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EDITORIAL

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Dear Readers,

We are delighted to present the latest issue of the *World Journal of Laparoscopic Surgery*, featuring a diverse array of articles that underscore the cutting-edge advancements and clinical insights in the field of laparoscopic surgery. This volume encapsulates a spectrum of research, ranging from innovative techniques to comprehensive reviews and intriguing case reports.

In our original articles, authors Ramesh S Koujalagi and Amol Agarwal explore the efficacy of using Trocars and Ports Dipped in 10% Povidone Iodine Solution to Prevent Port-site Infections, offering valuable insights from a randomized controlled trial. Meanwhile, Subbiah Shanmugam, Arun Victor Jebasingh, and Nagarajan Surulivelu present a detailed analysis of Laparoscopic Mesorectal Excision for Rectal Cancer, shedding light on its pathological outcomes and short-term survival benefits.

The comparative study by Arun P Moray, Suman S Balani, and Nitin Kulkarni on Total Laparoscopic Hysterectomy versus Laparoscopic-assisted Vaginal Hysterectomy provides critical perspectives on surgical outcomes in gynecological practice.

In the realm of research articles, Abd-Elfattah Kalmoush and colleagues investigated the Utility of Drains following Totally Laparoscopic Gastrectomy, contributing valuable data to the ongoing debate in gastric cancer surgery. Similarly, Sankaran U Prasanth Kumar, Thiagarajan Senthilkumar and Rangineni S Rohitha present findings on Laparoscopic versus Open Simple Nephrectomy, offering insights into the management of non-functioning kidneys.

Our review article by Shiv P Bagchi delves into the nuances of 24-hour pH Monitoring in Evaluating Pre- and Post-laparoscopic Fundoplication, synthesizing existing knowledge to guide clinical practice effectively.

The issue also features compelling case reports that illustrate the versatility of laparoscopic techniques in managing rare and challenging conditions. From the Laparoscopic Management of Achalasia Cardia and Acute Small Bowel Obstruction to the Complexities of Chyle Leak and Colonic Perforation, each case report offers valuable clinical lessons and showcases the expanding boundaries of laparoscopic surgery.

As editors, we are committed to advancing the frontiers of laparoscopic surgery through this journal, providing a platform for researchers and practitioners to share their expertise and innovations. We hope this issue sparks new ideas, fosters collaborations, and ultimately enhances patient care worldwide.

Thank you for your continued support and interest in the *World Journal of Laparoscopic Surgery*. We look forward to your feedback and contributions as we strive to drive excellence in minimally invasive surgical practices.

Warm regards,

RK Mishra
Editor-in-Chief
World Journal of Laparoscopic Surgery

ORIGINAL ARTICLE

Use of Trocars and Ports Dipped in 10% Povidone Iodine Solution vs Conventional Technique to Prevent Port Site Infection in Laparoscopic Surgeries: A Hospital-based Randomized Controlled Trial Study

Ramesh S Koujalagi[1], Amol Agarwal[2]

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Abstract

Context: This study was undertaken to reduce the incidence of port site infection (PSI).

Aim: The study aimed to evaluate the impact of povidone iodine (PI)-dipped ports on PSI and compare it to non-PI-dipped ports.

Materials and methods: A total of 164 patients undergoing elective laparoscopic surgery were enrolled in the study. All patients underwent routine preoperative workup. They were randomized into control and intervention groups. For patients in the intervention group, ports were dipped in 10% PI solution 5 minutes prior to usage. In the control group, conventional techniques were used. Patients were evaluated for infections on days 1, 3, 7, and 30.

Statistical analysis: Data was compiled in Microsoft Excel and processed using Statistical Package for the Social Sciences (SPSS) software. Quantitative parameters were compared using the *t*-test while qualitative were compared using the Chi-square test.

Results: The two groups were equally matched with respect to demographic and laboratory factors with no statistically significant difference between the two. Port sites were evaluated on days 1, 3, 7, and 30 using the Southampton scoring system. In the intervention group, infection was found to be 3.6% on day 1; 6.1% on day 3; and 1.2% on days 7–30. No statistically significant difference was found when compared to the infection rate in the control group (3.6, 2.4, and 1.2%).

Conclusion: Ports dipped in PI have no significant impact on the incidence of PSI in elective laparoscopic surgeries.

Keywords: Laparoscopic surgery, Port site infection, Povidone iodine.

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Introduction

The advent of laparoscopic surgery has revolutionized the field of surgery, with benefits ranging from decreased postoperative pain and quicker return to regular activity and fewer postoperative complications. However, even with minimally invasive surgery, port site complications are reported in as high as 6.8% of the patients.[1]

These complications include wound infection [port site infection (PSI)], bleeding, incisional hernia, omental injuries, port site metastasis, and port site pain. Port site infections are reported in some of the patients. Studies have reported the incidence of PSI between 1.8 and 6.7%.[2,3]

This incidence is less than that of open surgeries but still makes up a significant portion of patients. Surgical site infection (SSI) predisposes the patient to many other complications such as septicemia, wound dehiscence, and herniation.

Port site infection can easily negate the advantages of laparoscopic surgery by increasing the length of hospital stay, delayed recovery, increased hospital expenditure, and severe pain. The umbilical port is found to be more commonly affected than other ports with respect to infection.[2]

Povidone iodine (PI) is a frequently used antiseptic in surgeries, commonly used as a skin disinfectant before surgeries. It is available in 7.5 and 10% concentrations. About 7.5% PI is used for surgical scrubbing while 10% is used as an antiseptic agent.

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Conflict of interest: None

Intraoperative irrigation of the wound with 10% PI before closure has been shown to reduce the incidence of SSI and hence is commonly employed.[4]

A study conducted by Kumar et al. has shown that dipping trocars and ports in 10% PI solution before insertion into the abdomen can reduce the incidence of PSI.[5]

The drawback of the study was that the duration for which the trocars and ports were dipped in the PI solution was not mentioned, and it was limited to only laparoscopic cholecystectomies.

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Fig. 1: Ports dipped in PI

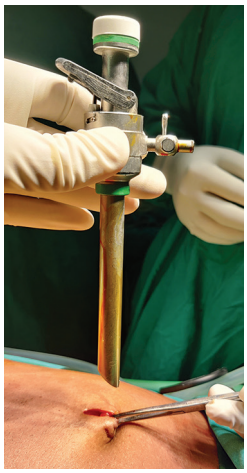

Fig. 2: Ports being inserted

The aim of our study is to determine whether trocars and ports dipped in PI solution, reduce the incidence of PSI in laparoscopic surgeries.

Materials and Methods

A total of 164 patients were enrolled in this study over a period of 1 year from January 2021 to December 2021. About 66 patients were male (40%) and 98 were females. All patients were explained about the procedure and were enrolled after obtaining due consent.

Patients were randomized using sequentially numbered opaque envelopes randomly selected. Patients were not informed about the group they had been allocated to.

Inclusion Criteria

All patients undergoing elective laparoscopic surgery in the Department of General Surgery were included in the study. Only patients above the age of 18 years were included.

Exclusion Criteria

Patients with signs of peritonitis were not included in the study. All patients were tested for PI sensitivity prior to surgery and sensitive patients were excluded. Patients with immunocompromised status were excluded from the study.

Preoperative Procedure

A routine workup of the patient was done. Detailed history with the examination was conducted. All blood investigations were done. Shaving of the parts from nipple to mid-thigh was done for all patients. All patients were tested for PI sensitivity. On the table, after induction of anesthesia, the abdomen was painted with PI solution.

Intervention Group

Ports and trocars were painted with 10% PI solution and left for 5 mins in a kidney tray as shown in Figure 1. After 5 minutes the ports were removed and were inserted into the abdomen either by open or by closed technique as shown in Figure 2.

Control Group

Ports and trocars were introduced into the abdomen without coating them with 10% PI solution as shown in Figure 3.

Fig. 3: Normal ports

Outcome

Surgical Site Infection

The patients in both groups were assessed for SSI on postoperative days 1, 3, 7, and 30 using the Southampton wound scoring system.

Statistical Analysis

Data was compiled in Microsoft Excel and processed using Statistical Package for the Social Sciences (SPSS) software. Quantitative parameters were compared using a *t*-test while qualitative were compared using Chi-square test.

Results

All patients were randomly allocated into the two groups, and 82 patients were allocated to each group. Both groups were checked for demographic parameters and were found to be equally matched. There was no statistical difference in age, gender, laboratory values, and types of surgeries. None of the included patients were diabetic. A total of 15 patients were found to be hypertensive and were equally distributed among the two groups.

Wounds were assessed for infection on days 1, 3, 7, and 30 using the Southampton wound scoring system. Seven patients were found to have infections over this period. On day 1, a total of

Table 1: Infection status at various time points

Infection status at	*Intervention group*	*%*	*Control group*	*%*	*Total*	*%*	*Yates Chi-square*	*p-value*
Day 1								
No	79	96.34	79	96.34	158	96.34	0.0000	1.0000
Yes	3	3.66	3	3.66	6	3.66		
Day 3								
No	77	93.90	80	97.56	157	95.73	0.5970	0.4400
Yes	5	6.10	2	2.44	7	4.27		
Day 7								
No	81	98.78	81	98.78	162	98.78	0.0000	1.0000
Yes	1	1.22	1	1.22	2	1.22		
Day 30								
No	81	98.78	81	98.78	162	98.78	0.0000	1.0000
Yes	1	1.22	1	1.22	2	1.22		
Total	82	100.0	82	100.0	164	100.0		

3 patients in the intervention group and 3 patients in the control group were found to qualify criteria for infection. On day 3, a total of 5 patients in the intervention group and 2 patients in the control group were found to have infection ($p > 0.05$) (Table 1). One patient in each intervention and control group was found to have purulent discharge and hence wounds were opened. On days 7 and 30, one patient in each group had signs of infection ($p > 0.05$).

Discussion

The advent of laparoscopic surgery has revolutionized the surgical field. The advantages such as reduced postoperative pain, decreased length of hospital stay, quicker return to regular activity, and a lower frequency of wound infection give it an edge over conventional open surgery in gastrointestinal procedures.

The advantages of laparoscopic surgeries along with the implementation of ERAS protocol have allowed the introduction of the concept of ambulatory or outpatient surgeries.[6] Procedures like laparoscopic cholecystectomies, laparoscopic appendicectomy, etc. are being actively done as outpatient surgeries.

Complications such as wound infection and postoperative pain act as a disadvantage with respect to ambulatory surgery. They not only add to the patient cost but also increase the inpatient load of a hospital.

We undertook a randomized control trial; in one group we dipped the ports and trocars in 10% PI before introducing them into the abdomen while in the other group, we directly introduced the trocars. A total of 164 patients who consented and met the inclusion criteria were enrolled in the study. No patients included in the study were showing signs of peritonitis. They were randomized into two groups of 82 patients each. The two groups were comparable with respect to the demographic and laboratory parameters.

In our study, the incidence of PSI was found to be comparable in the two groups and the results were not statistically significant. The overall infection rate in our study was found to be 4.27%. This is in line with the PSI rate found in other studies. This could be attributed to good sterilization techniques and maintenance of adequate asepsis during surgery.

This result was in contrast to the study conducted by Kumar et al. which had shown a significant decrease in the incidence of PSI. This difference could be attributed to the greater sample size in our study.[5]

A meta-analysis conducted by Fournel et al. found a significant reduction in the incidence of SSI when wounds were irrigated with PI intraoperatively.[4] This could not be reiterated in our results.

In our study, we found pain to be comparable between the two groups and had a sharp decline on day 1 of surgery. This decrease in pain score is in line with the principles of laparoscopic surgery. The patients reported a decrease in pain from 12 hours to 24 hours and from 12 hours to day 3. The decrease in pain was significant ($p < 0.0001$) in both groups. The change in pain was significantly more in the control group at these time points ($p < 0.05$).

A study by Leggett et al. showed how a smaller incision surgery can significantly reduce the pain of the patient.[7] This is also the basis of laparoscopic surgery becoming the new norm in general surgery. Lee et al. reported that the pain at the incision site is much more than the visceral pain and the pain is maximum in the initial 1–2 days.[8]

Conclusion

Povidone iodine dipped ports and trocars have no effect on the incidence of PSI.

Limitations

When considering the incidence of PSI, the sample size is small.

The study excluded emergency laparoscopic surgeries, which have a higher risk of infection.

Ethical Approval

Ethical clearance was obtained from the institutional ethics committee prior to the start of the trial. Trial registry: The trial was prospectively registered with the Clinical Trial Registry of India (CTRI No.: CTRI/2021/03/032108).

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ORIGINAL ARTICLE

Laparoscopic Mesorectal Excision for Rectal Cancer: Pathological Outcome and Short-term Survival Analysis

Subbiah Shanmugam[1], Arun Victor Jebasingh[2], Nagarajan Surulivelu[3]

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Abstract

Background: Total mesorectal excision (TME) by conventional laparotomy has been considered the standard of care for patients with rectal cancer. Over the past two decades, numerous prospective randomized studies have reported the feasibility, safety, and advantages of laparoscopic colorectal surgery. The benefits of laparoscopic surgery are advantageous only when the quality of the TME, as demonstrated by standardized pathological measures, is at least similar, if not superior, to that of open TME. However, in most of the studies, the impact of laparoscopic TME on pathological outcomes has been inconsistently reported. Therefore, we aimed to assess the quality of TME in laparoscopic resection of rectal cancer.

Materials and methods: We reviewed retrospectively the medical records of patients who underwent laparoscopic resection for rectal cancer post-chemoradiation during the period from 2017 to 2021 at our institute. Patient data were collected from the cancer registry. The quality of pathological outcomes was analyzed by the completeness of TME, circumferential margins, lymph node harvest, and distal resection margins. Data analysis was done using MS Excel, and SPSS 28.0 (Trail version). Using this software, frequencies, percentage, range, mean, and standard deviation. Chi-square test, *t*-test, and *p*-values were calculated.

Results: A total of 64 patients were included in the study. And 35 patients underwent low anterior resection (55%), 22 patients underwent abdominal perineal resection (34%), and 7 patients underwent anterior resection (11%). The mesorectum excision was complete in 58 patients (90.48%) and near complete in 6 patients (9.52%). The average number of lymph nodes harvested was 10. The multivariable analysis between patients with lymph nodes retrieved less than 12 and greater than 12 shows that the lymph node retrieved is less than 12 if the interval between radiotherapy and surgery is less than 6 weeks which is statistically significant (*p*-value –0.04). And there was no statistically significant association between the number of nodes retrieved and survival rate. Positive circumferential margins were seen in 2 patients (4%) and the rest 62 patients (96%) showed negative margins. In all the patients, distal resected margins were free of tumors. In a follow-up of 2 years, distant metastasis was seen in 5 patients. No one had local recurrence.

Conclusions: Our study has shown that optimal pathological outcomes can be achieved with laparoscopic mesorectal excision in rectal cancer patients. Among patients who received preoperative chemoradiation, the number of lymph nodes retrieved was not associated with overall survival.

Keywords: Laparoscopy, Rectal cancer, Total mesorectal excision.

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Introduction

Colorectal cancer ranks as the third most prevalent form of malignancy worldwide; out of these, one-third were rectal cancers.[1,2] Rectal cancer management has historically depended on ontogenetic principles. The existence of "planes" has facilitated optical local control using total mesorectal excision (TME). The basis of this embryological theory lies in the hypothesis that local dissemination of tumor cells initially occurs within the compartment of origin. During the early stages of cancer, further spread of tumor cells is restricted at these borders. The TME concept, designed by Heald, has been popularized with the ever-growing knowledge of the mesorectal fascia.[3] Appropriate traction on this fascia opens up an avascular plane between the mesorectal fascia and pre-sacral pelvic fascia. Meticulous, sharp dissection in this plane improves the quality of surgical resection.

Since its introduction in 1982, TME has been widely regarded as the standard treatment protocol for patients diagnosed with rectal cancer.[4] In the last two decades, several studies have documented the benefits and safety associated with laparoscopic rectal surgery. Laparoscopic TME has the added advantage of better vision with magnification, thus combining origin and evolution to attain excellent oncological outcomes.

The advantages of laparoscopic surgery are significant only if the quality of TME, as indicated by pathological outcomes, is on par

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Table 1: Grading of quality and completeness of the mesorectum in a total mesorectal excision specimen[5]

	Mesorectum	*Defects*	*Coning*	*CRM*
Complete	Intact, smooth	Not deeper than 5 mm	None	Smooth regular
Near complete	Moderate bulk, irregular	No visible muscularis propria	Moderate	Irregular
Incomplete	Little bulk	Down to muscularis propria	Moderate–marked	Irregular

with or superior to that achieved through open TME. However, most studies have inconsistently reported the pathological outcomes achieved through laparoscopic TME. In our current study, we assessed various domains to evaluate the standard of TME in our patients who underwent laparoscopic surgery for rectal cancer.

Materials and Methods

This is a retrospective study including all patients with rectal cancer who underwent laparoscopic resection after neoadjuvant therapy at our institute from January 2017 to June 2021. Data were collected from our cancer registry, encompassing basic demographic data, presentation history, examination findings, and diagnosis. We analyzed the quality of pathological outcomes, including the completeness of TME, circumferential resection margins (CRMs), number of nodes harvested, and distal margins.

All patients were monitored for a minimum of 2 years, with a follow-up protocol that included clinical examinations every 3–6 months, including per rectal examination. Investigations included CEA levels every 6 months, endoscopic evaluation every 6 months, and a yearly CT scan. If clinically indicated, MRI and PET CT scans were also performed.

Data analysis was conducted using MS Excel and SPSS 28.0 (Trial version), where various statistical measures such as frequencies, percentages, ranges, mean, median, mode, standard deviation, variance, *t*-tests, Chi-square tests, and *p*-values were calculated. A *p*-value of less than 0.05 was considered statistically significant.

Results

This study included 64 patients, of which 37 (58%) were male and 27 (42%) were female. The mean age was 50.39 ± 11.3 years, with a median of 51 years. Among the patients, 26 were classified as stage II (41%) and 38 as stage III (59%). Surgical procedures involved low anterior resection (LAR) in 35 patients (55%), abdominoperineal resection (APR) in 22 patients (34%), and anterior resection (AR) in 7 patients (11%), with preservation of the sphincter achieved in 66% of the cases.

The completeness of TME was assessed as given in Table 1.

In our study, the mesorectum was complete in 90.48% of cases and nearly complete in 9.52% of the study population. Positive circumferential resected margins (CRM) were observed in 4% of the study population, while the remaining 96% showed negative margins. Distal resection margins were negative in all cases.

Among the two patients with CRM-positive margins, one patient treated with adjuvant chemotherapy achieved disease-free survival of more than 4 years during follow-up. Unfortunately, the other patient, who had multiple comorbidities, passed away in the early postoperative period due to a medical complication.

During the 2-year follow-up, distant metastases were observed in 5 patients among the study population of 64. These metastases included 2 cases of skeletal metastases, and 1 each of peritoneal, liver, and port site metastasis. No cases of local recurrence were recorded.

Table 2: Survival: 1 year and 2 years

	1-Year survival		*2-Year survival*	
	Frequency	*Percentage*	*Frequency*	*Percentage*
Yes	60	93.7	55	85.9
No	4	6.3	9	14.1

The survival rates were 93.7% at the end of the first year and 85.9% at the end of the second year. These rates are summarized in Table 2.

In our study, the mean number of nodes retrieved was 9.19 ± 6.24 nodes ranging from a minimum of 0 nodes to a maximum of 23 nodes. Node positivity was observed in 19 patients, with a positivity rate of 0.83 ± 1.90 nodes.

The multivariable analysis was made between patients with the lymph node retrieved less than 12 and greater than 12, and the results are summarized in Table 3.

In our study, it was found that if the surgery was done within 6 weeks of completion of chemoradiation, lymph node yield was less than 12 nodes. This association is statistically significant (*p*-value –0.04).

The 1-year survival rate among patients with fewer than 12 nodes retrieved was 93.4% and the same for the patients with ≥12 nodes was 89.4%. Similarly, the 2-year survival rate in the patients with less than 12 nodes retrieved was 86.6%, and the same for the patients with ≥12 nodes was 84.2%.

However, this difference in the survival rate at 1 year and 2 years was not statistically significant. Thus, no association was observed between node retrieval and the survival rate. The findings are summarized in Table 4.

Discussion

Oncologic safety plays a crucial role in assessing the benefits of laparoscopic surgery in rectal cancer. The multicentric COREAN trial is noteworthy for presenting a comprehensive set of pathological parameters after both open and laparoscopic TME, highlighting the comparability of these approaches.[6]

In rectal cancer surgery, the circumferential resected margin (CRM) is an important prognostic factor. Patients with a positive CRM have a higher risk of recurrence and reduced overall survival. In this study, the incidence of positive CRM was 4%. This rate of CRM positivity is significantly lower than what other researchers have reported. The completeness of the TME specimen is also an important prognostic factor. The study by Nagtegaal et al. demonstrated that patients with incomplete mesorectal excision had higher recurrence rates compared with those with complete mesorectal excision.[7] Numerous studies have indicated that laparoscopic surgery does not influence the distal resected margin. In our study, distal margins were negative in all patients.

The COREAN trial reported lower rates of positive CRM, with rates of 2.9% for laparoscopic surgery and 4.1% for open surgery, compared with our study. However, it is crucial to note that in this

Table 3: Multivariable analysis of lymph node retrieval

	Lymph nodes retrieved		
Variables	*<12 (N = 45)*	*≥12 (N = 19)*	*p-value*
Age in years (mean ± SD)	50.73 ± 12.03	49.57 ± 9.59	0.71
Gender			
Male	24 (64.9)	13 (35.1)	0.26
Female	21 (77.8)	6 (22.2)	
Procedure			
APR	17 (77.3)	5 (22.7)	0.64
AR	5 (71.4)	2 (28.6)	
LAR	23 (65.7)	12 (34.3)	
TME			
Complete	39 (67.2)	19 (32.8)	0.16
Incomplete	6 (100.0)	0 (0.0)	
Pre-op clinical staging			
T2	12 (85.7)	2 (14.3)	0.27
T3	20 (62.5)	12 (37.5)	
T4	13 (72.2)	5 (27.8)	
Node imaging			
Yes	38 (73.1)	14 (26.9)	0.31
No	7 (58.3)	5 (41.7)	
Time interval between CRT and surgery			
≤6 weeks	13 (92.9)	1 (7.1)	**0.04**
≥6 weeks	32 (64.0)	18 (36.0)	
Post-op pathological staging			
T0 (PCR)	11 (57.9)	8 (42.1)	0.44
T1	3 (60.0)	2 (40.0)	
T2	22 (78.6)	6 (21.4)	
T3	9 (75.0)	3 (25.0)	
Recurrence/metastasis			
Yes	2 (40.0)	3 (60.0)	0.15
No	43 (72.9)	16 (27.1)	
No. of nodes positive (mean ± SD)	0.57 ± 1.17	1.42 ± 2.94	0.24

Bold value is statistically significant *p*-value. PCR, pathological complete response

Table 4: Nodes retrieved and survival rate

Nodes retrieved	*Survival*	*1-Year survival*	*2-Year survival*
<12 nodes (*n* = 45)	Yes	42	39
	No	3	6
≥12 nodes (*n* = 19)	Yes	17	16
	No	2	3
p-value		0.29	0.63

study,[8] we considered CRM as positive when tumor cells were present within 2 mm from the lateral surface of the mesorectum, whereas the COREAN study used a 1-mm margin. This difference in margin criteria resulted in a higher rate of positive CRM in our study.

The lymph node harvest is influenced by several factors, including patients' anatomical and physiological characteristics, preoperative treatments, the extent and technique of surgical dissection, and the pathologist's examination methods. Guidelines stipulate that a minimum number of nodes to be retrieved in rectal cancer specimens to achieve accurate pN staging and prevent under-staging is 12. In our study, the average number of nodes harvested was 10. Importantly, none of the patients experienced local recurrence.

In 2008, Rullier et al. demonstrated no significant association between lymph node yield and survival among 198 patients with rectal cancer post-chemoradiation.[9] Similarly, Kim et al. showed no significant association between lymph node yield and recurrence or survival in 150 patients with rectal cancer post-chemoradiation.[10]

The ACOSOG and ALaCaRT trials established pathological criteria for evaluating TME, including complete or near-complete TME, clear (>1 mm) CRM, and clear (>1 mm) distal margin.[11,12] In our study, we found that 90% (*n* = 64) of consecutive patients who underwent laparoscopic TME for rectal cancer achieved pathologically optimal TME.

This study's main constraint lies in its retrospective design; it lacks the rigor of a prospective randomized controlled trial. The second limitation is the small sample size of patients. The third limitation is the short duration of follow-up, which spans only 2 years. However, it is worth noting that most local site recurrences tend to occur within 2 years, as demonstrated by studies like the COLOR II and the Dutch TME study.[13] The fourth limitation is the potential for selection bias. It is noteworthy to mention that consecutive inclusion of patients with rectal tumors was ensured, and all cases of rectal cancer at our institution underwent exclusive treatment with laparoscopic TME of the rectum. The fifth limitation is we did not compare laparoscopic surgery with open surgery, but the results of this study are compared with the results of the literature.

Conclusions

The significance of pathological outcome in patient survival is indisputable. Laparoscopic TME has to meet determinants of quality of care before making it a standard procedure in any institution.

The relevance of negative CRM and low lymph node ratio in understanding the prognosis is reinstated in our study. This extends to patients operated on after neoadjuvant therapy. With the advent of personalized medicine, a complete and quality resection remains the only surgeon-modifiable risk factor in rectal cancer management.

Ethical Statement

Institutional ethical committee approved.

Orcid

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ORIGINAL ARTICLE

A Comparative Study on Total Laparoscopic Hysterectomy and Laparoscopic-assisted Vaginal Hysterectomy

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Abstract

Aim and background: Over the past few decades, laparoscopic hysterectomies have dramatically increased and even exceed vaginal hysterectomies (VHs). This study aimed to determine which approach offers the greatest benefits based on the results of a total laparoscopic hysterectomy (TLH) and a laparoscopic-assisted vaginal hysterectomy (LAVH).

Materials and methods: We performed a prospective study on patients posted for hysterectomy in the Department of Obstetrics and Gynecology from January 2021 to December 2021. An equal number of patients were posted for TLH and LAVH, according to the selection criteria, randomly, after getting written consent. The average age of the TLH group was 44 years and LAVH group was 46 years.

Results: Among 100 patients, 50 patients were included in the LAVH group and 50 were included in the TLH group. A total of 30 patients were presented with previous lower abdominal pelvic surgery such as tubal ligation and appendectomy LSCS. The majority of patients who underwent TLH and LAVH were pathologically confirmed uterine fibroids ($n = 36$) and adenomyosis ($n = 36$). The LAVH required longer surgery duration (122.5 ± 25.37) than TLH (114.2 ± 18.93) with $p = 0.066$. In both groups, the average hospital stay was almost the same (4.26 vs 4) days.

Conclusion: Total laparoscopic hysterectomy has an advantage over LAVH in terms of duration of surgery, blood loss, hospital stay, and postepisode recovery. Moreover, the decision to perform either LAVH or TLH should be based on the healthcare expertise in the field of laparoscopic and vaginal operative procedures. Also, patients' satisfaction and mental health is a hallmark of surgeries.

Clinical significance: Based on the present study, we recommended that TLH be an effective operative procedure as compared to LAVH. Because it requires a short duration for surgery, there is minimum blood loss, it does not require a prolonged hospital stay, and the patient's recovery time is also effective.

Keywords: Complications, Laparoscopically-assisted vaginal hysterectomy, Total laparoscopic hysterectomy, Sexual function.

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Introduction

In the present era when medical science is booming with all technological advances, new techniques are designed which offer some inherent improvement over traditional procedures. Improvement facilitates effectiveness, safety, patient satisfaction, and ease of execution. As a result of patient demand and quantum-level advances in biomedical technology, less invasive techniques have become more popular over the past decade. Techniques were analyzed based on steep learning curves, concerns about safety, and increased costs.

Among the female population, the most prevalent surgery performed is a hysterectomy which is quite an invasive procedure. To further make surgeries a lot more painless and desirable for the patients minimally invasive surgeries such as

- Laparoscopic-assisted vaginal hysterectomy (LAVH) and
- Total laparoscopic hysterectomy (TLH) are on a ride.

Reich et al.[1] described laparoscopic hysterectomy first in 1989. Laparoscopic surgery has developed rapidly in the modern era, and in the last two decades, LAVH has been prevalent.[1] According to several studies, laparoscopic hysterectomy reduces the incidence of laparotomies. A few indications of vaginal hysterectomy (VH) are narrow pubic arch or poor vaginal descent among patients. Vaginal hysterectomy even after being an easier procedure poses certain complications in patients with adnexal masses, endometriosis, pelvic pain, and prior abdominal surgery.

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Additionally, the previous study found that women undergoing laparoscopic hysterectomy had shorter hospitalization times, smaller wounds, faster recovery times, and shorter work absences than those undergoing abdominal hysterectomy. Inspite of some disadvantages of laparoscopic hysterectomy were noted such as longer operating times, higher costs, and learning curves, being minimally invasive and short recovery time, laparoscopy remains the approach of choice for hysterectomy.[2–6] Often, surgeons feel uncomfortable with the vaginal approach, especially when there

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Table 1: The demographic profile of patients and the indication for hysterectomy among both groups

Demographic data	*TLH*	*LAVH*	*p-value*
Age (years)	44.26 ± 4.11	46 ± 3.75	–
Body weight (kg)	22.3 ± 2.90	23.8 ± 3.01	0.0127*
Parity	2.36 ± 1.06	3.3 ± 1.34	0.002*

*Significant

Table 2: Patient indicating previous lower abdominal pelvic surgery for hysterectomy in both groups

Previous lower abdominal pelvic surgery	*TLH*	*LAVH*	*p-value*
Tubal ligation	10	18	0.68*
Appendectomy LSCS	1	1	

*Nonsignificant

Table 3: Intra- and postoperative results

	TLH	*LAVH*	*p-value**
Total operating time	114.2 ± 18.93	122.5 ± 25.37	0.066
Duration of hospital stay	4.26 ± 1.22	4 ± 1.30	0.30
Blood loss (mL)	154.5 ± 47.46	189.4 ± 97	0.024
Hb drop (mg/mL)	0.588 ± 0.36	0.724 ± 0.35	0.22
Uterine weight (gm)	167.1 ± 45.36	200 ± 60.07	0.002

*Nonsignificant

Table 4: Main indication for hysterectomy in both groups

	TLH (n = 50)	*LAVH (n = 50)*
Uterine fibroid	18	18
Endometrial hyperplasia	2	2
Ovarian tumor	2	2
Pelvic endometriosis	1	1
Adenomyosis	12	12
Cervical intraepithelial neoplasia	2	2
Postmenopausal bleeding	4	4
Menorrhagia	9	9

are dense adhesions, oophorectomy is required, vaginal access is narrow and pelvic relaxation is inadequate.[2–6]

In the present study, LAVH on benign lesions was performed routinely. Although in recent years LAVH is gaining popularity, laparoscopic surgery still has to be performed. Also, TLH is considered a substitute for LAVH. The present study aims to determine whether TLH truly poses any risk in the form of complications, longer hospital stays, and changes in recovery durations when performed in a center where LAVH is predominantly performed.

Materials and Methods

We conducted a prospective study on patients posted for hysterectomy in our department from January 2021 to December 2021. An equal number of patients were posted for TLH and LAVH according to selection criteria randomly, after getting written consent.

In the present study, researchers analyzed 100 women undergoing LAVH and TLH to treat uterine fibroids or adenomyosis.

Inclusion Criteria

- Volume of the uterus is less than that of a 16-week pregnancy (700 gm).
- Patients requiring hysterectomy indications of uterine fibroids, adenomyosis, abnormal uterine bleeding (AUB), or dysfunctional uterine bleeding (DUB).

Exclusion Criteria

- Uterine size above 16 cm.
- Previous abdominal surgeries with long vertical incisions.
- Patients with dense adhesions or intraoperative bleeding.
- Patients with combined procedures (e.g., colposuspension) were excluded.

A total of 100 patients were categorized into two groups, with 50 undergoing LAVH and 50 undergoing TLH. Prior to surgery, informed consent was obtained from the patients *via* written and oral means. The questionnaire and interview system about sexual disorders were followed. Questionnaires were performed preoperatively and 6–12 months after surgery.

Results

Table 1 summarizes that a total of 50 women were assigned to the LAVH group and 50 to the TLH group in this study. The statistical analysis shows that a nonsignificant difference was observed in both groups with respect to the mean age, body weight, and parity.

In the present study, it is concluded that tubal ligation showed the highest preponderance of occurrence which is $n = 28$. Out of the 28 cases, a maximum of 18 cases were presented with LAVH previously. Interestingly, appendectomy was the least chosen surgery as it was observed in only $n = 2$ cases (Table 2).

When comparing the surgery duration, we observed that LAVH required a longer surgery duration as compared to TLH, Whereas the mean duration for hospital stay was almost the same among both groups, that is, 4.26 ± 1.22 and 4 ± 1.30. Furthermore, the estimation of blood was noted slightly lower in the TLH group as compared to the LAVH group. A *p*-value of 0.024 shows a nonsignificant association among both groups as shown in Table 3.

In the present study, the majority of patients were pathologically confirmed uterine fibroids ($n = 36$) and adenomyosis ($n = 36$). Menorrhagia and Postmenopausal bleeding followed the same sequence ($n = 8$). However, endometrial hyperplasia ($n = 4$), ovarian tumor ($n = 4$), pelvic endometriosis ($n = 2$), and cervical Intraepithelial neoplasia ($n = 4$) were noted in the least number of patients presented to the hospital (Table 4).

The present study reported that patients undergoing LAVH benefit from a quicker and less complicated recovery than TLH. Approximately 72% ($n = 36$) of patients undergoing LAVH were returned to normal domestic activities within 0–4 weeks. However, only 44% ($n = 22$) of patients undergoing TLH were returned to normal domestic activities within 0–4 weeks (Table 5).

Satisfaction with the outcome of the operation or quality of life 4 weeks postoperatively between TLH and LAVH were categorized into three groups, namely, very satisfied, satisfied, and dissatisfied. The majority of patients undergoing TLH 32% ($n = 15$) were noted in "very satisfied" group. Furthermore, 64% ($n = 32$) of patients

Table 5: Duration of time required for recovery

Recovery time	*TLH*	*LAVH*	*p-value*
Return to normal domestic activities (0–4 weeks)	22 (44%)	36 (72%)	0.004*
Return to normal domestic activities (4–6 weeks)	28 (56%)	14 (28%)	

*Significant

Table 6: Satisfaction level with the operation

Satisfaction level with the operation	*TLH*	*LAVH*	*p-value*
Very satisfied	15 (32%)	13 (26%)	0.002*
Satisfied	25 (50%)	32 (64%)	
Dissatisfied	10 (20%)	5 (10%)	

*Nonsignificant

undergoing LAVH were noted to be in the "satisfied" group. Only 10% ($n = 5$) of the patients undergoing LAVH were "dissatisfied" with the surgery (Table 6).

Discussion

The uterus is the place where fertilized eggs are nurtured and housed until a fetus is born, but nowadays, women are frequently observed to have complications with their uterus. Complications such as fibroids, adenomyosis, endometriosis, abnormal periods, etc. increased day by day. An alternative to deal with such complications is a hysterectomy. Hysterectomy is a common procedure that can improve symptoms caused by various medical conditions discussed above. In some cases, the surgery can be life saving. In an era where technological advancement is on the rise, medical knowledge is advancing rapidly, leading to several advanced hysterectomy methods as well. In recent years, laparoscopic hysterectomy has become more popular.

In patients who suffer from an adnexal mass, endometriosis, pelvic pain, or prior abdominal surgery, or who have a narrow pubic arch or poor vaginal descent, laparoscopic hysterectomies are observed to reduce the number of laparotomies when VH is considered challenging.

Procedures vary in duration based on the severity of the pelvic pathology and the surgeon's experience. In the present study, the majority of patients affected by uterine fibroids ($n = 36$), adenomyosis ($n = 24$), and menorrhagia ($n = 18$) were primarily assigned either to LAVH or TLH.

Even patients who have had previous pelvic surgery can benefit from LAVH due to its reduced operating time and shorter hospital stay. For patients with a history of previous pelvic surgery, LAVH offers advantages over TLH with less hospital stay and reduced operating time. Several studies also emphasize the same.[7–9]

There is a higher rate of transfusion after vaginal procedures in the LAVH group compared to the TLH group, but these differences are not statistically significant according to the study by Long CY et al.[9] However, in the present study, there was no statistical difference in mean hemoglobin concentration that was dropped from a preoperative value on the first or the second postoperative day.

It was determined that no patients required blood transfusions in TLH and LAVH operations, as the bleeding was 0.588 ± 0.36 mg/mL and 0.724 ± 0.35 mg/mL, respectively.

Zero percent of the patients were reported with morbidity undergoing TLH and LAVH in the present study. These findings were opposite to the study by Long CY et al., which reported 6% of febrile morbidity.

The findings of the present study indicate that both techniques are safe and effective, but TLH was proved to be more effective in terms of blood loss and operating time. In contrast, LAVH recovers quicker and is less complicated than TLH. A total of 72% ($n = 36$) of patients undergoing LAVH were able to return to normal domestic activities during the first 4 weeks following the procedure.

Conclusion

The present study concluded that TLH offers an advantage over LAVH with relatively lower blood loss. During the operative process complications such as sexual dysfunction showed no correlation with the type of hysterectomy. While TLH can be performed within reasonable time limits in select cases, it represents technical challenges. Patient selection between both hysterectomies should prioritize the healthcare professional's expertise in laparoscopic and vaginal procedures, following the principle of "Do as much as you feel comfortable doing".

Clinical Significance

Based on the present study, we recommended that TLH be an effective operative procedure as compared to LAVH. As it requires a short duration for surgery, there is minimum blood loss, it does not require a prolonged hospital stay, and the patient's recovery time is also effective.

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RESEARCH ARTICLE

Drain vs No Drain after Performing Totally Laparoscopic Gastrectomy in Gastric Cancer Surgery

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Abstract

Background: Routine performance of a prophylactic postoperative drainage after abdominal surgeries was done to prevent and manage postoperative intra-abdominal complications.

Sure evidence to avoid routine performance of prophylactic drainage after surgery in gastric cancer (GC) patients and its role in reducing postoperative morbidity was not reached yet.

Aim: The aim of the present study was to compare between patients who underwent prophylactic drainage and patients who did not undergo prophylactic drainage following total laparoscopic gastrectomy in patients diagnosed with distal GC.

Patients and methods: We included 150 patients who underwent totally laparoscopic distal gastrectomy for surgical management of histopathologically confirmed GCs.

We divided patients into two groups, the first group included 100 patients and underwent totally laparoscopic gastrectomy with prophylactic drainage, and the other group included 50 patients underwent totally laparoscopic gastrectomy without performing drainage.

We compare between both included groups regarding short-term and long-term outcomes.

Results: Operative times in the group of patients who have drain group were longer than that in those with no drain. We showed that in the group of patients with drain, the number of days from time of surgery to time of soft diet initiation and time to first flatus was more than that in the no drain group.

Conclusion: Avoiding prophylactic drain insertion in some patients after performing totally laparoscopic gastrectomy for management of gastric cancer could be feasible. It increases patients comfort without increasing the risk of postoperative complications.

Keywords: Gastric cancer, Laparoscopic gastrectomy, Prophylactic drain.

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Background

Gastric cancer (GC) is still one of the commonest cancer and commonest cause of cancer-related death worldwide.[1] Although there is advancement in chemoradiation, immunotherapy and targeted therapy but surgical management remains the main therapeutic management of such cancer. Gastrectomy for management of GC has many postoperative complications such as postoperative bleeding, leakage, and infection.[2]

Routine performance of a prophylactic postoperative drainage after abdominal surgeries was done to prevent and manage postoperative intra-abdominal complications.[3] But, recent research demonstrated that routine performance of a prophylactic postoperative drainage might be not be as valuable as previously thought.[4] It was previously shown that prophylactic postoperative drainage did not reduce incidence of postoperative morbidities after colorectal surgeries, hepatectomy, appendectomy, and cholecystectomy.[5] Moreover, avoidance of drainage after surgical management of GC was encouraged by many studies as it decreases postoperative morbidity and length of hospital stay.[6,7]

Sure evidence to avoid routine performance of prophylactic drainage after surgery in GC patients and its role in reducing postoperative morbidity was not reached yet.

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Aim of the present study was to compare between patients who underwent prophylactic drainage and patients who did not undergo prophylactic drainage following total laparoscopic gastrectomy in patients diagnosed with distal GC.

Patients and Methods

We included all patients who underwent totally laparoscopic distal gastrectomy for surgical management of histopathologically confirmed GCs in the period from May 2019 to May 2023.

Exclusion Criteria

We excluded patients who underwent open gastrectomy, patients with proximal gastrectomy for management of proximal GC, patients with lower esophagectomy for esophagogastric junction cancer and patients with bleeding and perforation.

After application of our strict inclusion and exclusion criteria we included a total of 150 distal GC patients.

We divided patients into 2 groups the first group included 100 patients and underwent totally laparoscopic gastrectomy with prophylactic drainage, and the other group included 50 patients underwent totally laparoscopic gastrectomy without performing drainage.

We compare between both included groups regarding short-term and long-term outcomes.

Operative Procedures

We determined the extent of gastrectomy and dissection of lymph nodes according to guidelines of Japanese GC treatment.[8]

We performed reconstruction intracorporeally by using delta-shaped anastomosis after performing distal gastrectomy[9] and Roux-en-Y method after performing total gastrectomies.[10]

Postoperative Management

We initiated oral water intake after one day from performing surgery, then we initiated a soft diet, the patient tolerated liquid meals, and after confirmation of the absence of any leakage at the site of the anastomosis by postoperative upper gastrointestinal contrast.

Assessment of Surgical Outcome

We evaluated the incidence of occurrence of operative mortality (30 days after surgery), postoperative complications, and postoperative number of days after the surgery until soft diet initiation, and the postoperative hospital stay days. We assessed any adverse events using the Clavien–Dindo classification within 30 days postoperatively.

Outcome Assessment

We compared between both included groups of patients as regard; clinical, operative, perioperative and pathological variables.

Statistical Analysis

We expressed values as the mean ± SD. We used χ^2-test and Student's *t*-test for comparing between categorical and continuous variables, respectively. We performed Chi-squared test or Fisher's exact test for categorical data. We considered *p*-value of < 0.05 significant.

We performed all statistical analyses using Statistical Package for Social Science 20.

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Results

Demographic and Basic Data

We found no significant differences between both groups concerning patient sex, age, American Society of Anesthesiologists classification, BMI, previous history of abdominal surgery, smoking, co-morbid conditions, tumor stage, or regional lymph node metastases.

Operative Findings

We showed that operative time in the group of patients who have drain group were longer than that in those with no drain. We found no significant differences between both groups regarding estimated intraoperative blood loss or blood transfusion, the number of dissected lymph nodes or in tumor size.

Recovery

We showed that in the group of patients with drain, the number of days from the time of surgery to time of soft diet initiation and time to first flatus was more than that in the no drain group.

Short-time Outcomes

We recorded no operative mortality in either group.

No anastomotic bleeding, leakage, lymph leakage, ileus, pancreatic fistula occurred in either groups.

We found no significant differences between both groups regarding the need for percutaneous catheter drainage (PCD).

Patients with a large BMI have a higher liability of occurrence of postoperative complications.

So, a prophylactic drain might be useful in patients with a higher BMI.

Discussion

Since 2015, there was a wide use of totally laparoscopic surgery and there are conflicting data regarding the need of a drain or no after total laparoscopic surgery.[9,11] Most studies demonstrated the beneficial use of prophylactic drains in open gastrectomy.[12,13]

In the present study, we demonstrated that the use of a prophylactic drain was not routinely needed in laparoscopic gastrectomy. Our results were in line with the results of Liu et al.[14] Shimoike et al.[9]

Prophylactic drains are needed for early detection and prevention of postoperative complications. We demonstrated no significant differences in incidence and severity of postoperative complications between the group of patients who have drain and those without between the incidence and the severity of postoperative complications.

The complications were more liable to occur in the patients who have drain.

Additionally, we showed that in the group of patients who have drain, the postoperative days number until soft diet initiation

and the duration of postoperative hospital stay were longer than those in the group of patients who have no drain, pointing to that drains have no beneficial effect and even it might have many drawbacks and could worsen the management of postoperative complications. These results were similar to the findings of Liu et al.,[14] Shimoike et al.[9]

Liu et al.[14] found that routine use of prophylactic drains was not a must in all patients, but they demonstrated that prophylactic drain might be beneficial in some high-risk patients to facilitate early detection and adequate management of postoperative complications, decrease postoperative morbidity, fluid collection, mortality and hospital stay which is in line with our findings and findings of other reports.[15,16]

Conclusion

We concluded that avoiding prophylactic drain insertion in some patients after performing totally laparoscopic gastrectomy for the management of GC could be feasible. It increases patients' comfort without increasing the risk of postoperative complications.

So we demonstrated that routine postoperative use of prophylactic drainage after performing laparoscopic gastrectomy for GC is not always necessary in all cases, but it will be beneficial only in high-risk patients as patients with high BMI or with co-morbid conditions.

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RESEARCH ARTICLE

Comparative Study of Outcome and Complications of Laparoscopic and Open Simple Nephrectomy in Patients with Non-functioning Kidneys

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Abstract

Background: Nephrectomy is the cardinal treatment option for patients with non-functioning kidneys due to malignant and benign causes. Both laparoscopic and open nephrectomy is preferred but the laparoscopy has less complication and improved surgical outcome when compared over open procedure. In this backdrop, the present study was conducted to compare the surgical outcomes and complications of open and laparoscopic nephrectomy procedures.

Materials and methods: This was a retrospective study conducted on 50 patients admitted with non-functioning kidneys. They were divided into two groups—laparoscopic nephrectomy ($n = 25$) and open simple nephrectomy ($n = 25$). The duration of hospital stay, surgery, postoperative catheter drain removal and surgical complications were analyzed and compared between laparoscopic and open methods.

Results: Laparoscopic nephrectomy showed less operative time (90.60 ± 15.99 vs 133.64 ± 10.57 minutes; $p = 0.001$), shorter hospital stay (3.40 ± 0.12 vs 5.48 ± 0.16 days; $p = 0.001$) and early postoperative catheter removal (3.20 ± 1.08 vs 2.56 ± 1.04; $p = 0.03$) when compared with open nephrectomy and it was significant. The complication rate was lower in laparoscopic nephrectomy when compared with simple open nephrectomy (12 vs 36%).

Conclusion: Laparoscopic nephrectomy for non-functioning is an effective alternative to open nephrectomy, leading to reduced operative time, quicker recovery and fewer complications as indicated by our findings.

Keywords: Complications, Hospital stay, Laparoscopic nephrectomy, Non-functioning kidneys, Open nephrectomy.

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Introduction

Nephrectomy is the surgical excision of kidneys and it is indicated for both benign and malignant disorders. Common indications for these conditions include kidney stones, persistent pyelonephritis, untreated ureteropelvic junction obstruction, renal tuberculosis, and renal cell carcinoma.[1] The first nephrectomy procedure is conducted by Gustav Simon in 1869, and since then, this treatment has been widely performed globally, with subsequent advancements in methodology.[2] Open or laparoscopic methods is accepted for the nephrectomy procedures and in earlier days for both benign and malignant conditions open nephrectomy method are preferred. Urologic laparoscopy has gained significant attention with the first procedure of total laparoscopic nephrectomy conducted by Clayman in 1990.[3] The laparoscopic nephrectomy is used in benign conditions, such as renal tuberculosis, chronic pyelonephritis, obstruction of pelviureteric junction during renal stones, reflux nephropathy, multicystic dysplastic kidney, renal cystitis, renovascular hypertension xanthogranulomatous pyelonephritis, post-kidney transplantation hypertension.[4]

The advantage of laparoscopic nephrectomy is reduced hospital stay, quick recovery time, less bleeding, postoperative pain, and cosmetic benefits. Due to these benefits, laparoscopic surgery is now considered the preferred procedure for nephrectomy in cases of both benign and malignant illnesses.[5]

However, previous studies have shown that laparoscopic nephrectomy procedures elicit more risk for complications and also require longer duration for surgery when compared with open nephrectomy, but recent reports showed no differences.[6,7]

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Furthermore, wide range of studies have demonstrated that laparoscopic nephrectomy is associated with reduced morbidity, shorter times of ischemia, and shorter hospital stay as that of the open procedure.[8,9] So the present study was aimed to compare outcomes and complications in patients underwent laparoscopic and open simple nephrectomy due to non-functioning kidney.

Materials and Methods

This was a retrospective study conducted on 50 patients admitted with non-functioning kidneys at the Department of Urology and Renal Transplantation, SRIHER. The study was conducted for a period of 6 months from November 2022 to May 2023.

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Inclusion Criteria

Patients >18 years of age with non-functioning kidney confirmed through dimercaptosuccinic acid (DMSA) and diethylenetriamine pentaacetate (DTPA) scan were included in the study.

Exclusion Criteria

Patients with coagulopathy or use of platelet aggregation inhibitors, renal abnormalities physical abnormality, severe untreated hypertension and aortic aneurysms were excluded from the study. Patients who were prone to anesthetic risk and having pregnancy were excluded from the study.

Study Procedure

The data of patients who underwent laparoscopic nephrectomy and open simple nephrectomy with non-functional kidney were collected retrospectively for the study. Patients with non-functioning kidney were enrolled into the study-based DMSA and DTPA scans. The sociological data of the patients such as sides of kidney, percentage of non-functioning kidney, duration of the hospital stay, duration of the surgery were analyzed. Surgical complications, catheter removal day and drain removal day were documented. Preoperative assessment was done with routine investigations, such as complete blood count (CBC), renal blood test (RFT), coagulation profile, urine routine, urine culture, blood grouping, and typing and viral markers. If urine culture is positive, the required antibiotic is given for appropriate time period and the urine culture is repeated and preceded for the surgery if the urine culture is negative.

General anesthesia was used during open simple nephrectomy and laparoscopic nephrectomy. A urethral catheter and nasogastric tube were inserted for patients undergoing surgery. The laparoscopic nephrectomy was done in lateral position. Instruments used were Karl Storz, Richard Wolf and Olympus (Germany) based on surgeon's expertise. The open simple nephrectomy was done in lateral position with flexed operation table and flank approach. Instruments used were open and vascular equipment's (VL enterprises, India). The umbilicus served as the main entry point, and trocars were inserted directly there. The abdominal cavity was examined using a laparoscopic lens after creating a pneumoperitoneum with CO_2. Access to the retroperitoneum was made possible following colon medialization. The surgeon's tool (Valley lab) for laparoscopic dissection and bleeding control which was especially helpful in challenging cases.

Statistical Analysis

The data were represented as mean ± SD. The comparison of variables between the laparoscopic and simple open nephrectomy was done using independent sample student *t*-test. The *p*-value < 0.01 was considered statistically significant.

Results

We evaluated 50 patients who underwent laparoscopic and open simple nephrectomy due to non-functioning kidney during the period and fulfilling the inclusion criteria. The patients were divided into two groups as laparoscopic nephrectomy ($n = 25$) and open simple nephrectomy ($n = 25$), respectively.

The demographics and clinical characteristic of the study participants are given in Table 1. In both the groups, male preponderance was observed, 17 (68%) in laparoscopic group and 16 (64%) in open nephrectomy group. The most affected side of the kidney was left in laparoscopy 18 (72%) and right in open nephrectomy 14 (56%).

Table 1: Demographics and clinical characteristic of the study participants

Variables	*Laparoscopic nephrectomy (n = 25)*	*Simple open nephrectomy (n = 25)*
Gender (*n*, %)		
Male	17 (68%)	16 (64%)
Female	8 (32%)	9 (36%)
Kidney side (*n*, %)		
Right	7 (28%)	18 (72%)
Left	11 (44%)	14 (56%)

The surgical outcome between the laparoscopic group and open nephrectomy group is given in Table 2. The surgical operative time (90.60 ± 15.99 vs 133.64 ± 10.57 mins; $p = 0.001$ mins), hospital stay (3.40 ± 0.12 vs 5.48 ± 0.16 days; $p = 0.001$) was significantly lower in laparoscopic groups as compared with simple open nephrectomy. The postoperative catheter removal was earlier in laparoscopic nephrectomy group as compared with open nephrectomy and it was significant (2.56 ± 1.04 vs 3.20 ± 1.08; $p = 0.03$). Meanwhile drain removal was earlier in laparoscopic nephrectomy group as compared with open nephrectomy but it was not significant (1.24 ± 0.52 vs 1.48 ± 0.65; $p = 0.15$).

The complication among the laparoscopic nephrectomy and simple open nephrectomy is given in Table 3. The complication rate was lower in laparoscopic nephrectomy when compared with simple open nephrectomy (12 vs 36%). The most common complication in laparoscopic nephrectomy was bleeding, wound infection, and organ damage and in simple open nephrectomy, peritonitis was the major complication in 4 (16%) of the patients.

Radiological investigation among the groups is presented in Table 4. In this study, DMSA renal scan predicted renal function in 84% and DTPA predicted renal function in 16% of the patients in laparoscopic nephrectomy. Meanwhile, in simple nephrectomy, DMSA predicted renal function in 56% and DTPA in 44% of the patients respectively.

Discussion

In recent years, technological advancements have led to the increasing use of minimally invasive procedures over traditional open surgery. Laparoscopic nephrectomy offer significant benefits in terms of early return to perform daily activities, shorter hospital stays, low requirement of analgesics, enhanced cosmetic appeal, and faster healing compared to open nephrectomy.[10] Currently, laparoscopic nephrectomy is the primary treatments for patients with non-functional kidney disease who experience frequent infection, significant lumbar discomfort and severe renovascular hypertension due to advancements in clinical practice. Laparoscopic nephrectomy is performed by two approaches, namely, transperitoneal or a retroperitoneal, respectively. Retroperitoneal access allows for prompt management of the renal pedicle, although it can be challenging due to fibrotic tissue dissection in a confined surgical area. Retroperitoneal laparoscopic simple nephrectomy can be effectively performed by skilled surgeons with less complications rates.[11] Meanwhile, the transperitoneal method is commonly chosen for surgery for inflamed kidneys. The extensive surgical area and the surgeon's

Table 2: Comparison of surgical outcome between laparoscopic nephrectomy and simple open nephrectomy

Variables	*Laparoscopic nephrectomy (n = 25)*	*Simple open nephrectomy (n = 25)*	*p-value*
Surgical operative time (in mins)	90.60 ± 15.99	133.64 ± 10.57	0.001*
Hospital stay (in days)	3.40 ± 0.12	5.48 ± 0.16	0.001*
Catheter removal (POD)	2.56 ± 1.04	3.20 ± 1.08	0.03*
Drain removal POD	1.24 ± 0.52	1.48 ± 0.65	0.15^{NS}

The data were shown as mean ± SD. *$p < 0.05$ statistically significant (Independent student *t*-test). NS, non-significant

Table 3: Comparison of complication among the laparoscopic nephrectomy and simple open nephrectomy

Complication	*Laparoscopic nephrectomy (n = 25)*	*Simple open nephrectomy (n = 25)*
Bleeding	1 (4%)	2 (8%)
Wound infection	1 (4%)	2 (8%)
Organ damage	1 (4%)	1 (4%)
Peritonitis	0 (0%)	4 (16%)
Total	3 (12%)	9 (36%)

Table 4: Radiological investigation among the laparoscopic nephrectomy and simple open nephrectomy

Radiological investigation	*Laparoscopic nephrectomy (n = 25)*	*Simple open nephrectomy (n = 25)*
DMSA	21 (84%)	14 (56%)
DTPA	4 (16%)	11 (44%)

familiarity with anatomical landmarks provide comfort for the transperitoneal approach.[11] The current study compared surgical outcome and complication between laparoscopic nephrectomy and simple open nephrectomy.

In the current observation, the incidence of patients undergoing nephrectomy was higher in males. Likewise in a study done by Ölçücüoğlu,[12] among the patients undergoing donor nephrectomy, majority are males constituting 69.4%.

The surgical operative time showed significant decrease in laparoscopic nephrectomy as compared with simple open nephrectomy (90.60 ± 15.99 vs 133.64 ± 10.57 minutes; $p = 0.001$). In a recent meta-analysis study done by Wang et al.,[9] the operating time was less in laparoscopic as compared with open nephrectomy, and it was significant ($p = 0.01$). In contrast, mounting studies reported no significant variations in the operative time between laparoscopic nephrectomy and simple open nephrectomy as reported by Singh and Urry[13] (113 vs 111 minutes; $p > 0.05$), meta-analysis study You et al.[14] ($p = 0.13$) and Falahatkar et al.[4] (188 vs 176.25 minutes; $p = 0.57$), respectively.

In the present study, laparoscopic nephrectomy has shorter hospital stay as compared with simple open nephrectomy and it was significant (3.40 ± 0.12 vs 5.48 ± 0.16 days; $p = 0.001$). Likewise, in a study done by Falahatkar et al.[4] (3.45 vs 4.9 1 days; $p = 0.004$), Murtaza et al.[10] (3.30 vs 5.5 days; $p < 0.0001$), and Ganpule et al.,[15] (5.72 vs 9.18 days; $p < 0.001$), the hospital stay was shorter in laparoscopic procedure as compared with open for various indications, The shorter hospital stay in laparoscopic nephrectomy is attributed for various factors, such as strict bowel preparation, accurate analgesic protocols and improved quality of life.

In our study, the postoperative catheter and drainage removal was shorter in laparoscopic nephrectomy as compared with open nephrectomy. Prophylactic placement of drains postoperatively is important for both open and laparoscopic nephrectomies. Studies indicate that there was a significant association between the use of surgical drains and abdominal and surgical wound infections and abdominal infections. Lebowski and Saclarides.[16] reported that the use of drains showed the development of postoperative ileus and more time for bowel recovery. In addition, some studies also reveals that drain use might allow infections by the formation of ascites as a result of peritoneal irritation and provokes abdominal pain.[17] The shorter hospital stay in our study in patients underwent laparoscopic nephrectomy might be due to early drain removal and low incidence of infections.

In the present study, the incidence of complications in laparoscopic nephrectomy is 12% and in simple, open nephrectomy is 36%, respectively. Likewise in a study done by Murtaza et al.,[10] the incidence of complication was lower in laparoscopic nephrectomy as compared with simple open nephrectomy and it was significant (16.7 vs 26.7%; $p < 0.05$). In a meta-analysis done by Chen et al.[18] Laparoscopic nephrectomy displayed less complications as compared with open procedures (OR 0.59, 95% CI, 0.40–0.86; $p = 0.007$). In another study done by Liu et al.,[19] the incidence of postoperative complications in laparoscopic surgery was significantly lower when compared with open technique (19.5 vs 47.8%; $p = 0.004$). In a recent study done by Lyu et al.[20] complications due to surgical cause measured by the Clavien-Dindo scoring was lower in laparoscopic procedure as compared with open (5 vs 23; $p < 0.001$).

In this study, DMSA predicted renal function effectively in both laparoscopic and open nephrectomy group encompassing 84% and 56%, respectively as compared with DTPA in 16% and 44% of the cases. Momin et al.[21] reported that both 99mTc- DMSA and 99m Tc- DTPA scans produces similar results on renal function and DMSA scan is the primary choice for evaluating renal function.

Conclusion

Overall, laparoscopic nephrectomy demonstrated several advantages over open nephrectomy in terms of outcomes and complications. Laparoscopic nephrectomy resulted in shorter hospital stays and lower complication rate compared with those who underwent open nephrectomy. Based on the available literature, laparoscopic nephrectomy appears to be a safe and effective alternative to open simple nephrectomy for treating non-functioning kidney. However, the choice between laparoscopic and open simple nephrectomy should be individualized based on patient's characteristics, surgeon expertise and institutional resources.

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RESEARCH ARTICLE

Laparoscopic Management of Complicated Appendicitis

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Abstract

Aims: The aims of this study are to evaluate the effectiveness, feasibility, and safety of laparoscopy for managing complicated appendicitis and to look for postoperative complications as well as morbidity, in a Tertiary Care Hospital.

Objectives: To study the laparoscopic appendicectomy in cases of complicated appendicitis with respect to:

- Mean duration of the surgical procedure.
- Number of days of antibiotics given, postoperatively.
- Postoperative day-start of oral feeds.
- The incidence of postoperative morbidity.
- Analgesics required.

Materials and methods: This prospective study was conducted in a Tertiary Care Hospital in Ahmedabad on 50 patients who underwent laparoscopic appendicectomy between June 2022 and March 2023.

Conclusion:

- Our study has shown results encouraging the use of laparoscopic appendicectomy in cases of complicated appendicitis, having found less postoperative morbidity along with early start of postoperative oral feeds and decreased requirement of postoperative antibiotics.
- Although the laparoscopic method can be technically challenging, but the results have demonstrated its feasibility and safety.
- Although the number of patients enrolled in this study is far too small, preliminary results show that our experiences with laparoscopic appendicectomy in complicated appendicitis have been encouraging, although technically demanding, with proper surgical technique, it can be done without much postoperative complication.
- As the laparoscopic approach has less morbidity in our study, we recommend the use of laparoscopy even with complicated appendicitis.

Keywords: Complicated appendicitis, Laparoscopic appendicectomy, Laparoscopic surgery.

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Introduction

The abdomen is both a magic box and a temple of surprises, according to a well-known proverb. Diseases of the abdomen are a topic rich in clinical fascination because the abdomen accommodates numerous viscera and other anatomical complements.

- One of the most satisfying diagnostic techniques accessible to the physician, particularly the surgeon, is a thorough examination of the abdomen, which helps to plan the best course of action.
- As stated by Bailey "A correct diagnosis is the handmaiden of successful operation".[1]
- Acute appendicitis is a common cause of acute abdomen in surgical practice that requires prompt surgery.[2]
- In men, the lifetime incidence of appendicitis is 12%, whereas in women, it is 25%. About 7 percent of the population will have an appendix removed at some point in their lives due to acute appendicitis. Male-to-female appendicitis rates have been found to be greater across all age categories, ranging from 1.2 to 1.3:1.[3]
- Despite the fact that advancements in surgical techniques, antibiotic therapy, and diagnostic facilities have reduced mortality from 50% (prior to 1925) to less than 1/1,000,000, the morbidity rate remains at 5–8%, primarily because of complications resulting from delayed diagnosis and treatment.[4]

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The development of the laparoscopic technique gave rise to the chance to investigate novel therapeutic approaches for the treatment of suspected cases of acute appendicitis.[5]

- Laparoscopic appendicectomy is the least morbid operation that combines the benefits of diagnosis and treatment.[6] Compared to patients who have had an open appendectomy, patients are likely to experience less discomfort following surgery, be discharged from the hospital sooner, and resume their regular activities of daily living.[7]
- There are additional benefits such as a lower risk of wound infection, improved aesthetic results, the capacity to examine the whole peritoneal cavity for the identification of different

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conditions, as well as effective peritoneal toileting without the need to extend the incision.[4]

- Laparoscopic appendicectomy is becoming more and more common, especially in young women who are fertile and have a wide differential diagnosis for pain in the right lower quadrant, which includes gynecological pathology.[8]
- The advent of laparoscopic surgery in the modern period has brought about notable shifts in the way surgical disorders are treated. In view of a shift toward minimally invasive surgery, general surgeons are paying close attention in almost every surgical operation to determine whether it may be converted to a laparoscopic procedure.[9]

Materials and Methods

Fifty patients who underwent laparoscopic appendicectomy in a tertiary care hospital in Ahmedabad between June 2022 and March 2023 were included in this study.

Study type: Prospective research.

50 is the sample size.

Inclusion Criteria

- Every patient with diagnosed with complicated appendicitis.
- Every patient who gave consent for study.

Exclusion Criteria

- Ages <12 and >65.
- Females who are pregnant.
- Simple acute appendicitis.
- Gross peritonitis associated with tense abdomen.
- Individuals in whom it would be dangerous to induce a pneumoperitoneum due to poor cardiopulmonary reserve.
- Patients who are morbid and potentially risky candidates for laparoscopic surgery.
- Previous abdominal procedures including significant adhesions.
- Every patient who declined to participate in the trial.
- Every patient who satisfied the inclusion and exclusion criteria of the study was included and admitted.
- Every patient who is suspected of having complicated appendicitis will undergo a clinical examination as well as imaging, which will always involve computed tomography in some cases and ultrasonography in all others. Laparoscopic appendicectomy would be performed on each patient.

The following characteristics confirm that the patients have complicated appendicitis:

History and Clinical Examination

- A history of fever, vomiting, constipation, and acute onset lower abdomen pain on the right side.
- An examination of the abdomen indicates the existence of a mass and pain in the right iliac fossa, as well as widespread rigidity and guarding.

Ultrasound Findings of Perforated Appendicitis

Interloop fluid collections; thickened bowel loops with decreased peristalsis; an appendix larger than 6 mm in diameter; an appendicolith and fluid collections in the subhepatic or subdiaphragmatic spaces. Peri-vesical mass without peristalsis.

Table 1: Type of appendix

Type of appendix	*No. of patients*	*Percentage*
Perforated	30	60%
Gangrene	20	40%

Table 2: Operating time

Operating time (mins)	*No. of patients*	*Percent age*
50	7	14%
55	8	16%
60	11	22%
65	4	8%
70	7	14%
75	6	12%
80	4	8%
85	2	4%
90	1	2%

Table 3: Fever in patients studied

Fever	*No. of patients*	*Percentage*
Yes	7	14%
No	43	86%

CT Scan Findings of Perforated Appendicitis

An arrowhead sign, an appendix more than 6 mm in diameter, and focal cecal apical thickening, appendicoliths, fat streaking, abscesses, pockets of fluid in the pericecal area, pelvis, etc.

Total Leucocyte Count

With a higher white blood cell count (>15,000 cells/μL) the patient is more likely to have a perforation.

Results

Patients who met the inclusion and exclusion criteria were included in our research. Every patient had an appendicectomy via laparoscopic surgery.

According to Table 1, of the 50 patients who took part in the study, 30 (60%) had a perforated appendix and 20 (40%) had gangrenous appendices.

According to Table 2, only 14% of cases took longer than 80 minutes to complete, while nearly 52% of patients had surgery in less than 60 minutes. The identification of the appendix and the management of dilated bowel loops, which made the procedure technically challenging, adhesiolysis, etc., contributed to the prolonged intraoperative duration. The extended duration of the procedure was further explained by the amount of time needed to complete a full peritoneal lavage using warm saline. It was discovered that the mean operating time in our study was 64.6 minutes on average.

Throughout their hospital stay, all patients had their temperatures taken twice a day. Table 3 shows that 86% of patients did not have a fever, while 14% did, with the reason being antibiotic course extensions for pelvic collections, small inter-loop collections, or persistent drainage.

Table 4 shows that, based on the daily rounds, the clinical assessment, and the symptoms, 18% of patients complained of

Table 4: Postoperative abdominal pain in patients studied

Postop abdominal pain	*No. of patients*	*Percentage*
Yes	9	18%
No	41	82%

Table 5: Intra-abdominal abscess in patients studied

Intra-abdominal abscess	*No. of patients*	*Percentage*
Yes	5	10%
No	45	90%

Table 6: Length of postoperative stay in the patients studied

Length of postop stay	*No. of patients*	*Percentage*
POD-3	41	82%
POD-5	3	6%
POD-7	6	12%

stomach pain even after receiving sufficient analgesics, whereas the remaining 82% of patients did not report any abdominal pain.

According to Table 5, 5 patients (10%) had intra-abdominal abscesses.

According to Table 6, 41 patients (82%) were discharged on POD-3, three patients (6%), on POD-5, and 6 patients (12%), on POD-7.

There were no postoperative bowel obstruction characteristics seen in any of the individuals investigated.

Among the patients studied, there were none who had port site infection.

Discussion

Surgical emergencies with complicated appendicitis are frequent. The best course of action for treating complicated appendicitis in the era of limited access surgery remains up for debate: should one pursue an open appendectomy or a laparoscopic appendectomy? laparoscopic appendicectomy has been the standard treatment for adult cases of uncomplicated appendicitis in many locations throughout the world.

The role of laparoscopic surgery in treating complicated appendicitis is still up for debate, nevertheless, few published studies report a higher risk of postop intra-abdominal abscess following surgery.

The rationale for the citations included the following: in an open appendectomy, the appendix is delivered externally to the abdominal cavity, and the stump is inverted following division, potentially reducing the incidence of intra-peritoneal contamination; in a laparoscopic appendectomy, however, the appendix is dissected inside the abdominal cavity, potentially leading to the spillage of infected contents into the peritoneal cavity.

Even yet, laparoscopic appendectomy is a widely acknowledged therapeutic option for appendicitis that is not complicated. Concerns have been raised regarding its usage, especially in cases with complicated appendicitis. These concerns include the lengthier surgical recovery period, surgical site infections, intra-abdominal abscesses, etc.

In complicated appendicitis, however, laparoscopic appendicectomy offers the benefits of a panoramic view with greater magnification, the capacity to see nooks and crannies (many pouches and intraperitoneal spaces), and the removal of purulent material with a thorough saline wash.

- Compared to an open treatment, a laparoscopic appendicectomy carries a lower risk of wound infection. The results of 2,877 people who participated in 28 trials were included in a meta-analysis of randomized controlled trials that was published. Although the overall rates of complications were similar, there was a noticeable decrease in wound infections following laparoscopy (2.3–6.1%).
- While most research indicates that wound infection is less likely after laparoscopic procedures, Rohr et al. found higher rates of wound infection after laparoscopic appendicectomy. During our research, we found no port site infections.

Why Surgeons disagree greatly on whether to perform a laparoscopic treatment for complicated appendicitis because of the possibility of an intra-abdominal abscess forming (gangrenous or perforated).

- Several data suggest that a laparoscopic appendicectomy should be converted if gangrene or perforation is discovered during the procedure. Frazee and Bohannon presented a retrospective analysis of 15 patients with gangrenous appendicitis and 19 patients with perforated appendicitis who had laparoscopic appendicectomy. In the gangrenous group, the rate of postoperative intra-abdominal abscess was reported to be 7%, whereas in the perforated group, the incidence was 26%.
- Tang et al. discovered that the likelihood of a postoperative intra-abdominal abscess was 11% in laparoscopically treated perforated appendicitis cases and 3% in openly treated cases.
- A prospective study of 75 children with perforated appendicitis was published by Paya et al. 10 had laparoscopic appendicectomies, while the other nine had open procedures. While 2 (3.1%) of the 65 patients who had open appendectomies were found to have postop intra-abdominal abscesses, there were no postop abscesses in the group which underwent laparoscopic surgery.
- In adults with complicated appendicitis, between 5.8 and 41% of patients who have had a laparoscopic appendicectomy develop an intra-abdominal abscess after the procedure.
- However, our investigation revealed a 10% incidence of the establishment of intra-abdominal abscesses. This condition was successfully treated with empirical and long-lasting antibiotics, blood work, and abdominal ultrasounds at the conclusion of the antibiotic course.
- Compared to open appendicectomy, laparoscopic appendicectomy has less intestinal wall hematoma and postop intestinal paralysis due to less bowel handling, which facilitates the start of oral feedings sooner than with the conventional approach.

Although the follow-up period has not been long enough, our children have also shown a lower rate of postop adhesions, which is another benefit of the laparoscopic method.

- Ages 26–30 are the most common age-group for acute appendicitis.
- Of the patients, 56% are male. This indicates a small male majority.
- Perforated types of appendices accounted for 60% of all cases.
- The majority of operation times (52%) are fewer than 60 minutes on average.

- Merely 14% of patients experience postoperative fever, with the majority of those cases resulting in the establishment of an intra-abdominal abscess.
- 10% of patients develop an intra-abdominal abscess that is treated conservatively and is accompanied by fever and abdominal pain.

Almost none of the patients have experienced any further complications, such as postoperative intestinal blockage or port site infection.

- 90% of the patients had begun receiving their meals orally by the end of POD-1.
- The majority of patients (84%), did not require analgesics after POD-1.
- For the majority of patients (82%), antibiotics are necessary until POD-3.
- Routine blood investigations were within normal limits, and USG abdominal results were normal, and the majority of patients (82%), were discharged by the end of postoperative day 3.

Conclusion

- The results of our study support the use of laparoscopic appendicectomy in patients with complicated appendicitis, since we saw a decrease in postoperative antibiotic need, early initiation of oral feeds following surgery, and decreased postoperative morbidity.
- The laparoscopic approach can be technically difficult, but the outcomes have shown that it is safe and feasible.
- Although less common, postoperative intra-abdominal abscesses can be treated conservatively with the appropriate antibiotics, further blood work, abdominal USG imaging, and follow-up monitoring.
- Almost no risk of postoperative paralytic ileus associated with intestinal obstruction symptoms and surgical site infection in the form of port site infection.
- Postoperative fever and abdominal discomfort are also less common, and they are mostly linked to the establishment of an intra-abdominal abscess.
- The majority of patients may begin early oral feeding without any more issues.
- Postoperative analgesic requirements are often minimal, suggesting reduced postoperative morbidity.
- Postoperative antibiotic needs are also uncommon unless a patient develops an intra-abdominal abscess that necessitates long-term antibiotic usage.
- Short hospital stays are also common, barring the development of complications.
- Despite the far too small number of patients enrolled in this study, preliminary findings indicate that our experiences with laparoscopic appendicectomy for complicated appendicitis have been supportive. Although technically challenging, it can be performed with appropriate surgical technique and little postoperative complications.
- We advocate using laparoscopy even in cases with complicated appendicitis since our research indicates that this method has a lower rate of morbidity.

Clinical Significance

The use of laparoscopic appendicectomy in cases of complicated appendicitis, having found less postoperative morbidity along with the early start of postoperative oral feeds and decreased the requirement of postop antibiotics.

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REVIEW ARTICLE

The Ideal Hand Hygiene Method in the Age of Water Scarcity: A Systematic Review and Meta-analysis

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Abstract

In modern times, surgical site infections (SSIs) are defined as infections occurring within 30 days after surgery (or 1 year in patients with implants) at the incision or deep tissue level. Purulent drainage should be observed and organisms from the site should be isolated for epidemiological purposes. Most of the factors contributing to SSIs are patient-related, as the majority of infections are caused by endogenous flora. It has also been suggested that unclean operating hands due to glove contamination do not affect rates of postoperative infections. While the traditional surgical scrub has so far stood the test of time, it is important to consider its environmental impact. There have been multiple attempts to reduce the carbon footprint of the surgical hand scrub, including usage of a different model of tap but there is an easier option available to us: hand rubbing. It takes up significantly less water, as reported by some of the studies given above. It is also particularly beneficial in resource-limited settings. All studies except one reported that hand rub solutions are also more affordable, making them accessible in poorer countries and hospitals. Our study results similarly suggest that waterless hand rubbing is at least as effective as hand scrubbing in preventing SSIs, and is a viable solution to address water scarcity concerns.

Keywords: Antisepsis, Hand wash, Povidone-iodine, Scrub.

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Introduction

The discovery of the link between infections and hand hygiene is attributed to Oliver Wendell Holmes and Ignaz Philip Semmelweis.[1,2] Hand hygiene was first advocated by Oliver Wendell Holmes in the early 1840s, for preventing postpartum infections. In the late 1840s, Semmelweis of Vienna also promoted hand antisepsis with chloride or lime before attending to women in labor, to remove 'cadaverous particles' that medical students carried after autopsies. In 1855, Holmes published Puerperal Fever, as a Private Pestilence, and Semmelweis published The Etiology, Concept, and Prophylaxis of Childbed Fever in 1861.[3,4] Unfortunately, both doctors received little recognition for their remarkable medical contributions during their lifetimes and faced ridicule from their peers. Holmes eventually found success in the arts, while Semmelweis deteriorated and was ostracized by the medical community. Any discussion of surgical hygiene is incomplete without mentioning Joseph Lister. In 1867, Lister published the groundbreaking "*On the Antiseptic Principle in the Practice of Surgery*", and is known as the "Father of antisepsis."[5]

In modern times, surgical site infections (SSIs) are defined as infections occurring within 30 days after surgery (or 1 year in patients with implants) at the incision or deep tissue level.[6] Purulent drainage should be observed and organisms from the site should be isolated for epidemiological purposes.[6] Most of the factors contributing to SSIs are patient-related, as the majority of infections are caused by endogenous flora.[7] It has also been suggested that unclean operating hands due to glove contamination do not affect rates of postoperative infections.[8]

Gloves were introduced in late 1899 by Dr William Halstead.[9] They soon spread in popularity and are now a cornerstone in prevention of SSIs. Despite the use of gloves, hand antisepsis remains a crucial part of preoperative preparation for the following reasons: micro tears occur frequently after surgery (18%) and might not be noticed by surgeons.[10] There have been proposals of using gloves coated with antiseptics, and the results found a significant drop in hand flora was observed.[11] However, more research and higher quality evidence are warranted before this enters regular surgical practice.

Since the time of Semmelweis, hand scrubs have involved water for cleanliness. But in recent times, the question of water scarcity arises. The self-reported number of major surgeries per day is 800 in a major Indian hospital.[12] The average amount of water per hand scrub was estimated to be 20.2 L.[13] We assume an average of six staff including doctors and nurses scrubbing in per surgery. An easy calculation shows that at just one tertiary care center, close to one hundred thousand liters of water are being used in just one day. This number is probably doubled if we account for other procedures such as minor surgeries, and other interventional procedures requiring aseptic conditions. It has been calculated that using hand rubs can save around one million liters of water annually.[14] Water scarcity is a global threat in this century. Currently, three out of four people live in water-insecure countries.[15] Availability of fresh and safe drinking water for various uses is a major healthcare

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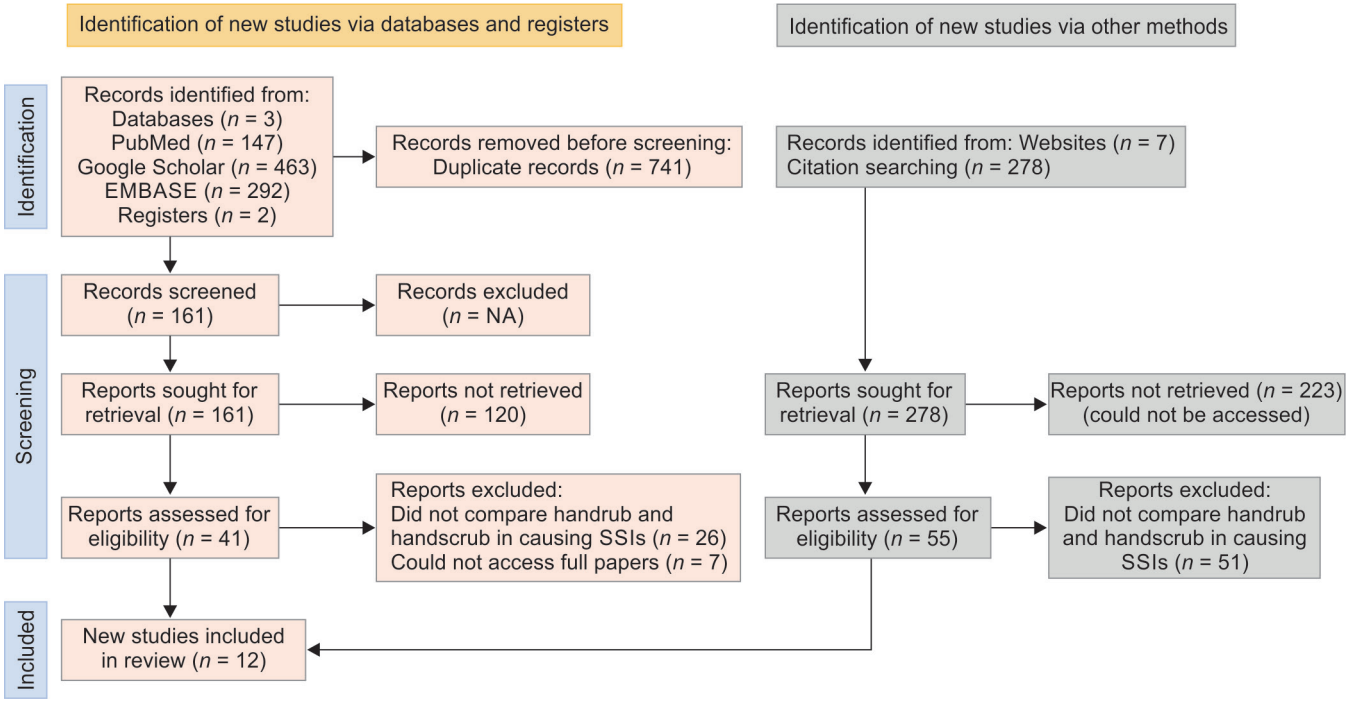

Fig. 1: PRISMA

determinant. With increasing population in India, water may be reasonably expected to become even more scarce. Currently, India is the largest user of groundwater globally.[16] It is now crucial to save water in all aspects of life, and one of the ways is via switching to a waterless hand rub protocol over traditional hand scrub.

Various methods of hand antisepsis have been developed in recent decades, but have not been widely implemented. Given the emphasis on evidence-based medicine in the modern era, it is essential to study patient-centric outcomes such as the rates of SSI, and question whether traditional hand scrubbing is still the most relevant option in light of water scarcity. According to the current WHO guidelines (2018), as stated in the Global Guidelines for the Prevention of Surgical Site Infections, 2018, 2nd edn: The panel recommends that surgical hand preparation be performed either by scrubbing with a suitable antimicrobial soap and water or using a suitable alcohol-based hand rub (ABHR) before donning sterile gloves. There is a lack of research on the factors of hand antisepsis and their impact on SSI rates. Notably, the WHO guidelines mentioned above have not been updated since 2009.[17] This study aims to compile current research on preoperative hand antisepsis to determine whether waterless handrubs are as suitable as hand scrubs.

Methodology

To formulate the research questions, we chose studies which considered the patient population of surgeons and other operating theater staff. A comparison was made between the waterless hand rub (with iodine, alcohol, or chlorhexidine) and a traditional hand scrub using soap and water. The primary outcome considered is the rate of SSIs in patients. The secondary outcome is the reduction in usage of water resources, summarized qualitatively.

After the question was defined, multiple databases were searched online between December 2022 and March 2023. The search was conducted online on PubMed, looking for studies containing: Surgical hand rub, surgical hand scrub, SSIs, etc. The results were combed through by hand to find relevant articles. A similar protocol was used on Cochrane library, Google Scholar, and EMBASE. Only studies from January 1980 to March 2023 were considered. All languages were included in the search but the studies that qualified were in English, Spanish, or French. Refer to PRISMA (Fig. 1).[18]

Handsearching was done through registers and the citations of each of the included studies, to ensure no relevant studies were being excluded. Additional studies were found but six were excluded because the full text and results could not be accessed. The others were duplicates from the Boolean search shown above. Multiple studies citing 'antimicrobial efficacy' via CFU's or other measures without mention of SSIs were excluded. A couple studies with veterinary patient groups were also excluded. Two authors independently assessed all studies for inclusion and extracted data.

A total of 12 studies published in all languages were included: six clinical trials and six observational studies. They were summarized (Table 1) and the cumulative results of nine were statistically analyzed. Meta-analysis was conducted in some studies to find the singular conclusion.[19–28] These studies used for quantitative analysis were conducted by: Parienti et al., Al-Naami et al., Gaspar et al., Nthumba et al., Kentarolwakiri et al., Adjoussou et al., Chen et al., Vergara-Fernández et al., Murie et al, Weight et al., Oriel et al., and Rubio et al.[19–30]

Results

The results of all the studies have been summarized in Table 1.

Statistical Analysis

Combined risk ratio (RR) with 95% confidence intervals (95% CIs) was calculated to assess the effect of SSIs due to traditional hand scrub and waterless handrub. Heterogeneity was calculated by Q statistic to indicate presence or absence and Q statistic follows Chi-square distribution with *k*-1 degrees of freedom, where *k* being

Table 1: Result of the studies

Citation	*Name of study*	*Authors*	*Year*	*Rate of SSI*	*Conclusion (summarized)*
19	Hand-rubbing with an aqueous alcoholic solution vs traditional surgical hand-scrubbing and 30-day surgical site infection rates	Parienti et al.	2002	The SSI were 55 out of 2,252 in handrub (2.44%) and 53 out of 2,135 (2.48%) in hand scrub ($p = 0.008$)	The SSIs were lower with hand rub than with hand scrub. Hand rub showed increased compliance, better tolerance, lesser dryness, and skin irritation.
20	Alcohol-based hand-rub versus traditional surgical scrub and the risk of surgical site infection: A randomized controlled equivalent trial	Al-Naami et al.	2009	The SSI were 8 out of 272 (2.94%) in hand rub and 12 out of 228 (5.3%) in hand scrub ($p = 0.27547$)	The SSIs were lower in hand rub than hand scrub. Hand rub resulted in less skin reactions and more compliance.
21	Alcohol-based surgical hand preparation: Translating scientific evidence into clinical practice	Gaspar et al.	2018	The SSIs were 4 out of 99 (4.0%) in hand rub and 11 out of 132 (8.3%) in hand scrub ($p = 0.563$)	The SSIs were lower with hand rub but not statistically significant. Hand rub also showed better compliance.
22	Cluster-randomized, crossover trial of the efficacy of plain soap and water versus alcohol-based rub for surgical hand preparation in a rural hospital in Kenya	Nthumba et al.	2010	The SSIs were 127 out of 1,537 patients in hand rub and 128 out of 1596 in hand scrub ($p = 0.666$)	The SSIs were higher with handrub but not significant hand rubs were also more expensive, however, were noted to be feasible when water is limited.
23	Waterless hand rub versus traditional hand scrub methods for preventing the surgical-site infection in orthopedic surgery	Kentarolw-akiri et al.	2017	The SSIs were 8 of 688 (1.1%) in hand rub and 9 of 712 (1.3%) in hand scrub ($p < 0.05$)	The SSIs were lower in handrub but not significantly different. Handrub protocol was quicker and cheaper than hand scrub.
24	Value of hand disinfection by rubbing with alcohol prior to surgery in a tropical setting	Adjoussou et al.	2009	The SSI were 13 out of 113 (11.5%) with handrub and 27 out of 111 (13.2%) in hand scrub ($p = 0.80$)	The SSIs were lower in handrub but not significant hand rub was cheaper and quicker than hand scrub.
25	Effect of surgical site infections with waterless and traditional hand scrubbing protocols on bacterial growth	Chen et al.	2012	–	The SSI were not significantly different in the two groups.
26	Surgical team satisfaction levels between two preoperative hand-washing methods	Vergara-Fernández et al.	2010	The SSI rates were two patients (4%) in handrub and one patient (2%) in hand scrub ($p = 0.31$)	The SSI rates were not different hand rub is as effective as hand scrub, and it is associated with less washing time, dry skin, cost and use of water.
27	Chlorhexidine in methanol for the preoperative cleansing of surgeons' hands: A clinical trial	Murie et al.	1980	The SSIs were 26 of 117 wounds (22%) for handrub and 23 of 109 patients (21%) for hand scrub	The SSI rate differences were not statistically significant. Hand rubs are acceptable, fast, cheap and effective preoperative hand antisepsis and can replace hand scrubs.
28	Avagard hand antisepsis vs traditional scrub in 3600 pediatric urologic procedures	Weight et al.	2010	The SSIs were 2/1,800 (0.11%) in hand rub and 3/1,800 (0.17%) in the hand scrub group ($p > 0.99$)	No significant differences were noted in SSI rates, skin irritations/allergic reactions, but handrubs are cheaper than hand scrubs.
29	The impact of surgical hand antisepsis technique on surgical site infection	Oriel et al.	2016	($p = 0.31$)	Implementation of an ABR for use in surgical hand antisepsis did not alter SSI rates.
30	Septisol antiseptic foam: A sensible alternative to the conventional surgical scrub	Rubio et al.	1987	The SSI rates were 11 out of 3,480 cases (0.3%) for handrub. previously reported estimates of SSI rates of 3–5% with hand scrub	Hand rubs are safe, effective, and easy to use, and result in decrease in water consumption and monetary savings.

the number of trials.[31] Tau2 (τ2) was measured for estimating the variances between studies. A total of I2 index was used to quantify the degree of heterogeneity among studies. Fixed-effects models were used as pooling methods when the heterogeneity was low ($I2 < 50\%$, $p > 0.1$ for the Q statistic). On the other hand, random-effects models were used when the heterogeneity was high ($I2 \geq 50\%$, $p \leq 0.1$ for the Q statistic). Funnel plot was used to assess the publication bias visually.[32] Publication bias was further evaluated using the Begg's and Egger's tests, for which a p-value > 0.05 indicated no publication bias. If publication bias was present, the trim and fill method was used to adjust the publication bias and further assess the stability of the results. Meta mar software was used for statistical analysis and to draw forest and funnel plots (Fig. 2).

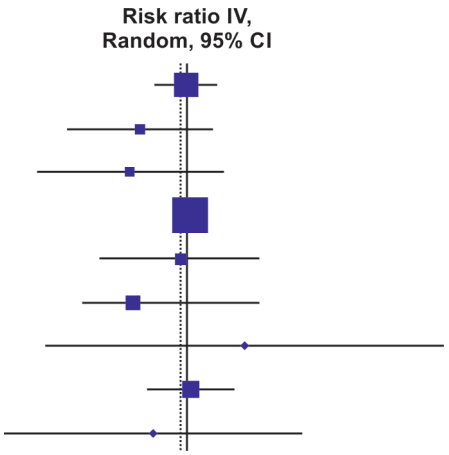

Fig. 2: Forest lot

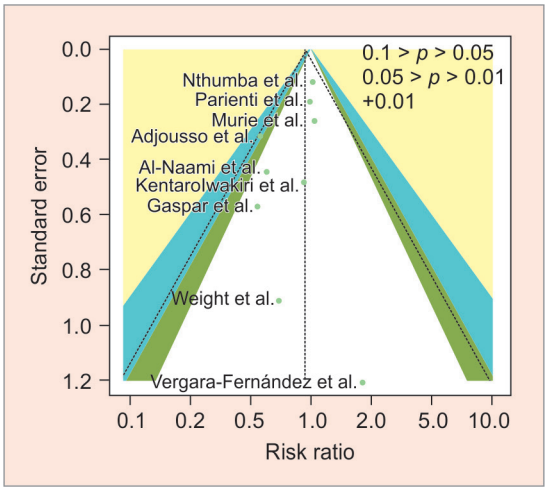

Fig. 3: Funnel plot

The combined RR was found to be <1, indicating that handrubs may in fact decrease the incidence of SSIs compared with hand scrubs. However, this difference is insignificant as shown by the *p*-value.

The funnel plot (Fig. 3) here shows a symmetrical and inverted funnel shape, which is desirable. Linear regression test was done for funnel plot asymmetry and the *p*-value was found ($p = 0.1926$). Fail safe N calculation was done using the Rosenthal approach, where the observed significance was found to be 0.0791 for a target significance of 0.05.

Meta-analysis was conducted using both the fixed and random effects models.

Random effects model was chosen here because of the differences in the patient populations, types of surgeries conducted, exact procedures of hand rub/hand scrub etc. The results are reported (Fig. 4). The *p*-value was found to be 0.3844 and is insignificant (Fig. 5).

Discussion

We found that the rates of SSIs were not significantly different in the two hand hygiene protocols compared a traditional hand scrub or the newer waterless handrub. Different studies were included in this meta-analysis and their individual definitions of hand scrub and hand rub were considered. Regardless of the exact protocol used, all of these studies reported no significant difference in SSI rates, and a majority showed a lower percentage of incidence in hand rubbing protocols. Combined RR is also less than one (<1) which shows that hand rubs may actually decrease the incidence of SSIs.

A study conducted by Kramer et al. affirms our notion that surgical hand scrubbing is seen as a ritualistic practice performed without exception.[33] Yet, it remains unclear if there are equally effective alternative options available. While the majority of SSIs are caused by the patient's own endogenous flora, and the use of gloves by surgeons provides an additional layer of protection, pathogens that survive the preoperative hand antisepsis do cause infections.[34] Therefore, it is crucial to identify the best methods for preventing healthcare-associated infections and adhere to antisepsis guidelines. There are many reports which conclude that hand rubbing provides antimicrobial coverage for longer than hand scrubbing.[35–39]

Another significant concern, especially during longer surgeries, is recolonization of the hands by bacteria. A pivotal threshold is the 5 hours mark, as the contamination reaches or exceeds pre-scrub levels here.[40] Rescrubbing can mitigate this risk if performed between the fourth and fifth hours of surgery, and alcohol-based hand rubs may have a greater use here because they are faster. Assuming the increased microbial counts in surgeons' hands lead to more SSIs, microbial counts in the gloves can be taken as a substitute. A meta-analysis conducted by Ho et al. found that there were no significant differences between waterless hand rubbing and hand scrubbing, and affirmed that alcohol-based handrubs have increased compliance.[41]

Multiple studies included in ours included the other benefits of handrubs: better compliance by providers, lesser skin irritation, faster prep, and cheaper.

Providers confirmed lesser skin reactions in studies by Al-Naami et al., Weight et al., and Vergara Fernández et al., also reported a lesser incidence of dryness with waterless hand rubs.[20,26,28]

Skin irritation is greatly decreased by dry hand rubs as opposed to traditional hand scrubs. This observation is supported by multiple authors in this study and specific clinical trials.[42] They may also prevent eczema in susceptible users.[43,44] This subsequently leads to increased compliance by the staff and superior hand hygiene practices. The specific contribution of compliance as opposed to antimicrobial efficacy, to the reduction in surgical site infection rates, remains undetermined. Nonetheless, research using colony forming units as a measure of efficacy affirm that handrubs are at least on par with hand scrubs, as given before.

There is a paucity of research about preoperative hand antisepsis, and the few studies that do exist are not without faults. Further research is recommended to define patient centric outcomes and study the effect of different hand preparations on them. Given the current body of research, and our findings, it appears that an improbable number of participants would be required to detect a significant difference between the efficacy of different hand antisepsis methods. Consequently, we conclude that waterless hand rubbing with an appropriate agent is a suitable alternative to using water.

Hand scrubs were traditionally described by two doctors, Oliver Wendell Holmes and Ignaz Philip Semmelweis. They revolutionized surgery and led to better outcomes, and caused a huge shift by lowering mortality and morbidity. Various studies done afterward improved the methods leading to where we are today in modern medicine. However, in the twenty-first century, when we stand on

Review: Model: DM—Fixed and random effect

	RR	95% CI	%W (common)	%W (random)
Parienti et al.	0.9842	[0.6780; 1.4287]	20.4	20.8
Al-Naami et al.	0.5714	[0.2375; 1.3747]	3.7	3.9
Gaspar et al.	0.5049	[0.1654; 1.5411]	2.3	2.4
Nthumba et al.	1.0280	[0.8118; 1.3017]	50.8	49.0
KentaroIwakiri et al.	0.9208	[0.3573; 2.3730]	3.2	3.3
Adjoussou et al.	0.5273	[0.2848; 0.9764]	7.5	7.8
Vergara-Fernández et al.	1.9615	[0.1835; 20.9660]	0.5	0.5
Murie et al.	1.0435	[0.6274; 1.7355]	10.9	11.4
Weight et al.	0.6670	[0.1116; 3.9872]	0.9	0.9

Number of studies combined: k = 9

Number of observations: o = 14313

Number of events: e = 512

	RR	95% CI	z |t	*p*-value
Common effect model	0.9313	[0.7871; 1.1019]	–0.83	0.4070
Random effects model	0.9270	[0.7666; 1.1209]	–0.92	0.3844

Fig. 4: Results of common and random effects model

Study	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Risk ratio IV, Random, 95% CI
Parienti et al.	55	2,307	53	2,188	20.8%	0.98 [0.68; 1.43]
Al-Naami et al.	8	280	12	240	3.9%	0.57 [0.24; 1.37]
Gaspar et al.	4	103	11	143	2.4%	0.50 [0.17; 1.54]
Nthumba et al.	127	1,664	128	1,724	49.0%	1.03 [0.81; 1.30]
Kentarolwakiri et al.	8	696	9	721	3.3%	0.92 [0.36; 2.37]
Adjoussou et al.	13	126	27	138	7.8%	0.53 [0.28; 0.98]
Vergara-Fernández et al.	2	52	1	51	0.5%	1.96 [0.18; 20.97]
Murie et al.	26	143	23	132	11.4%	1.04 [0.63; 1.74]
Weight et al.	2	1,802	3	1,803	0.9%	0.67 [0.11; 3.99]
Total (95% CI)		**7,173**		**7,140**	**100.0%**	**0.93 [0.77; 1.12]**

Heterogeneity: $Tau^2 = 0.0014$; $Chi^2 = 7.08$, df = 8 ($p = 0.53$); $I^2 = 0\%$

Fig. 5: Random effects model and heterogeneity

the verge of devastating water scarcity, with access to many more advanced antiseptic agents than our predecessors, it may be time to consider waterless hand rub policies with no compromise on infections or patient safety. It is the need of the hour to decrease the rampant utilization of limited resources, starting with replacing traditional hand scrubbing with waterless methods that have shown equal efficacy. It has been found that the combination of chlorhexidine gluconate (CHG) and ethanol is synergistic and yields a significantly augmented antimicrobial impact compared with their individual applications.[45] Solo application of chlorhexidine surpasses disinfection efficacy of alcohol alone, as shown by a study measuring glove contamination.[46] A review conducted in 2017 advises to avoid formulations containing substances without clear benefits.[47] For example, a study conducted by the same author found that mecetronium etilsulfate (MES), a common additive, had questionable efficiency.[48] In alcohol-based hand rubs, the formulation – gel, foam, or liquid – matters less than the potency of the active ingredient itself.[49]

It is important to acknowledge the limitations of our study. There has been little research conducted comparing patient-centric outcomes in hand scrubs and hand rubs, clinical trials fewer still. Furthermore, while the underlying procedures in the studies included are largely similar, variations do exist.

While the traditional surgical scrub has so far stood the test of time, it is important to consider its environmental impact. There have been multiple attempts to reduce the carbon footprint of the surgical hand scrub, including usage of a different model of tap but there is an easier option available to us: hand rubbing.[50] It takes up significantly less water, as reported by some of the studies given above. It is also particularly beneficial in resource-limited settings. All studies except one reported that hand rub solutions are also more affordable, making them accessible in poorer countries and hospitals. Our study results similarly suggest that waterless hand rubbing is at least as effective as hand scrubbing in preventing SSIs, and is a viable solution to address water scarcity concerns.

Conclusion

Waterless hand rubbing is at least as effective as hand scrubbing in preventing SSIs, and is a viable solution to address water scarcity concerns.

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REVIEW ARTICLE

A Comprehensive Review of 24-hour pH Monitoring in the Assessment of Pre- and Post-laparoscopic Fundoplication

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Abstract

This review addresses gastroesophageal reflux disease (GERD), a prevalent and challenging condition worldwide, focusing on the role of 24-hour pH monitoring in assessing pre- and post-laparoscopic fundoplication. Laparoscopic fundoplication reinforces the lower esophageal sphincter (LES) in GERD. The review analyzes 35 relevant studies, exploring pH monitoring's significance in patient selection, tailored surgical intervention, and postoperative evaluation. Pre-fundoplication pH monitoring establishes baseline acid exposure, aiding surgical decision-making. Post-fundoplication monitoring evaluates procedure effectiveness, revealing reduced acid exposure time (AET) and improved De Meester Score (DMS), indicating symptom relief. The review draws from diverse databases, emphasizing pH monitoring's clinical importance in GERD management. Despite various diagnostic tools, 24-hour pH monitoring remains the gold standard, enhancing personalized patient care. The review identifies gaps, emphasizing the need for further research in wireless pH monitoring and laparoscopic or robotic antireflux surgery. Overall, integrating 24-hour pH monitoring with laparoscopic fundoplication shows promise for improving outcomes, warranting future research for methodological refinements and technological advancements in GERD management.

Keywords: 24-hour pH monitoring, Future research, Laparoscopic fundoplication, Pre- and postoperative outcome.

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Introduction

Gastroesophageal reflux disease (GERD) poses a global health challenge, affecting millions worldwide with an incidence of about 14%. Laparoscopic fundoplication has come out as the best surgical remedy to relieve the symptoms of GERD and prevent further complications. Accurate evaluation, particularly through 24-hour pH monitoring, plays a pivotal role in the success of this procedure. This diagnostic modality quantifies esophageal acid exposure, serving as the gold standard for GERD evaluation. The review aims to comprehensively evaluate the role of 24-hour pH monitoring before and after laparoscopic fundoplication, offering nuanced insights into patient selection, treatment decisions, and outcomes. The focus is on bridging knowledge gaps, analyzing the multifaceted aspects of pH monitoring, and addressing the evolving techniques in GERD management. This review emphasizes the vital role of 24-hour pH monitoring to improve patient care, various surgical interventions, and the diagnostic capabilities of laparoscopic fundoplication.

Materials

This review obtained data from 35 studies from diverse surgical and gastroenterology journals over the past 32 years. The article was predominantly conducted in hospital settings, with the main emphasis on the role of 24-hour pH monitoring in GERD patients pre- and post-fundoplication. The inclusion criteria ensured clinical applicability and relevance to GERD management. The selected studies varied in publication year, study design, sample sizes, and patient demographics, representing a wide range of geographical regions. Follow-ups up to 20 years after laparoscopic fundoplication, with preoperative and postoperative assessments using 24-hour pH monitoring and De Meester Score (DMS). Three types of pH monitoring devices were utilized, including ambulatory pH monitoring, a double intraluminal pH monitor (MII-pH), and wireless pH monitoring. The systematic data extraction process focused on essential information, providing a comprehensive understanding of laparoscopic fundoplication's role in GERD management. The review offers clinicians and surgeons an overall view in this field.

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Methods

Thorough literature searches were carried out methodically in surgical and gastroenterology journals, Google Scholar, Medline, and PubMed regarding 24-hour pH monitoring, laparoscopic fundoplication, and GERD.

The search used targeted keywords of pH monitoring, laparoscopic fundoplication, and GERD without data restriction. In line with the review objective, specific inclusion criteria focused on articles concerning 24-hour pH monitoring pre- and post-laparoscopic fundoplication, studies lacking relevant data, or studies not published in English.

The initial search yielded numerous articles, and after removing duplicates, titles and abstracts were reviewed for analysis. A total of 35 articles from gastroenterology and surgical journals were selected for detailed analysis. The extraction of data was thorough,

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as were publication details, study characteristics, and specifics related to the methods and findings of 24-hour pH monitoring. The extracted data were structured for subsequent analysis.

The review covered three types of pH monitoring tools, i.e., 24-hour pH monitoring, multichannel intraluminal impedance pH monitor (MII-pH), and wireless capsule technology (Bravo). Ambulatory and MII-pH are invasive procedures involving catheter insertion, while wireless capsule technology is non-invasive, adhering to the esophageal mucosal wall. Fasting before pH monitoring is recommended, with 24-hour pH monitoring extensively used worldwide and being relatively cheaper and more effective.

Post-laparoscopic fundoplication, fasting is advised for 24-hour pH monitoring to assess surgical effectiveness. Patient adherence to specific fasting instructions is crucial. Proton pump inhibitors (PPI), H2 antagonists, and antacids should be withdrawn a week prior to the pH monitoring procedure.

Laparoscopic fundoplication, including Nissen fundoplication (360-degree wrap), Toupet fundoplication (270-degree wrap), and partial fundoplication are commonly performed for GERD. The primary goal is to strengthen the lower esophageal sphincter (LES), which gets weaker in GERD.

While the reviewed literature offers valuable insights into 24-hour pH monitoring in GERD management, examination in depth reveals variations in protocols and criteria. This proves there should be uniformity for standardization and patient-oriented care, future research is needed in this field. The introduction of modern technology, for example, wireless pH monitoring, may be a game changer in the future.

Results

Extensive detailed analysis of 35 studies from gastroenterology and surgical journals demonstrates diverse 24-hour pH monitoring findings before laparoscopic fundoplication operation in GERD patients. Heterogeneity existed; some showed a severe type of acid reflux (pH <4) and prolonged acidic periods, while others showed weak acidic or non-acidic reflux. This highlights the individualized nature of GERD profiles.

Most reviewed literature emphasized the vital role of 24-hour pH monitoring prior to laparoscopic fundoplication to ascertain the diagnosis of GERD and evaluate the extent and severity of acid reflux. Across the 35 articles, centers consistently performed pre- and postoperative pH monitoring. Multichannel intraluminal impedance pH monitor monitoring was predominant, with consistent pre-operative pH findings confirming the GERD diagnosis. Postoperative monitoring consistently demonstrated reduced acid exposure time (AET) and reflux episodes, validating laparoscopic fundoplication's efficacy in controlling acid reflux.

Clinicians generally agree that GERD patients with esophagitis proven by gastroscopy and a good response to PPIs may not need preoperative pH monitoring. Abnormal acid exposure (>5 minutes) predicts positive outcomes after anti-reflux surgery. Recommendations include preoperative pH monitoring for patients without esophagitis and a good PPI response or those with symptoms unresponsive to high-dose PPI.

A detailed comparative analysis of pre- and postoperative pH monitoring consistently showed substantial postoperative improvements in acid reflux parameters following laparoscopic fundoplication. Studies demonstrated better outcomes with laparoscopic fundoplication compared to PPI for GERD patients.[1]

Studies on 24-hour pH monitoring device efficacy concluded that ambulatory monitoring is a sensitive and specific diagnostic tool. Wireless pH monitoring, although promising, requires standardization. Long-term follow-ups affirmed laparoscopic fundoplication's effectiveness, emphasizing its role in managing GERD by reducing acid reflux and improving esophageal motility.[2]

Comparisons between laparoscopic Nissen fundoplication and other types consistently favored Nissen for symptom control and acid reflux reduction. Predictors of positive outcomes included male gender, BMI <30, typical reflux symptoms, abnormal acidic reflux (pH <4), and positive GERD symptoms.[3]

The compiled results highlight laparoscopic fundoplication's effectiveness in managing GERD by reducing acid reflux, with variability in preoperative pH monitoring emphasizing the need for personalized approaches. While short-term success is reported, long-term outcomes and potential complications require further investigation. Standardization of pH monitoring protocols is crucial for reliable and comparable results in future research and clinical practice. The review underscores laparoscopic fundoplication's efficacy but emphasizes the individualized nature of GERD and the importance of consistent pH monitoring techniques.

Discussion

Gastroesophageal reflux disease, characterized by acid reflux into the lower esophagus, poses significant health risks. Laparoscopic fundoplication is a common surgical intervention, but its impact on 24-hour pH monitoring outcomes varies. Preoperative monitoring helps identify suitable candidates by assessing acid reflux severity. Postoperatively, it gauges surgical success, though it may miss non-acidic reflux events.

Though 24-hour pH monitoring is the real benchmark, the gold standard, impedance (MII-pH), and wireless devices offer extended monitoring, but with limitations. Laparoscopic Nissen fundoplication is favored for controlling acid reflux, outperforming Toupet and partial fundoplication in pH monitoring. Long-term studies confirm its sustained benefits.[4]

Ambulatory pH monitoring aids GERD management, especially in assessing laparoscopic fundoplication efficacy. Persistent postoperative acid reflux prompts adjustments, potentially involving medication changes or revision surgery. Monitoring also detects complications like gas bloating early.[5]

Comparative studies highlight the Laparoscopic Nissen Fundoplication superior control over acid reflux, correlating with symptom relief. Toupet and partial fundoplication are viable alternatives, but they may not match Nissen's outcomes. The improvement in motility favors partial fundoplication. Laparoscopic anti-reflux surgery also excels at laryngopharyngeal reflux.[6]

Individual factors influence outcomes; patients with typical GERD symptoms benefit more. Gas-related symptoms may vary, with Nissen causing a transient problem. pH monitoring, though sensitive, may yield false positives or false negatives. Combining it with impedance improves accuracy.[7]

Multivariate analyses suggest pH monitoring strongly predicts Nissen fundoplication outcomes. Despite negative endoscopies, pH monitoring detects pathological reflux. Specialists should interpret results, guiding individualized treatment decisions and realistic postoperative expectations.[8]

Future research should explore advanced surgical techniques, individualized patient criteria, and ancillary testing. For children, newer pH monitoring approaches are crucial. Wireless devices

and smart implants may enhance monitoring accuracy. Research should focus on the early detection and prevention of long-term complications.[9]

Alternative techniques like Transoral Incisionless Endoscopic Fundoplication and the LINX device show promise but need validation. Robotic-assisted fundoplication, though precise, is expensive and in its early phases. Personalized care, involving shared decision-making, is essential for optimal outcomes.[10]

In conclusion, 24-hour pH monitoring remains an integral part of GERD management, guiding pre- and post-laparoscopic fundoplication decisions. The evolving field emphasizes informed decision-making for improved patient care.[11–16]

Conclusion

This review highlights the vital role of 24-hour pH monitoring in managing GERD and evaluating laparoscopic fundoplication. Pre-operative pH monitoring is essential for GERD diagnosis and selecting suitable surgical candidates. Postoperative monitoring consistently demonstrates laparoscopic fundoplication's efficacy in reducing acid reflux and improving symptoms, with laparoscopic Nissen fundoplication often favored. While traditional 24-hour pH monitoring is the gold standard, impedance MII-pH monitoring excels in comprehensive diagnostics, detecting non-acidic and weakly acidic reflux events. Standardized guidelines for patient selection and postoperative monitoring are crucial to reducing literature variations, and future research should focus on long-term outcomes and quality of life assessment. Despite study limitations, laparoscopic fundoplication remains a significant intervention for GERD, emphasizing the importance of personalized care and comprehensive guidelines for optimal outcomes.

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CASE REPORT

Sigmoid-shaped Esophagus of Advanced Achalasia Cardia–Laparoscopic Management: A Case Report

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Abstract

Background: Achalasia cardia (AC) is an esophageal motility disorder which, if left untreated, may progress to end-stage sigmoid achalasia characterized by mega-esophagus. It occurs with equal frequency in men and women and there is no racial predilection. Peak incidence has been reported between 30 and 60 years of age.

Case presentation: We herein report a case of a 48-year-old male with progressive dysphagia due to Sigmoid Achalasia, who was treated successfully with laparoscopy.

Clinical significance: Several treatment options exist for the surgical management of a sigmoid esophagus with achalasia, but there is no clear gold standard. In our case, Heller's cardiomyotomy with Dorr's fundoplication provided favorable results.

Keywords: Case report, Dorr's fundoplication, Esophagogram, Heller's cardiomyotomy, Sigmoid achalasia.

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Background

Achalasia cardia (AC) is an idiopathic, rare, and primary disorder of esophageal motility caused by the selective degeneration of inhibitory neurons of the esophageal myenteric plexus and characterized by reduced peristalsis in the body of the esophagus and incomplete or absent relaxation of the lower esophageal sphincter.[1,2]

This affects the emptying of the food from the esophagus to the stomach and causes dilatation and tortuosity of the esophageal body. If left untreated, it may progress to end-stage of achalasia which is characterized by mega-esophagus or also known as a sigmoid-shaped esophagus. Achalasia cardia has an incidence and prevalence of 1.63/100,000 and 10.82/100,000, respectively.[3] However, end-stage achalasia is even a rarer entity, comprising only 4% of all AC.[2]

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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.

Case Presentation

A 48-year-old male farmer was brought to us by his general practitioner for a 3-year history of complaints of dysphagia, epigastric pain, and on and off regurgitation of partially digested food material, and early sensation of satiety. He was a resident of a village in the Pune district of the Maharashtra state in western India. Earlier, he had been referred to a gastroenterologist who had diagnosed his achalasia on esophagogastroduodenoscopy (EGD-scopy), barium swallow and upper gastrointestinal manometry. The EGD had revealed a grossly dilated, tortuous esophagus with undigested food particles in its terminal part and a high resistance to entry into the stomach through the cardia (Figs 1A and B). The patient underwent esophageal manometry which revealed a hypertonic lower esophageal sphincter with severely impaired relaxation on wet swallows. The esophageal body was peristaltic (Fig. 1C). A normal esophageal manometry picture is placed for side by side comparison (Fig. 1D). The patient was then advised pneumatic balloon dilatation by the gastroenterologist. He underwent three sessions of the same. These alleviated his symptoms, but only for 1–2 months. An upper gastrointestinal (GI) barium swallow study revealed a grossly dilated thoracic esophagus with smooth tapered narrowing at the esophageal junction, giving it the look of a characteristic "bird beak" along with a sigmoid mega-esophagus (Fig. 1E). The postoperative barium swallow film provides a side by side comparison (Fig. 1F). The endoscopic and radiographic results led to the provisional diagnosis of sigmoid achalasia. Given the patient's continued dysphagia, he was planned for surgery. A laparoscopic Heller's cardiomyotomy with Dorr's fundoplication was performed.

Intraoperatively, an 8 cm long anterior myotomy was performed while safeguarding the anterior vagus nerve (Fig. 2). Due to inherent fibrosis probably caused by the balloon dilatation done previously, he had an intraoperative iatrogenic esophageal mucosal perforation. The same was sutured closed using 3-0 Vicryl® (Fig. 3). The lips of the myotomy were sutured to the two crurae on either side using 2-0 Prolene®, to keep the myotomy open (Figs 4A and B). A Dorr's fundoplication was then fashioned as an anti-reflux mechanism (Figs 4C and D). He had an uneventful postoperative recovery. He was kept nil per oral for 3 days. He underwent a Barium swallow study on POD4, which showed easy

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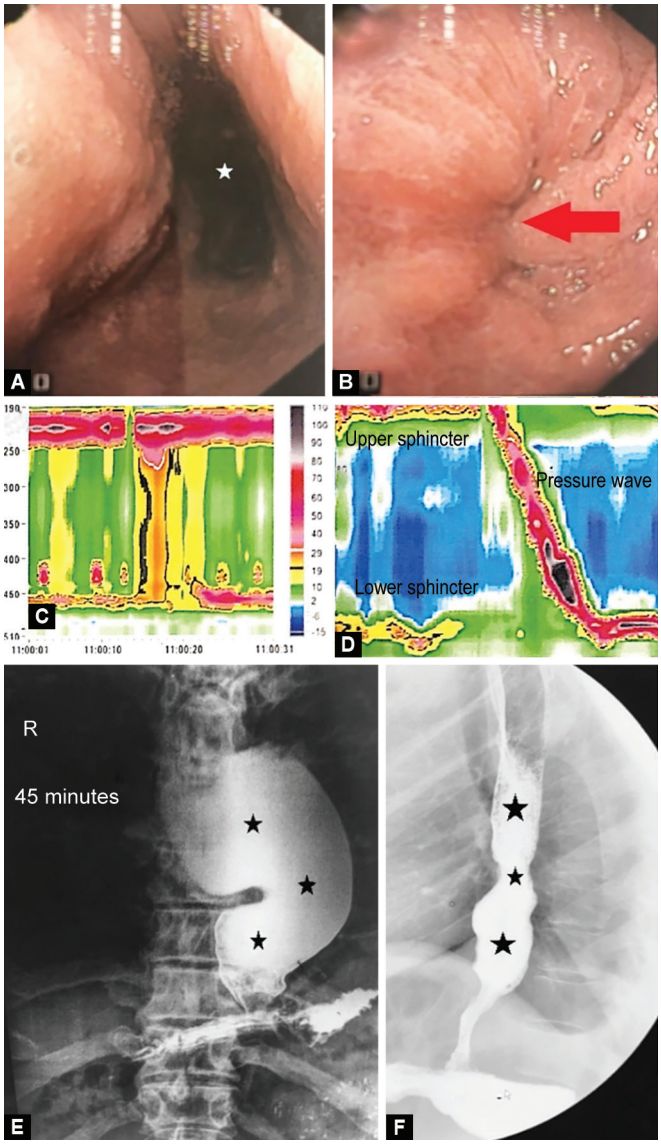
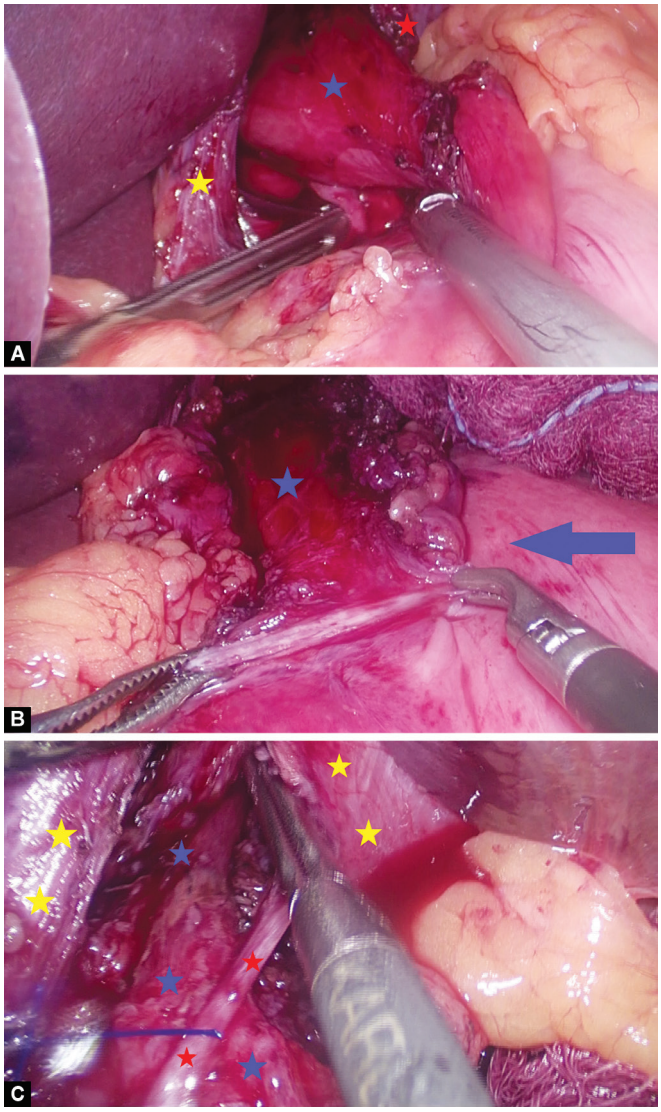


Figs 1A to F: Investigations. (A–E) Pre-op reports, (A) EGD showing the grossly dilated esophageal lumen (white asterisk); (B) EGD showing the tight lower esophageal sphincter-LES (red arrow); (C) Upper-GI manometry of patient showing non-relaxation of LES and pan esophageal pressurization; (D) Normal upper-GI manometry, for comparison; (E) Pre-op barium Esophagogram showing grossly dilated sigmoid esophagus (black asterisks) indicating advanced achalasia; Post-op report, (F) 3 months post-op Esophagogram showing normalization of lumen and straightening of 'S' curve

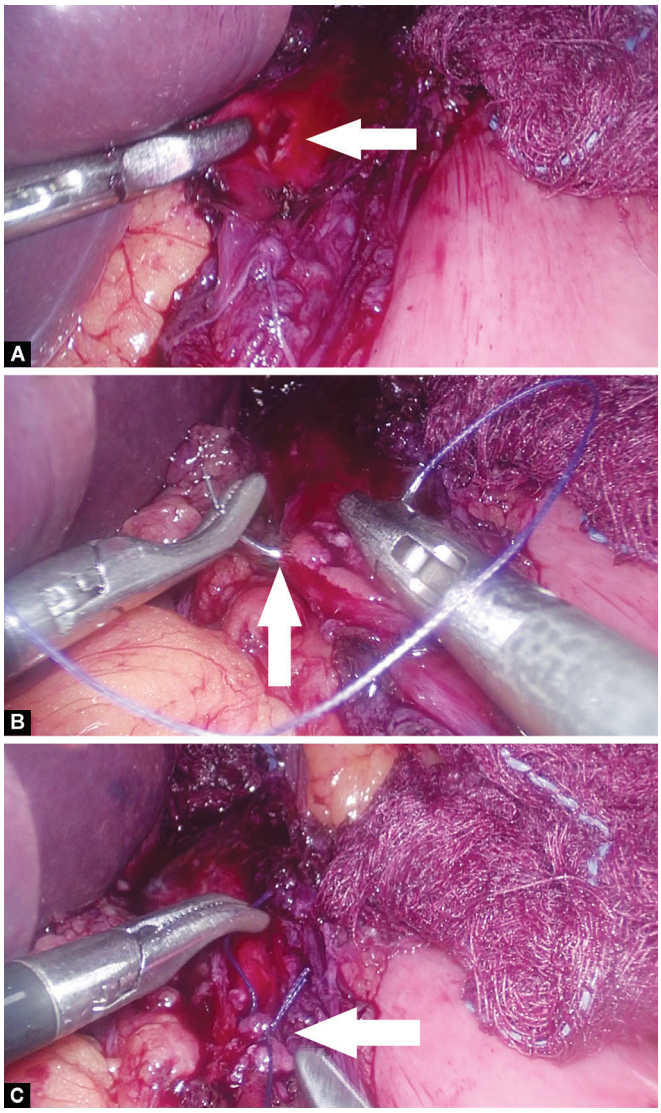


Figs 2A to C: Operative pics. (A) Initial dissection at the cardia showing the dilated terminal esophagus (blue asterisk), right crus (yellow asterisk) and left crus (red asterisk); (B) Myotomy in progress (blue arrow) and exposed esophageal mucosa (blue asterisk); (C) Completed myotomy showing the overlying traversing anterior vagus nerve (red asterisks), exposed esophageal mucosa (blue asterisks) and the crurae (yellow asterisks)

passage of contrast into the stomach and no leak. He was then started on oral feeds – liquids followed by a mashed diet on POD4, which he tolerated. He was discharged from the hospital on POD5. On his POD10 outpatient department visit, all his wounds had healed well. He was counseled to remain on a semi-solid diet for one month. The patient steadily shifted to a completely normal diet, thereafter. In 6 weeks, he was able to accept a full normal standard diet without any symptoms of regurgitation or dysphagia. On his repeat Barium Esophagogram done on his 3rd monthly postoperative follow-up visit, there was a marked reduction in the dilatation of the esophagus and free passage/emptying of the contrast into the stomach (Fig. 1F). At the time of writing this paper, he was telephonically interviewed 8 months after his operation. He continues to be asymptomatic.

Discussion

Dysphagia is the most common and primary presenting symptom in 90% of patients with achalasia,[4] followed by heartburn, regurgitation, and chest pain. Eckardt symptom score is a self-reported tool used to assess the effectiveness of achalasia treatment and its symptoms. It takes these clinical findings into account.[3] Dysphagia starts initially to solids alone and later as the disease progresses, also to liquids. As the esophagus progressively gets more and more dilated and turns to end-stage disease, the symptoms progress to nocturnal cough, regurgitation and aspiration of food



Figs 3A to C: Operative pics. (A) Iatrogenic esophageal mucosal perforation (white arrow); (B) Suture closure of the perforation in progress (white arrow); (C) Completed suture line (white arrow) after closure of perforation

particles, and weight loss. Many patients frequently present with recurrent pneumonia. Tracheal compression causing respiratory distress due to the compressive effect of mega esophagus is also rarely noted in some cases.

The etiology of achalasia is not known. Research has indicated a multi-factorial complex etiology.[5] It's thought that achalasia is directly linked to an autoimmune inflammatory or viral response, resulting in the selective degeneration of the inhibitory neurons of esophageal myenteric plexus.[6]

Achalasia is diagnosed based on clinical features, EGD, Barium Esophagogram, and high-resolution manometry. An EGD shows esophageal dilation and incomplete relaxation of the lower esophageal sphincter even with air insufflation. Barium esophagram demonstrates a dilated esophagus and the typical 'bird beak' appearance of the terminal esophagus. The gold standard in diagnostics is manometry (Fig. 1D). It can distinguish between incomplete or absent lower esophageal sphincter relaxation and the absence of peristalsis.[6]

According to the contractility pattern, the more detailed high-resolution manometry offers an extensive reporting of pressures that qualify for achalasia based on the Chicago classification.[6] High-resolution manometric studies reveal that patients with achalasia have wide variations in the basal pressure of the upper esophageal sphincter, which appears to be correlated only with esophageal pressurization and not with the degree of esophageal dilatation. Most of the time, relaxation is more constantly impaired, most likely as a safeguard against aspiration. These days, the study of the esophagus body is more significant for prognosis and diagnosis than the results of lower esophageal sphincter manometry.[7]

The esophagus slowly dilates progressively in advanced achalasia and loses its straight axis which then resembles the contour of the sigmoid colon. An esophageal dilatation of 10 cms or more with or without a tortuous form is characteristic of the sigmoid esophagus.[3,7]

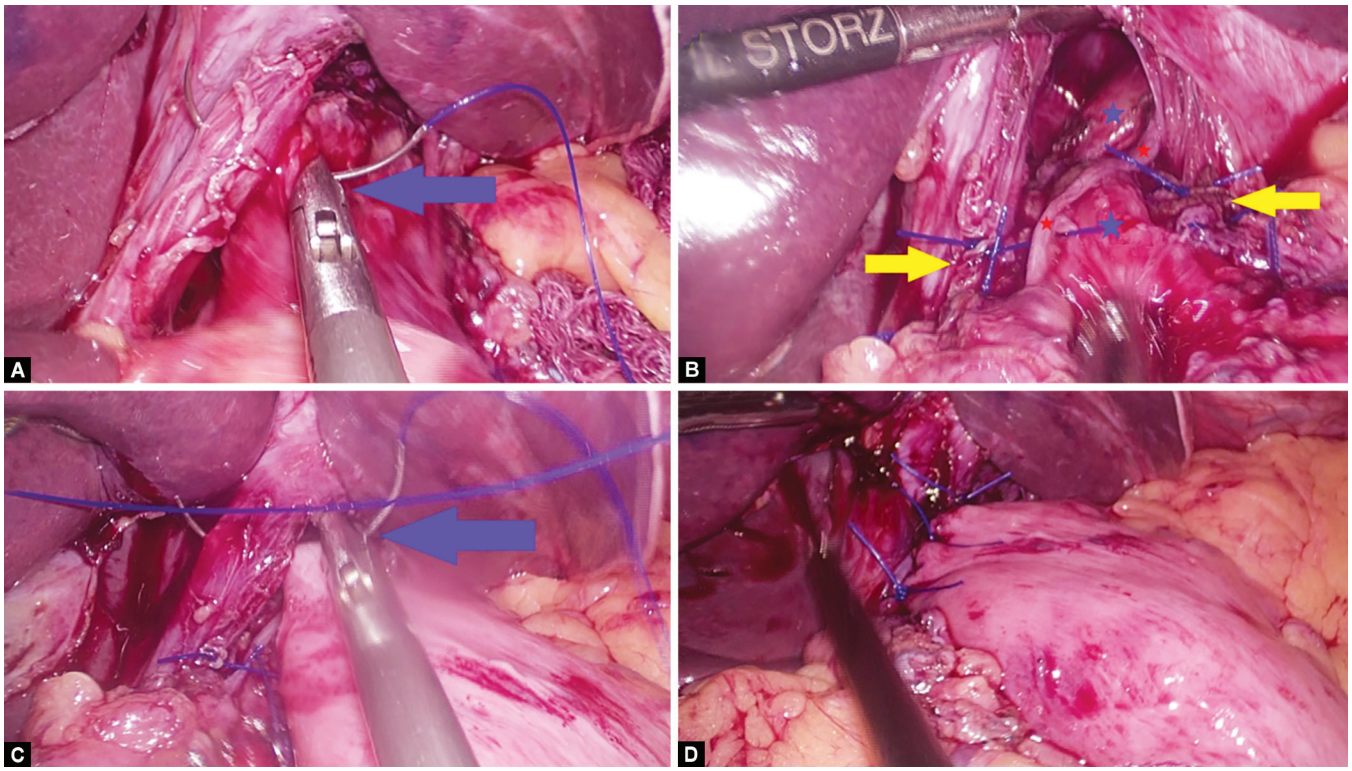
In 2012, a revised Japanese classification system for AC was released. In addition, it classified the esophageal morphology into three groups according to the degree of angulation and the results of its X-ray: straight, sigmoid, and advanced sigmoid.[8]

Although achalasic sigmoid esophagus is considered the most advanced stage of achalasia, the best course of treatment for these patients is controversial. Treatment can be surgical or non-surgical. Over time, non-surgical interventions such as botulinum toxin injections and mechanical pneumatic dilatation become less effective, frequently necessitating retreatment. Other pharmacologic treatments, such as calcium channel antagonists and nitrates, are less useful in clinical settings due to more serious side effects.[9] The results of surgery may be compromised by Botox injections. It is thought that botulinum toxin injection and serial pneumatic dilatations induce local inflammation and eventual fibrosis.[9] This may complicate Heller's myotomy, as was seen in our case.

Surgical treatments include myotomy with or without fundoplication which can be open, laparoscopic, or robotic, and radical definitive treatment, i.e., esophagectomy.

Some surgeons recommend myotomy as a first line of treatment and save esophageal resection for patients with chronic symptoms. Another group recommends esophagectomy as the primary choice of treatment, believing that significant esophageal dilation and the redundancy of esophagus make it impossible to improve the emptying by a simple myotomy.[1] This was based on the impression that the esophageal body peristalsis would not be able to empty effectively even after an adequate myotomy. Moreover, there is usually significant periesophageal inflammation, esophagitis, and ulceration due to prolonged food retention making myotomy a difficult procedure.[2] Currently, this concept has been questioned, and the latest data have shown a symptomatic improvement in more than 90% of patients treated with laparoscopic Heller's myotomy (LHM) with anterior fundoplication.[10]

According to Faccani et al., when kinked to the left and outside of the esophageal axis, the pull-down approach, also known as verticalization of the esophageal axis, enhances the results of LHM + anterior fundoplication for treatment of sigmoid achalasia. The anterior wall of the stomach is drawn downwards, and the phrenoesophageal membrane is divided anteriorly. The lower mediastinal esophagus and gastroesophageal junction (GEJ) is completely mobilized for at least 6 cm. Two or more U intramuscular stitches are placed at the level of the esophageal curling to pull



Figs 4A to D: Operative pics. (A) Suture-approximation of the right lip of myotomy to right crus (blue arrow); (B) Completed suture-approximation of both myotomy lips to the respective crurae (yellow arrows), overlying traversing anterior vagus nerve (red asterisks) and exposed esophageal mucosa (blue asterisks); (C) Dorr's (anterior) fundoplication in progress (blue arrow); (D) Completed Dorr's fundoplication

down and rotate the side of the GEJ with sutures before performing the Heller + fundoplication technique.[11]

Esophagectomy with gastric, colonic, or jejunal interposition should be reserved as a last resort in patients in whom all other modalities have failed.[2] If the patient's symptoms are not alleviated and are severe in nature and affecting the quality of day-to-day life, esophagectomy may be considered following Heller myotomy for both postsurgical stenosis of scar at the GEJ and those who had a unsuccessful redo myotomy. Esophagectomy complications can include reflux esophagitis, Barrett's esophagus in the esophageal stump, injury to the laryngeal nerve, tracheal rupture, pleural effusion, chylothorax, cervical fistula, leakage at the anastomotic site, nocturnal regurgitation and dumping symptoms. Furthermore, 38.5–50% of patients may require anastomotic dilatation to relieve postoperative surgical and/or recurrent bouts of dysphagia due to cervical esophago-gastrostomy stenosis. Between 4 and 19% of patients have reported having dumping symptoms.[12]

An open Heller's myotomy can be performed under thoracic epidural anesthesia in a patient with a sigmoid esophagus causing tracheal compression who is not suitable for general anesthesia (poor performance status).[2]

The safest dissection under direct visibility would be achieved with an open or laparoscopic trans-thoracic approach. However, a trans-hiatal approach performed by a skilled surgeon result in significantly less complicated postoperative outcomes, such as a reduction in respiratory complications.[6]

Another surgical option that is used in the management of extremely dilated esophagus is Vertical esophagectomy + myotomy.[13]

Achalasia can now be treated with the minimally invasive per-oral endoscopic myotomy (POEM), which has excellent clinical results and functional restoration (i.e., reduction of esophageal diameter, decrease in lower esophageal sphincter pressure, and partial restoration of peristalsis). Per-oral endoscopic myotomy is now indicated for sigmoid-type achalasia which is also long-standing and also in patients who have previously not responded to endoscopic surgery or surgical myotomy. The advantage of POEM is that technique allows for a somewhat free option in the location of the incision of myotomy, either anterior or posterior, and the ability to execute a long myotomy incision (of the full length of the esophagus, if so necessary). The increased incidence of postoperative gastroesophageal reflux is a disadvantage of POEM. Proton pump inhibitors, however, can usually be used to regulate this; if necessary, a laparoscopic fundoplication can be performed in the future.[6] For patients who present with sigmoid-type achalasia however, POEM is a challenging technique because patients having severe esophageal stasis might have inflammation and submucosal fibrosis, which in turn hinders the submucosal tunneling. Submucosal tunneling is more so difficult because of the severe angles in sigmoid-type achalasia.[14]

Clinical Significance

There are various options available for managing an achalasic sigmoid esophagus surgically. Management should be decided on symptomatic treatment based on each case individually as there is no established gold standard treatment protocol. In this case, Heller's cardiomyotomy with Dorr's fundoplication gave a good result and outcome to the patient.

Ethical Approval

Ethical approval is not required at our institution to publish an anonymous case report.

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CASE REPORT

Acute Small Bowel Obstruction due to Internal Hernia Through Defect in Broad Ligament: A Rare Case Report

Ajay M Rajyaguru[1], Vishal S Karamata[2], Jatin G Bhatt[3]

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Abstract

Internal hernia through a defect in the broad ligament of the uterus is a very rare condition. We review a case of a 55-years-old female with small bowel obstruction due to herniation of a small bowel loop through a defect in the broad ligament of the uterus on the right side. Computed tomography of the abdomen reported finding of small bowel obstruction, a small bowel loop seen between the uterus and urinary bladder in the right lower pelvis with surrounding inflammatory changes, possibility of an Internal hernia through a defect in the broad ligament. This was managed laparoscopically.

Keywords: Broad ligament, Case report, Internal hernia, Laparoscopy, Small bowel obstruction.

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Introduction

The broad ligament hernia is a variety of internal hernia that occurs rarely, accounting for a mere 4–7% of the known internal hernias;[1,2] of which the premier description is given by Quain as an autopsy finding.[3] Preoperative diagnosis is difficult due to the lack of overt clinical symptomology, thus rendering surgical exploration as the most accurate modality for apt diagnosis. Internal herniation through the uterine broad ligament due to a defect within the ligament; could be either unilateral or bilateral. Furthermore, the etiology of the defect in the broad ligament causes internal hernia can be attributed to being primary or secondary; developmental abnormality leads to a congenital defect in a broad ligament is primary, and acquired defects occur due to various causes such as traumatic, postoperative, pregnancy and rupture of cystic lesion causes the secondary defect.[2]

Case History

A 55-years-old multiparous lady was admitted with chief complaints of lower abdominal pain and nausea of 3 days duration with one episode of bilious vomiting. The patient's vitals were within normal limits. Abdominal examination revealed the distended abdomen and on palpation generalized tenderness was present. She underwent lower segment cesarean section (LSCS) 17 years before. She was a known case of pulmonary tuberculosis started upon anti-tubercular therapy for the previous three months. Also, an X-ray and ultrasonogram of the abdomen showed the features of intestinal obstruction and contrast-enhanced computed tomography reported changes of small bowel obstruction, a small bowel loop seen between the uterus and urinary bladder in the right lower pelvis with surrounding inflammatory changes. Internal hernia (broad ligament hernia) is shown in Figure 1; complete blood count was normal, and renal function test and serum electrolytes were within normal range.

The patient underwent laparoscopy under general anesthesia. A 10-mm supraumbilical port was inserted by open method, after that under vision another 5-mm port was inserted over the right lumbar region and a 6-mm third port was placed in the left iliac fossa. On laparoscopy, we found the trapped loop of small bowel through a defect of 3 × 3 cm in the right broad ligament of the uterus (Figs 2A and B) with dilated jejunum and proximal ileum

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Fig. 1: The CT scan image showing small bowel loops that are seen between the uterus and urinary bladder on the right side

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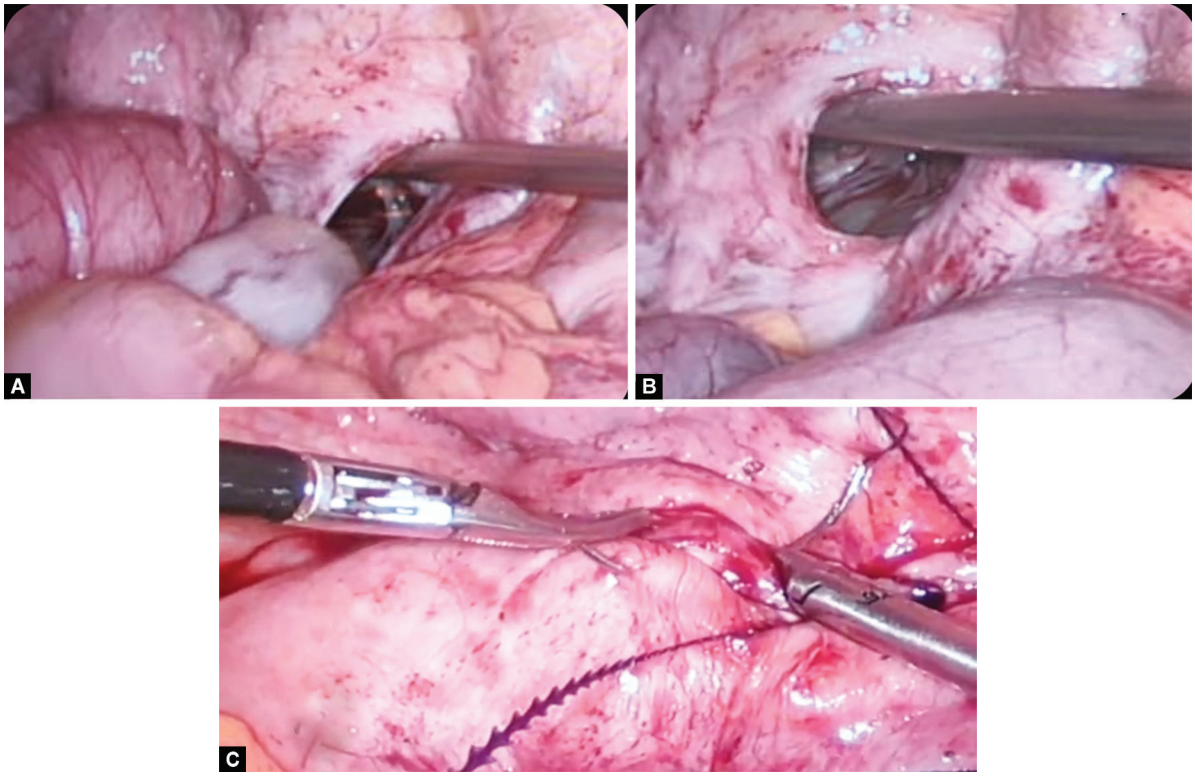

Figs 2A to C: (A) Defect in right side broad ligament with bowel loop within; (B) Defect in broad ligament after reduction of bowel loop; (C) Defect closure with knotless suture

with collapsed distal terminal ileum, cecum, and ascending colon. Then about 25-cm loop of the small bowel was reduced with gentle traction which was found viable. The defect was closed using an antibacterial knotless tissue control device (STRATAFIX™ Symmetric PDS™ Plus 1–0 Ethicon®) (Fig. 2C). There was a defect of 2 × 2 cm sized, found on the opposite side of the broad ligament which was managed by a wide opening of the defect by dividing the broad ligament. The postoperative period was uneventful.

Discussion

Internal abdominal hernia causes small bowel obstruction in approximately 4% of cases which is very rare.[4] Internal abdominal hernia is a hollow visceral herniation in the peritoneal cavity due to any defect within the peritoneal cavity. An *internal hernia* is defined as a protrusion of abdominal viscera through an opening within the confines of the peritoneal cavity.

In 1934, the first classification of broad ligament defect by Hunt was based on the involvement of the peritoneum.[5]

- Fenestra type: If the defect in the two layers of the peritoneum, it is the commonest variety.
- Pouch type: The defect in only one of the peritoneal layers.
- Hernia sac type: A hernial sac formed by layers of peritoneum covering the viscera.

In 1986, Cilley et al. simply classified broad ligament hernia based on the anatomical location of the defect.[6]

- Type I: Defect caudal the round ligament of the uterus.
- Type II: Defect above the round ligament, that is, defect in the mesosalpinx and mesovarium.
- Type III: Defect between the round ligament and the remainder of the broad ligament through the meso-ligamentum teres.

The defects in hernia can be congenital or acquired. Acquired opening or defect is usually unilateral due to surgery, trauma, inflammation, pregnancy, or rupture of cystic lesion whereas congenital defect is usually bilateral due to developmental abnormalities. Broad ligament hernia is the most frequently encountered type of pelvic internal hernia it occurs on either the left or right side (unilateral) or both sides of the broad ligament of the uterus (bilateral) due to congenital or acquired defect in the ligament. The majority of defects in broad ligaments have been reported in multiparous women.[7] Herniation of small bowel loops most commonly occurs, also other organs such as the colon, ovary, and ureter have been reported.[8]

Management consists of two steps as follows: First gently reduce the contents, if nonviable than resection, and the second step is either closing the defect or dividing the broad ligament to prevent recurrence.[9] The laparoscopic surgery has the advantage of greater postoperative comfort and shorter duration of hospital stay when compared to the open approach.[10]

Conclusion

Acute small bowel obstruction through a defect in the broad ligament occurs very rarely and is difficult to diagnose clinically. A high index of suspicion is required in females presented with acute small bowel obstruction and a contrast-enhanced computed tomography scan has a pivot role in the diagnosis. Early diagnosis and immediate treatment prevent catastrophic events in the cases of acute obstruction due to a broad ligament hernia. The laparoscopic approach should be considered as a better option for

confirmation of the diagnosis and management of this condition in experienced hands.

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CASE REPORT

Laparoscopic Cholecystectomy-Chyle Leak: A Case Report

Lingam Sridhar[1], Rohit Phadnis[2], Faiz Hussain[3], Sarath C Chappidi[4], Subrahmanya Narayan Dora K[5]

Received on: 24 January 2024; *Accepted on:* 26 February 2024; *Published on:* 16 August 2024

Abstract

Aim: To elucidate the findings in a rare yet potentially morbid complication in a case of uncomplicated Cholecystitis.

Background: Chyle leak after laparoscopic cholecystectomy (LC) is rarely reported. However, it must be recognized promptly and managed as it can lead to further metabolic and infectious complications.

Case description: We present the case of a 40-year-old lady who was admitted with ultrasound-proven cholelithiasis with no signs of cholecystitis. Her Total leukocytic count and liver function tests were within normal limits. She underwent an uneventful standard LC. Postoperatively there was a cumulative collection of 150 mL of white fluid in his drain. The fluid triglyceride was 1620 mg/dL, confirming it to be chyle. She was clinically asymptomatic. She was managed conservatively as a low-volume chyle leak with a fat-free diet. The drain was removed on postoperative day (POD) 11 after nil collection for 3 consecutive days.

Conclusion: Chyle leak, though a rare complication, after LC timely response and active intervention help in managing rare complications of LC like chylous leak for better outcomes.

Significance: The 'take home' message is that although rare, chyle leaks should be considered even in uncomplicated LC.

Keywords: Case report, Chyle leak, Laparoscopic cholecystectomy, Triglycerides.

World Journal of Laparoscopic Surgery (2024): 10.5005/jp-journals-10033-1620

Introduction

Gallstone disease is widespread, and laparoscopic cholecystectomy (LC) is the commonly chosen and safe treatment option on a Global scale each year. The postoperative complications of the procedure have been well elucidated, including bile leak and common bile duct (CBD) injury. While less common, chylous ascites represent an unusual yet serious postoperative complication.

Case Description

A 40-year-old female with no comorbidities was admitted with a clinical diagnosis of symptomatic cholelithiasis. Her preoperative ultrasound was suggestive of 12.5 mm calculus in the gallbladder (GB) with normal GB wall thickness and no evidence of pericholecystic fluid collection. LFT within normal limits. Elective LC was planned. Intraoperatively, after extracting the specimen, a turbid discharge (Fig. 1) was identified from the region superior to Rouviere's sulcus for which saline irrigation was done, and an abdominal drainage kit was placed before closure. On postoperative day (POD) 2, a milky white discharge was observed (Fig. 2) and chylous discharge was suspected. Ultrasonography (USG) abdomen was done, and drain fluid was sent for amylase and triglycerides. A USG scan was suggestive of minimal fluid in the GB fossa with no pelvic collection. Drain fluid for amylase and triglycerides were 69 IU and 1620 mg/dL respectively. The patient was advised to consume a fat-free diet with which the patient clinically improved. Given progressively decreasing drain output a review USG on POD 9 was suggestive of no free fluid in the intraabdominal cavity. The patient was discharged on POD 11 with the drain *in situ* and advised of a no-fat diet. After 7 days the patient was reviewed in the OPD with an empty drain bag. Review USG was suggestive of no collection and the drain was removed. The patient was advised to review in the presence of pain abdomen or distension.

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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.

Discussion

Laparoscopic cholecystectomy, a minimally invasive surgery to remove a diseased gallbladder, has largely supplanted the open technique for routine cholecystectomies since the early 1990s.[1] In the United States, where roughly 20 million individuals have gallstones, approximately 300,000 cholecystectomies are conducted each year.[2] Although well-documented complications such as injury during trocar or Veress needle placement, bleeding, CBD injury, bile leakage, and gastrointestinal injury are commonly associated with laparoscopic cholecystectomies, the incidence of postoperative chyle leak is exceedingly rare, with only six reported cases documented to date.

There are many hypotheses for explaining the mechanism of chyle leak, which are yet to be proven.

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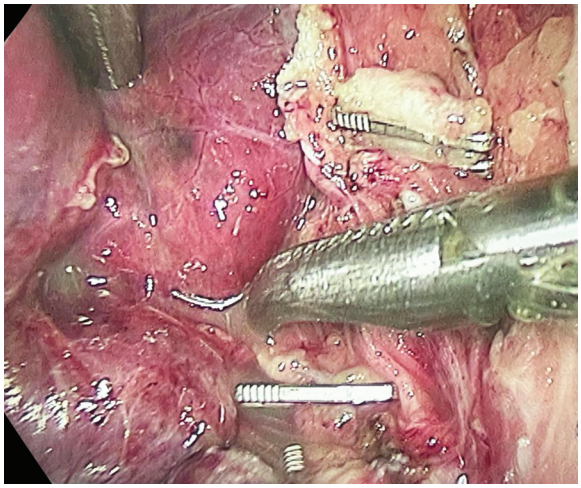

Fig. 1: Intraoperative picture showing milky white collection below CBD near the Rouviere's sulcus

Fig. 2: Drain fluid on postoperative day 3 showing milky white, thick chylous output

Chyle typically lacks odor, is alkaline, sterile, and contains abundant lymphocytes while being low in bilirubin and amylase content. Furthermore, the ratio of triglycerides in the drain fluid to that in the serum exceeds 1.0. In this instance, the distinct appearance of the postoperative drain fluid, characterized by its significantly elevated triglyceride content, allowed us to make an initial diagnosis. Confirmatory chylomicron testing, although not deemed necessary for our patient due to the notably high triglyceride levels, could have been employed for verification.[3]

In our case, given declining drain content; neither computed tomography (CT) nor lymphangiography was advised.

Management is generally categorized into conservative and surgical management. Initial intervention should involve conservative measures, reserving surgical management for severe cases with persistent high output.[4,5]

Conservative management primarily aims to decrease enteric lymph flow while addressing any electrolyte deficits, fluids, or protein.[6]

Sustaining the advantages of enteral feeding involves placing the patient on a diet low in fat but high in protein, supplemented with medium-chain triglycerides (MCT). Medium-chain triglycerides have the ability to bind with albumin and enter the portal system directly, thereby bypassing the lymphatic system.[5]

In our scenario, we adhered to our institutional protocol by introducing a regular diet on POD 1. Nevertheless, prompt identification of the complication and the immediate initiation of a low-fat diet were pivotal in swiftly resolving the low-volume chyle leak. The risk of such a leak following LC for uncomplicated cholelithiasis is notably low, demonstrated by only six documented cases found in the literature.

In cases where traditional treatments prove ineffective, surgical intervention becomes a critical component of the treatment plan. The decision to proceed with surgery hinges on many factors, including the patient's overall health, the extent of the chyle leak (especially if it surpasses 500 mL daily), and any past surgical procedures. It is essential to tailor these considerations to each individual case. The core principle of surgical intervention involves facilitating the drainage of leaked chyle within the abdomen, followed by the closure or ligation of the identified lymphatic leak source. In our patient's case, such intervention was deemed unnecessary given the low output and spontaneous resolution.

Among 4 out of 6 cases were managed with a low-fat diet alone, without requiring TPN, Somatostatin, octreotide infusion, or surgery. All four cases had less than 1 L/day leakage after initial drainage.[6]

This case underscores that while chyle leaks are exceedingly rare, they can still manifest even in technically uncomplicated LC, leading to heightened patient morbidity and increased treatment expenses.

Conclusion

Timely response and active intervention help in managing rare complications of LC like chylous leak for better outcomes.

Clinical Significance

The key takeaway is that, despite being uncommon, one should consider the possibility of chyle leaks even in cases of uncomplicated LC.

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CASE REPORT

Prolapse of Tinea Coli of the Sigmoid Colon through a Perforated Uterus Following Manual Vacuum Aspiration: A Case Report

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Received on: 19 February 2024; *Accepted on:* 17 March 2024; *Published on:* 16 August 2024

Abstract

Introduction: When performed by a skilled provider appropriately, induced abortion is a very safe medical procedure. However, a series of complications such as uterine perforation can still occur rarely.

Case presentation: We present a case of tinea coli evisceration through a uterine perforation that occurred during a manual vacuum aspiration (MVA) procedure for uterine evacuation. The case presented with crampy lower abdominal pain 2 days after she had an MVA procedure for an incomplete abortion. The diagnosis of uterine perforation was considered on ultrasonography (USG) examination. Explorative laparoscopy was subsequently done and a posterior uterine wall perforation of ~2 cm was identified. A tinea coli of the sigmoid colon was seen sucked into the uterus through the perforation but no wall of the colon was lacerated or sucked in. The tinea coli was pulled out and the uterine defect was repaired laparoscopically.

Conclusion: This unique case, the first of its kind to be reported to our knowledge, could be a reminder to consider tinea coli evisceration in suspected uterine perforation but without typical manifestations of bowel injury.

Keywords: Case report, Laparoscopy, Manual vacuum aspiration, Tinea coli, Uterine perforation.

World Journal of Laparoscopic Surgery (2024): 10.5005/jp-journals-10033-1628

Introduction

Induced abortion is a safe medical procedure when performed by a skilled provider using correct medical techniques and drugs under hygienic conditions.[1] However, like any other procedure, an induced abortion can cause minor-to-severe consequences that can lead to life-threatening outcomes.[2]

The use of manual vacuum aspiration (MVA) has led to fewer complications making the method more effective and safe.[3] Despite the safety record of MVA, there have been reports of complications that potentially are life-threatening.[4] Although rare, one of the series complications is procedure-related uterine perforation. The case to be reported here is unique and is of high interest. It is a case of MVA-related uterine perforation associated with evisceration of tinea coli of the sigmoid colon which to the best of our knowledge is the first to be reported. There are reports of prolapse of some part of the bowel through the perforated uterus, but in all the reports all the layers of the bowel were involved.[5]

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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.

Case Presentation

A 34-year-old P-1 A-2 (spontaneous) mother presented with crampy lower abdominal pain of 2 days duration referred from a health facility with a diagnosis of uterine perforation. She had an MVA done 2 days back in the same health facility for incomplete abortion after amenorrhea of 13 weeks for a blighted ovum. She also had offensive vaginal discharge and loose stool at presentation. The MVA procedure was completed with a No. 12 cannula. Pelvic ultrasonography (USG) was done on the day of referral by the referring facility which revealed highly thickened hypoechoic foci seen in the posterior wall of the myometrium which extended into the endocervical canal (Fig. 1).

On physical examination, the pulse rate was 104/minute but the other vital signs were within normal range. She had pink conjunctivae. The abdomen was soft and moved with respiration. There was deep suprapubic tenderness but no palpable mass or signs of fluid collection. On pelvic examination, the cervix was closed and smooth but there was cervical motion tenderness. There was no adnexal mass or tenderness. On investigation, all results were within normal range, and the white blood cells (WBCs) count was 5,900.

With the assessment of uterine perforation and postabortal pelvic inflammatory disease (PID), she was admitted to the ward.

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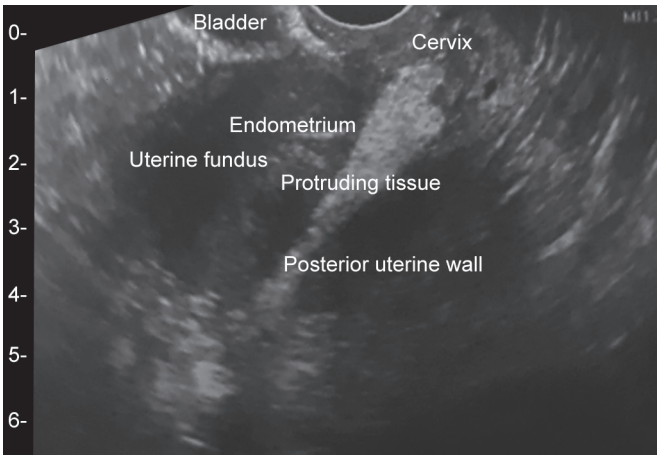

Fig. 1: Ultrasound picture of the uterus with posterior perforation and tissue invagination

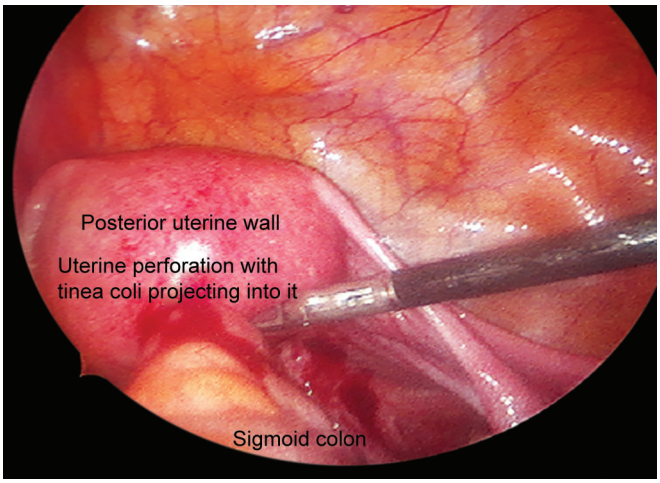

Fig. 2: Laparoscopic picture of the uterus with posterior perforation and tinea coli invagination

She was started on intravenous (IV) ceftriaxone and metronidazole and kept NPO (which means "nothing by mouth") in preparation for exploratory laparoscopy.

Subsequently, explorative laparoscopy was done under general anesthesia. Intraoperatively the uterus was about 8 weeks in size with a posterior uterine wall perforation of ~2 cm identified. A tinea coli of the sigmoid colon was seen sucked into the uterus through the perforation but no wall of the colon was lacerated or sucked in. Intraoperatively a surgeon was consulted and the bowel was inspected. There was no laceration of the bowel. An intact appendix was seen in its normal position (Fig. 2; Video 1).

Then an elongated ~5 cm and edematous tinea coli was pulled out gently through the perforation (Fig. 3; Video 1). Some dark clots were removed from the tip otherwise it was viable. Sigmoid was checked for laceration and was intact.

The uterine wall defect was repaired laparoscopically (Fig. 4). The abdomen was lavaged with normal saline (N/S). There was no bleeding after the procedure. After the surgery IV antibiotics were continued for 48 hours. She was subsequently discharged in stable condition. On outpatient follow-up, there was no complaint and she had uneventful progress.

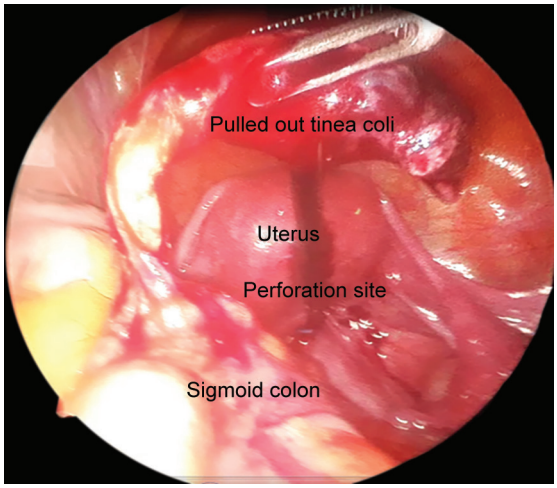

Fig. 3: Laparoscopic picture showing an elongated tinea coli pulled out of a uterine cavity

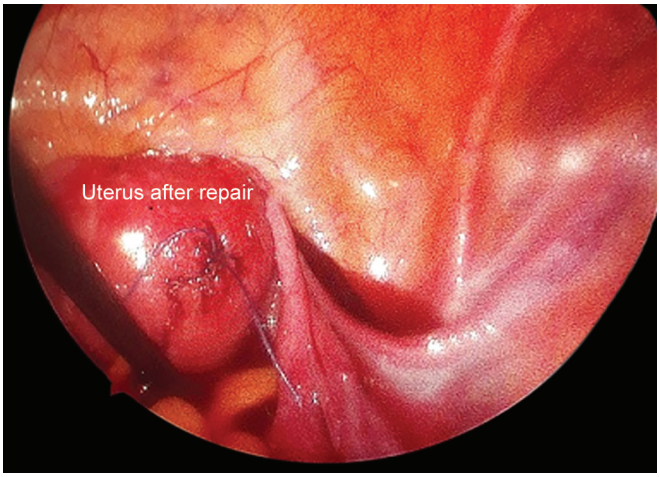

Fig. 4: Uterus after laparoscopic repair of the perforation

Discussion

For safe and effective early pregnancy termination MVA is currently the standard surgical procedure.[6] It is effective with a success rate of more than 98% and safe with a major complication rate of less than 1%.[7] The risk of uterine perforation during MVA is very low estimated at 0.1–3 per 1000 induced abortion procedures, but it can potentially be serious.[8–10] The risk of perforation increases with increasing gestational age and decreasing experience of providers.[11]

If uterine perforation is suspected in a woman undergoing a surgical evacuation procedure, she needs to be informed of the condition and her clinical condition should be followed even if asymptomatic.[7] Timely detection and management are critical in preventing severe morbidity and mortality. In the present case, uterine perforation was not detected during the vacuum aspiration abortion procedure but after the patient became symptomatic and presented afterward. Ultrasound is a useful diagnostic tool to detect complications such as uterine perforation timely.[8] In our case, USG played a crucial role in timely diagnosis and management of the uterine perforation such as a few prior reports where uterine perforation was diagnosed similarly.[12]

To reduce the risk of uterine perforation during evacuation prior studies recommended USG-guided surgical abortions. Supporting this recommendation Acharya et al. in their randomized clinical trial reported complication rates of below 4% and above 15% when the abortion procedure is done under USG guidance and without USG guidance, respectively, showing a significant reduction in complications with USG guidance.[13] A randomized control trial by Abdulkareem et al. also reported uterine perforation incidences of 0% and approximately 3% in procedures with and without U/S guidance, respectively.[14] Hence, the use of U/S to guide surgical abortion procedures should be considered whenever feasible.

When the bowel is involved in perforation and evisceration, signs and symptoms of bowel obstruction develop fast. However, in our case, only the tinea coli of the sigmoid colon was involved. The tinea coli was sucked into the uterine cavity because a large-size cannula No. 12 was used. The tinea coli subsequently became elongated and swollen as it was strangulated and inflamed. Hence, all typical presentation symptoms of bowel obstruction or perforation did not occur. This has delayed the suspicion and diagnosis of uterine perforation. Had the diagnosis been delayed more it would have ultimately led to sepsis involving the bowel and the uterus.

When there is clear evidence of bowel injury or prolapse of the bowel through a defect in the uterus, immediate laparotomy may be a preferable approach to management. However; if abdominopelvic visceral injury is suspected in a clinically stable individual, the preferred diagnostic approach is laparoscopy provided the experience and equipment are available.[8] In the present report, the laparoscopic approach was used to diagnose and manage the patient successfully in line with the above recommendation.

Conclusion

Although evacuation of the uterus with MVA is widely in use and known to be safe this case can be a shred of additional evidence to show it can rarely be associated with a series of complications. This unique case, the first of its kind, to be reported to our knowledge, could be a reminder to consider tinea coli evisceration in suspected uterine perforation but without typical manifestations of bowel injury.

Supplementary Material

The supplementary video 1 is available online on the website of https://www.wjols.com/journalDetails/WJOLS

Video 1: Uterine perforation with MVA with prolapse of tinea coli of the sigmoid colon.

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CASE REPORT

Robotic Laparoscopic Management of Acute Iatrogenic Colonic Perforation Following Colonoscopy: A Case Report

Mario del Pino[1], Diego Hidalgo-Avendaño[2]

Received on: 07 March 2024; *Accepted on*: 29 March 2024; *Published on*: 16 August 2024

Abstract

Background: Complications during colonoscopy such as perforation or bleeding may occur. Colonic perforation must be detected early in order to manage and reduce morbidity and mortality. Conservative, endoscopic, or surgical (laparoscopy or laparotomy) management techniques are available. The objective of this case report is to describe the management of a patient with post-colonoscopy polypectomy colonic perforation using a robotic platform approach.

Case presentation: A 59-year-old male presented with a medical history significant for hypertension and hyperlipidemia, and he had several polyps removed with colonoscopy the day before admission. He started to have some left-sided abdominal pain which worsened and then moved to the right side.

The primary diagnoses, interventions, and outcomes: CT scan was performed and revealed a small volume pneumoperitoneum, consistent with hollow viscus perforation and peritoneal signs on physical exam. He was taken to the OR for emergency robotic diagnostic laparoscopy, and proximal transverse colon repair with peritoneal lavage was successfully completed. There were no intraoperative complications or need for open conversion. The patient was discharged after 2 days and he did not suffer postoperative complications and did not need readmission.

Conclusion: The robotic platform offers advantages that overcome the limitations of the laparoscopic approach including visualization, stability, dexterity, and precision. We believe that these advantages are maximized in the acute surgery setting. This case report proves that in experienced hands, the robotic platform is safe and effective for acute complex surgery cases. Further studies are recommended to determine the specific benefits of robotic laparoscopy in colonic emergency procedures.

Keywords: Case report, Colonic perforation, Colonoscopy, Da Vinci robot, Polypectomy, Robotic surgery.

World Journal of Laparoscopic Surgery (2024): 10.5005/jp-journals-10033-1622

Background

Colonoscopy is an effective procedure for the diagnosis and treatment of diseases of the colon and distal ileum; however, complications such as perforation or bleeding may occur.[1] Colonic perforation during a diagnostic procedure range from 0.03 to 0.08%,[2] and this incidence increases in the case of therapeutic colonoscopy.[3] Early detection is the key to the management and reduction of morbidity and mortality. Currently, there are conservative, endoscopic, or surgical (laparoscopy or laparotomy) management techniques available. Thanks to technological advancements, robotic surgery can be used to address surgical emergencies.[4] The objective of this case report is to describe the management of a patient with post-colonoscopy colonic perforation using robotic laparoscopy.

Case Presentation

A 59-year-old male presented with a medical history significant for hypertension and hyperlipidemia and previous cholecystectomy. He underwent a colonoscopy the day before the admission and had a polyp removed from the ascending colon.

Clinical Findings

After the colonoscopy, the patient started to have left-sided abdominal pain. The next morning, pain became worse and moved to the right side. Over the counter analgesics did not give him any relief. He denied fever, chills, nausea, vomiting, diarrhea, or chest pain. Physical exam revealed rebound in the right upper quadrant of the abdomen.

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Conflict of interest: None

Patient consent statement: The author(s) have obtained written informed consent from the patient to publish his case and associated investigations.

Diagnostic Assessment

An extensive work up was done in the emergency room (ER). The CBC showed leukocytosis, and a chest X-ray demonstrated free air under the right hemidiaphragm (Fig. 1). CT confirmed pneumoperitoneum (Fig. 2) and mild wall thickening of the ascending colon. The history of a polyp removal in the hepatic flexure of the colon, suggested a perforation in that area.

Therapeutic Intervention

Fluid resuscitation and wide spectrum IV antibiotic therapy was started, and the patient was taken to the OR for emergency robotic

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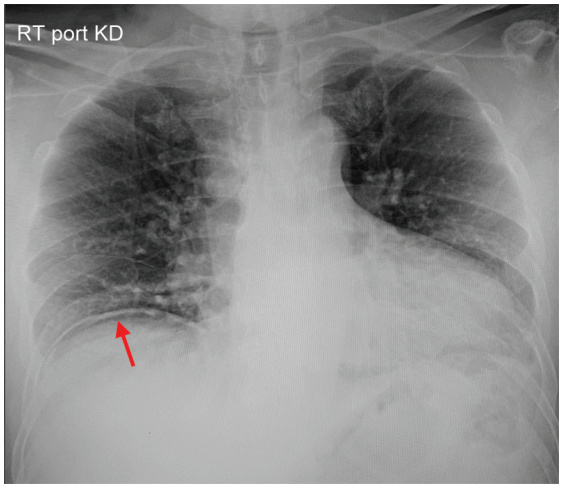

Fig. 1: X-ray chest which demonstrated pneumoperitoneum at the red arrow

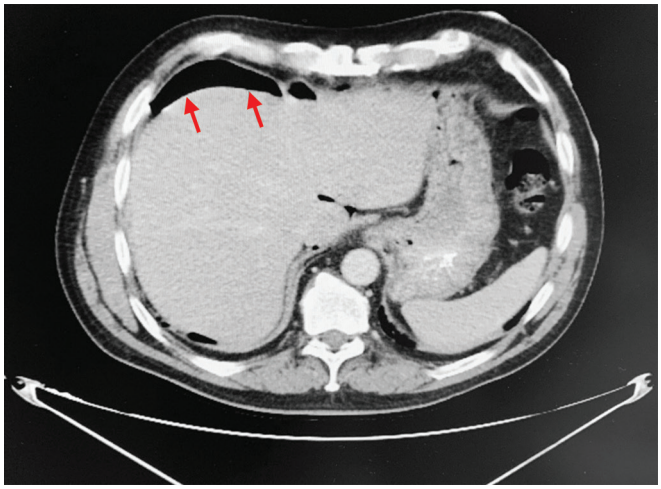

Fig. 2: CT scan which demonstrated pneumoperitoneum at the red arrows

diagnostic laparoscopy with a diagnosis of sepsis and colonic perforation.

The patient was placed supine, anesthetized, and intubated. Pneumoperitoneum was established with a 5 mm Opti-View trocar. Laparoscopy revealed purulent peritonitis and signs of inflammation in right upper quadrant. The robotic trocars were placed as shown in Figure 3 and the table was tilted 8 degrees to the left. After docking the robot, we proceeded to aspirate the purulence. Adhesions caused by a previous cholecystectomy were taken down between the gallbladder fossa and the transverse colon. Once the hepatic flexure of the colon came into view, a perforation in the proximal transverse colon was identified. Next, the colo-hepatic ligament was divided which gave us good exposure to the affected area.

We proceeded to close the perforation with 2-0 silk suture in a running fashion. Once the source of infection was controlled, extensive peritoneal lavage with warm saline was performed. Finally, the colporrhaphy site was reinforced with an omental patch and a Jackson-Pratt drain was placed in the right upper quadrant, next to the liver (Supplemental Video 1, Fig. 4).

The patient was admitted to the surgical floor. He was started on po liquids on postop day 1. On postop day 2, he passed gas and tolerated a full liquid diet. The drain had minimal output, so it was removed. Pain was well controlled and he was discharged home on oral antibiotics.

Follow-up and Outcomes

Two weeks later, he was seen in the office for follow-up. He was doing great, incisions healed well and he did not have any complications.

Discussion and Conclusions

Colonic perforation is a relatively rare complication that can occur after a colonoscopy. However, it constitutes an emergency and requires prompt intervention for a better outcome.[2] The treatment options can be either conservative, or in cases where it is necessary, invasive. These may involve endoscopy, laparoscopic, or open surgery.[5] Minimally invasive approaches offer several advantages over laparotomy, such as shorter hospital stay, reduced risk of

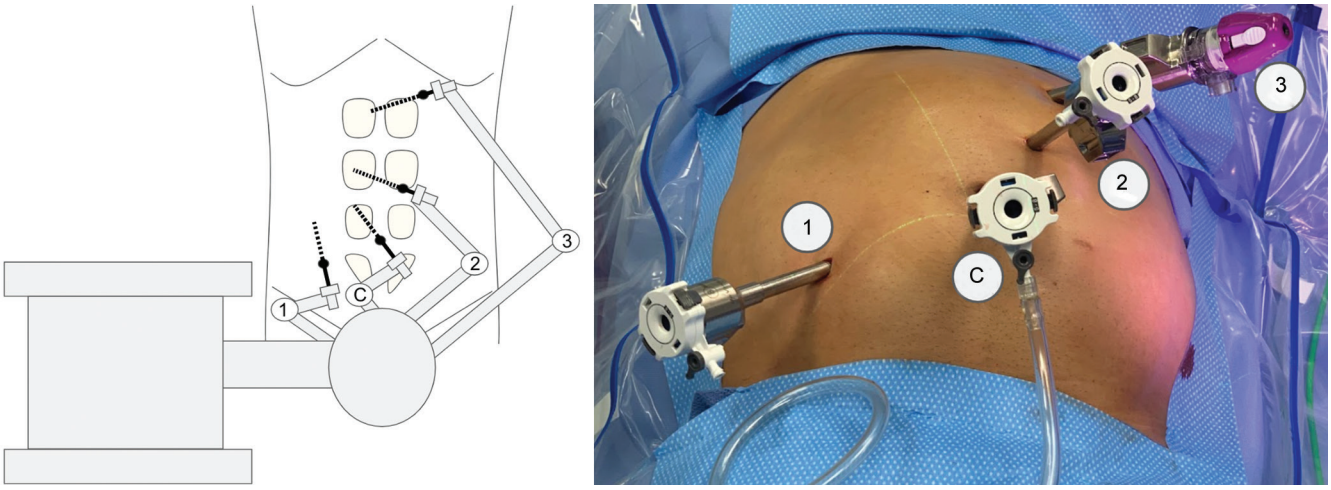

Fig. 3: Robotic arm docking diagram. The robot was docked on the right side of the patient. The robotic camera arm (C) was placed in the periumbilical region, additional trocars (1, 2, and 3) were placed in the right lower quadrant, midclavicular line on the left and in the left subcostal region, respectively

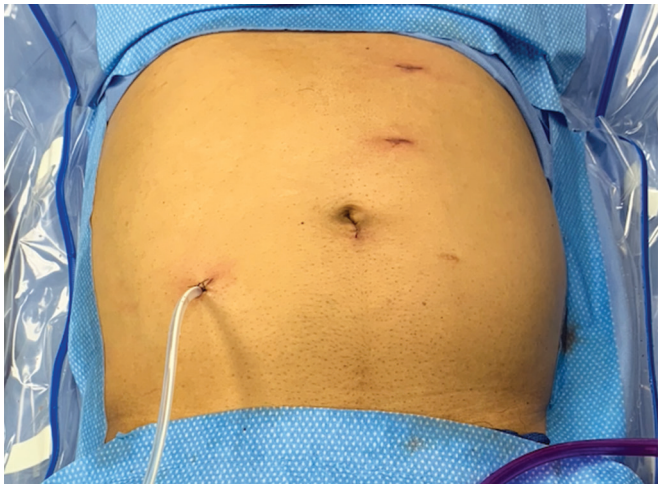

Fig. 4: Abdomen after closing wounds

surgical site infections, smaller incisions with reduced postoperative pain, and faster recovery.

Minimally invasive surgery (MIS) approach with the assistance of the da Vinci® robotic system is also a potential option for cases of colonic perforation following colonoscopy. Nevertheless, there is limited information available about this method, with only one case report on record.[6]

Robotic surgical platforms, like the da Vinci® system, come with numerous advantages. They address the constraints of laparoscopic surgery, such as mitigating physiological tremors and expanding the range of motion. Furthermore, they offer a stable camera platform, three-dimensional visualization, and a 10-fold magnification capability. These systems also facilitate movements similar to a human wrist and allow for precise motion scaling during surgery. Additionally, robotic procedures are conducted with the surgeon comfortably seated at an ergonomic console, reducing surgeon fatigue. Many research publications have documented superior outcomes with robotic surgery, including reduced conversion rates, lower rates of complications (including postoperative ileus), and shorter postoperative hospital stays in colorectal surgery.[6]

In addition to that the laparoscopic approach for colonic procedures has a higher rate of conversion to open surgery than the robotic approach,[7] which makes this last option a good alternative.

However, it is important to note that one of the primary disadvantages of robotic surgery is the higher cost compared with laparoscopic surgery. Efforts are ongoing to reduce operative room expenditures, particularly in terms of shorter hospital stays, lower complication rates, and shorter operative times.[8] Prolonged operative time is also seen as a drawback, but this can depend on the system configuration and setup time, which can be lengthier for non-elective unplanned procedures.

The surgeon's experience also plays an important role in the duration of surgery and in the reduction of postoperative complications, handling complex cases also allows to obtain better results from the early learning phases. Complications in colorectal surgery are minimized following the completion of 15 robotic procedures, as more patients are attended by the hospital, it allows to improve the learning curve and achieve better results.[9] It is very important to highlight the role of the staff and the hospital to opt for a robot in an emergency situation; our surgeon has completed more than 3,000 cases with the Da Vinci platform. It allows to manage this complex case and demonstrates the importance of the surgeon's experience.

Recent evaluations are considering the use of robotic surgery in emergency setting. It is utility has been demonstrated in cases like cholecystectomy and hernia repair,[7] but there is still limited information available for other gastrointestinal tract surgeries. Therefore, this case report aims to propose robotic surgery as an alternative surgical approach for cases of colonic perforation.

In this report, the second case of primary repair of an iatrogenic colonic perforation following colonoscopy using robot-assisted surgery is presented. In contrast to the first published case which involved a sigmoid colon perforation, our patient had an injury in the proximal transverse colon and a history of previous surgery in that area. In spite of the complexity and emergency nature of the case, the robotic assistance provided an ideal platform to overcome the limitations of the laparoscopic approach, ensuring a proper bowel repair without the need for conversion to an open procedure. This case underscores the safety of this method for such cases and suggests that in the hands of an experienced robotic surgeon and high-volume institution, it could serve as an alternative to traditional open and laparoscopic surgery. Further studies are needed to determine the specific benefits of robotic laparoscopy in colonic emergency procedures.

Declarations

Availability of Data and Materials

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

Authors' Contributions

MP was involved in the team caring for the patient, and was the surgeon. All authors had a role in the writing of the manuscript, read and approved the final manuscript.

Acknowledgments

The patient is thanked warmed for allowing the publication of this case.

Supplementary Materials

The supplementary video 1 is available online on the website of https://www.wjols.com/journalDetails/WJOLS.
Video 1: This video shows the procedure of the surgery.

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CASE REPORT

Wandering Accessory Spleen: Laparoscopic Approach for an Extremely Rare Condition: A Case Report

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Abstract

Background: Wandering accessory spleen (WAS) is a very rare but dangerous condition. Patients are often asymptomatic and the diagnosis can be accidental. An early diagnosis and a correct treatment are fundamental.

Case presentation: A young woman with renal disorders underwent laparoscopic surgery after sudden abdominal pain. Radiological exams show a wandering abdominal mass located in different abdominal areas.

Discussion: Wandering accessory spleen is often asymptomatic. A torsion on its vascular axis leads to emergency surgery. Laparoscopy is the gold standard treatment in the correct management of this rare condition. Definitive diagnosis is based on histological exams.

Keywords: Case report, Laparoscopic surgery, Wandering accessory spleen.

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Introduction

Wandering accessory spleen (WAS) is an extremely rare anatomical anomaly characterized by presence of an accessory spleen with a long vascular pedicle and a normal spleen located in abdomen.[1] Although accessory spleen is often asymptomatic in general population and incidentally diagnosed during radiological exams, WAS might be symptomatic and abdominal pain, related to intermittent or acute torsion, can be the onset symptom.[2,3]

Frequently patients suffer of hematological or renal diseases. Wandering accessory spleen may also mimic abdominal tumors or mass like lymphadenopathy, abscess, organized hematoma or cysts and an accurate diagnosis is necessary.

The US, CT, and MRI usually show a mass with a different localization and a surgical exploration is often necessary. Laparoscopy represents the gold standard in the surgical management of this rare clinical condition and definitive diagnosis is based on histopathological analysis.[4]

Case Presentation

A 19-year-old young woman was admitted at the emergency room of our hospital following sudden upper abdominal pain and hypotension.

The patient referred in the previous 2 months a first admission to the Emergency Department due to a sudden onset of nephrotic syndrome with lower limbs edema and contraction of diuresis. At that time, laboratory exams showed proteinuria and hypoalbuminemia; renal biopsy was performed with a subsequently diagnosis of membranous glomerulonephritis and she started therapy with rituximab.

Physical examination on readmission revealed abdominal tenderness mainly in the right flank and upper abdomen with mild peritoneal signs of rebound and guarding. A palpable mass was appreciated in the periumbilical area. Abdominal bloating was remarkable and peristalsis was torpid on auscultation. The patient was pale and very suffering.

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Laboratory exams showed a reduction of hemoglobin (10.2 mg/dL), neutrophilic leukocytosis, a slight reduction in albumin values, and an increase in CRP (45.38 mg/L). There was no procalcitonin movement and creatinine was normal.

Contrast-enhanced CT scan showed presence of an oval mass of approximately 6 × 4.5 cm in correspondence of the mesentery, close to the left rectus abdominis muscle (Fig. 1A). The expansive mass showed significant enhancement in the arterial and portal phases and slow wash-out in the late one. The angiographic study showed a vascular supply from mesenteric vessels and the presence of tributary venous circles. Contrast-enhanced CT scan excluded areas of vascular disorders or intestinal ischemia, signs of bowel occlusion or perforation and other diseases of abdominal organs.

Since the patient's condition was stable, it was necessary performed an MRI of the upper abdomen to clarify any doubts about the nature of the mass.

Abdominal MRI showed the presence of a solid oval mass of approximately 6.9 × 4.8 × 5.3 cm with regular margins which, compared with the CT scan performed a few hours earlier, was located in the right upper abdomen, in front of the right kidney and

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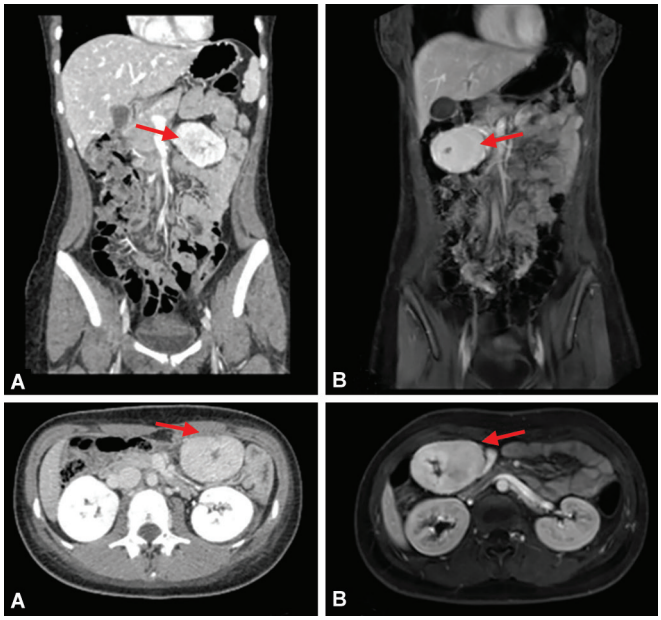
close the right rectus abdominis muscle. The MRI showed also the presence of coarse vascular pedicle with abnormal venous tributary circles and a modest free fluid in the Douglas (Fig. 1B).

An emergency explorative laparoscopy was necessary in the hypothesis of an extremely mobile (Fig. 1) and bleeding abdominal mass.



Figs 1A and B: (A) Contrast-enhanced CT scan shows WAS in left abdomen; (B) MRI shows WAS in right abdomen

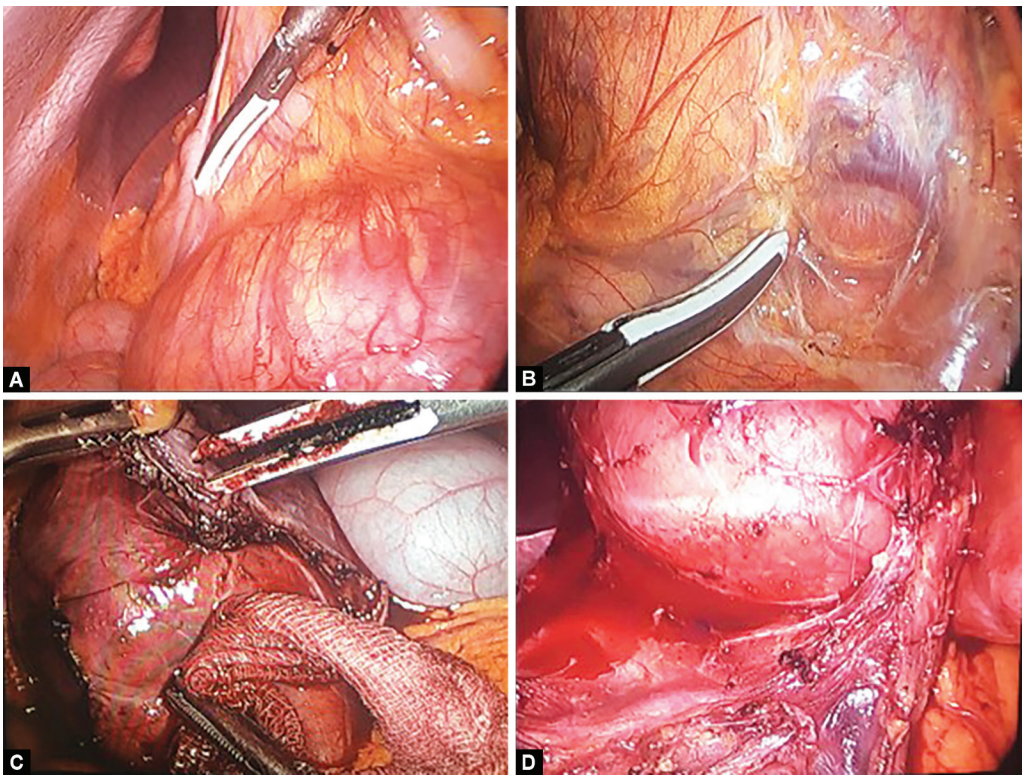
Therefore, an open technique pneumoperitoneum was performed. The exploration of the peritoneal cavity showed a voluminous oval brownish mass of about 5 cm in diameter close the transverse mesocolon. There were no signs of hemoperitoneum but minimal free effusion of dark fluid was present and it was taken for cytological examination. The mass was released from adhesions up to its vascular peduncle which appeared congested by transient and reversible torsion phenomena on its own axis. The pedicle was sectioned with a vascular EndoGIA and then the mass was extracted with an endobag. Control of hemostasis and placement of an abdominal drain concluded the phases of the surgical procedure (Fig. 2).

The postoperative hospitalization was uneventful. The drain was removed on the second postoperative day and the patient was discharged 4 days after surgery.

Gross examination of specimen revealed a pedunculated nodular mass, brownish-grey colored, large about 5 cm in diameter with own capsule.

Microscopic examination on paraffin embedded sections revealed splenic parenchyma type architecture with thickened fibrous capsule and congested dilated vessels with a sinusoid appearance, follicular formations with diffuse central reactive hyperplasia phenomena and minute arterioles with thickened walls and sometimes fibrotic (penicillary-like arteries).

Hemorrhagic-congestive phenomena were observed with dilatation of sinusoidal vessels and the presence of fibro-sclerosis and sclero-hyalinosis was the expression of chronic ischemic phenomena due the probable torsion of the peduncle. Congo Red stains were negative for amyloid detection. The diagnosis of WAS was made (Fig. 3).



Figs 2A to D: Laparoscopic procedure: Release of the adhesion and vascular pedicle isolation

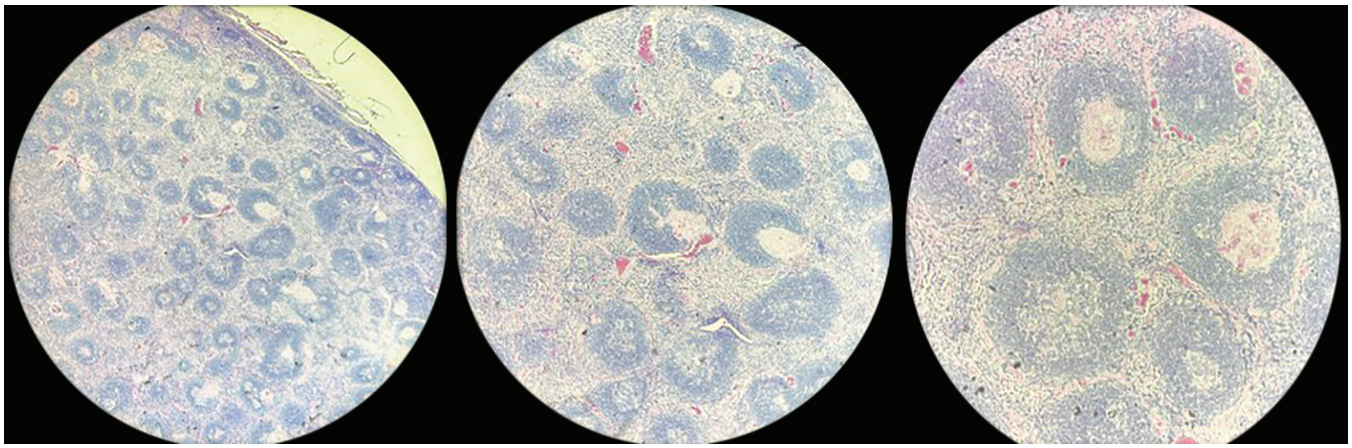


Fig. 3: Histological section shows splenic parenchyma architecture with the presence of red and white pulp and reticular connective tissue

The presence of proteinaceous and fibrinoid material on the arteriolar walls with some concentric sheaths of fibrous tissue like "onion bulb" and sclero-hyalinosis phenomena are also described as a consequence of vascular damage of an autoimmune genesis in patients with chronic nephrotic syndromes or membranous-type glomerulonephritis.

Discussion

The WAS is a rare condition with an estimated incidence of less than 0.5% in general population.[5] Two different peaks of prevalence have been described: One in women aged 20–40 years, more frequent, and a second one in children aged less than 10 years.[6,7]

An important feature of WAS is its hypermobility, caused by the presence of a long vascular pedicle or, more rarely, by a laxity defect of its suspensory ligaments. It can be caused by congenital defects in embryonic development of the dorsal mesogastrium or by acquired defects, such as abdominal wall laxity or hormonal status during pregnancy.[8]

The extreme mobility gives this rare anatomical condition, is the characteristic of being able to migrate in the abdomen with a possible different localization during radiological exams. Due this characteristic, literature has coined the term of wandering spleen.[9,10]

Most often WAS remains asymptomatic and is discovered incidentally. Ultrasonography, preferably used with children, but mainly CT and MRI suggest diagnosis. Presence of a spleen in its normal anatomical position in the left hypochondrium and the presence of a mass located somewhere in the abdominal cavity are suspicious signs of WAS.[11,12]

Spontaneous torsion of WAS on its pedicle can take place. If the torsion occurs suddenly, it can determine an acute abdomen of non-univocal interpretation, as in the case described and, therefore, imposes a correct diagnostic classification through a multidisciplinary evaluation and an exact differential diagnosis (bowel obstruction, perforation, bleeding, or ischemia).[1,13,14]

Minimally invasive surgery represents the gold standard treatment and laparoscopy allows to resolve the diagnostic doubt by safe and reproducible exploration of the peritoneal cavity and in the same time offers a therapeutic intervention. A recent literature analysis shows as dimensions of the WAS can lead to a laparotomic surgical approach.[15]

Definitive diagnosis is possible only on histological analysis with a necessary integration of anamnestic, laboratory and radiological information.

Conclusion

The WAS is an ectopic accessory spleen characterized by marked anatomical mobility resulting from a defect in the normal embryological development. The WAS is a rare condition that can arise as an acute abdomen and diagnosis may be challenging and often difficult. Laparoscopy is the gold standard treatment.

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