). Laparoscopy was purely diagnostic (*n* = 6, 11.8%), therapeutic (*n* = 45, 88.2%), cholecystectomy (*n* = 11, 21.6%) and intraperitoneal onlay mesh (IPOM) (*n* = 11, 21.6%) were the two most common procedures done. The mean duration of surgery was 96.96 [minutes (diagnostic)], 150 [minutes (therapeutic)]; average duration of hospital stay was 2.3 (±1.7 days).

Conclusion: Laparoscopic services are expanding in our center with improved facilities, females appear to benefit more in our study and the services involved the young and elderly.

Keywords: Diagnostic, Laparoscopy, Therapeutic.

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Introduction

Laparoscopy is a minimal access surgical system that permits direct visualization of the peritoneal cavity and its contents for diagnosis and therapy.

Historical Perspective

Giulio Cesare Aranzi (1530–1589) used sunlight for a nasal endoscopy procedure.

Hans Christian Jacobeus (1879–1937) a Swedish surgeon credited with coining the term laparoscopy (laparothorakoskopie) in 1910, performed the first laparoscopic operation in humans.[1,2] Kurt Semm (1927–2003) performed the first laparoscopic appendicectomy in 1980. Also, Phillipe Mouret performed the first laparoscopic cholecystectomy in 1987.

Laparoscopy is of immense benefit in making diagnoses, therapy, and other interventions such as biopsies, cultures, and laparoscopic ultrasonography.

The advantages of laparoscopy include the following:

- Shorter hospital stay
- Lesser wound pain/stress
- Less tissue trauma and related complications
- Better cosmetic results
- Quick return to work
- Video conferencing
- Records of procedures are stored and relayed in use for teaching research and medicolegal proceedings

However, laparoscopy is highly technology dependent. The cost of setup is substantial involving imported equipment and instruments.[3,4] In an underdeveloped economy and low-resource setting where there is a limited supply of resources and consumables and suboptimal basic infrastructure such as poor power supply, the laparoscopic practice may turn out to be a nightmare.

Other challenges include limitations in manpower—doctors, nurses, and technicians skilled in the maintenance of the equipment, poorly funded health, poor level of awareness by the populace, and low willingness of medical personnel to refer patients for this laparoscopic service.[5]

The setup of the laparoscopic tower included the following:

- Hand instruments
- Light source technology
- Lens and optic system development
- Insufflation
- Energy sources such as diathermy, ligasure, harmonic, and thunderbeat energy systems
- Video cameras and monitors. Video laparoscopy is of immense advantage in telehealth and video conferencing. This also has a medicolegal impact on image storage and transmission.

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Methodology

Our study was a 2-year prospective study based on patients from our riverine community who presented in our center between January 2020 and January 2022 and 51 patients were recruited for the study. Both diagnostic and therapeutic procedures were followed up during this period and patient selection was based on ASA 1 and ASA 2 (anesthesia) criteria. Data on patient age, gender, indications for surgery, duration of hospital stay, and outcome of surgery were analyzed using Statistical Package for the Social Sciences (SPSS), version 23, software (IBM Corporation, Chicago, USA).

Results

A total of 51 patients were recruited for the study. The median age was 42 years (mean = 41.73 ± 11.4 years; age range 8–75 years). The male-to-female ratio was 1:1.3. Laparoscopy was purely diagnostic ($n = 6$; 11.8%), therapeutic ($n = 45$,88.2%). Cholecystectomy ($n = 11$, 21.6%) and intraperitoneal onlay mesh (IPOM) ($n = 11$; 21.6%) were the two most common procedures performed. Table 1 shows the age-group and frequency distribution of the patients. Figure 1 shows the age and gender distribution of patients. Figure 2 describes gender distribution among patients. Table 2 shows the indications for laparoscopy while Figure 3 shows the distribution of the procedures that we performed. Table 3 shows the histological findings of specimens taken at laparoscopy.

Discussion

The progress in the practice of laparoscopy in recent times in the developing countries is commendable.[6] Benefits of laparoscopic surgical services in the low resource setting has improved the outlook in the management of patients.[7]

Table 1: Age-group and frequency distribution of patients

Age-group (years)	*Frequency*	*Percent*	*Cumulative percent*
0–10	2	3.9	3.9
11–20	5	9.8	13.7
21–30	3	5.9	19.6
31–40	12	23.5	43.1
41–50	18	35.3	78.4
51–60	7	13.7	92.2
61–70	3	5.9	98.0
71–80	1	2.0	100.0
Total	51	100.0%	

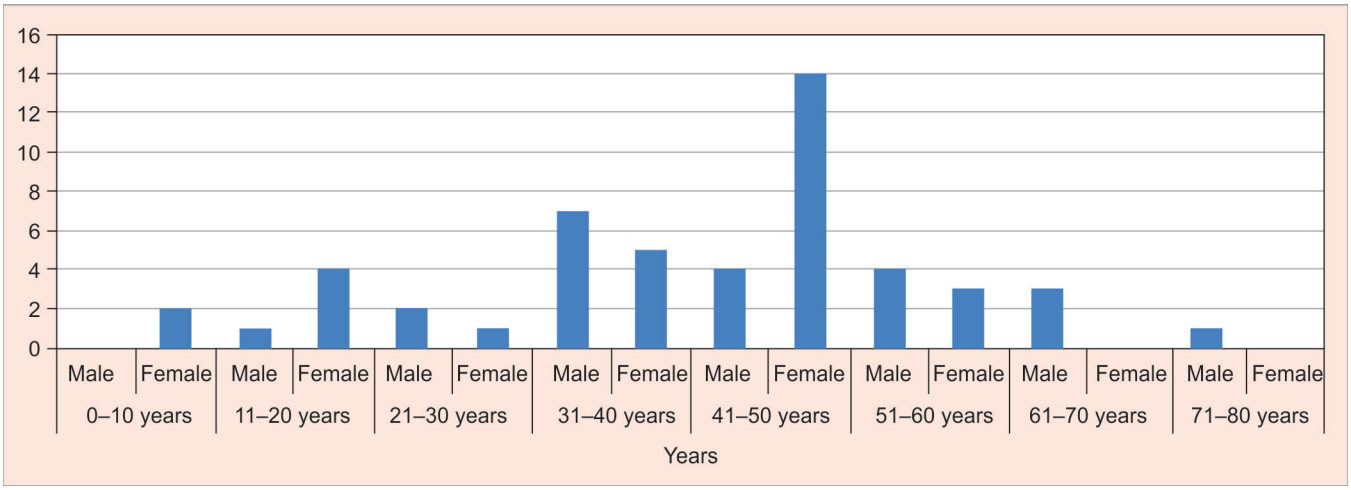

Fig. 1: Age and gender distribution of patients

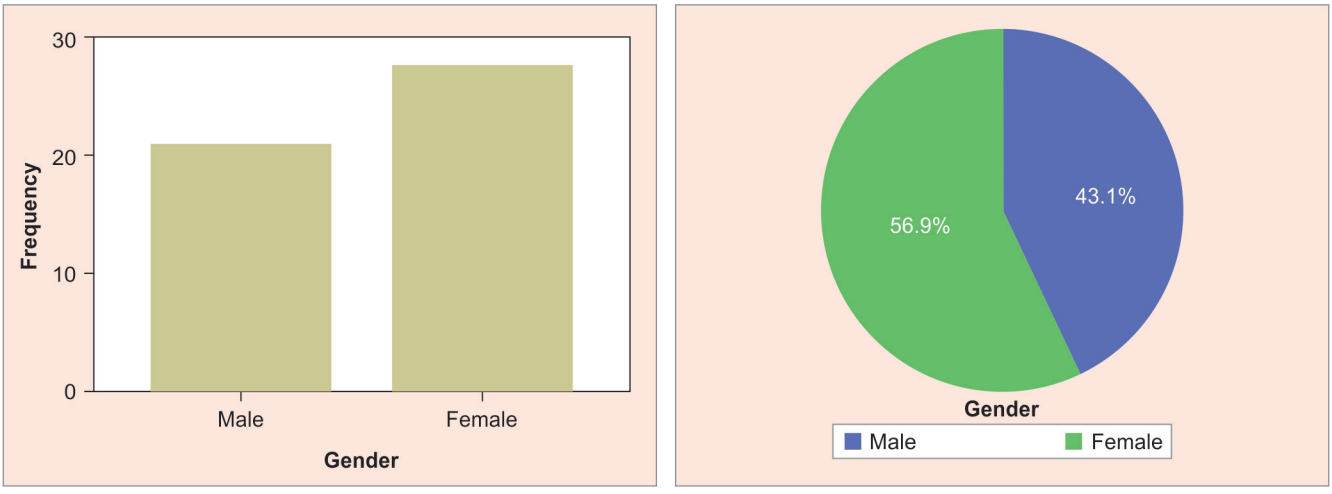

Fig. 2: Gender distribution among patients

Table 2: Indications for laparoscopy

Aim of laparoscopy	*Diagnosis*	*Frequency*	*Percentage*
Diagnostic laparoscopy	Intra-abdominal mass	4	7.8
	Blunt abdominal trauma	2	4
Therapeutic laparoscopy	Appendicitis	9	17.6
	Perforated peptic ulcer	2	4
	Paraumbilical hernia	1	1.9
	Epigastric hernia	5	9.8
	Cholelithiasis	8	15.6
	Cholecystitis	3	5.8
	Recurrent postoperative adhesions	3	5.8
	Empyema gallbladder	2	4
	Mucocele gallbladder	1	1.9
	Pancreatic pseudocyst	2	4
	Amebic liver abscess	1	1.9
	Incisional hernia	5	9.8
	Groin hernia	1	2
	Reflux esophagitis	2	4
Total		51	100

Despite the high cost in the initial setup of this surgical practice our experience revealed local adaptions that could mitigate this cost.[8]

This relates to the practice elsewhere, where such adaptations have been used to make provision for basic requirements in both manpower and equipment setup.

Diagnostic laparoscopy as recorded in our work is beneficial where there are limited resources for modern diagnostic imaging facilities. This diminishes unnecessary laparoscopy with improvement in obtaining tissue samples for histological analysis. This is evident in the literature that estimated the equipment cost ratio of laparoscopy/computed tomography (CT)/magnetic resonance imaging (MRI) at 1:2500:4500.[9–11]

The trend in laparoscopic cholecystectomy as seen in our work shows the progressive acceptance of laparoscopy in our developing economy, for even more painstaking abdominal surgeries and a changing pattern in the management of gallbladder disease in a low-resource setting such as ours. This is in contrast to some work elsewhere that highlighted mistrust for new technology, lack of education, poor health knowledge and non-scientific beliefs as barriers to showcasing laparoscopy in poor-income communities.[12–14]

The lower incidence of amebic liver abscess in our study vindicated the spirited effort made via public health intervention

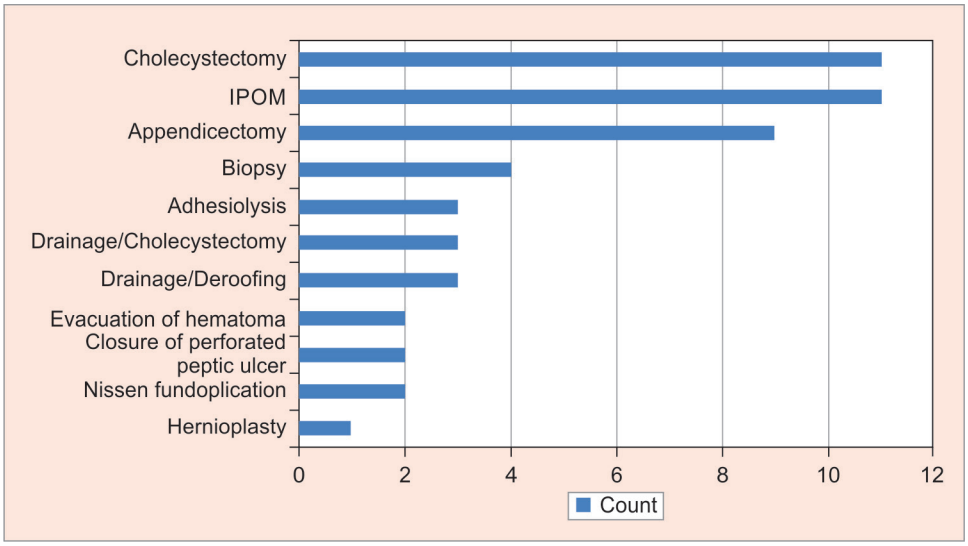

Fig. 3: Distribution of procedures done

Table 3: Histological findings of specimen taken at laparoscopy

Histological findings	*Frequency*	*Percentage*
Biopsy not taken	24	47.1
Metastatic gastric adenocarcinoma	1	2.0
Advanced gastric lymphoma	1	2.0
Hepatocellular cancer	1	2.0
Cirrhosis	1	2.0
Chronic cholecystitis	4	7.8
Calculous cholelithiasis	10	19.6
Appendicitis + Fecolith	4	7.8
Appendicitis – kinked	2	3.9
Appendicitis – without fecolith/kinking	3	5.9
Total	51	100.0

in environmental hygiene which otherwise could have been a problem in such a riverine community. Also, no case of appendicitis was associated with schistosomiasis as compared to our previous pilot study.[15]

In our work, we did not encounter conversion to open surgery. We also had no technical difficulties like challenges in port placement and loss of tactile feedback likely to be experienced by surgeons in their initial learning curve. We did not experience complications at the establishment of pneumoperitoneum and there were no visceral or vascular injuries.

While some studies showed higher anesthesia-related mortalities in low and middle-income communities compared to developed economies, our study did not show such because of our method of meticulous patient selection.[16,17]

After the initial expensive setup of the laparoscopy system, some adaptations may be required to lessen the subsequent cost of the equipment.[18] This was credited to Adisa et al. and Galukand and Jombroe.[19,20]

These cost-effective strategies include the use of reusable instruments, a rubber glove system of tissue retrieval instead of an endo bag, and the use of a television set instead of standard monitors. A dedicated theatre suite for laparoscopy is ideal to allow for a more relaxed atmosphere for surgeons and other staff involved in the delivery of laparoscopy services.

The endpoint in our clime is to establish a dedicated laparoscopy unit with improved facilities and adequate manpower to also achieve on-the-job training and retraining of health workers. Collaborative work among hospitals in laparoscopy services will be fulfilling to improving the more advanced robotic laparoscopy system.[20]

Conclusion

Laparoscopic services are expanding in our center. Appendicitis secondary to schistosomiasis and amoebiasis are no longer the most prevalent pathological findings in our riverine community. Instead, gallbladder diseases are the most predominant finding. Laparoscopic services are beneficial to both the young and elderly. Females appear to benefit more in our study. Cholecystectomy and IPOM hernioplasty are the more popular procedures from our study followed by appendicectomy.

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ORIGINAL ARTICLE

A Prospective Randomized Study to Evaluate if Cyanoacrylate Glue is Superior over Traditional Suturing in Laparoscopic Port Site Skin Closure

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Abstract

Background: This study was undertaken to evaluate if the cyanoacrylate glue was superior to conventional suturing for skin closure of the laparoscopic port site.

Materials and methods: A prospective randomized trial was performed on patients scheduled for elective laparoscopic surgery at the department of general surgery at a tertiary care hospital. Patients were followed up to evaluate postoperative pain using the visual analog scale (VAS). The time required for closing the wound, postoperative pain at the wound site, rate of surgical site infection (SSI), and the period for which the patients stayed in the hospital were studied.

Results: A total of 70 patients were enrolled and divided into two groups. In group I (the study group) incisions were closed by applying *N*-Butyl-2-Cyanoacrylate glue and in group II (the control group) incisions were closed by conventional suturing method using Ethilon 2.0 RC. Statistically significant difference was found between the average time required for the closure of a single port site ($p < 0.0001$), surgical site infection ($p < 0.021$), and the average number of days the patient stayed in the hospital. It was less in the group I as compared with that of group II. There was no significant difference between the two groups for postoperative pain assessment.

Conclusion: The use of *N*-Butyl-2-Cyanoacrylate at laparoscopic port site skin closure was beneficial as it took comparatively less time for laparoscopic port skin closure and had less rate of surgical site infection at the wound site.

Keywords: Adhesive glues, Laparoscopic port site skin closure, Southampton scoring system, Surgical site infection, Visual analog scale.

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Introduction

Scar formation is an unavoidable result of wound healing after a traumatic or surgical intervention. The aesthetic look of a scar is the most crucial factor in evaluating the surgical outcome. The most common technique for wound closure continues to be sutures, which have been used for generations. Other new techniques such as the use of tapes, staples, and adhesive tapes have been developed over time.[1] To know which method will produce the best results, it is helpful to research and contrast new techniques, such as cyanoacrylate glue with conventional suture materials. The best technique for closing an incision must be simple, risk-free, fast, quick, inexpensive, painless, and bactericidal. It should also result in the best cosmetic appearance of the scar, less postoperative pain, less wound infection, and a shorter stay in the hospital.

Although cyanoacrylates, a liquid monomer that forms a strong bond between two wound edges when it comes into contact with it, were discovered in 1949, their practical use in the closure of surgical wounds was not documented until the next 10 years.

Cyanoacrylate glue can be used as tissue adhesive as they are easy to apply and takes less time to close, offering a hurdle to microorganisms at the healing location so it has less rate of wound infections, and the best cosmesis is achieved as compared to sutures.[2] As we can see in a conventional suturing technique, the source of infection is the puncture wounds created by the needle.[3] This is avoided in adhesive glue, decreasing the rate of surgical site infection using cyanoacrylate glue for skin closer, but in the use of cyanoacrylate glue, the dead space should be eliminated, and complete hemostasis is required to achieve a better result.

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One of the earliest instruments for assessing pain was the visual analog scale (VAS), which Hayes and Patterson used in 1921.[4] It is widely employed in clinical and epidemiologic studies to evaluate the frequency or severity of certain symptoms.

For instance, a patient may experience very little discomfort or very significant pain.

The most common way to show it is as a 100-mm horizontal line with a point in the middle that represents the patient's pain threshold between "no pain at all" and "worst pain imaginable."[5]

The VAS's validity, reliability, and simplicity make it the best instrument for describing the degree or intensity of pain.

One of the most often used wound rating systems is the Southampton wound grading system. It allows surgical wound healing to be assessed based on particular criteria and assigned

a numerical value, providing a more objective assessment of wounds.[6] minimally invasive surgeries have grown over the past decades this is due to less painful operations, quicker postoperative recovery, and fewer hospital stays. Traditionally laparoscopic port site skin was closed by Ethilon 2.0 RC.

This study's main goal was to assess the effectiveness of cyanoacrylate glue vs Ethilon 2.0 RC in terms of the average amount of time needed to close a wound, postoperative pain at the wound site, and surgical site infection.

Materials and Methods

A single-center prospective randomized trial was designed to compare the closure of laparoscopic port site incisions using cyanoacrylate glue vs Ethilon RC.

This study was approved by the institutional ethics committee. A signed informed permission form was required before the patients could be included in the trial. The study included all patients who underwent elective laparoscopic surgery in a tertiary care hospital's department of general surgery between November 2020 and November 2022.

Exclusion criteria included the patients who were immunocompromised, had collagen diseases and had a history of keloid formation and hypertrophic scars. The same group of surgeons with substantial laparoscopic experience performed all procedures. Consenting patients were randomized into two groups by chit-picking to eliminate the bias (Fig. 1A). All the surgical interventions were performed by the same set of surgeons. Demographic details, the average time required for closure of single port site incision, postoperative pain at the wound site using the VAS, and rate of surgical site infection according to the Southampton scoring system were analyzed.

Analytical Statistics

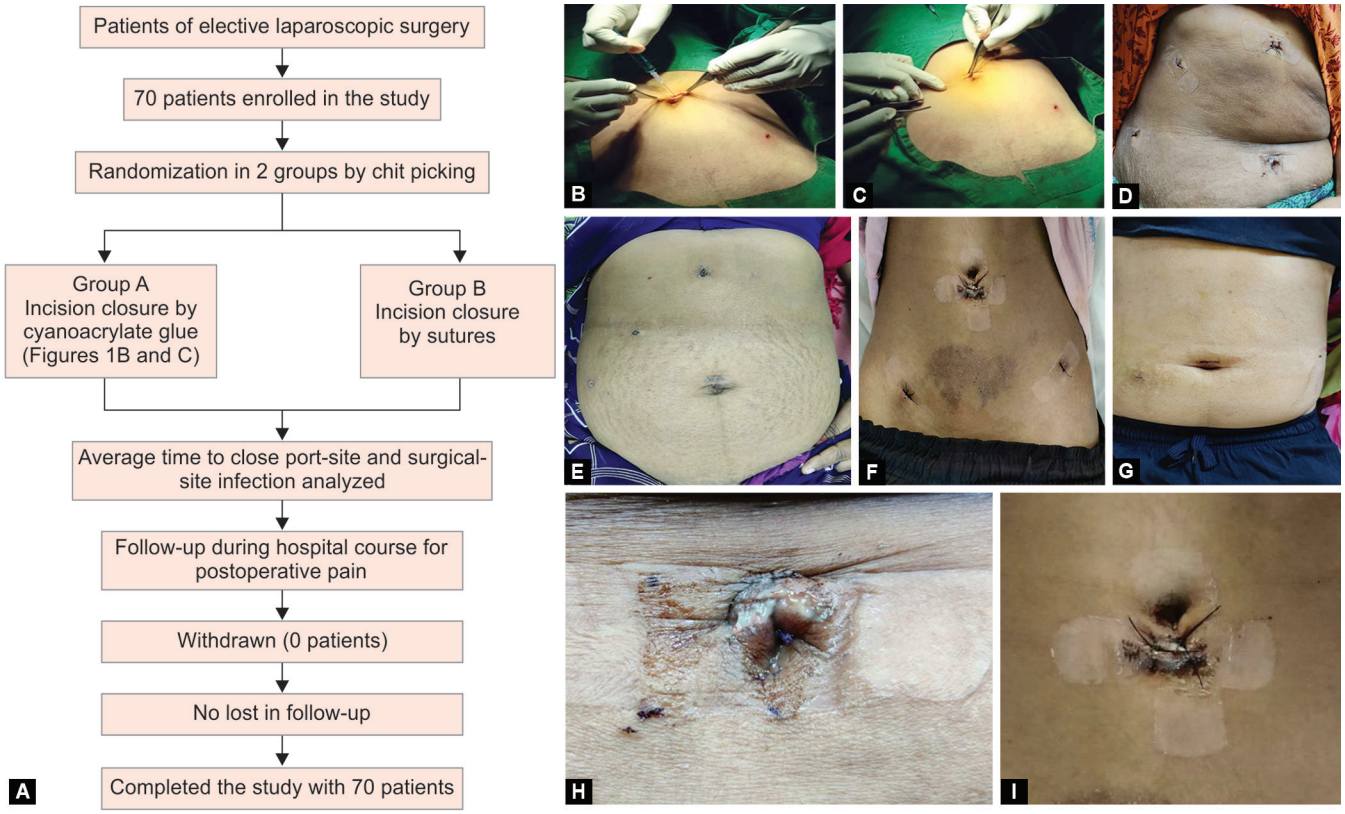
A statistical tool for the social sciences (version 20.0) was used to undertake statistical analysis after the collected data was entered into a Microsoft Excel sheet.

The Independent *t*-test was used to compare continuously distributed data with a normal distribution between the two groups. The Mann–Whitney *U* test was employed for variables that were not regularly distributed. To compare categorical variables between the two groups, the Mann–Whitney test was employed. Statistics were deemed significant when $p < 0.05$. Every statistical test that was run was two-tailed.

Results

The study involved the enrolment of 70 patients, of whom 35 were randomly assigned to group I (closure by cyanoacrylate glue) and 35 to group II (closure by sutures).

Analysis was performed on all the enrolled subjects and there were no dropouts. None of the patients enrolled in the study had



Figs 1A to I: (A) Study outlines and milestones; (B) Application of *N*-Butyl-2-Cyanoacrylate Glue; (C) Skin holding with forceps after application of *N*-Butyl-2-Cyanoacrylate glue; (D) Postoperative day 3 laparoscopic cholecystectomy port site skin closure by suture; (E) Postoperative day 3 laparoscopic cholecystectomy port site skin closure by *N*-Butyl-2-Cyanoacrylate glue; (F) Postoperative day 3 laparoscopic appendicectomy port site skin closure by suture; (G) Postoperative day 3 of laparoscopic mesh hernioplasty (TAPP) port site skin closure by *N*-Butyl-2-Cyanoacrylate glue; (H) Grade-IV surgical site infection on POD 3 in laparoscopic cholecystectomy port site skin closure by suture; (I) Grade-II surgical site infection on POD 3 in laparoscopic appendicectomy port site skin closure by suture

any comorbid condition. The demographic details are as given in Table 1.

In both groups of the current investigation, there were male and female patients. Both the study group and the control group included the same number of men and women. Ages ranged from 10 to over 60 in both groups. The patients from the 30- to 39-year-old age group were found to be the majority in both groups. The demographic information of the patients enrolled in the two groups did not significantly differ from one another.

The diagnosis of the patients was based on blood investigations, ultrasonography, and endoscopic findings. The maximum number of patients were diagnosed with cholelithiasis (39) followed by acute appendicitis (18), recurrent appendicitis (7), left indirect inguinal hernia (2), hiatus hernia (2) and achalasia cardia type 3 (2). The maximum number of patients underwent laparoscopic cholecystectomy (39) (Figs 1D and E), followed by laparoscopic appendicectomy (25) (Fig. 1F), laparoscopic modified hellers cardiomyotomy (1), laparoscopic Toupet fundoplication anterior cardiomyotomy (1), laparoscopic Toupet fundoplication posterior cardiomyotomy (1), laparoscopic Nissen fundoplication (1), and laparoscopic mesh hernioplasty [transabdominal preperitoneal (TAPP)] (2) (Fig. 1G).

It was noted how long it typically took to close a single port location. It was discovered that the control group needed 17.80 seconds on average to close a single port site, while the study group needed 7.94 seconds on average. After running the Mann–Whitney *U* test, a *p*-value of 0.0001 was found. A statistically significant variation was seen in the mean duration needed for the shutdown of a single port location. Visual analog scale was used to measure postoperative pain after six hours as well as on days 1, 2, and 3 of the procedure in both the study group and the control group. The results were not statistically significant.

An analysis was conducted on the mean duration of hospitalization for the patient. It was discovered that the research group's average patient stay was 4.89 days, whereas the control group's average stay was 5.46 days. The average number of days spent in the hospital did not differ significantly between the two groups. The Southampton scoring system was also used to evaluate surgical site infections (SSIs). A study was conducted to determine the rate of surgical site infection using the Southampton scoring system. The study group did not have any instances, while the control group had five cases (Figs 1H and I) which is significant ($p = 0.021$). Among the five cases found, three were of acute appendicitis and two were cholelithiasis which was significant; it is shown in Table 2.

Table 1: Demographic details of the patients enrolled in the study

	Study group	*Control group*	*Mann–Whitney U test*	*p-value**
Mean age	32.34	37.57	513.000	0.242
Gender				
Male	13	13	–	–
Female	22	22		

*Significant when $p < 0.05$

Discussion

Techniques for suturing can be meticulous and time consuming. Early removal of sutures can cause dehiscence, which can lead to an increase in the need for a dressing to cover the wound and a suture. Tissue glue was created as a result of these disadvantages. Methyl-2-cyanoacrylate and ethyl-2-cyanoacrylate, are two hazardous forms of cyanoacrylate that are employed for adhesion in nonmedical applications. Currently, the optimal nontoxic.

Version for medical application is the longer chain *N*-Butyl-2 Cyanoacrylate and 2-octyl-cyanoacrylate.[7] Applications of cyanoacrylate in various surgical situations and the enclosure of laparoscopic port site closure operations have grown in popularity in recent years.[8] Compared to traditional sutures, cyanoacrylates have a number of useful advantages. The main advantage is how simple and convenient their application is, which leads to quicker wound healing.

Sterility is preserved because cyanoacrylates provide an antibacterial barrier around the incision, negating the need for topical antibiotics.[9] In addition, they make a waterproof bandage that allows the patient to take a shower sooner following surgery. The ease of not needing postoperative suture removal is another benefit for the patients.

This study is a comparative study that assessed if cyanoacrylate glue application is superior over conventional suturing for the incision closure of the laparoscopic port site. Endobags were used in Laparoscopic cholecystectomy and laparoscopic appendicectomy surgery to reduce the specimen contact with port site skin. While performing the procedures, the appendix specimen was removed from the telescopic 10 mm port, and GB was removed from the epigastric 10-mm port. In our study, the maximum number of patients underwent Laparoscopic cholecystectomy followed by laparoscopic appendicectomy, laparoscopic modified heller's cardiomyotomy, laparoscopic Toupet fundoplication anterior cardiomyotomy, laparoscopic Toupet fundoplication posterior cardiomyotomy, laparoscopic mesh hernioplasty, and laparoscopic Nissen fundoplication. In a study conducted by Tapsi Sharma et al.[10] All patients enrolled were for elective laparoscopic cholecystectomy. In a similar study by Maniar N et al.[11] most

Table 2: Average time to close the port site, postoperative pain, SSI score, and hospital stay

	Mean value						
Groups	*Average time to close port site in seconds*	*PO pain 6 hours*	*POD 1*	*POD 2*	*POD 3*	*Hospital stay (Number of days)*	*SSI score*
Study group	7.94	9.00	6.37	3.03	0.57	4.89	0.00
Control group	17.80	9.17	6.40	3.49	0.91	5.46	0.40
Mann–Whitney *U* test value	0	562.500	595.000	517.500	524.500	475.000	525.000
p-value	0.0001*	0.527	0.832	0.247	0.200	0.098	0.021*

*Statistically significant. PO pain, Postoperative pain; POD, Postoperative day

commonly performed surgery was laparoscopic cholecystectomy. It was discovered that the control group needed 17.80 seconds on average to close a single port site, while the study group needed 7.94 seconds on average. A statistically significant variation was seen in the mean duration needed to close a single port site. When comparing the study group that employed cyanoacrylate glue to the control group that used the traditional suturing approach, there was a decrease. Studies by Michael J Sebesta and Jay T Bishoff[12] and Tapsi Sharma et al.[10] also produced findings that were comparable.

One of the earliest studies which was conducted by Quinn J et al.[13] in 1997 also reported similar results. In a Cochrane review done by Dumville JC et al.[14] it was found that sutures were significantly faster to use when compared to glue. Additionally, working in the surgical sector with fewer tools, sutures, and needles is undoubtedly simpler, safer, and more practical. Also, the possibility of a needle stick injury need not be a concern. The average score of 9 was obtained in the study group and 9.17 in the control group after a 6-hour postoperative pain assessment done using VAS.

There was no discernible statistically significant variation in the postoperative pain assessment conducted 6 hours after the surgical operations. Our findings concurred with those of a related study by Dowson et al.[15]

In the study group, the mean postoperative pain value obtained postoperative day (POD) 1 (6.37), POD 2 (3.03) and POD 3 (.57) was compared with the mean postoperative pain value in the control group, that is POD 1 (6.40), POD 2 (3.49), and POD 3 (0.91).

The postoperative pain assessment showed no statistically significant difference; this is because postoperative pain varies depending on the type of surgery, intraoperative tissue handling, and complications. Similar outcomes were observed in research by Ben Safta et al.[16]

It was investigated how often surgical site infections occurred using the Southampton scoring system. It is noteworthy that there were five cases reported in the control group and none in the study group. This might be a result of the polymerized adhesive's barrier qualities, which stop microorganisms from infecting the wound site. Similar findings were found in studies conducted by Michael J Sebesta and Jay T Bishoff[12] and Aitchison LP et al.[17] Early time points in a related trial by Dumville JC et al.[14] revealed that both techniques periodically had mild wound problems, with the adhesive group suffering little superficial dehiscence and the sutured group experiencing erythema and edema. The average number of days the patient stayed in the hospital was studied. It was found that the patients in the study group stayed an average of 4.89 days as compared with that in the control group which was 5.46 days. It was found that the average number of days of hospital stay was not significant.

Conclusion

Our research showed that *N*-Butyl-2-Cyanoacrylate closure of the skin at the laparoscopic port site was quicker than with conventional suturing. It also resulted in a lesser rate of surgical site infection due to the bacteriostatic properties of *N*-Butyl-2-Cyanoacrylate, which helps in better wound healing without any complications and cosmetically better scarring as compared to conventional suturing. Although the price of glue is costlier than that of the suture, it results in reduced overall cost. The reason is that it does not require frequent follow-up visits for suture removal which makes it more convenient for patients and early return to work. This method of closing the incision site is simple to learn and requires little technical expertise, which reduces the length of the entire procedure and brings minimally invasive surgery one step closer. It is however important to apply it correctly and choose the wounds carefully. The difference in postoperative pain and hospital stay was not significant between conventional suturing and *N*-Butyl-2-Cyanoacrylate glue as it depends upon the type of surgery, intraoperative tissue handling, and other complications. By undertaking this study, we can conclude that *N*-Butyl-2-Cyanoacrylate is better than conventional suturing in laparoscopic port site skin closure. More studies should be conducted to compare the effectiveness of *N*-Butyl-2-Cyanoacrylate as compared to conventional suturing in other types of surgeries as well.

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ORIGINAL ARTICLE

Role of Early Laparoscopy in Acute Nonspecific Abdominal Pain at Suez Canal University Hospitals

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Abstract

Introduction: Nonspecific acute abdominal pain (NSAP) is considered a serious problem in the surgical field. To assess this condition, many approaches have been used, such as observation and early laparoscopy.

Methods: This prospective interventional study was conducted at the tertiary care hospital in the Department of General Surgery and the Department of Emergency at Suez Canal University Hospital on 50 patients who presented with NSAP; the outcomes of early laparoscopy versus clinical observation were compared.

Results: The current study results revealed that the definitive diagnosis was achieved in 88% of cases in the laparoscopy group and 80% of cases in the conservative group. The laparoscopy could recognize a pathology in 22/25 cases. Therefore, our research presents a diagnostic yield of 88% which aligns with other studies that have shown comparable rates of high definitive diagnostic rates (between 86 and 100%).

Conclusion: Diagnostic laparoscopy (DL) is a safe and very effective minimally invasive therapeutic and diagnostic method, as it is used to identify and treat acute abdominal diseases. It minimizes morbidity, permits treatment and diagnosis in the same facility in most cases, shortens hospital stays, and reduces investigative costs.

Keywords: Abdominal pain, Acute abdomen, Laparoscopy, Nonspecific.

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Introduction

The surgical department often receives presentations of acute abdomen, which may occur in both primary care and secondary referral hospitals. Acute abdominal pain presents a challenge in terms of diagnosis.[1]

The acute abdomen is distinguished by the abrupt onset of abdominal symptoms that need the surgeon to make a rapid decision on whether to perform emergency surgery, provide conservative treatment, or examine the patient.[1]

Nonspecific acute abdominal pain (NSAP) is a serious problem in the surgical field and represents at least 13–40% of emergency surgical admissions for acute abdominal pain. To assess this condition, many approaches have been used, such as observation and early laparoscopy.[2]

Nonspecific acute abdominal pain is considered acute abdominal pain lasting for fewer than seven days without a definitive diagnosis instead of a baseline examination and diagnostic procedures.[3]

A variety of approaches have been used to evaluate these patients, such as observation, imaging techniques, and early laparoscopy. The watchful waiting option is also considered when the physician can balance the presently anticipated advantages of immediate therapy against the associated risks even if uncertainty exists. However, diagnostic laparoscopy (DL) is advised to prevent treatment postponement and the possible difficulties that may arise as a result.[4]

Diagnostic laparoscopy enables a surgeon to directly see aberrant abdominal contents that may be the source of pain but would not be detected otherwise, and it can exclude other sources of pain.[5]

Emergency situations in which laparoscopy is often performed include appendicitis, cholecystitis, and perforated peptic ulcer. Laparoscopy remains a contentious procedure when applied to perforated diverticulitis, small bowel obstruction, or abdominal trauma.[6]

Utilizing DL in this context is justified on the basis that it prevents treatment postponement, which may result in unfavorable patient outcomes, and laparotomy, which is linked with comparatively high rates of morbidity (5–22%). When a patient has a clear indication for surgical intervention, such as hemodynamic instability or perforated viscous (free air), DL should only be performed if the institution has the necessary facilities and equipment, and the surgeon has the necessary expertise.[7]

The clinical signs and symptoms of the majority of patients are often obscured by the various therapies administered by different physicians at different hospitals at different times and by varied radiological reports. Under these conditions, diagnostic laparoscopy by itself is sufficient to resolve the problem.[8]

Laparoscopy is the most efficacious method for connecting major surgical investigations with clinical assessment. It is a significant diagnostic tool because of its safety benefits, lower

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morbidity, and mortality, decreased postoperative pain, and short hospital stay.[8]

Aim

To evaluate the role of early laparoscopy in NSAP.

Patients and Methods

This prospective interventional study was done between January 2020 and January 2022 in the Department of General Surgery and the Department of Emergency at the Suez Canal University; 50 patients with acute NSAP were studied and outcomes of early laparoscopy versus clinical observation were compared.

The sample was a random sample of both sex adult males and females, as appendicitis is the most prevalent cause of acute abdomen; we used the relative risk reduction of complications among patients presented with appendicitis. Based on that the prevalence of a relative risk reduction of complications in the clinical observation group, 31%; and a relative risk reduction of complications in the laparoscopy group, 69%, the sample size was 25 cases for each group after adding 10% dropout.[3,9,10]

Inclusion Criteria

Patients with NSAP aged above 18 years of both sexes, hemodynamically stable, have no signs of sepsis or septic shock, accepted coagulation profile, and fit for general anesthesia American Society of Anesthesiologist (ASA I–ASA II).

Exclusion Criteria

patients with hemodynamic instability, uncontrolled coagulopathy, multiple previous laparotomies, massive abdominal distension, or patient refusal of a laparoscopic procedure.

Preoperative Evaluation and Preparation

All patients who presented to the emergency department (ED) with acute abdominal pain during the study period underwent preoperative evaluation in the form of history taking, thorough physical examination, and laboratory and radiologic investigations. Patients were classified randomly into two groups: Group I—for whom early laparoscopy was done; Group II—who were put under clinical observation and follow-up.

Preoperative History Taking

A full history was obtained from all patients. The pain was analyzed in terms of onset, course, duration, location, character, quality, and severity. Other symptoms associated with abdominal pain (e.g., anorexia, nausea, and vomiting) were reported. Medical causes for acute abdominal pain (e.g., diabetic ketoacidosis) were excluded. Comorbidities (e.g., diabetes, hypertension, cardiac, hepatic, or renal pathology) were identified and managed, as necessary.

Preoperative Examination

Vital signs were recorded to exclude hemodynamic instability. Abdominal examination (including rectal and pelvic examination if necessary) was performed in all patients.

- Inspection: Critical diagnostic indicators included a careful examination of the abdominal shape, scars, visible masses, and abdominal movement during breathing.
- Palpation: For the diagnosis of abdominal guarding, epigastric pulsations, and tenderness. A rectal examination was performed to detect any obvious or concealed blood, pain, or mass (fecal impaction, prostate, tumor, or pelvic abscess). A pelvic examination is often performed on women who present with lower abdominal pain to exclude ectopic pregnancy, ovarian torsion, and pelvic inflammatory disease (PID).
- Percussion: For the diagnosis of large cysts, ascites, and abdominal masses.
- Auscultation: Initially, mechanical intestinal obstruction was characterized by hyperactive bowel sounds. Additionally, a renal and abdominal aortic bruit may be audible.

Investigations

- Laboratory investigations: Complete peripheral blood count, serum electrolytes, creatinine, liver function tests, and serum amylase levels in patients with right upper quadrant abdominal pain, blood glucose, urinalysis, and urine pregnancy test for all women of childbearing age.
- Imaging investigations: Plain abdominal X-ray and abdominal ultrasound: Abdominal computed tomography (CT) and for early laparoscopy group (group I): Preoperative preparation involved one or more of the following, as necessary: (A) Intravenous (IV) fluid resuscitation; (B) Correction of electrolyte or acid–base disturbances; (C) Antibiotics.

Operative Technique

Creation of pneumoperitoneum and port placement. Frequently, the access port was positioned in the supraumbilical or infraumbilical area, depending on the technique. Pneumoperitoneum was achieved by the "open method" in all cases. To generate the pneumoperitoneum using the open or Hasson approach, a little skin incision was made, and the rectus fascia was dissected to locate the peritoneum, which was then grasped with Allis clamps and opened with scissors. Confirmation of entry into the peritoneal cavity was accomplished either by digital palpation of the smooth intraabdominal tissues or vision of the omentum or small bowel. After port placement, a detailed examination of the peritoneal cavity was performed.

Placement of Additional Ports

Additional ports (5- or 10 mm) were placed under direct vision to prevent unintended injuries, to further explore any areas of interest, or to execute a therapeutic technique.

Perioperative Care

In diagnosed cases and negative cases, the procedure was done, intraoperative bleeding, conversion to open, bowel injury, postoperative wound infection, port site hernia, shoulder pain, postoperative hospital stay, postoperative complications (deep venous thrombosis, chest infection, and urinary tract infection).

Postoperative Care

Intravenous fluids, antibiotics, and analgesics. Drains were removed once the daily output was less than 50 cc. Patients were instructed to come for follow-up 2 weeks, 1 month after the operation. Stitches were removed 10–14 days postoperatively.

For the Clinical Observation Group (group II)

Patients who were randomized to this group were those who were hospitalized under active clinical observation. A comprehensive clinical examination was conducted twice daily. The baseline

Table 1: Age and gender among both groups

Variable	*Laparoscopic group N = 25*	*Conservative group N = 25*	*p-value*
Age[a]			
Mean ± SD	41 ± 12.01	36 ± 11.48	0.136
Range	18–55	19–56	
Gender			
Female[b]	14 (56)	16 (64)	0.773

[a]Data were expressed as mean ± SD; [b]Data were expressed as *n* (%)

Table 2: Final diagnosis of both groups

Variable	*Laparoscopic group N = 25*	*Conservative group N = 25*	*p-value*
Final diagnosis[b]			
Acute appendicitis	6 (24)	4 (16)	0.496
Acute cholecystitis	3 (12)	4 (16)	1.00
Adhesions	3 (12)	4 (16)	1.00
Diverticulitis	3 (12)	0 (0)	0.235
Perforated peptic ulcer	2 (8)	0 (0)	0.490
Ovarian cyst	2 (8)	8 (32)	0.074
PID	3 (12)	0 (0)	0.235
Undiagnosed	3 (12)	5 (20)	0.702

[b]Data were expressed as *n* (%). PID, pelvic inflammatory disease

blood tests were repeated 24 and 48 hours after admission, and supplementary hematologic and/or radiologic investigations were conducted in accordance with the patient's clinical progression. As soon as a clinical diagnosis could be established, the necessary surgical or medical intervention was initiated. Admission, close observation, IV fluids, antibiotics, analgesics, complete blood picture and other investigations as needed, erect chest and abdomen X-ray, pelviabdominal ultrasound, monitoring of (vital signs–pain–signs of peritonitis), hospital stays, surgery if done, operative time, intraoperative bleeding, bowel injury, postoperative wound infection, urinary tract infection, chest infection, and deep venous thrombosis.

Statistical Analysis

Statistical analysis was applied using Statistical Package for Social Sciences (SPSS), version 21.0. Correlations between various factors were assessed using Spearman and Pearson rank correlation; $p < 0.05$ is considered significant. All data were expressed as mean ± standard deviation (SD).

Results

Table 1 showed that age and gender were matched amongst both groups and female predominance in the conservative group.

Table 2 shows that acute appendicitis was the most common diagnosis following laparoscopic surgery 24%, whereas in the conservative group, ovarian cyst was the most common diagnosis 32%.

Table 3 demonstrates that laparoscopic surgery was carried out for group I and the procedures were completed in 25 patients (100) with a mean operative time of 37 minutes, intraoperative bleeding was reported in 4 patients which were significantly presented in this group with no need to convert to open surgery. In the conservative group II 13 out of 25 patients were subjected to laparoscopic surgery following conservative management for 48 hours in the surgery department with a mean operative time of 42 minutes.

Table 3: Operative data of both groups

Variable	*Laparoscopic group N = 25*	*Conservative group N = 13*	*p-value*
Operative time (minutes)[a]			
Mean ± SD	37.04 ± 5.76	42.31 ± 12.28	0.164
Range	29–47	34–60	
Intraoperative bleeding			
Yes[b]	4 (16)	0 (0)	0.001
Conversion to open			
Yes	0 (0)	4 (31)	0.001

[a]Data were expressed as mean ± SD; [b]Data were expressed as *n* (%)

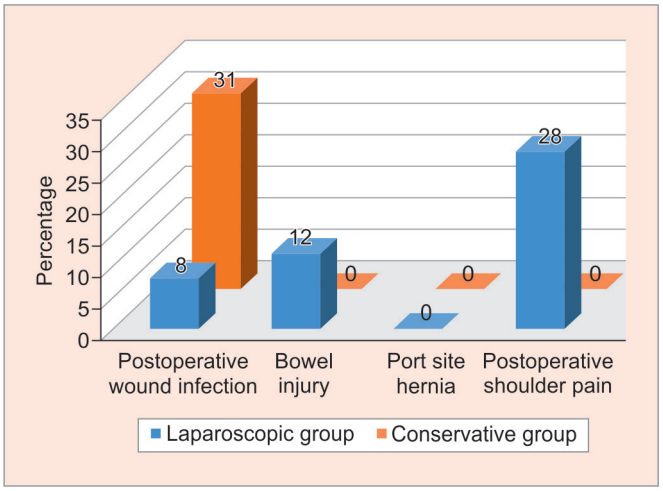

Fig.1: Postoperative complications of both groups

Table 4: Hospital stay of both groups

Variable	*Laparoscopic group N = 25*	*Conservative group N = 25*	*p-value*
Hospital stay (days)[a]			
Mean ± SD	2.96 ± 0.88	4.44 ± 1.29	<0.001
Range	2–5	3–6	

[a]Data were expressed as mean ± SD

Figure 1 illustrates that four patients in the conservative group who were subjected to surgery developed wound infection compared to two patients in the other group with a statistically significant difference, however, three patients in the laparoscopic group developed bowel injuries which was not occurred to any patient in the other group.

Table 4 shows that the mean hospital stay was significantly higher in the conservative group compared to the laparoscopic group.

In Table 5, patients were missed in the follow-up from the laparoscopic group where no missed patients in the other group with free of symptoms at this time among both groups, three patients were still missed in the follow-up from the laparoscopic

Table 5: Follow-up post operative for laparoscopic group and after admission for conservative group

Variable	*Laparoscopic group N = 22*	*Conservative group N = 25*	*p-value*
Follow-up 2 weeks			
Free	22 (100)	25 (100)	1.00
Follow-up 1 month			
Recurrence	3 (14)	0 (0)	0.198
Readmission	0 (0)	0 (0)	

group where no missed patients in the other group with free of symptoms at this time among both groups.

Discussion

Since the intraabdominal pathology of acute abdominal pain represents major conflict and may need urgent or immediate intervention evaluating the laparoscopy role in acute abdominal pain management was highlighted as a main point of interest.[11,12]

Consequently, this study was conducted and aimed to evaluate the role of early laparoscopy in NSAP.

In this research, 70 cases were assessed for eligibility. Of all eligible cases, 14 cases were excluded regarding the inclusion criteria and 6 cases refused to participate; 50 cases were included (25 in each group).

This research demonstrated that there was no significant difference between the studied groups regarding age and gender.

This research revealed that the definitive diagnosis was achieved in 88% of cases in the laparoscopy group and 80% of cases in the conservative group. Acute appendicitis was the commonest diagnosis following laparoscopic surgery 24%, whereas in the conservative group, ovarian cyst was the commonest diagnosis 32%.

Consequently, the laparoscopy could recognize a pathology in 22/25 cases. Therefore, our research presents a diagnostic yield of 88% which aligns with other studies that have shown comparable rates of high definitive diagnostic rates (between 86 and 100%).[13]

Morino et al.[14] revealed that diagnosis was achieved in 83.4% of the laparoscopy group and in 45.1% of the clinical observation group.

The most common diagnoses in laparoscopy were appendicitis in 16 cases (30.1%), PID in 7 (13.2%), and no diagnosis in 11 (20.7%) while the most common diagnoses in observation were appendicitis in 3 cases (5.8%), PID in 8 (15.6%), and no diagnosis in 28 (54.9%).[14]

In one study done by Townsend et al.[15] laparoscopy was capable of achieving a definite diagnosis in 93–100% of patients and could perform a definitive therapy of the underlying condition in 44–73% of patients.

Agresta et al.[16] reported that a definitive diagnosis was achieved in 85.7% of patients and 90.6% of those patients were effectively managed with laparoscopy.

The current study results revealed that 13 out of 25 patients in conservative group were subjected to surgery following follow-up in the emergency room (ER), and the operative time was not different among both groups.

In agreement with our research, Sharaf et al.[12] reported that a definitive diagnosis was achieved in 99% of the instances. A total of 64% of the cases under investigation were effectively handled using laparoscopy. Conversely, the conversion rate to open surgery was 33%, which exceeded the rates documented in prior research.

Mehta et al.[17] also demonstrated that the conversion rate was 19%, with challenging procedures or inability to establish a definitive diagnosis serving as the causes for conversion, while Karamanakos et al.[18] revealed that the conversion rate was 2.2%.

Regarding postoperative complications, this research found that four patients in the conservative group who were subjected to surgery developed wound infection compared to two patients in the other group with significant differences.

In concordance with our research, Morino et al.[14] demonstrated that the average length of hospitalization was 3.7 days in laparoscopy and 4.7 days in observation which is significantly high in the observation group. This is consistent with Rubbia et al.[13] who reported that mean hospital stay was 3.36 days, and most cases were discharged on 1–3 postoperative days.

At follow-up postoperatively, the current study results revealed that three patients were missed in the follow-up within 1 month after admission from the laparoscopic group whereas no missed patients in the other group with free of symptoms at this time among both groups.

After 3 months of follow-up, 4 patients of the conservative group were missed during follow-up and 4 patients (19%) returned with abdominal symptoms which were managed conservatively; however, 5 patients (23%) in the laparoscopic group returned with abdominal symptoms which did not require any surgical intervention and referred to gastrointestinal tract (GIT) department for further management.

Morino et al.[14] revealed that 3 months after discharge, 20% of cases in laparoscopy and 52% in observation had recurrent abdominal pain with significant difference between them while after 12 months, 16% in laparoscopy and 25% in observation with no significant difference between them.

Rubbia et al.[13] followed up the patients at 10 days, 1 and 3 months postlaparoscopically and revealed that most cases exhibited enhancement in their condition in both groups with 2.3% of cases claiming that their problems persisted at 10 days, none thereafter.

The strength points of this study are that it is a prospective study design, its setting at a single tertiary care hospital, and the inclusion and evaluation of two different management routes. It provided that laparoscopy seems to be a promising, safe minimally invasive diagnostic and therapeutic procedure that is very effective in diagnosing and treating acute abdominal problems. Additionally, it may assist surgeons in selecting the most appropriate targeted incision for patients in whom laparoscopic therapy is not feasible for definitive treatment.

Limitations of the study include a very small sample size in comparison to prior research and the absence of a multicentric design, which introduces a substantial potential for publication bias. Also, the relatively short-term follow-up of patients postoperatively as Morino et al.[14] tracked outcomes for 12 months postoperatively, which may underestimate the incidence of recurrence of symptoms of abdominal pain.

Conclusion

Diagnostic laparoscopy is a safe and very effective minimally invasive therapeutic and diagnostic method, as it is used to identify and treat acute abdominal diseases. It minimizes morbidity, permits treatment and diagnosis in the same facility in most cases, shortens hospital stays, and reduces investigative costs.

Ethical Approval

Written consent was obtained from participants and they have the right to refuse without effect on their management.

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REVIEW ARTICLE

The Challenges and Adaptations of Laparoscopy for Abdominal Pathologies in Nigeria: A Systematic Review

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Abstract

Background: Even though, laparoscopy has evolved as the gold standard of treatment for abdominal surgical pathologies, a lot of problems and challenges are still associated with its routine use in the treatment of such patients in Nigeria. The hurdles involved in the use of laparoscopy are still pervasive even though most of the procedures performed are not advanced. This study aims to enumerate, via a qualitative synthesis performed on the selected studies, the challenges of laparoscopy in Nigeria.

Methodology: We assessed articles, written in English language in the last 20 years, from PubMed, African Index Medicus and Scopus. A few were also manually added from bibliography and references of articles. The search terms were "challenges," "laparoscopy," and "Nigeria." The inclusion criteria were studies on laparoscopy in Nigeria whose content could be assessed. The challenges and adaptations and reason for converting to open surgery were subsequently noted. The exclusion criteria included studies on gynecologic laparoscopy, case reports, articles with fragmented data and articles not discussing the challenges that were encountered. PRISMA guideline for systematic review was followed.

Results: The search yielded 226 papers. Seventeen papers which met the inclusion criteria were studied in-depth. The challenges identified included incessant power outages during surgery, staff apathy, high cost of set-up and incessant strikes. The adaptive strategies noted include the use of uninterrupted power system (UPS), training of support staff, re-use of disposable instruments. The reasons for conversion to open surgery varied from excessive bleeding to difficult anatomy.

Conclusion: The challenges facing the laparoscopic surgeon in Nigeria are peculiar and likely to snowball in the future. In order to ensure its sustainability, policymakers should solve the highlighted challenges and also provide enabling environment. This might promote the adoption of laparoscopy for treating patients with abdominal pathology in the future.

Keywords: Adaptations, Challenges, Conversion, Laparoscopy.

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Introduction

Surgical care, in the sub-Saharan Africa, has been associated with poor funding and non-availability of health insurance.[1] About 33 million people, in 2010, experienced catastrophic spending as a result of payments for surgical care and the majority of these patients were living in the sub-Saharan Africa.[2]

Despite the benefits of laparoscopy for treating abdominal disease and the recent advances in the techniques of minimally invasive surgery, its adoption in the treatment of abdominal pathology in Nigeria continues to be slow.[3–8] In several low-income and medium-income countries (LMIC), the laparoscopic procedures performed by the surgeons are still basic and associated with various hurdles many of which could be frustrating. Moreover, several senior surgeons have developed apathy toward minimally invasive surgeries and this might not be unconnected to the challenges encountered during the process of minimally invasive surgery.[7] The adoption of laparoscopy is associated with steep learning curve, need for specialized training and a high cost of set-up, especially in a low-resource setting like Nigeria.

Gynecologic laparoscopy has been carried out steadily, in Nigeria, in the last 50 years due to donation of instruments by charitable organizations.[4,5,9] The procedures done were limited to diagnostic laparoscopy and bilateral tubal sterilization.[10] This was due to decay in infrastructural in most government hospitals in Nigeria.[11] Despite this, a few private hospitals in the country still managed to have gynecologic laparoscopy in their services.[10] Due to the special tertiary healthcare intervention by former President Olusegun Obasanjo (1999–2007), the use of minimally invasive surgeries for abdominal pathologies became common in Nigeria.[11]

Several challenges of minimally invasive surgery in the LMIC have been enumerated.[4] Those challenges associated with laparoscopy for abdominal pathology in Nigeria have not been properly outlined in a structured review. Since the problems of the healthcare industries in Nigeria are peculiar, we believe that a review would help to highlight the various hurdles encountered. Perhaps, this might help in the drafting and implementation of appropriate policies. Furthermore, these might assist in aiding the increased adoption of laparoscopy in the treatment of abdominal pathology if these impediments are solved. This study aims to highlight the problems and challenges associated with laparoscopic

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surgeries for abdominal pathology in Nigeria. We also made some recommendations to bypass some of these enumerated problems.

Methodology

The research question was "what are the challenges of laparoscopy in Nigeria?" The PubMed, African Index Medicus, and Scopus were assessed for articles written in English Language published in the last 30 years. In accordance with PRISMA guidelines (Fig. 1), this review was registered on the PROSPERO registry for systematic review with identification number: CRD42022367935.[12] The complete search terms were as follows: ("Challenges"[Text Word] OR "Problems"[Text Word]) AND (("laparoscope*"[Text Word] OR "Minimally invasive"[Text Word]) AND "laparoscopy"[MeSH Terms]) AND ("Nigeria"[MeSH Terms] OR "Nigeria"[All Fields] OR "Nigeria"[All Fields]). The last search was conducted on the 26th of November, 2022.

The inclusion criteria were original articles or primary research studies on laparoscopy which were published in the last 30 years, whose content could be assessed. The concept included the problems encountered at surgery and adaptations for successful laparoscopic surgery. The context was laparoscopy for abdominal pathologies in Nigeria.

The exclusion criteria included studies on gynecologic laparoscopy, case reports, commentaries, case series, articles with fragmented data and articles not discussing the challenges that were encountered. A qualitative synthesis was performed on the selected studies.

Article screening and selection were done in a multistage process. The first stage involved skimming the titles and abstracts of identified articles for inclusion. The second stage involved another screening of the titles and abstracts by the second author to minimize the chances of excluding potentially useful articles and vice versa. At the final stage, the full texts were assessed for relevance before inclusion in the final cohort.

Results

The search was done from 28/10/2022 to 26/11/2022 and it yielded 226 papers. Seventeen papers which met the inclusion criteria were studied in-depth (Table 1). The articles included patients recruited between 2005 and 2019.

The challenges encountered during laparoscopic surgeries were divided into equipment/technical, systemic, patients and technical factors (Table 2). The most common challenges identified were incessant power outages during surgery and lack of trained support staff.[13–19] Abdur-Rahman et al. noted that there was a need to train camera operator on the job.[19]

Staff apathy is another challenge noted as theater staff were not tolerant of long procedure and hence, not willing to set-up instruments for laparoscopy, especially emergency procedures.[19–21] Several staff also had poor mindset about laparoscopy.[21]

The absence or failure of electrosurgical equipment, high cost of set-up, incessant strikes by healthcare workers and limited intra-operative radiologic imaging were among the other challenges noted (Table 2).[9,13,15,16,19,22–24]

The adaptive strategies used during laparoscopic surgeries included the re-use of disposable instruments, using disposable tube drapes for camera and re-training of support staff.[9,16] The other adaptive strategies were the use of adult instruments for pediatrics, sourcing for donations from pharmaceutical companies, the use of uninterrupted power system (UPS) to overcome power outages during procedures and the use of latex gloves as retriever bag (Box 1).[19,25,26]

Seven studies discussed the reasons for conversion to open surgery.[9,16,20,22,23,26,27] The most common reasons for converting

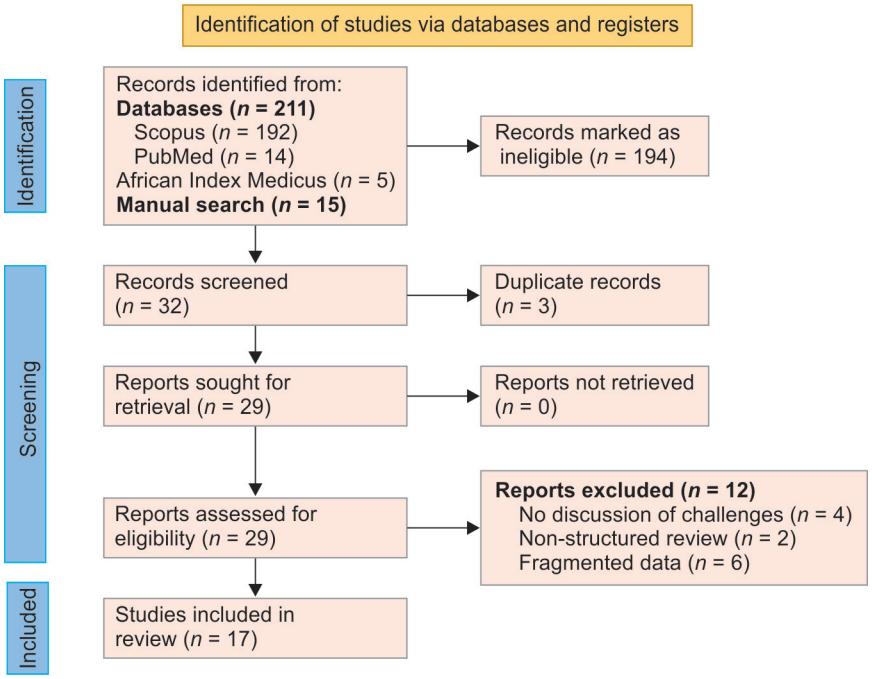

Fig. 1: PRISMA flow diagram

Table 1: A summary of the included studies

Author of study	*Center*	*Year*	*Type of study*	*Number of patients*	*Duration of study*
Sheshe et al.[27]	AKTH Kano	2013	Retrospective	42	2005–2013
Adisa et al.[9]	OAUTHC IFE	2013	Retrospective	175	2009–2012
Ray-Offor et al.[14]	Port Harcourt	2014	Retrospective	15	2011–2012
Ekwunife et al.[15]	NAUTH and FMC Owerri	2012	Retrospective	20	2006–2009
Balogun et al.[16]	LUTH	2020	Retrospective	137	2015–2019
Ismaila et al.[17]	JUTH	2013	Retrospective	21	2011–2012
Afuwape et al.[25]	UCH	2012	Retrospective	13	2009–2011
Misauno et al.[23]	Multicenter	2012	Retrospective	21	2008–2011
Ekwunife and Nwobe[20]	FMC Owerri	2014	Retrospective	100	2007–2013
Obonna et al.[13]	Multicenter	2020	Retrospective	181	2009–2018
Mba et al.[18]	GOMBE	2018	Retrospective	22	2012–2016
Olajide et al.[24]	LUTH	2020	Retrospective	32	2014–2018
Ayandipo et al.[26]	UCH	2013	Retrospective	42	2011–2013
Ekwunife et al.[21]	NAUTH	2017	Retrospective	15	2014–2016
Igwe et al.[22]	OAUTHC	2020	Retrospective	114	2011–2019
Abdur-Rahman et al.[19]	UITH	2016	Retrospective	73	2009–2014
Takure et al.[28]	UCH	2021	Retrospective	12	2015– 2019

Table 2: Showing the various challenges experienced by the laparoscopic surgeons in Nigeria

Equipment and infrastructure	*Systemic*	*Patient*	*Technical*
Gas leakage[17]	Delay in other cases (long waiting list)[27]	Delay in presentation[21,28]	Spillage of gallstone[15]
Absence or failure of electrosurgical device[13,15,22]	High cost of set-up[9,23]		Excessive bleeding[9,15]
No laparoscopy clip[17,27]	Lack of trained support staff[14,16,18,19]		
No knot pusher[17]	Incessant strikes[16,19]		
Unavailable spare parts[16,19]	Staff apathy[19–21]		
Inadequate laparoscopy tower[18]			
Instrument failure[25]	Poor record-keeping[18]		
Limited intraoperative radiologic imaging[24]	Long duration to set-up equipment[19]		
Inappropriate instrument[18,22]			
Poor maintenance[21]			
Incessant power outage during surgery[13–17]			
No capnograph[14]			

Box 1: Showing the various adaptations by different surgeons

Using latex gloves as specimen retriever bag[9,26]	Establishment of surgical skill dry lab[22]
Extracorporeal suture ligation[9,14]	Training and re-training of support staff[16]
Use of reloadable clip[9]	Sourcing for donations from pharmaceutical companies[19]
Use of disposable tube drapes for camera[9]	
Re-use of disposable instruments[9,22]	
Use of uninterrupted power system (UPS)[19]	
Using adult instrument for pediatrics[19]	

Box 2: Reasons for converting to open surgery

Abnormal anatomy[9,26,22]
Bleeding[22,23,27]
Faulty cable with loss of view[9]
Dense adhesions[22]
Cardiac arrhythmias[16]
Appendix mass[16]
Intraoperative bladder injury[16]
Gallbladder mass[20]
Difficulty in assessing tumor resectability[20]
Edematous rectum during laparoscopic rectopexy[20]
Gross spillage of gallstones[26]
Autolyzed appendix not found[22]
Equipment failure[9]

to open surgeries were excessive bleeding and difficult anatomy (Box 2).[9,22,23,26,27]

Discussion

Laparoscopy has evolved as the gold standard of treatment for abdominal surgical pathologies due to associated benefits and recent advances in technology as it helps to reduce the rate of surgical site infection and hospital stay; significant improvement in postoperative pain control; reduced the incidence of unnecessary laparotomy; enhanced clinical diagnosis and achieved histopathological confirmation of intra-abdominal tumors.[3,4,6–8,29]

The studies reviewed were on subjects treated in the public hospitals several of which were beneficiaries of the healthcare intervention program by the former President Olusegun Obasanjo.[11] Only five of the studies were located in the northern part of the country. Several hospital managers kept the costs of laparoscopic procedures comparable to those of open surgeries during the initial phase.[17–20,23,27,30] Udwadia in a retrospective study involving 1,084 patients who had laparoscopic cholecystectomy found that the cost per case was $20 due to the various adaptations used intra-operatively.[31] Also, Bendinelli et al. found that laparoscopy was cost-effective as patients had shorter hospital stay hence, reduced total hospital costs.[32]

Lack of trained staff and incessant power outages were among the most common challenges encountered during laparoscopy. A sustainable laparoscopy program requires a well-funded training program for a variety of staff, including nurses and other support staff.[33,34] This may involve travelling to another city or overseas.[35] Hence, establishment and sustainability of such training is expensive.[20] The hierarchical nature of the Nigerian society means that residents and junior surgeons will sparingly push their seniors for training opportunities. In addition, lack of interest and the conservative attitude of older surgeons to new technologies have led to a slow adoption of laparoscopic surgery in Nigeria.

A total of 25 countries are still experiencing power cuts in one form or the other sub-Saharan Africa.[36] In a retrospective study by Apenteng et al., there was increased mortality by 43% for each day in which the power cut lasted more than 2 hours.[36] The flip-flop nature and associated surge of the power supply was found to cause damages to equipment.[37] The proposed solutions are upgrade of power generation and distribution system, employment of competent staff, and the use of energy conservation techniques.

Incessant strikes in the health sector is also a major challenge noted by different studies. The major causes of industrial strike actions, according to Oleribe et al., were poor staff welfare, poor hospital infrastructure, and inter-professional rivalry.[38] This led to disruptions in service delivery, loss of confidence in the system, and consequent fall in the number of patients presenting in the hospitals. The Nigerian Federal Government has been charged with the improvement in welfare; improved leadership training to physicians; and ensure implementation of the National Health Act.

Staff apathy is a major challenge to the practice of laparoscopic surgeries in Nigeria. Kroposki et al. found that healthcare workers with much role conflict and role ambiguity had less organizational commitment.[39] The essential criteria of good teamwork include close communication, team philosophy, and good interpersonal relationships.[40] The absence of clear goals, tasks, and role delegation is associated with poor teamwork and hence, reduced output.

The laparoscopy tower was incomplete in some of studies due to the high cost of set-up. In other developing countries, the various adaptions that have been done include the use of sigmoidoscope air pump, incorporating a surgical blade between bipolar diathermy to form a tripolar forceps, and the use of sunlight as a light source.[18,31,41,42] The conversion of disposable to re-usable instruments led to significant cost savings and such instruments could be used for up to 18 years.[43] However, the use of glutaraldehyde for chemical sterilization of such instruments[32] has led to an increased rate of surgical site infection by atypical mycobacterium species.[44] Hence, ethylene oxide has been recommended as sterilization of laparoscopic instruments. Adisa et al. and Igwe et al. noted that the conversion of disposable instruments to re-usable ones but the mode of sterilization and the incidence of atypical *mycobacterium* surgical site infection were not discussed.[9,22] The unavailability of retrieval bags has led to a lot of adaptations like the use condoms, nasogastric tube covers, and sterile gloves. However, the use of adapted retriever bag led to a spillage of gallstones on attempt at retrieval during a laparoscopic cholecystectomy.[15]

We hereby make the following recommendations for adaptations:

- Provision of a universal healthcare insurance in order to make laparoscopic procedures affordable. A public private partnership with encouragement of pharmaceutical companies and non-Governmental organizations to donate laparoscopic equipment to hospitals. The use of equipment leasing in the public hospitals.
- The manufacturing of re-usable equipment and spare parts in the country to ensure a reduction in the pressure exerted on the foreign exchange reserve.
- Equipment modifications like using solar powered laparoscopic devices, insufflation with air, abdominal lift device, using sunlight as light source and using condoms as endopouches.
- Revision and re-structuring of the curriculum of the post-graduate training in surgery. Using appropriate methodology, training could be done by teleproctoring and the use of immersive reality technology. There should be gradual exposure, accumulation of skills and repetition. There should be establishment of dry labs and use of animal models to promote improvement in skills acquisition.

- To reduce staff apathy, the hospital managements should set goals for the theatre staff, ensure clarification of the visions, promote positive mindset, and build a reward system. The use of mentoring to promote good behavior and positive mindset should also be explored.

Conclusion

Despite the successes recorded, the challenges facing the laparoscopic surgeon in Nigeria, though surmountable, are peculiar and enormous. We believe that staff in various hospitals in Nigeria would need to be adequately trained in changing the prevalent apathy and to promote the routine use of laparoscopy. Hence, to ensure improvement and sustainability of laparoscopic surgery in Nigeria, there must be a teamwork between surgeons, policy makers, and manufacturers to overcome limitations to the adoption and implementation of laparoscopic surgery in Nigeria.

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REVIEW ARTICLE

Difficulty in Diagnosing Gastrointestinal Stromal Tumors: Literature Review and Case Report

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Abstract

Background: Gastrointestinal stromal tumors (GISTs) are mesenchymal tumors originating primarily from the stomach and small intestine. Preoperative diagnosis of GIST relies on improved computed tomography (CT), endoscopy, and endoscopic ultrasonography (EUS), but despite these tests, there is a high rate of misdiagnosis. The aim of this study was to review the literature focusing on diagnostic methods for such lesions by analyzing preoperative contrast-enhanced CT, endoscopy, EUS, and other tests.

Materials and methods: A systematic search of articles using electronic databases (MEDLINE, and Embase) was conducted in the last 10 years and 106 items were filtered from the search list. Finally, we report our experience of "difficult diagnosis" in which several diagnostic methods were needed and a definitive diagnosis could only be made after surgical resection.

Results: After a review of all papers, 95 studies were excluded, due to incorrect study design, wrong population, non-English language, or other reasons. Finally, 41 studies were included, with a total of 2860 analysis cases. Conclusions Difficult diagnosis when dealing with GIST is particularly notable. Our study emphasizes how the need to reach the correct diagnosis may lead to performing countless preoperative examinations without arriving at the goal. Our case presentation reports a GIST mimicking pancreatic cyst.

Keywords: Case report, Diagnostic challenge, Diagnostic laparoscopy, Endoscopic ultrasound, Gastrointestinal stromal tumor, Pancreatic neoplasms.

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Introduction

Gastrointestinal stromal tumors (GISTs) are mesenchymal tumors, that mainly originate from the stomach (60%) and the small intestine (30%). Originating from Cajal cells (intestinal pacemaker cells located between the layers of the muscularis propria), and most frequently happen at the age >50 years.[1]

Several classifications can be found in the literature to catalog this broad spectrum of lesions.[2] Considering that they most often affect the stomach, it is useful for diagnostic and therapeutic purposes to distinguish them into the following four types: (A) A GIST protrudes into the luminal side, like polyps; (B) it has a wide connection with the muscularis propria and bulges into the luminal side; (C) it is located in the middle of the gastric wall like a transmural location; (D) it protrudes mainly into the serosal side of the gastric wall and protrudes from the outer wall of the organ.[3]

In numerous patients, GIST is an occasional finding, and tumors are often detected with unspecific symptoms.[4] The preoperative diagnosis of GISTs depends on enhanced computed tomography (CT), endoscopy, and endoscopic ultrasonography (EUS), but despite these tests, there is a high misdiagnosis rate. Fine needle aspiration (FNA) biopsy plays an important role in differentiating GISTs from other gastrointestinal submucosal tumors (SMTs), but this technique has a certain false negative rate due to both the small sample size and the few histological differences between these types of lesions.[5]

According to the most recent guidelines and GIST risk assessment standards, the biggest tumors are meant to be treated with complete surgical resection.[6,7] What often happens is that lesions suspicious for GIST actually return from histologic evaluations as leiomyoma, heterotopic pancreatic tissue, lymphoma, plasmacytoma, or even perivascular epithelioid cell tumors (PEComa). Dealing with GISTs, it has to be clear that preoperative diagnosis constitutes a medical challenge considering that these neoplasms represent the most frequent nonepithelial tumor of the digestive system, although not the only cluster.[8,9]

In this study, we made a review of the literature with a focus on the diagnostic approach to these types of lesions analyzing the preoperative enhanced CT, endoscopy, EUS, and any other examinations that were carried out (Table 1). A description of a case of an uncommon neoformation of the left hypochondrium with the preoperative diagnostic tests in disagreement occurred at our department was also reported.

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Patient consent statement: The author(s) have obtained written informed consent from the patient for publication of the case report details and related images.

Table 1: Type of diagnostic examination conducted

Author	*Research type*	*N cases*	*EUS**	*CT***	*MRI****
Tanaka H et al.[10]	Original article	53	53		
Hirai K et al.[11]	Journal article	631	631		
Hu B et al.[12]	Original article	128	128	128	
Lefort C et al.[13]	Journal article	54	54		
Miratashi Yazdi SA et al.[14]	Case report	1	1	1	
Apte SS et al.[15]	Journal article	113	50	110	9
Kanagalingam G et al.[16]	Case report	1	1		
Hasuda H et al.[17]	Case report	1	1		
Dhali A et al.[18]	Case report	1	1	1	
Kim YH et al.[19]	Journal article	909	909		
Ren L et al.[20]	Case report	1	1	1	1
Val–Bernal JF et al.[21]	Journal article	30	30	28	2
Lai J et al.[22]	Journal article	7	7		
Chen T et al.[23]	Journal article	50	50	50	
Lomdo et al.[24]	Case report	1	1	1	
Peltrini R et al.[25]	Case report	1	1	1	
Pesenti C et al.[26]	Journal article	9	9		
Attila T and Aydın Ö[27]	Journal article	22	22		
Okagawa Y et al.[28]	Case report	1	1	1	
Antonini F et al.[29]	Journal article	16	16		
Lopes CV et al.[30]	Journal article	89	89		
Ignee A et al.[31]	Journal article	62	62		
Li BJ et al.[32]	Case report	1	1	1	
Duan K and Chetty R[33]	Case report	1	1	1	
Vig T et al.[34]	Case report	1	1	1	
Wambura C and Surani S[35]	Case report	1	1	1	
He G et al.[36]	Journal article	224	224		
Tatangelo F et al.[37]	Case report	1	1	1	
Hamza AM et al.[38]	Case report	1	1	1	1
Kane JR et al.[39]	Case report	1	1	1	
Tsuji Y et al.[40]	Journal article	25	25		
Chen TH et al.[41]	Journal article	110	110		
Raddaoui E et al.[42]	Journal article	13	13	13	
Hirose Y et al.[43]	Case report	1	1	1	
Yamashita Y et al.[9]	Journal article	13	13	13	
Zhang Y et al.[44]	Case report	1	1	1	
Choi YR et al.[45]	Journal article	120	120	120	
Akahoshi K et al.[46]	Journal article	90	90		
Kim MN et al.[47]	Journal article	55	55		
Todaro P et al.[48]	Case report	2	2	1	
Kakeji Y et al.[49]	Journal article	18	18	18	

CT, computed tomography; EUS, endoscopic ultrasonography; MRI, magnetic resonance imaging

Materials and Methods

An extended review of the literature was conducted limited to the last 10 years, based on the results available on MEDLINE and Embase.

The search was conducted using the following keywords: gastric GIST, EUS, misdiagnosis, EUS, used with the Boolean operator "AND" diagnosis.

All articles written and published in a language other than English were excluded and not considered in the study. All publication types including journal articles, case reports and case series, and clinical trials were considered, while the left-out articles were excluded due to a wrong study design or having considered a wrong population.

Results

A screening of 106 items in total was done from the search list. After reviewing, all titles and abstracts were excluded from the study 95 papers, for wrong study design, wrong population, language other

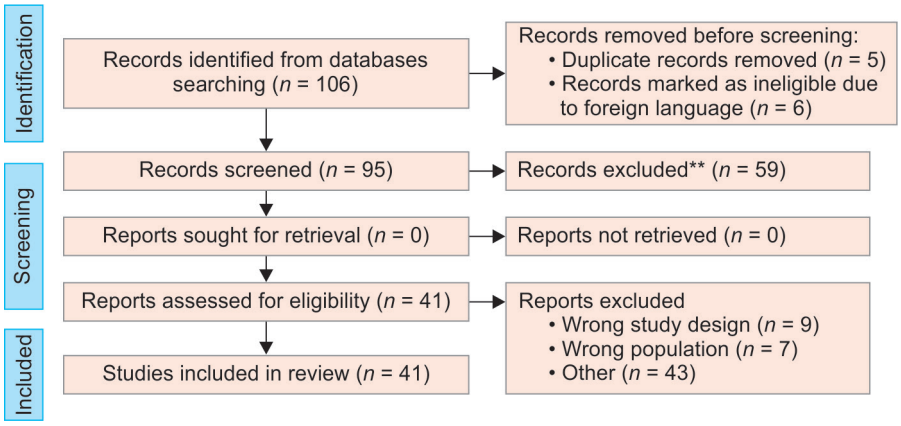


Fig. 1: Flow diagram of study choice procedure

than English, or other reasons. In the end, 41 studies were included for a total of 2,860 cases analyzed (Fig. 1).

In all the reviewed studies, an EUS diagnostic investigation was conducted. In 496 cases the aid of a CT scan was necessary, while the use of a magnetic resonance imaging (MRI) was only in 12 cases. More recent articles have stressed the role of artificial intelligence-based diagnosis. Contrast-enhanced EUS was suggested by Tanaka H et al. both in the diagnostic process and to estimate the risk of malignant potential.[10]

Endoscopic Ultrasound

Endoscopy alone is not reliable for the definitive diagnosis, and a histological examination is mandatory to differentiate the different types of lesions. The role of EUS is to provide information about vascularity, layer of origin, echogenicity, and regional lymphadenopathies. Van–Bernal JF et al. in 2020 affirms that pathological diagnosis can be based on a combination of cytological, histopathological, and immunohistochemically characteristics and EUS-FNA is a reliable, method for the final diagnosis of GIST.[21] He G et al. report in a prospective study that GIST more commonly originated from muscularis propria detected satisfactorily with EUS.[36] Nankano Y et al. in 2020 focused on issues potentially related to diagnostic failure, the tumor site and its dimensions, the number of biopsies performed, and the endoscopist who carried out.[50]

Computed Tomography

Apte SS et al., in 2021 conducted a study to evaluate the role of preoperative imaging of gastric GISTs, concluding that EUS, underestimates gastric GIST size.[15] In 2019, Chen T et al. analyzed how CT and EUS features can be helpful for risk stratification of gastric GISTs larger than 2 cm, and in their study, CT performed better than EUS for predicting tumor mitotic index and therefore the prognosis of gastric GISTs.[23]

Magnetic Resonance Imaging

Magnetic resonance imaging is not particularly used in the diagnosis of the GISTS. It is performed above all in the cases of endo-abdominal masses of uncertain nature. In 2014 Yu MH et al. led a study on how the apparent diffusion coefficient value may help predict the high malignancy potential of GISTS.[51] However, the diagnosis and treatment strategies of GIST mainly depend on the results of radiological examinations such as CT and MRI, when endoscopic treatment cannot be performed due to tumor size or location.

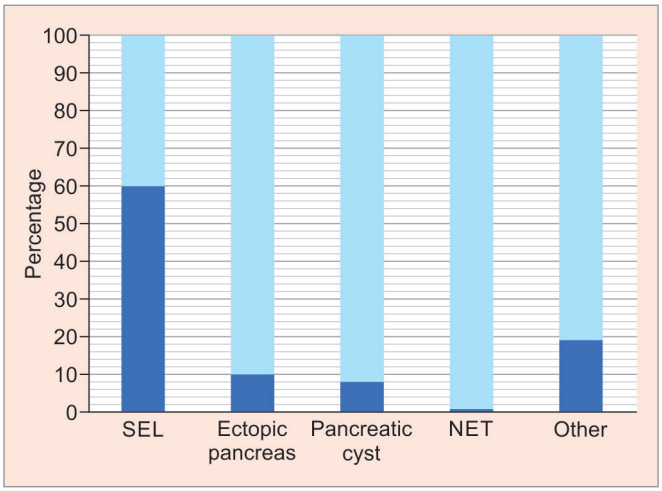


Fig. 2: Differential diagnosis and misdiagnosis in articles reviewed. SEL, subepithelial lesions including leiomyomas, neurinomas, and schwannoma; NET, neuroendocrine tumor; Other, the group that includes congenital accessory spleen, peptic ulcer gastic splenosis, gastric glomus tumor, and gastric plexiform fibromyxoma

In our work among the papers reviewed, GISTs are in differential diagnosis with other subepithelial lesions (SELs) such as leiomyomas, leiomyosarcomas, neurinomas, schwannoma, ectopic pancreatic tissue, pancreatic cysts, NETs (Fig. 2). Not all lesions essentially require surgical resection owing to their malignant nature. All gastric leiomyomas are almost benign; so, they do not need of invasive treatment. Therefore, the precise diagnosis of these lesions is central to ensuring appropriate clinical management.

Case Report

A 78-year-old man with rheumatoid arthritis, chondrocalcinosis, and pulmonary fibrosis, undergoing a follow-up chest CT scan after a long period of lack of clinical controls due to the pandemic period. The report shows the appearance of a neoformation with poorly limited edges that arises in the left hypochondrium and contracts with the splenic vessels, the tail of the pancreas, and the great gastric curvature. For this reason, the patient is admitted to our surgical department. Considering that the CT examination had not been decisive for the diagnosis, it was decided to carry out a diagnostic examination with MRI examination (Fig. 3), and subsequently with EUS and FNA.

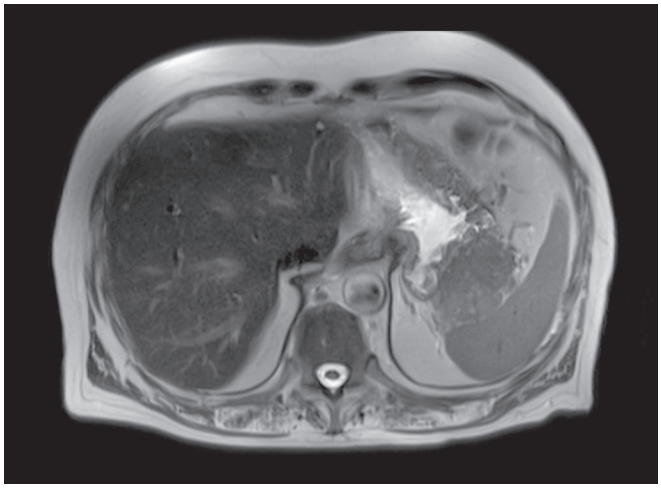


Fig. 3: A magnetic resonance imaging (MRI) picture, T2 phase. The close relationship with the stomach and spleen is evident

Magnetic resonance imaging (MRI) confirms the presence in the left hypochondrium of expansive formation with lobulated profiles, 70 × 50 × 60 mm in size, with an isointense signal in T1 and markedly inhomogeneous in T2 due to the presence of a colliquative zone with micro calcific areas, corresponding to signal restriction in DWI. This formation seems to mark laterally the superior pole of the Spleen and medially the gastric fundus. These findings appear to be referable in the first hypothesis to likely primary heteroplastic peritoneal lesion (leiomyosarcoma?) although we cannot exclude a different genesis with certainty. Surgical videat was required.

The EUS examination also confirms the presence of a multichambered area with anechoic zones inside, clear margins, and no vascularized present in the left hypochondrium. It shows no relationship with the gastric wall, while it shows a contiguous relationship with the pancreatic tail. The endoscopic diagnosis points to a serous cyst of the tail of the pancreas. A biopsy examination was performed, but the histological report was not diagnostic. No preoperative examination was allowed to reach a final diagnosis, and all diagnostic tests disagreed. In consideration of a suspected malignant lesion, the patient was a candidate for laparoscopic surgical resection.

During surgery, the lesion appears to be polylobate, parenchymatous in consistency, and shows an evident cleavage plane from the pancreatic tail and the splenic vessels. It is more adherent to the gastric wall, so a small tangential resection of the great gastric curvature was performed (Fig. 4).

The patient was discharged on the third postoperative day and the postoperative course was regular. Histological examination was conducted on an 8.5 cm gray–yellowish nodular excised mass, which revealed a low risk of recurrence, GIST (according to Miettinen and Lasota),[1] with a mitotic count below 5 mitosis × 50HPF. Immunohistochemistry was positive for CD117, CD34, and discovered on GIST-1 (DOG 1), and negative for protein S100 (Fig. 5). The exercise was complete without neoplasia on the resection margins.

The postoperative period was uneventful and a tumor board discussion with surgeons, and medical oncologists was conducted, so the patient was started on imatinib considering the large size of the tumor. The patient was in good condition, satisfied with the treatment he received, and remained disease-free after 6 months of follow-up.

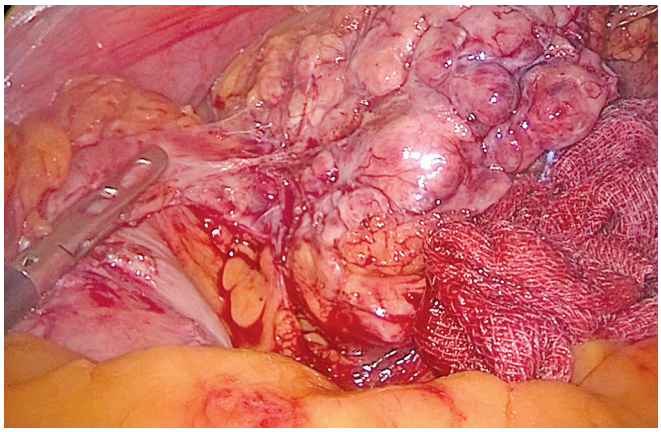


Fig. 4: Intraoperative picture shows the relationships of the neoformation with the walls of the greater curvature of the stomach

Discussion

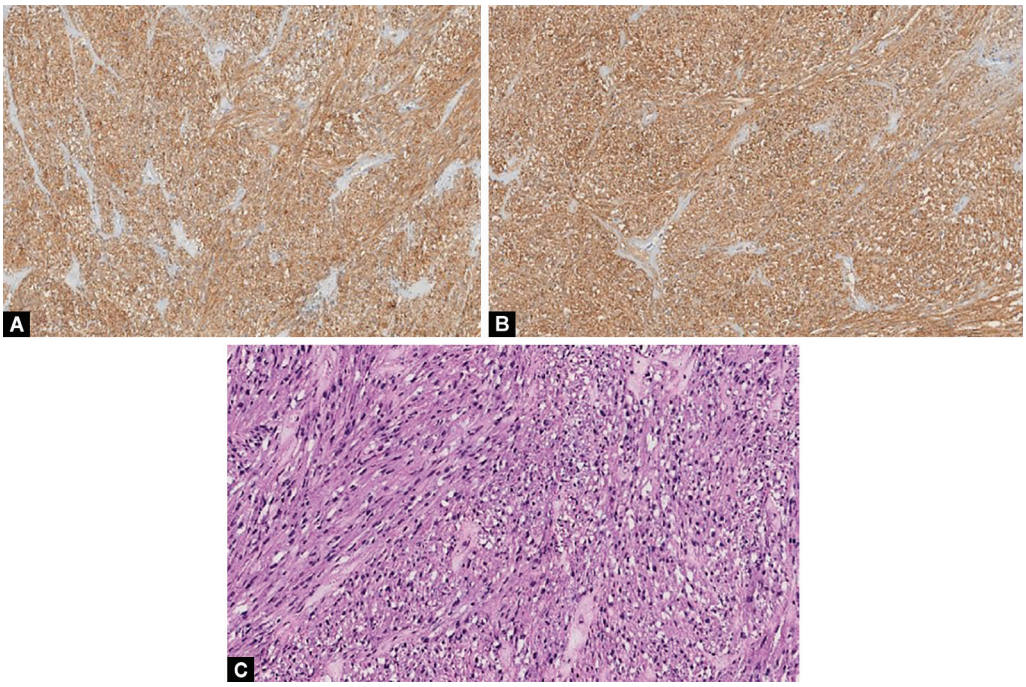
This study is aimed at understanding how difficult and complex it can be to arrive at a precise preoperative diagnosis of some forms of GIST.

In our case report, it is a GIST with exophytic growth that started from the gastric wall (great curvature) up to intercourse with other organs of the left hypochondrium and also the center of the abdomen (spleen and pancreas). The diagnosis occurred during a chest CT examination, performed after a long period of absence from follow-up controls due to the pandemic era.[52,53] This is also due to the great variability of this type of mesenchymal lesions, which can have both an endoluminal growth, and therefore be diagnosed and treated, even exclusively with an endoscopic approach. However, when they have exophytic growth, surgical treatment is often unavoidable, even if it has not been possible to have a precise preoperative diagnosis.[54]

Diagnosis and treatment strategies for GIST are determined mainly by the results of radiological investigations such as CT, and MRI when endoscopic treatment is not possible due to tumor size or site. Ultrasound-guided endoscopic FNA biopsy is useful for the diagnosis of SMTs in fact the diagnostic accuracy of EUS-guided FNA biopsy for GIST is very high, however because of SMTs are covered by normal mucosa, obtaining a specimen of tumor tissue by endoscopic biopsy might be difficult.[55,56] Nevertheless, some authors do not recommend biopsy for diagnosis of GISTs because of the possibility of their dissemination.[57,58]

The clinical manifestations of GISTs are often scarce, give no specific symptoms, and are frequently diagnosed accidentally. However, in the case of gastric GIST, these are more associated with upper gastrointestinal bleeding, so that, sometimes, the urgency to intervene endoscopically or surgically to stop the bleeding can also be configured.[59]

If a histological diagnosis has been made, then surgical resection is the first choice of treatment for GISTs defined as resectable and nonmetastatic.[60] The goal of surgery is an R0 resection, and a lymph node dissection is generally not indicated if there are no clinically suspicious lymph nodes. Numerous studies and National Comprehensive Cancer Network (NCCN) clinical guidelines have shown that laparoscopic resections are safe and feasible with oncological outcomes comparable to those of open surgery.[61,62] The possibility of chemotherapy treatment with imatinib significantly better the follow-up management of GISTs



Figs 5A to C: Histological examination. (A) Positive immunohistochemistry for CD117; (B) DOG 1; and (C) 20× hematoxylin and eosin

by improving prolonging recurrence-free survival after surgery and overall survival in metastatic or unresectable cases.[63]

From our study, it is clear that all cases of GIST are studied endoscopically with EUS because this allows us to optimally establish the size of the tumor, the edges, the layer of the wall from which the GIST originates, and other fundamental characteristics.[64–66] For these reasons, there is no doubt that the EUS investigation is the main one in these cases. But in all cases of difficult lesions with strange morphological characteristics and, most of all with an exophytic growth outside the lumen, the EUS investigation is not sufficient, and therefore it is mandatory to use other radiological techniques (CT and MRI) that are not just necessary for staging the disease and deciding on the right therapeutic approach, but they are also useful for arriving at the right diagnosis and making a differential diagnosis with other similar lesions (pancreatic cysts and pseudocysts, cystic tumors, different mesenchymal tumors).[67,68]

Our study demonstrates that this kind of lesion, in some cases, is very difficult to be recognized and the risk is to nominate a patient for surgery for an incorrect preoperative diagnosis. Certainly, in doubtful cases and in cases where there is suspicion of a misdiagnosis, all the diagnostic techniques available must be used, also because sometimes the histological examination, if carried out, may not be conclusive.

Conclusion

Accurate diagnosis is crucial for appropriate treatment and management of undefined intrabdominal mass. The chance of misdiagnosis when dealing with GISTs is particularly remarkable considering the fact that they miss pathognomonic symptoms and imaging suggestions. In difficult cases, the need to reach the correct diagnosis may lead to performing countless instrumental and noninstrumental examinations without arriving at the goal. Our case emphasizes the difficulty to achieve a correct preoperative diagnosis, noting that pancreatic lesions should be always considered in the diagnosis of gastric GIST. Professionals dealing with these clinical scenarios are strongly encouraged to engage in a multidisciplinary team discussion to grasp the function and associated differential diagnosis of GIST to provide the best treatment for the patient. This work focuses on the critical issues involved in misdiagnosis providing information aimed at the overall improvement of treatment outcomes.

Data Availability

All data generated or analyzed during this study are included in this article. Further inquiries can be directed to the corresponding author.

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CASE SERIES

Laparoscopic Splenectomy for Splenomegaly: Case Series with Literature Review

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Abstract

Aim and background: Laparoscopic splenectomy for enlarged spleen even for massive splenomegaly can be accomplished with a good overall outcome. Removal of specimens in toto, without morcellate, is also beneficial as it decreases the chances of splenosis.

Case description: Here we are presenting our early experience of laparoscopic splenectomy in five cases where one patient had massive splenomegaly.

Conclusion: Laparoscopic splenectomy for an enlarged spleen is a safe technique as it causes less post operative pain and the need for analgesia, early recovery, and less postoperative complication in the form of atelectasis. Clinical significance: Splenectomy by laparoscopic should be attempted even in massively enlarged spleen and specimen should be taken out in toto.

Keywords: Case report, Extrahepatic portal vein occlusion, Laparoscopic Splenectomy, Noncirrhotic portal fibrosis, Noncirrhotic portal hypertension, Pancytopenia, Splenomegaly.

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Background

A myriad of diseases cause enlargement of the spleen requiring its removal. Conventional open splenectomy is being replaced by a laparoscopic approach with, advancement in laparoscopic tools for ligation and the acquired experience of surgeons.

In cases of the massive spleen (spleen >20 cm in long axis), its removal mandates laparotomy through the left subcostal/midline incision often extended to the incision of the left hemidiaphragm. Laparoscopic splenectomy can be attempted in such cases with a positive outcome.

Here, we are presenting data and our experience of five cases of laparoscopic splenectomy done recently.

Out of these two cases were diagnosed as extrahepatic portal vein occlusion (EHPVO), one EHPVO with early cirrhosis (Child A), one case of hereditary spherocytosis, and one child with idiopathic thrombocytopenia.

Case Description

Case 1

A 37-year-old lady was diagnosed with massive splenomegaly clinically on an antenatal visit 5 years back outside our center. On further evaluation, her hematological parameters were hemoglobin (Hb) of 6 gm%, total leukocyte count (TLC) of 3300 mm^3, and platelets count was 20,000 mm^3. Her ultrasonography (USG) abdomen coupled with a color Doppler of the portosplenic axis revealed multiple cavernoma which replaced the portal vein, the spleen was enlarged 22 cm in long axis, perisplenic collaterals with coarse liver echo texture. She never had any symptoms neither in form of pancytopenia nor related to EHPVO and was nonbleeder. Her pregnancy was uneventful, and she delivered a normal baby by cesarean section.

After that she needed multiple hospitalizations with blood transfusion (4–6 times/year) for the last 10 years outside this center. She presented to our center and on further evaluation the diagnosis was confirmed as EHPVO, however, her liver size was reduced to 11 cm. In view of the long-standing history and reduced liver size on USG abdomen a possibility of Child A cirrhosis was made.

She underwent a laparoscopic splenectomy and biopsy of the liver. Specimen delivered in toto using improvised plastic endo bag (sterile urobag) by midline supraumbilical incision (Figs 1 and 2).

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Fig. 1: Specimen removed in toto

Fig. 3: Enlarged spleen seen on laparoscopy

Fig. 2: Final surgical scar and port sites

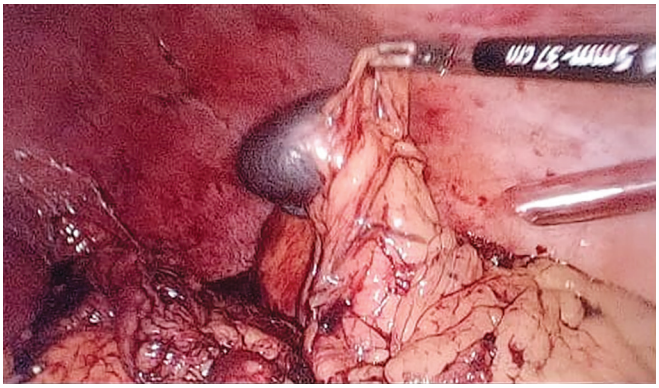


Fig. 4: Accessory spleen at hilum

Case 2

A 36-year-old lady diagnosed to have splenomegaly secondary to hereditary spherocytosis during evaluation for easy fatiguability. She was referred for splenectomy due to persistent anemias (Hb <10 gm%).

She underwent laparoscopic splenectomy. Intraoperative findings were splenomegaly with accessory spleen at hilum (Figs 3 and 4).

Prior to dissection at the hilum, control of the splenic artery was taken by applying Hem-O-lok clip. It reduces splenic blood flow thus the size of the spleen which facilitates handling better and lesser risk of intraoperative bleeding (Fig. 5).

Specimen removed in toto through midline incision is shown in Figure 6.

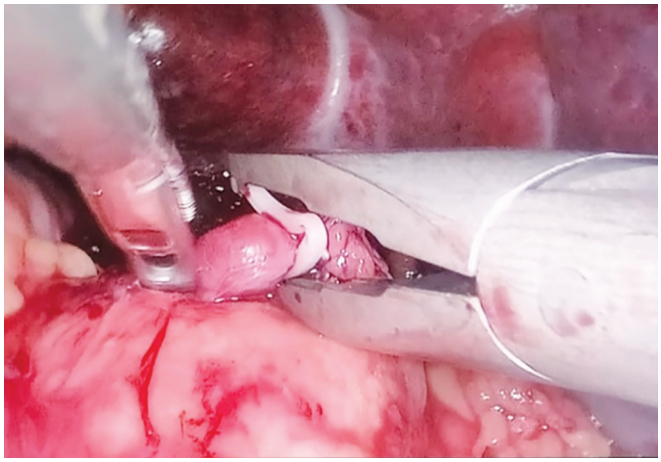


Fig. 5: Hem-O-lok application on splenic artery

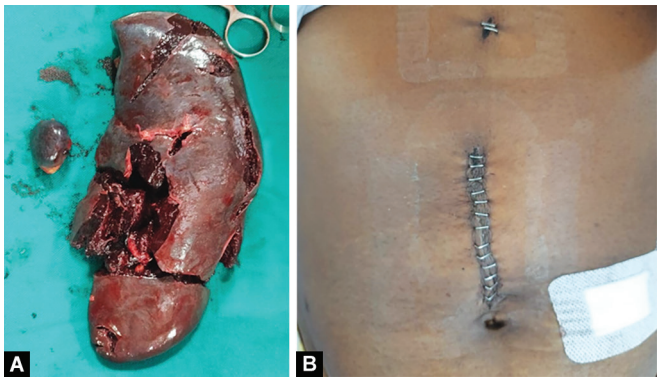
Case 3

A 14-year-old male child presented with a massive lower gastrointestinal (GI) bleed. On evaluation, he was anemic and had palpable splenomegaly. The further workup was diagnosed with persistent thrombocytopenia. He was initially managed symptomatically with a blood transfusion and subsequently underwent a laparoscopic splenectomy. We used the left-up position of the patient by tilting the table and preoperative marking of the spleen which guides port placement precisely (a total four ports of 01 × 10 mm, three ports of × 5 mm were placed) (Fig. 7). Specimen delivered by midline supraumbilical incision (Fig. 8).

Case 4

A 29-year-old lady presented with features of obstructive jaundice of 15 days duration. On evaluation by USG abdomen, multiple calculi were present in the common bile duct (CBD), portal cavernoma was present on color Doppler flow imaging (CDFI) splenoportal axis, and spleen was enlarged to 16 cm in long axis. She never had gastrointestinal bleeding or features of splenomegaly in the form of pancytopenia. She was initially managed with endoscopic retrograde cholangiopancreatography (ERCP) with CBD clearance with stent placement. During stent stent-free period, she again developed obstructive jaundice and magnetic resonance cholangiopancreatography (MRCP) revealed CBD stricture. So finally, she was planned for proximal splenorenal shunt (Linton shunt) followed by hepaticojejunostomy (HJ) later if required.

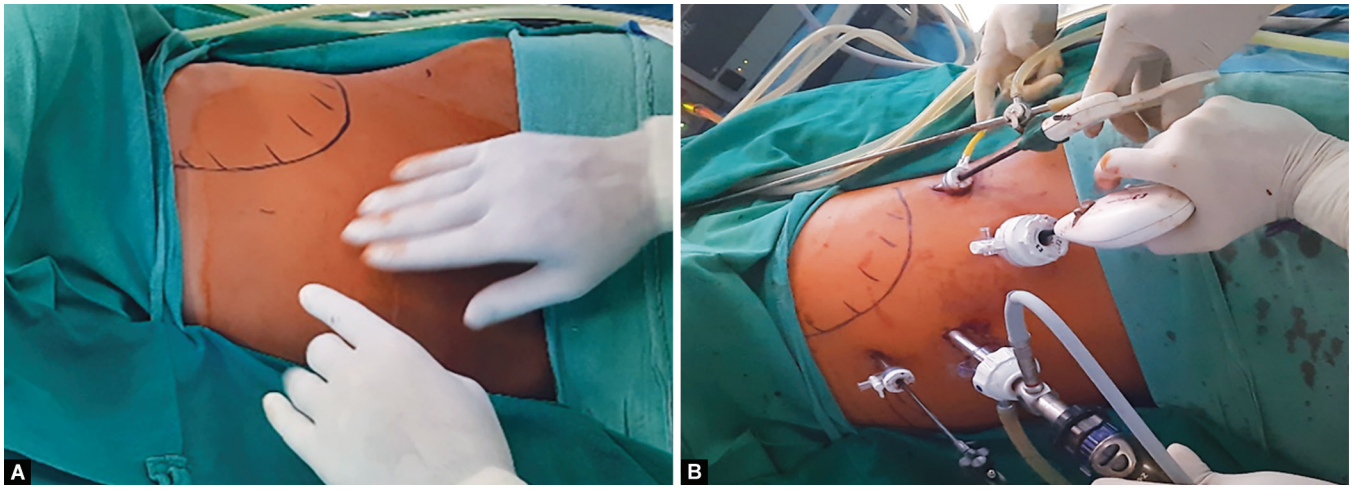
In this patient, a hybrid technique used as splenectomy done laparoscopically and subsequently shun surgery accomplished using a left subcostal incision (Fig. 9A).



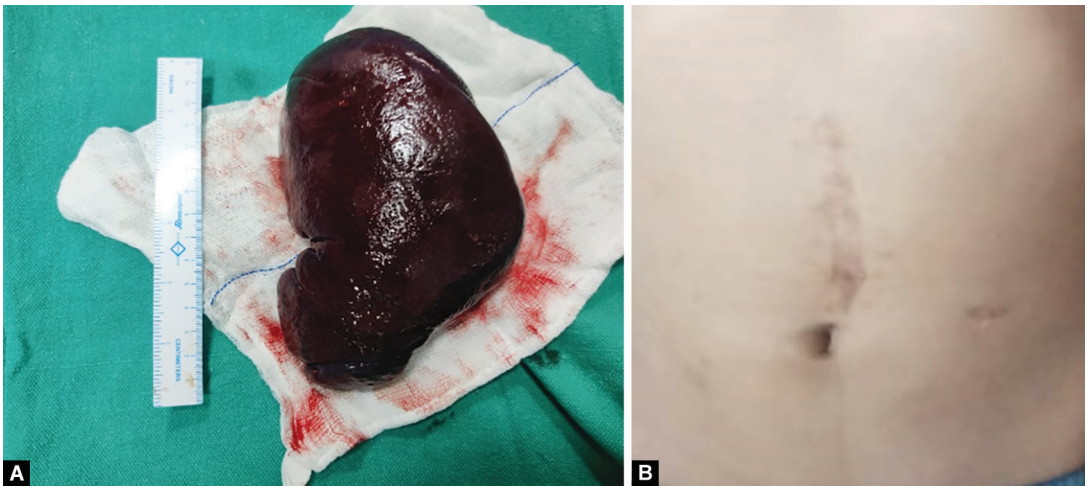
Figs 6A and B: (A) Specimen delivered in toto; (B) Final small surgical scar

Case 5

An 18-year-old girl was diagnosed with a case of EHPVO for 8 years. She initially presented with hematemesis and on evaluation found to have esophageal varices which were managed with endoscopic banding. She also developed pancytopenia with menorrhagia and multiple recurrences of GI bleed. She finally underwent laparoscopic splenectomy. Shunt procedure was not done due to nonshuntable splenic vein. Specimen removed through supraumbilical incision (Figs 9B and C).



Figs 7A and B: (A) Preoperative marking of the spleen; (B) Position of ports placed



Figs 8A and B: (A) Intact specimen; (B) Final healed small surgical scar

Figs 9A to C: (A) Specimen that was taken out in toto; (B) Specimen that was taken out in toto; (C) Final measurement of intact specimen

Discussion and Review of Literature

A myriad of causes [congenital, hematological, portal hypertension (HTN), etc.] leads to enlargement of the spleen. This enlarged spleen is usually required to be removed as it causes pancytopenia, poses a risk of rupture, or is a part of the Linton shunt.

Laparoscopic splenectomy has become the standard approach since 1991 when was first described by Delaitre and Maignien.[1] Moreover, the introduction of advanced laparoscopic tools for the ligation of vessels at the splenic hilum reduced the risk of intraoperative bleeding. It is considered a safe procedure, with a better overall outcome in comparison to the open approach, and the increased experience of surgeons allows operative times comparable to those of an open splenectomy.[2]

Traumatic splenic rupture (advanced grade) is the commonest indication for emergency splenectomy which is usually done by laparotomy in hemodynamically unstable patients. Laparoscopic splenectomy for trauma is reported only in some cases of hemodynamically stable low-moderate grade splenic injuries.[3]

In our series out of five cases, three patients were diagnosed as a case of noncirrhotic portal HTN while two cases of hematological disorders. All patients were vaccinated 4 weeks prior to surgery against *Streptococcus pneumoniae, Neisseria meningitidis, and Haemophilus influenzae* type b.

Three different patient positions to perform surgery have been described in literature anterior, hemilateral, and lateral position. These different patient positions have their advantages and disadvantages. We operated on all these patients in hemilateral position (right lateral 45° tilt of operation table). It allows easy division of short gastric vessels, and good access to the posterior surface and perisplenic ligaments. It also makes dissection and ligation of hilar vessels easier, by keeping the pancreatic tail away from hilar structures.[4] A single dose of prophylactic intravenous antibiotic (third-generation cephalosporin) was given just prior to intubation.

In patients with portal HTN extra precautions are taken during first port (camera port) placement as there is a risk of injury and subsequent bleeding from periumbilical collaterals. After creating the pneumoperitoneum, three additional 5-mm ports (two working and one in the left flank for an assistant to lift the spleen) were placed under vision.

Control of the splenic artery reduces the blood supply thus size of the spleen decreases which facilitates its manipulation and less risk of bleeding at the hilum.[5] We also took control of the splenic artery at the superior border of the pancreas by applying Hem-O-lok clips. Vessels at the splenic hilum can be divided by using an Endo GIA stapler with white reload or by applying a vascular clip.

Specimen usually delivered by putting it into a retrieval bag followed by morcellation. In our series, we removed the spleen in toto as it mitigates the risk of splenosis, and spillage of splenic tissue into peritoneal cavity and also provides intact specimen for histopathological (HPE) examination. Due to the very large size of the specimen in the first patient, we kept the specimen in a sterile urobag and thus delivered it in toto by a small supraumbilical vertical scar.

Incision to deliver spleen supra- or infraumbilical is also a matter of concern as both have pros and cons. Infraumbilical horizontal incision is better cosmetically accepted. Benefits of supraumbilical in patients needed to be reexplored for any postoperative bleeding from the surgical bed. In four patients, we used supraumbilical vertical while in one left subcostal incision to accomplish the shunt procedure.

Conclusion

The size of the spleen does not matter for the laparoscopic approach and the massive spleen can be removed through this method with the advantage of less postoperative pain, hospital stay, and better cosmetically accepted surgical scar.

Ethical Approval

All collected data are retrospective in nature and departmental permission is obtained to publish it.

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CLINICAL TECHNIQUE

Innovative Surgical Approach for Cervical Insufficiency and Uterovaginal Prolapse: Laparoscopic Transabdominal Cerclage with Sacrocervicopexy Using Single Polyester Tape

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Abstract

Aim and background: This case report documents the management of a 32-year-old female with a history of precipitate labor, failed cervical cerclage, and recurrent pregnancy losses with 2nd degree uterovaginal prolapse. The patient was counseled for a laparoscopic transabdominal cerclage and sacrocervicopexy to address cervical insufficiency and uterovaginal prolapse in single setting.

Case description: A laparoscopic procedure where transabdominal cerclage with sacrocervicopexy with a single polyester tape was done. Postoperative recovery was uneventful, and the patient was discharged after 48 hours.

Conclusion: This case report highlights a novel approach to managing complex obstetric issues, offering step-by-step guide to successful application of laparoscopic transabdominal cerclage and sacrocervicopexy for patients with recurrent pregnancy loss and uterovaginal prolapse using single polyester tape.

Clinical significance: This is a novel single setting procedure to combat cervical insufficiency and uterovaginal prolapse using single polyester tape with several advantages over conventional treatment options available.

Keywords: Case report, Cervical cerclage, Cervical insufficiency, Laparoscopy, Prolapse, Sacrocervicopexy.

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Introduction

Pelvic organ prolapse (POP) is quite common in the developing world and thereby making up a large volume of gynecological surgeries being performed. Several laparoscopic surgeries have been designed for uterovaginal prolapse to preserve uterus in women desiring fertility. Sacrocervicopexy being a preferred modality.[1,2] Cervical insufficiency complicates up to 1% of pregnancies. Cerclage is usually placed vaginally; however, laparoscopic abdominal cerclage is an effective alternative in refractory cases of cervical insufficiency. Neonatal survival rates are comparable to abdominal approach offering benefits of laparoscopy and commonly being performed prior to pregnancy.[3] We present the management of 32-year-old female who presented with history of recurrent pregnancy losses, cervical insufficiency, and uterovaginal prolapse. Her previous attempt at cervical cerclage had failed, prompting advanced intervention. Considering her complex clinical presentation, the patient was advised laparoscopic transabdominal cerclage in conjunction with sacrocervicopexy. The intricate methodology, findings, and postoperative recovery are outlined, shedding light on a comprehensive treatment strategy for such complex conditions.

Case Description

A 32-year-old female, presented with history of mass per vagina and second trimester pregnancy losses. She had a history of precipitate labor in the first pregnancy, followed by two medical termination of pregnancies and two consecutive pregnancy losses in second trimester, all of which were spontaneous singleton conceptions. She had history of McDonald's cervical cerclage which had failed in the last pregnancy. On examination, external os was visible at the level of introitus with a rectocele. The external os was patulous with a lax cervical canal, cervical insufficiency test with size 8 Hegar's dilator was positive. She was evaluated for recurrent pregnancy loss with tests for antiphospholipid antibodies, homocysteinemia, thyroid disorders, and couple karyotyping, which were all normal. Patient was counseled for a laparoscopic transabdominal cerclage pre-pregnancy along with sacrocervicopexy in view of uterovaginal prolapse with cervical insufficiency and an informed consent was obtained.

Under general anesthesia, pneumoperitoneum was created with Veress needle and laparoscopy ports introduced. A diagnostic hysteroscopy was performed to rule out local pathologies in uterine cavity. Using ultrasonic dissector vesicouterine peritoneum was opened and bladder dissected (Fig. 1A). Maryland forceps was

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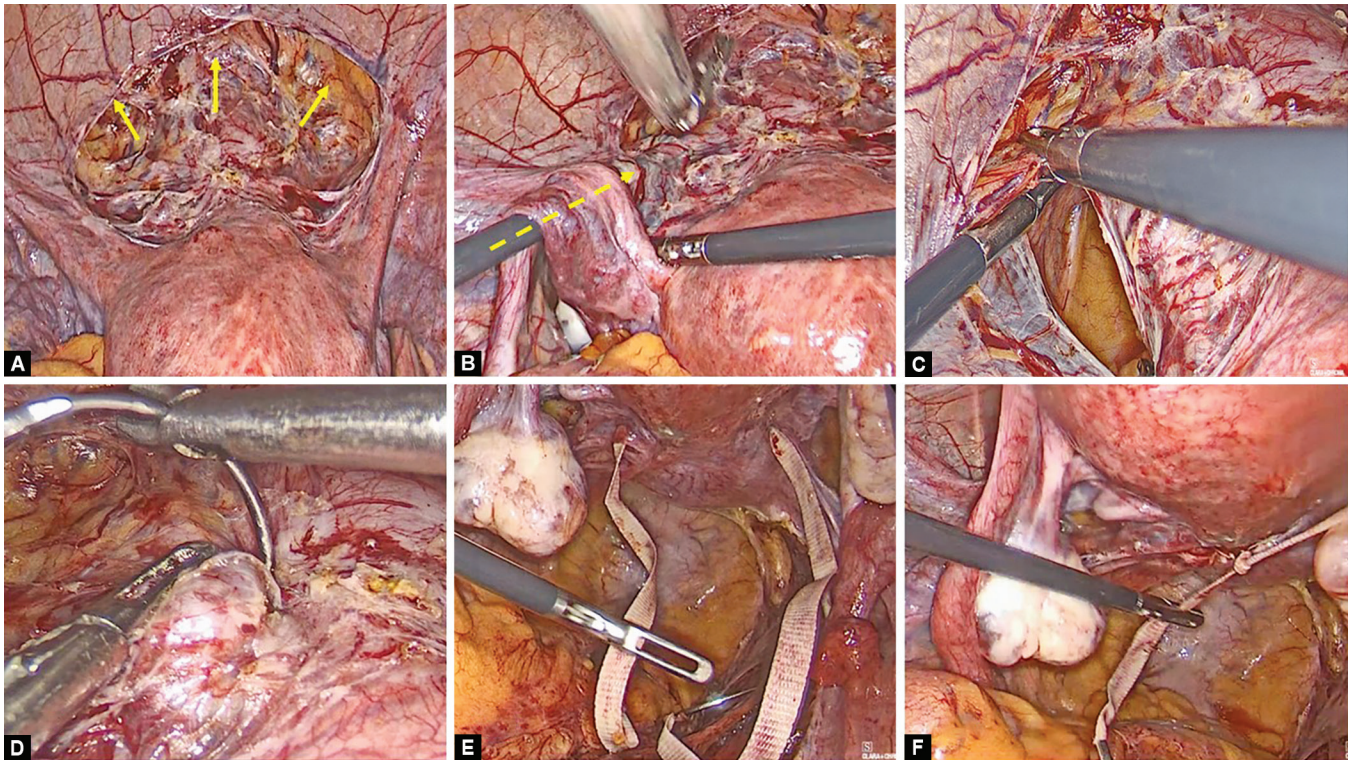
Conflict of interest: None

Patient consent statement: The author(s) have obtained written informed consent from the patient for publication of the case report details and related images.



Figs 1A to F: Laparoscopic transabdominal cerclage procedure. (A) Uterovesicle fold opened and bladder pushed down; (B) Introduction of Maryland grasper posterior to broad ligaments and creation of a window; (C) Left sided 2 × 3 cm broad ligament window; (D) One end of polyester tape needle bite taken medial to the uterine vessels; (E) Level of bilateral needle bites medial to the uterine vessels and above the uterosacrals arch, at level of internal os; (F) Knots placed posteriorly

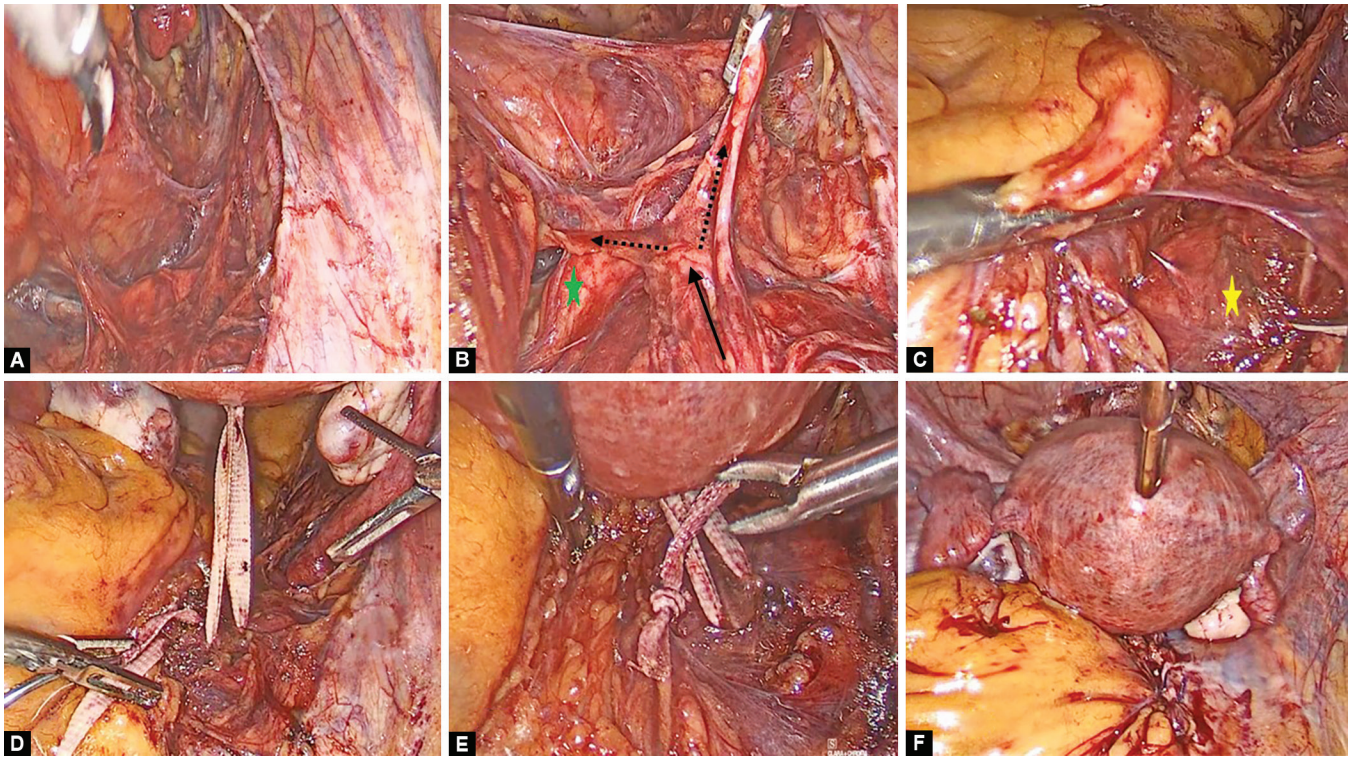
used to elevate the posterior broad ligament on left side (Fig. 1B). Ultrasonic dissector was used to make an avascular window in the broad ligament using Maryland forceps as a guide. Similar steps implemented on the right. Thus, 2 × 3 cm windows were dissected on either side at the level of internal os, lateral to the uterine, providing access to both anterior and posterior aspects of uterus (Fig. 1C). A 30 cm × 5 mm polyester tape with needles at both ends introduced into the abdomen. Bite taken just medial to the left uterine using first needle, near cervix from anterior-to-posterior direction, visually guided by the window at the level of internal os (Fig. 1D). Similar steps were executed on right side using second needle. Placing the bites too laterally risks ureter injury. Care taken to avoid placing sutures in cervical lumen and prevent bleeding. Both needles were kept in pouch of Douglas by pulling the tape (Fig. 1E). Knots placed posteriorly above the level of uterosacral ligaments arch at level of internal os (Fig. 1F). The presacral peritoneum opened along anterior border of sacrum on the right side of the rectum, from sacral promontory to the pouch of Douglas using ultrasonic dissector and graspers (Fig. 2A). Superior and inferior hypogastric plexus of nerves were identified and preserved (Fig. 2B). Anterior longitudinal ligament along with the midline of sacral promontory was identified and the median sacral vessels over it were coagulated with bipolar to avoid bleeding during fixing of the polyester tape to anterior longitudinal ligament. A bite taken over the anterior longitudinal ligament with needles on both the ends of the tape (Fig. 2C). The uterus is elevated to the desired position using the uterine manipulator, ends of the tape adjusted and knots tied to suspend the cervix to the anterior longitudinal ligament (Figs 2D and E). Correction of prolapse confirmed by per speculum examination (Fig. 3). The polyester tape was then reperitonized by closing the presacral peritoneum over it (Fig. 2F). Vaginally rectocele repair done with 2-0 Polyglactin 910 after excision of redundant vaginal wall by hydrodissection.

Postoperative recovery was uneventful. The patient was discharged after 48 hours. The couples were counseled regarding lower segment cesarean section in the future pregnancy in view of an abdominal cerclage.

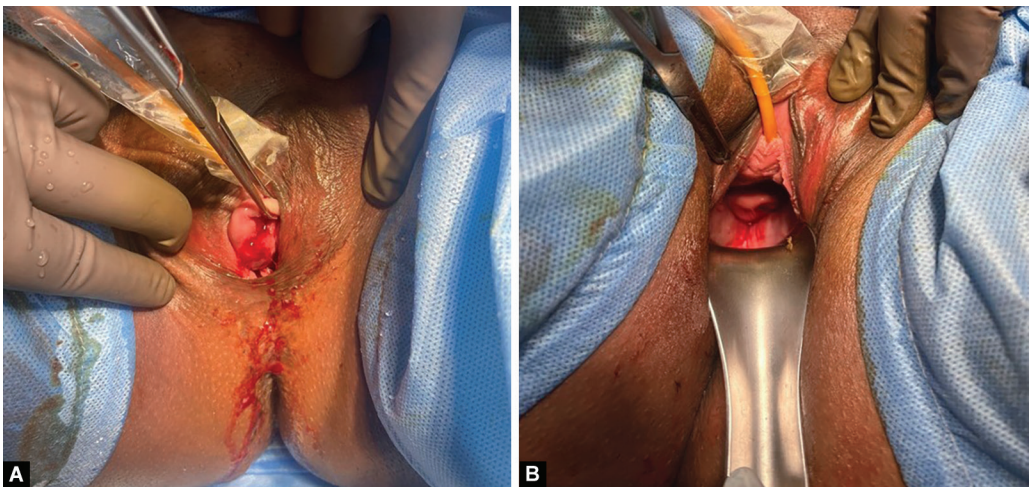
Discussion

Uterovaginal prolapse is a common gynecological problem, often seen in older multiparous women. It is best treated with hysterectomy and pelvic floor repair. But, with a recent changing trend toward women wanting to preserve their uterus and women desirous of future fertility, the surgical advances are now focused on minimally invasive surgeries which include laparoscopic hysteropexy, sacrohysteropexy, and sling suspensions. Among the uterus sparing surgeries, suspension of uterus to the sacrum (anterior longitudinal ligament) has been the most preferred technique.[1,2] Successful pregnancies have been well documented even after these suspension procedures.[4]

Cervical insufficiency can be suspected by the history of one or more second-trimester losses related to painless cervical dilation in the absence of labor or placental abruption. Due to the invasive nature of abdominal cerclage and the need for a cesarean delivery, obstetricians often prefer vaginal cerclage. Abdominal cerclage has, therefore, typically been offered to patients who have had at least two prior failed vaginal cerclages with evidence supporting more efficacy compared with vaginal cerclage in patients with one prior



Figs 2A to F: Laparoscopic sacrocervicopexy procedure. (A) Dissection of presacral peritoneum to create space for graft placement; (B) Superior hypogastric plexus (black arrow) identified over the sacral promontory (green star) and preserved; (C) Bite taken over the anterior longitudinal ligament along the sacral promontory after cauterizing the median sacral vessels (yellow star); (D) Polyester tape pulled and adjusted to adequately correct the prolapse; (E) Polyester tape fixed to anterior longitudinal ligament with multiple knots; (F) Reperitonization of the polyester tape and end result



Figs 3A and B: Per speculum examination. (A) Preoperative; (B) Postoperative

failed vaginal cerclage.[3] Increasingly, an abdominal cerclage is being offered even after just one failed vaginal cerclage,[3] given the ability to place the cerclage laparoscopically with a shorter recovery and fewer complications due to simplified techniques like the broad ligament window technique, laparoscopic transabdominal cerclage can be the preferred method.[5]

Laparoscopic cerclage prior to conception yielded better reproductive outcomes than when performed in pregnancy and were associated with fewer perioperative complications.[6] Women with cervical incompetence have a preponderance to develop uterovaginal prolapse.[7] This case report highlights the success of a laparoscopic transabdominal cerclage with sacrocervicopexy in addressing the complex obstetric challenges faced by the patient. A cervical cerclage although performed with various types of suture materials and grafts, one of the popular options remains to be the polyester tape.[8,9] Traditionally, a sacrocervicopexy is performed with polypropylene mesh, which anchors the uterus to sacrum.[2,10] Here, we are advocating polyester tape for both cerclage as well as sacrocervicopexy. Despite the advantages of a laparoscopic procedure, polyester tape being a cheaper material, with better

tissue acceptance rates and reduced fibrosis around the graft, makes for an excellent material to be used in this combined procedure.[1,11] This technique has a short learning curve due to broad ligament window technique of abdominal cerclage, use of single graft material and minimal laparoscopic suturing which obviates the need for multiple sutures needed to fix a traditional polypropylene graft. It is also a time-saving procedure due to the above-mentioned advantages with minimal tissue dissection. As the tape holds the cervix all around with knots posteriorly, it provides a better anatomical suspension with reduced chance of graft erosion. An additional advantage being better sexual quality of life.[1]

There was no previous documentation of such a procedure in the past and as seen in this patient, due to the desire of future fertility and with advanced minimal invasive techniques, we believe this is a simple and inexpensive technique with excellent patient satisfaction. The limitation of this procedure being the need for lower segment cesarean section in subsequent pregnancies.

Conclusion

Laparoscopic transabdominal cerclage with concomitant sacrocervicopexy represents a promising approach to manage such complex presentations. This case illustrates the importance of individualized treatment strategies in complex cases, especially when traditional interventions have proven ineffective. This innovative surgical approach not only provides a better anatomical repair by simultaneously managing cervical insufficiency and UV prolapse, but also has the advantage of being a time-saving, cost-effective procedure which uses a less reactive graft material with a short learning curve.

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