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Editorial

Recently, major developments in video imaging have been taken place; among them, the use of near-infrared fluorescence imaging is emerging as major contribution to intraoperative decision making during minimal access surgical procedures. Many infrared imaging systems are developed to determine the potential role of infrared imaging as a tool for localizing anatomic structures and assessing tissue viability during laparoscopic and robotic surgical procedures.

As we know, human eye cannot see infrared or ultraviolet rays, we can only see the visual spectrum of the light. However, infrared emitted by near-infrared fluorescence indocyanine green (ICG) can be captured by camera, an advantage now we have in the laparoscopy. There are some dye which emits the infrared fluorescence like ICG, manufactured by the Kodak Company in 1954. After two years, the FDA has approved the ICG for the mapping and angiography of the retina.

The ICG very tightly bind with the plasma protein and once injected in the peripheries circulates throughout our circulatory system. Thereafter, it can be mapped by the laparoscopic camera. In cholecystectomy, we can clearly see the cystic duct which is stained by the ICG. On setting the infrared sensitivity ON, the infrared light will be stimulated by the blood vessels, it will be absorbed by the ICG, and in IR mode, it reflects the infrared light, the filter of the camera will allow this infrared light to be seen. Different IR modes can magnify the infrared light; like in the Olympus camera, IR mode 1 and IR mode 2 can be used for more precise viewing. In IR mode it will be colored and we can see the infrared, and in IR mode 2 it will be black and white image, but it can show us more perfusion. Different companies are coming with different techniques of using infrared in their electronic circuits but overall their use is similar.

The ICG has a very short half-life; only it secretes into the liver and then comes out of body. It is very safe and noise to image ratio is very good, i.e. it has very less noise and very good and high quality image. In cholecystectomy, we have to inject the ICG 45 minutes before the procedure: the entire Calot's triangle will be visualized, we can see the common hepatic duct, common bile duct and cystic duct. The liver is also seen and the liver is also completely profuses with ICG that also will emit the infrared green.You can use it for different type of procedure like in the cholecystectomy to prevent the injury of CBD. In the other procedure like sleeve gastrectomy, we inject the ICG only 2 minutes before the procedure. It can also be used for the liver resection and for the nodules of metastasis of the liver. It can also be for the sentinel lymph node mapping in cervical cancer and sleeve gastrectomy to find out the circulation of the blood circulation near the gastrosophegal junction. In the mesorectal resection of the colon, it is injected approximately 5–7 minutes before the procedure. ICG-based fluorescence imaging is very helpful in localization of prostate cancer and metastatic lymph nodes. There is role of ICG for laparoscopic and robotic partial nephrectomy. The near-infrared technology will be able in the future to better outline the way we perform endoscopy, laparoscopy and robotic surgery and therefore to improve significantly patient outcomes and hospital costs.

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ORIGINAL RESEARCH

Rising Trend of Laparoscopic Hysterectomy Over Abdominal Hysterectomy: A Comparative Study

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ABSTRACT

Aim: Hysterectomy is one of the most common surgeries being performed in perimenopausal women. It can be done either vaginally, abdominally or laparoscopically. The laparoscopic surgery is now on rising trend since it is associated with less peroperative complications, less postoperative pain, has better wound healing and early recovery and returns to normal activities. Hence, this study is being conducted to compare abdominal and laparoscopic hysterectomy.

Materials and methods: A retrospective observational study is conducted at the tertiary hospital. Total 135 women underwent surgery, of which 100 had an abdominal hysterectomy (TAH) while 35 had a laparoscopic hysterectomy (TLH). In mobile uterus of size < 12 weeks, TLH was done. The comparison was done between two groups as per and postoperative complications.

Results: The mean age, parity, and BMI was comparable in two groups. Duration of hospital stay was significantly less in women who underwent TLH. Peroperative complications as bowel and bladder injury were found in 4 cases and all of them occurred during TAH. Wound sepsis was also seen during TAH only. However, postoperative blood transfusion was given in more number of women who underwent TLH than in TAH, although the difference was statistically insignificant.

Conclusion: Laparoscopic hysterectomy is preferred over open procedure as it is associated with less per-operative complications, shorter hospital stay, and wound complications.

Laparoscopic surgery is more beneficial to the patient than abdominal hysterectomy. However, the decision regarding the mode of surgery shall be based on patient consent and surgical expertise.

Keywords: Abdominal, Hysterectomy, Laparoscopy.

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INTRODUCTION

Hysterectomy is one of the most common surgeries being performed in women of perimenopausal age group. In earlier days, it is done either vaginally or abdominally.

The vaginal route is the most preferred method as it is associated with lesser per and postoperative complications with early recovery and lower morbidities. However, in cases where uterus size is large, removal of adnexa is required, or vaginal access is narrow, the abdominal route is preferred.

Abdominal hysterectomy is performed either by open technique (TAH) or laparoscopically (TLH/LAVH). Although TAH is a fast procedure with more cost effectivity, it is associated with more abdominal trauma, requires prolonged hospital stay and has a slower recovery rate. So, now a day, laparoscopic surgeries are on the inclining trends as it leads to less postoperative pain, has faster recovery, better wound healing and early return to normal activities.

Hence, this study is being conducted to compare peroperative and postoperative complications of abdominal and laparoscopic hysterectomy.

MATERIALS AND METHODS

A retrospective observational study was conducted in the Department of Obstetrics and Gynaecology at a tertiary hospital for seven months (February 2018 to August 2018), after clearance from the Institutional Ethical Committee.

A total of 135 women who underwent a hysterectomy during this period were included in the study. Out of these 135 women, 100 women (74.1%) had a TAH while 35 (25.9%) underwent a laparoscopic hysterectomy. Of these 35 women, 31 (88.6%) women had a TLH and in rest 4 women (11.4%), LAVH was done.

Most of these patients presented to the outpatient department of our institute with a chief complaint of abnormal menstrual cycles. Few of them, presented with abdominal pain or lump in the abdomen. After complete history and examination, ultrasound pelvis was done. All peroperative investigations were done, and the patient was taken up for surgery with informed consent.

Mode of hysterectomy was decided on basis of clinical findings (uterus size and mobility of uterus), radiological findings, patient consent, and surgical expertise. In women with the uterine size of < 12 weeks with the mobile uterus and after informed consent, laparoscopic hysterectomy

was done. In women with obesity and previous surgeries, laparoscopy was preferred. Few cases with uterine size >12 weeks and fibroid size of 8 to 10 cm have also been operated laparoscopically.

The data was collected in form of a demographic profile, an indication of surgery, complications observed during surgery and postoperative complications. The comparison was done between two groups, women undergoing TAH (group I) and women undergoing TLH (group II). A p value < 0.05 was considered significant.

Surgical Technique

After informed consent, the patient was taken for surgery. Surgery was done under general anesthesia with end tracheal intubation. The patient was placed in the dorsal lithotomy position. After per vaginum examination, the uterine manipulator (Marva's) was placed and Foley urinary catheter was inserted.

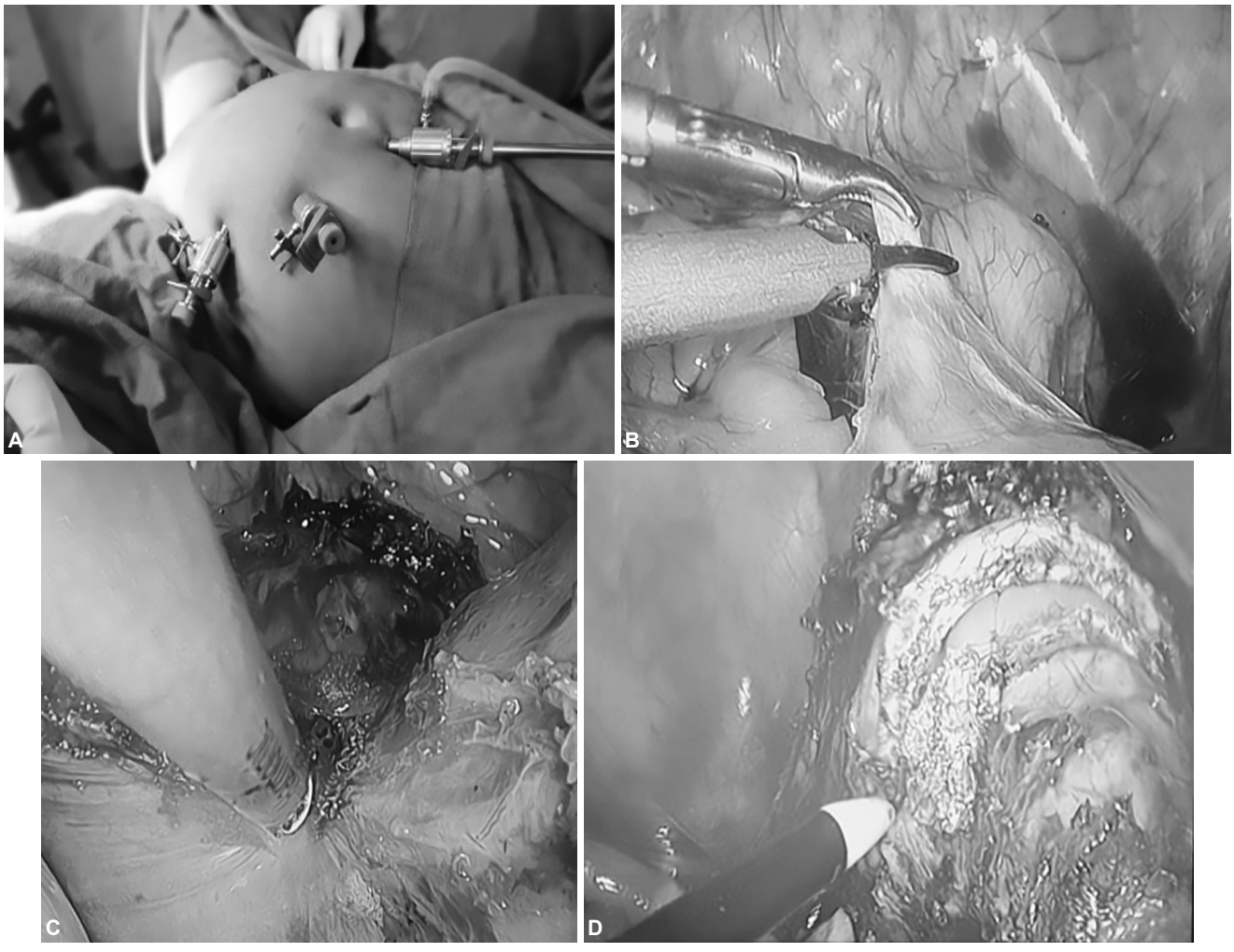
After creating CO_2 pneumoperitoneum with Veress needle, a 10 mm trocar was placed at the supra-umbilical site. Two ancillary 5 mm trocars were placed as shown in Figure 1A. In cases with the large uterus or big fibroid, another 5mm trocar was placed on the lateral side for uterine manipulation by introducing myoma screw.

The round ligament was first cauterized with bipolar forceps and then cut with Enseal forceps. Similarly, fallopian tube and ovarian ligament were also cauterized and cut.

After cutting the fundal structures, the vesicouterine fold of peritoneum was opened by the harmonic blade in the central part of the lower uterine segment. After that, bladder dissection is continued in either direction and bladder is pushed downwards. During this step, a cup of the uterine manipulator is pushed inside to locate the right cleavage plane (Fig. 1B).

After careful skeletonization, the uterine artery was coagulated with bipolar forceps and cut with scissors or harmonic blade (Fig. 1C). The uterosacral ligaments were then coagulated and sectioned, by harmonic.

Lastly, circular colpotomy was then done by using the unipolar hook (Fig. 1D) and the uterus was removed



Figs 1A and D: (A) Laparoscopic image showing placement of supra-umbilical 10mm port and two ancillary 5 mm ports; (B) Laparoscopic image showing bladder dissection via opening of vesico-uterine fold of peritoneum by harmonic blade; (C) Laparoscopic image showing coagulation of uterine artery followed by cutting by harmonic forceps; (D) Laparoscopic image showing circular colpotomy by unipolar hook

through the vagina. The vault was closed vaginally in all the cases. Hemostasis was checked and port sites were closed.

Abdominal hysterectomy was performed according to the technique described by Mattingly and Thompson[1] for benign disease.

RESULTS

The demographic profile of patients has been shown in Table 1. The mean age of women undergoing TAH and TLH was 46.8 ± 6.3 years and 46.4 ± 7.6 years, respectively. In 41% of cases with previous surgery, TAH was done while TLH was done with 50% of women with a history of prior surgery. No significant difference was found in demographic profile among two groups. Average BMI was higher in women undergoing TAH than TLH. However, no significant difference was found. Although no significant difference was found in BMI among the two groups, but after developing good expertise in surgery, the authors here started to prefer TLH in women with morbid obesity.

Indication of surgery is shown in Table 2. It was found that most common indication of hysterectomy was fibroid uterus in both the groups. However, it was found that in women with ovarian cyst, more commonly TAH was performed. This can be explained on basis of size of ovarian cyst, making laparoscopic surgery difficult and secondly could be due to suspicion of malignancy in such cases.

Peroperative and postoperative complications are shown in Table 3. Mean duration of hospital stay was lesser in group II with mean values of 6.93 ± 2.1 days and 4.68 ± 1.3 days in group I and group II respectively, with difference being statistically significant. Postoperative was also found less in women who underwent TLH. Most of the patients did not require intravenous analgesics after 2 days of laparoscopic surgery and were comfortably discharged on day 4/5.

It was found that bladder injury occurred in two cases; both of them were operated by open technique (TAH). In both of these cases, there was history of previous two caesarean sections and bladder was completely adherent over the uterus. Bowel injury occurred in two women who underwent TAH. No visceral injury was reported in group II (TLH).

Among postoperative complications, it has been observed that postoperative fever and abdominal distension was found in more number of women who underwent TAH. This might be explained on basis of more tissue handling and prolonged environmental exposure during open surgery as compare to minimal invasive surgery.

Stitch line sepsis occurred in seven cases (5.1%), all of which occur after TAH. No wound sepsis occurred after TLH showing better wound healing after laparoscopic surgery.

Table I: Demographic profile of women who underwent TAH (group I) and TLH (group II)

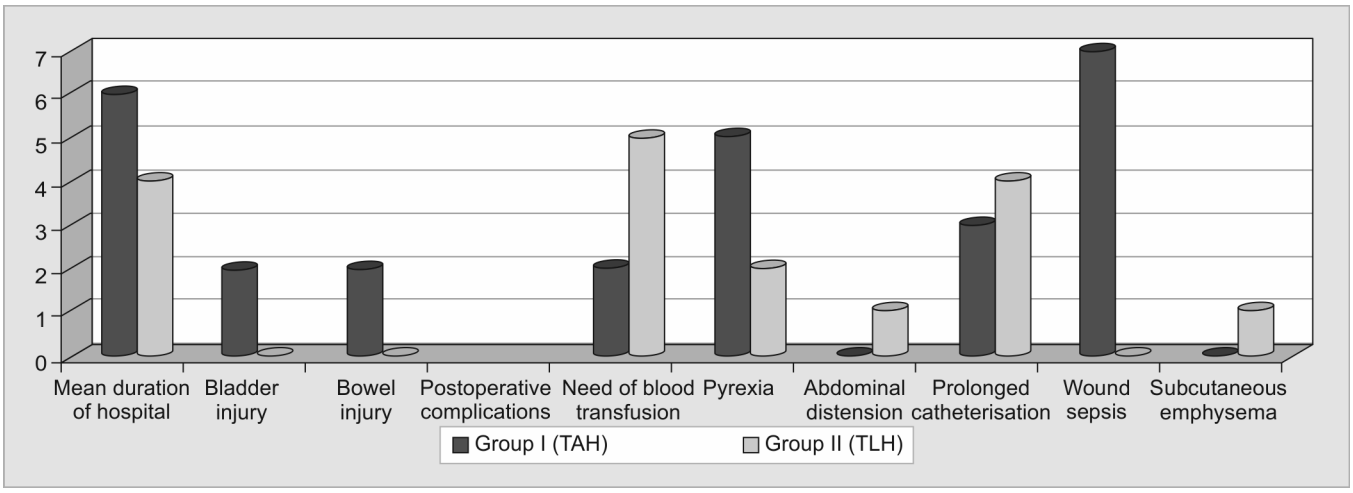
	Group I (TAH) (n = 100)	*Group II (TLH) (n = 35)*	*p value*
Age (years)	46.8 ± 6.3	46.4 ± 7.6	0.784 NS
Parity	1.43 ± 1.6	1.49 ± 1.1	0.85 NS
BMI (kg/m2)	27.2 ± 5.1	26.1 ± 4.5	0.11 NS
Previous surgery			
Tubal ligation	21 (22.1%)	7 (26.9%)	0.608 NS
Caesarean section	12 (12.6%)	4 (15.4%)	0.709 NS
Myomectomy	2 (2.1%)	0	NS
Cystectomy	4 (4.2%)	2 (7.7%)	0.46 NS
Total	39 (41.1%)	13 (50%)	0.41 NS

Table 2: Indications of surgery in women who underwent TAH (group I) and TLH (group II)

Indication of surgery	*Group I (TAH) (n = 100)*	*Group II (TLH) (n = 35)*
Fibroid uterus	80 (80%)	20 (57.2%)
DUB	3 (3%)	12 (34.3%)
Ovarian cyst	12 (12%)	1 (2.8%)
Chronic PID	2 (2%)	0
Adenomyosis	0	2 (5.7%)
Postmenopausal bleeding	2 (2%)	0
Endometrial hyperplasia	1 (1%)	0

Table 3: Per- and postoperative complications observed in women who underwent TAH (group I) and TLH (group II)

	Group I (TAH) (n = 100)	*Group II (TLH) (n = 35)*	*p value*
Duration of hospital stay (days)	6.93 ± 2.1 days	4.68 ± 1.3 days	0.0001
Bladder injury	2 (2%)	0	NS
Bowel injury	2 (2%)	0	NS
Postoperative complications:			
Need of blood transfusion			0.001
Pyrexia	2 (2%)	5 (14.2%)	NS
Abdominal distension	5 (5%)	2 (5.7%)	NS
Prolonged catheterisation	5 (5%)	1 (2.8%)	0.01
Wound sepsis	3 (3%)	4 (11.4%)	0.001
Subcutaneous emphysema	7 (7%)	0	NS
	0	1 (2.8%)	0.001



Graph 1: Bar diagram showing comparison of per- and post-operative complications between group I (TAH) and group II (TLH)

Hence, it was observed that laparoscopic surgery is associated with lesser risk of visceral injuries, lesser duration of hospital stay, minimal risk of postoperative wound complications, better wound healing and early return to normal activities (Graph 1).

However, it was also observed that more number of patients need blood transfusion and prolonged catheterisation was done in patients undergoing TLH as compare to TAH. Although, no bladder injury was observed during TLH but catheter was removed on day 4/5 in majority of cases for prophylactic purpose only.

During this study period, authors observe that complications rate decreased as we did more number cases showing that laparoscopy has a slower learning curve as compare to the open procedure.

DISCUSSION

Laparoscopic gynaecological surgery was first started by Palmer et al. in 1950s. While Reich et al.[2] in 1989 did surgical procedure such as adhesiolysis, cyst aspiration and ovarian biopsy. Minimal invasive surgery in gynaecology is being done since ages. Even then, it is not being practised commonly by the gynaecologist and surgeons due to requirement of comprehensive surgical education as well as equipment.

In number of studies,[3] it has been reported that laparoscopic hysterectomy is more beneficial than abdominal hysterectomy in terms of lesser peroperative and post operative complication, shorter hospital stay and early return to normal activities.

Hence this study is being conducted to further reinforce the need of laparoscopic surgery in this era.

Duration of hospital stay is a major concern to the patient and the family. Longer hospital stay leads to more financial burden to the family as well as psychological stress to the patient. Therefore, surgery with lesser hospital stay is always preferred. So, when duration of hospital stay was compared between two groups it was found that post operative hospital stay was significant lesser in women undergoing TLH than TAH. Our results were similar to the study by Osama et al.[4] done in 2014, in which comparison was done between 40 patients who underwent TLH (Group 1) and 40 patients who underwent TAH (Group 2). In this study, it was found that mean duration of hospital stay was statistically shorter in group 1 (2.48 ± 0.6 days) as compare to group 2 (4.88 ± 1.2, p value < 0.001), showing early recovery in women undergoing TLH. Similar results were found in number of other studies.[5,6] This could be related to the fact that laparoscopic surgery is associated with lesser abdominal trauma and inflammatory response than open surgery.

Peroperative complications in term of visceral injury occur in 4 cases, of which bladder injury occurred in 2 cases and in other 2 cases, bowel injury occurred. All these injuries occurred during abdominal hysterectomy and no such complication happened during TLH. The results were in concordance with study by Sridhar et al.[7], in which complications rate during laparoscopic hysterectomy was 21.1% as compare to 34.9% found during abdominal hysterectomy. However, in another study by Garry et al.,[8] Lumsden et al.,[9] and Mäkinen et al.,[10] complications rate were found to be higher during laparoscopic hysterectomy than abdominal hysterectomy.

Wound dehiscence was found in 7 cases, all of them were seen after TAH. No stitch line complication was found after TLH, hence confirming the fact that laparoscopic surgeries has better wound healing than open surgeries. Similar results were found in study by Kanmamni M et al.,[11] in which wound infections was seen in 9 cases out of 32 cases of TAH while none of the patients had it after TLH. Postoperative pyrexia was also seen more commonly after TAH than TLA however, the difference was statistically insignificant.

In five women who underwent TLH, postoperative blood transfusion and prolonged catheterisation was done. But in all of these cases, size of uterus was >12 weeks and fibroid of size 5 to 10 cm was present, because of which peroperative blood loss was little more and hence, postoperative transfusion was given and catheter was kept for longer period for prophylactic purpose. In these cases of large fibroid uterus, first Myomectomy was done and then we proceeded with hysterectomy. Both uterus and fibroid were removed by Ribbon Coring technique[12] vaginally. However, none of the patient had bladder or ureteric injury, and catheter was kept for little longer time for prophylactic purpose, especially in women with adherent bladder or previous surgery.

In a Cochrane database systemic review Johnson et al.,[13] surgical approach to hysterectomy was given for benign diseases. When TLH was compared to TAH, it was found that TLH is associated with more benefits in term of lower intraoperative blood loss, shorter duration of hospital stay, speedier return to normal activities, fewer wound or abdominal wall infections, fewer unspecified infections or febrile episodes, but more urinary tract (bladder or ureter) injuries. Hence, it was concluded that vaginal hysterectomy (VH) should be performed in preference to abdominal hysterectomy where possible and in cases where VH is not possible, laparoscopic hysterectomy may avoid the need for abdominal surgery.

In another meta analysis by Garry et al.,[8] it was reported that although laparoscopic surgery has been associated with major complications, but still it leads to less post operative pain and quick recovery. Hence, surgeon should decide the mode of surgery after weighing risk and benefits associated with surgery.

Hence, it can be observed that laparoscopic surgeries are beneficial but the pros and cons should be equally balanced before deciding the mode of surgery.

CONCLUSION

Laparoscopic hysterectomy is the upcoming procedure which is associated with less post operative complications, shorter hospital stay and wound complications as compared to abdominal hysterectomy. Hence, it can be the preferred over open procedure especially in cases with previous surgery and obesity. However, decision shall be taken with patient consent and better surgical expertise.

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ORIGINAL RESEARCH

Two Port Laparoscopic Cholecystectomy—An Initial Experience of 25 Cases with a New Technique

Aswini Misra A

ABSTRACT

Background: In Nepal, it is quite common to find patients with large stone burden and thick gallbladderwall which often leads to incision extension. We have used this extended incision to our advantage.The present technique of 2 port Laparoscopic cholecystectomy not only helps overcoming thespecimen extraction difficulties but also contributes to better cosmesis.

Patients and methods: Total of 25 patients were underwent the surgery in 2008–2010.

Results: The mean operating time was 50 minutes. None had significant procedural blood loss, iatrogenic injury, perforation of gallbladder, bile spillage, significant gas leak or subcutaneous-emphysema at either port site. All patients were comfortable in the postoperative period and were routinely discharged on 2nd postoperative day except for 2 patients who has surgical site infection and fever respectively. Although 3 cases were converted to standard 4 port technique, none required conversion to open cholecystectomy. Out of 25 patients, 7 cases have completed 3 months follow up and did not show any complication like port site hernia.

Conclusion: The described method of performing 2 port laparoscopic cholecystectomy is safe,simple and inexpensive yet cosmetically rewarding.

Keywords: Cholecystectomy, Laparoscopic.

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BACKGROUND

In Nepal, it is quite common to find patients with a large stone burden and thick gallbladder wall which often leads to specimen extraction difficulties. Out of all the available methods to facilitate the extraction like fascial dilatation, stone crushing, high-speed ultrasonic rotary, or laser lithotripsy, we prefer to use incision extension since it has been described as the optimal method and does not aggravate postoperative pain.[1] Many of the 11 mm epigastric wounds land up in a dimension of 13 to 14 mm or more at times at the completion of the procedure. However, we have used this wound extension to our advantage by introducing another 5 mm port through the epigastric wound from the outset. This not only obviates the need for any additional port insertion but also aids in specimen extraction. This forms the rationale behind two port laparoscopic cholecystectomy. With the technique described in this article, one will be able to perform laparoscopic cholecystectomy with only two incisions leading to a more cosmetic scar and less postoperative pain. Last decade has seen many innovations like squamous intraepithelial lesion (SILs), NOTES from healthcare industries driven by an ever-increasing demand for cosmesis. However, the cost factor keeps them out of the reach of a common man in developing countries. This technique certainly adds to cosmesis still fitting to the budget of a common man.

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PATIENTS AND METHODS

Twenty-five patients underwent the operation from 2008 to 2010 after the hospital ethical committee approval. Informed consent was obtained from all the patients. The same team of surgeons performed all the surgeries. Every single patient had investigation proven gallstone or related complications. Operative time, hospital stay and complications were recorded in each case.

The patient characteristics are mentioned below. There were 10 male and 15 female patients, and none of the patients had any abdominal surgery in the past. The mean age was 40.5 years (range 27–55 years). All the patients had body mass index (BMI) below 30. Total fourteen patients were anesthetic risk assessment (ASA) I and II were ASA II (8 patients were controlled hypertensives and 3 were controlled diabetics).

Operative Technique

The open technique does a peritoneal entry with the insertion of a 10 mm port through the umbilicus. After creating pneumoperitoneum, a 1-centimeter transverse skin incision is taken in the midline at a level 1 inch cephalad to the level of the inferior border of liver for the epigastric port. A 10 mm port is inserted through the

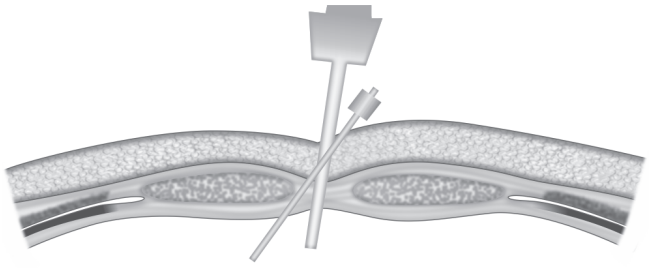

Fig. 1: Position of port assembly in the epigastric region

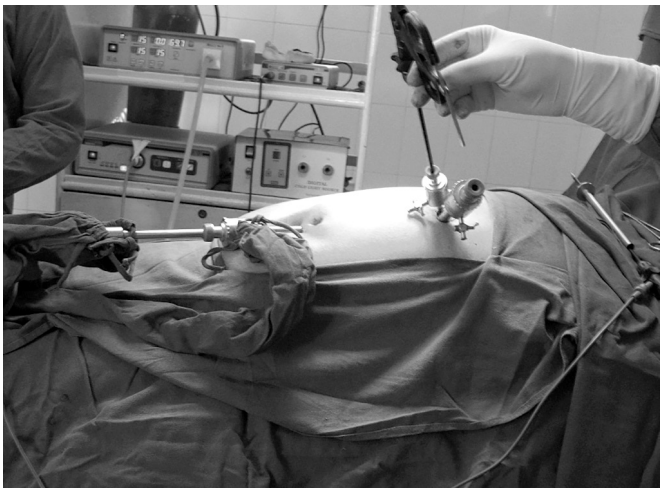

Fig. 3: Side view of the ports positions and port assembly

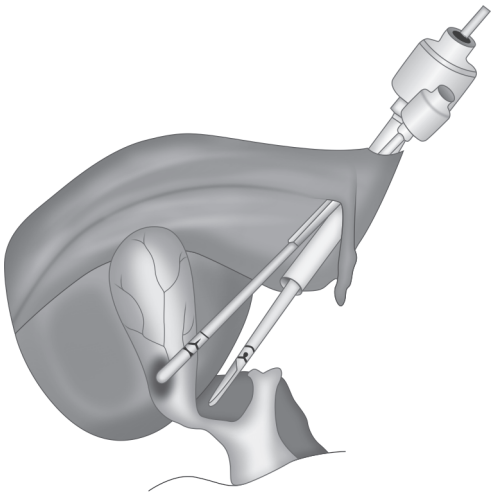

Fig. 5: Calot's triangle dissection using the port assembly

later incision vertically till it pierces the rectus sheath (This will be referred henceforth as port–2). Afterward, a slight right side angling of the port is done to bring it through the angle between the falciform ligament and the anterior peritoneum. A 5 mm grasper (with reducer) is introduced through the port 2, and the fundus of the gallbladder is grasped, and traction is applied towards the right shoulder. This step displays the gallbladder anatomy in entirety. Now an intraoperative assessment is done to determine if the two-port laparoscopic cholecystectomy can be done safely (patient suitability has been described in the discussion). If conditions are found to be favorable, with the traction maintained in

Fig. 2: Position of port assembly in the epigastric region-intraoperative view

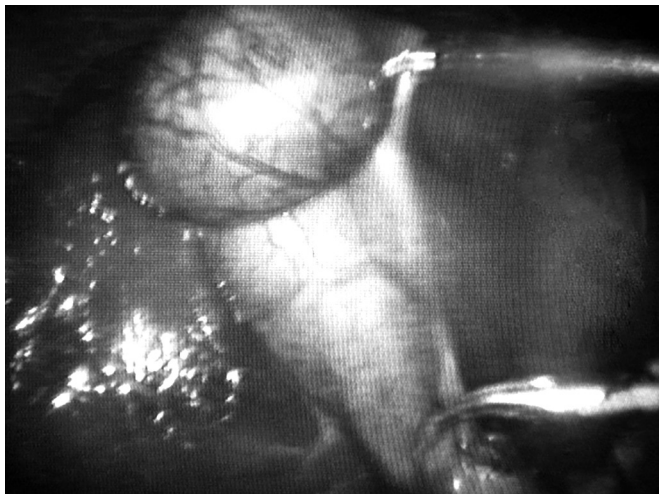

Fig. 4: Intraoperative view of gallbladder dissection

the described way, a 5 mm port is inserted through the existing epigastric skin incision (but through a separate stab traversing a different path to the peritoneal cavity) little away from the port two pointing towards the Hartman's pouch of the gallbladder (This will be referred henceforth as the port-3) (Figs 1 to 4). Before this step, the skin incision may be extended 3 to 5 mm or more as required.

Now appropriate traction is applied to the Hartman's pouch in the lateral direction by the port–3 instrument, and this widens up the Calot's triangle. With a suitable instrument (preferably a Maryland introduced through the port–2), Calot's triangle dissection is done. The traction and dissection instruments are used interchangeably through the ports 2 and 3 as per requirement. The rotational freedom of the port three around port 2 helps in traction and dissection to be done at various points and depth (However the rotation of the port should never be attempted with the instrument inside the port) (Figs 4 and 5). The cystic artery and duct are circumferentially skeletonized. With double clips placed on the body side and a single clip on the specimen side, both the structures

are divided. This step is completed by traction through the port 3 instrument and clip application through port-two. With continued traction applied to the Hartman's pouch in the upward and right direction (this open up the interface between the gallbladder and the gallbladder fossa of the liver), the gallbladder is separated from the gallbladder fossa by electro-dissection with an appropriate instrument (either a monopolar hook, Maryland or scissor). Before the final detachment of gallbladder from the liver, the hemostasis of the gallbladder bed is achieved, and the cystic pedicle (artery and duct) security is confirmed. The 5 mm port is now withdrawn and the specimen extracted through the epigastric port. A generous amount of peritoneal wash is given, and 100 mL of normal saline mixed with bupivacaine is left in the subdiaphragmatic space. Pneumoperitoneum is evacuated, and the wounds closed in two layers.

Because of the presence of two ports in the same wound the range of their movement is likely to be affected. Hence, careful attention should be paid to proper alignment of the ports at the epigastric site. The chamber of the 5 mm port should be as close to the skin as possible whereas that of 10 mm port should be as far away from the skin as possible (Figs 2 and 5). The maneuverability and the freedom of a port depend on the rotational capacity or the swing of the ports (Please watch the video). With the measures mentioned above, we have observed that there is adequate overall maneuverability including a range of movement and reach of the instrument to complete the procedure safely. The right and left-hand instruments work in close harmony as an assembly, with one grasping/retracting at a short distance from the other one(Figs 4 and 5). They move in tandem performing the dissection bit by bit sequentially from Calot's Triangle to the fundus till the point of complete separation of the organ.

RESULTS

There was no incidence of the bile duct or vascular injury, bile leak, iatrogenic injury, intra-operative perforation of the gallbladder, bile spillage, significant procedural blood loss, significant gas leak or subcutaneous emphysema at either port site. The mean operating time was 50 minutes (range 40–155 minutes).

We have converted three cases from the two port technique to the standard four-port technique. One was due to the technical difficulty arising out of bleeding and the other two due to difficult intra-operative findings. These two cases had dense adhesions in the Calot's triangle and gallbladder fossa respectively. However, none of them required conversion to open cholecystectomy.

Patients were allowed orally as early as 6 hours following surgery. All patients were routinely discharged on the 2nd postoperative day except for two patients. One had severe abdominal pain and later developed surgical site infection, which subsided with wound drainage and the other patient developed fever in the postoperative period. All the patients were happy and satisfied due to rapid and comfortable recovery and of course, about their small wound. Many patients were astonished small incision used to perform the surgery and hence were curious to know the procedure details (Fig. 6). Patients were advised follow up on the 10th day, 3 months and 1 year following surgery. Out of 25 patients, 23 patients visited the hospital for 10th day follow-up and were fine at that point in time. However, only seven have completed three months follow up at the point of data collection, and none of them had any complications including port site hernia.

Fig. 6: Appearance of wounds immediately after closure

DISCUSSION

Although laparoscopic cholecystectomy has been practiced as a day care surgery, it is far from reality in our set-up as most of the patients are from remote rural and hilly areas with poor access to health care. That is the reason for the patient being discharged routinely on the 2nd postoperative day. Secondly, the follow-up of the patients has remained far from ideal. Many of them, once discharged, tend to avoid hospital follow up unless they are unwell. The geographic and telecommunication barriers are other factors which have prevented us from reaching out to them.

Two-port laparoscopic cholecystectomy has been practiced by many surgeons successfully and has been reported to be safe and superior to 4 port cholecystectomy in terms of pain, cosmesis and patient acceptance.[2,3] Various techniques and special instruments like innovative extracorporeal knot by Mishra et al., "Twin-port" system (that allows a 5 mm camera and a forceps through a single port) by Kagaya et al., 2 mm or 3 mm endo graspers by Lee KW, have been used to accomplish the procedure without the

need of additional ports. However, traction sutures on gallbladder may end up in tearing of the organ leading to stone spillage and associated consequences like an abscess, fistula formation and other septic complications later on.[4-7] This possibility further increases in patients with a high stone burden. So, we aim at the gentle handling of the gallbladder and take preventive steps to avoid intra-operative spillage and hence do not use sutures for traction.[8,9] However, the present technique requires no special instrument or complex technique.

Although the present technique is safe, there are some inherent limitations. This should not be used for cases where technical difficulty is anticipated or encountered for example in acute cholecystitis, empyema, dense adhesions in Calot's triangle, intrahepatic gallbladder, anatomic abnormality in the hepato-biliary system, Mirrizzi's syndrome, cirrhosis of the liver, etc. Drain insertion in the subcostal region nullifies all the purported advantages of the procedure. Hence, it is better to perform a feasibility assessment before attempting this two port technique, and difficult cases should routinely be done in four port fashion. If there is bleeding during the procedure, a low threshold should be maintained to convert to the standard four-port technique. Meticulous dissection and gentle handling of instruments are a sine qua non for safe and successful completion of the procedure. One should not expect the freedom of a four-port technique in this method. With careful case selection coupled with precise technique and patience, one can make this two-port laparoscopic cholecystectomy an amazing reality in one's surgical practice.

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ORIGINAL RESEARCH

Diagnostic Laparoscopy as an Effective Tool in Evaluation of Intra-abdominal Malignancies

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ABSTRACT

Accurate diagnosis and staging are crucial in defining an effective plan of management in intra-abdominal malignancies. Despite the availability of a wide array of imaging techniques, a high incidence of nontherapeutic procedures have been observed. Laparoscopy finds its utility in reducing this discrepancy by an accurate assessment of the extent of the disease. This review article explores applications of laparoscopy in the staging and diagnosis of abdominal malignancy and its comparative advantages against imaging studies and conventional laparotomy.

Keywords: Diagnostic laparoscopy, Gastrointestinal tract, Gynaecology, Malignancy, Metastasis, Staging.

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INTRODUCTION

Unresectable tumors are undesirable diagnostic surprises during laparotomies for surgeons. A well-staged diagnosis and an assessment of resectability in abdominal malignancies are necessary determinants for the definition of an effective treatment strategy since laparotomies in patients with improperly staged, and non-resectable tumors will increase mortality and morbidity, cost as well as reduce the quality of life in the remaining lifetime. So laparoscopy can play a complementary role in diagnosis and staging of abdominal malignancy and its extent.[1]

The last three decades have witnessed tremendous improvements in laparoscopic equipment and technique, which has now led to a wider application of laparoscopy and an increasing interest in the use of laparoscopy as a staging tool.[2]

Despite ever evolving, sophisticated radiological diagnostic modalities like (CT), magnetic resonance imaging (MRI), A diagnosis of unresectable, metastatic diseases has been made at exploratory laparotomy for many patients with gastric, hepatic, pancreatic malignancy. Visualization of primary tumors, identification of hepatic metastasis, regional nodal metastasis and intra-peritoneal metastasis, which at times may not be efficiently spotted by imaging modalities, are possible with laparoscopy.[1]

If laparoscopic finding results in an unresectable disease, then further management can be planned, such as neoadjuvant chemotherapy, radiotherapy, etc. It will give a tissue diagnosis and can have a biopsy where the definitive treatment or surgery is not possible.[3] Thus, it is recommended that diagnostic laparoscopy for a staging of abdominal malignancy be performed at the time of planned laparotomy or in cases where in spite of preoperative imaging resectability is in doubt.[3]

Many authors have stressed the importance of laparoscopic ultrasonography during diagnostic laparoscopy for abdominal malignancy since it gives the surgeon valuable information that would be difficult to obtain from a little laparoscopic visual exploration.

Since the introduction of laparoscopic staging, lavage of the peritoneal cavity has been added to the procedure for identification of early peritoneal seeding and eventual metastases, with free cancer cells found in the peritoneal lavage fluid as an effective indicator.

Unnecessary surgery, diagnostic delays, ineffective treatment leading to prolonged operative and in-patient stay which may affect the quality of life, in the long run, can be avoided by effectively using diagnostic laparoscopy. It finds its utility and efficacy as a preoperative tool for timely diagnosis, accurate staging, assessment, and evaluation of intra-abdominal malignancies as a determinant of standard treatment for more regular use.

BACKGROUND

Diagnostic laparoscopy is a minimally invasive modality for the diagnosis of intra-abdominal diseases through direct visual inspection. Tissue biopsies, acquisition of culture, peritoneal lavages along with a variety of therapeutic interventions are possible during the procedures.[4,5]

The main advantages of diagnostic laparoscopy over traditional open laparotomy are as follows:

- Reduced morbidity
- Reduced postoperative pain

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- Reduced in-patient stay permitting patient selection for curative resection or a neoadjuvant chemotherapy

This review article provides a comprehensive description of the role of diagnostic laparoscopy in the evaluation of patients of abdominal malignancies.

Historical Perspective

Over the past decade, the use of laparoscopy has expanded into virtually every surgical discipline, with surgical oncology being no exception. Much of the early work of Jacobaeus in 1910 focused on the diagnosis of malignant diseases.[6]

Setup and Equipment

As with any surgical procedure, an appropriate setup of the operating room is critical for an efficient, safe and effective laparoscopy. For most procedures, the patient is placed supine on the operating table with the surgeon positioned on the right side. The camera operator stands on the opposite side of the patient, with monitors placed above the operative field.

A basic set of equipment is necessary for safe and effective laparoscopy. The basic tray consists of scissors, a grasper, and a dissector. Reusable ports are also used as well as suction irrigation device. Since electrocautery is used during the procedure, all instruments are insulated to the tip.[7]

Laparoscopic telescopes are either forward viewing (0°) or oblique (30°). Oblique views are essential to visualize relatively inaccessible regions of the abdomen. The telescope has an eyepiece at the proximal end, serves as the site of attachment for the camera.

Veress needle is used to gain access to the peritoneal cavity. The ability to obtain tissue safely for pathological evaluation is important. Both cup and grasping forceps are effective instruments, achieving an adequate specimen. Cup forceps help in reduction of the amount of tumor spillage by maintaining the entire specimen within the jaws of the forceps. As the prevalence of minimal-access surgery for staging purposes increases, new equipment and techniques continue to emerge, laparoscopic ultrasound and ultrasound-guided biopsy being essential examples.[7,8]

LIMITATIONS IN DETECTING METASTATIC DISEASE BY CT AND MRI

Computed Tomography

The CT scan has undergone a revolutionary evolution over the last twenty years with new developments that have improved data acquisition, processing, and image handling. Conventional CT has been replaced by dynamic thin-section CT, spiral CT, Multidetector CT. CT is accurate in assessing abdominal malignancy, But there are certain limitations:[9]

- It has a limited role in the assessment of local vascular invasion, and there is difficulty in distinguishing whether the tumor is touching vascular structures or invading them, e.g., portal vein and superior mesenteric artery involvement in pancreatic carcinoma.
- It is relatively non-specific for predicting resectability.
- Tumors less than 1 cm in diameter are difficult to detect, thereby reducing the efficacy in detection of peritoneal metastatic deposits, small liver metastasis, and peritoneal micrometastasis
- It cannot distinguish between reactive lymphadenopathy and malignant deposits.
- Lastly, due to faulty techniques and human error.

There are definite concerns about the potential for a false positive diagnosis of unresectability resulting in a repudiation of surgery or a false positive diagnosis of resectability resulting in an unnecessary trip to the operating room. These limitations can be potentially overcome by incorporating other imaging modalities, especially diagnostic laparoscopy with laparoscopic ultrasonography and biopsy.

Magnetic Resonance Imaging

Abdominal MRI is rapidly evolving but currently provides essentially the same information as CT scan.

Its limitations involve image artifacts from respiration, aortic pulsation, bowel peristalsis and lack of ideal contrast material for the gut lumen. Recent advances have improved abdominal imaging with MRI, but it has not replaced high-quality CT scanning.[10]

Laparoscopic Ultrasonography

Laparoscopic ultrasound (LUS) probes offer a possible solution allowing the surgeon to perform laparoscopic diagnostic procedures with the use of ultrasound, thereby improving the accuracy of predicting resectability up to as high as 98% in some studies.[11,12]

Staging of Intra-abdominal Cancers

Staging laparoscopy is useful in the evaluation of intra-abdominal malignancy in the following aspects:[4,13-15]

- Precise staging of the tumor
- Avoidance of unmerited, non-therapeutic laparotomy in patients with metastatic diseases
- For exclusion of metastatic disease and extraction of tissue biopsy antecedent to the initiation of neoadjuvant chemotherapy
- For procuring tissue for diagnosis (lymphomas) or peritoneal lavage fluid for cytology to exclude the

presence of otherwise undetectable peritoneal metastasis.
- Diagnosis of locally advanced disease (fixed tumor or vascular invasion) where no evident distant metastasis is found.
- Development of tailor-suited palliative treatment in patients with advanced or metastatic disease catering to the requirements.
- For assessment of treatment response or disease progression before a definitive laparotomy.

A detailed discussion of the utility of staging laparoscopy for individual cancer types is beyond the scope of this article; however, a brief overview is provided below.

Esophageal Cancer

Presentation of Esophageal cancer is often accompanied by locally advanced tumors, as well as lymph nodes and distant metastases, which is a predictor of a poor prognosis. Studies suggest that preoperative chemotherapy and radiation followed by surgical resection has been shown to improve survival, however, as with other gastrointestinal malignancies, preoperative imaging may point towards a resectable tumor even though a significant percentage of esophageal cancers (20–65%) are found unresectable at the time of exploratory laparotomy.

There is a significant value of diagnostic laparoscopy in staging oesophageal cancer because of its utility in the identification of patients who may or may not be likely to benefit from preoperative chemotherapy, therefore avoiding unnecessary laparotomy or thoracotomy which may have eventually yielded negative findings.

Placement of feeding tubes can be performed at the same time as the staging laparoscopy, to improve the nutritional status of these patients and to prevent the need for additional, technically difficult procedures like percutaneous endoscopic gastrostomy (PEG).[4,14]

Staging laparoscopy has shown an accuracy of 75–80% in identification of peritoneal metastasis with sensitivity and specificity of 64% and 70% compared to ultrasonography (40–50%) and computerized tomography (45–60%). Addition of LUS and video thoracoscopy has shown to improve the utility of diagnostic laparoscopy in oesophageal cancer.[16]

Lymph node staging is an important independent indicator of prognosis in patients with oesophageal cancer. Metastasis to thoracic lymph nodes is unvaryingly involved because of lymph node spread, despite the level of the primary tumor.[17]

Hagen et al.[18] showed improved survival for patients undergoing complete lymphadenectomy associated with oesophagectomy for distal third and gastroesophageal junction tumors. Appropriate therapy can be determined by actual tumor node metastases (TNM) status, defined by preoperative assessment of thoracic and abdominal lymph nodes.[19]

Krasna et al.[20] reported on similar diagnostic accuracy for thoracoscopic and laparoscopic staging procedures (93% and 94%, respectively). Celiac lymph nodes were missed by standard non-invasive techniques in six of 20 patients, who underwent laparoscopy and thoracoscopy.

Watt et al.[21] comparatively evaluated the accuracies of laparoscopy, sonography and computerized tomography in detection of intra-abdominal metastases in patients diagnosed with oesophageal cancer and adenocarcinoma of the cardia. Laparoscopy had a noteworthy higher significance and accuracy (sensitivity 88%; specificity 100%; accuracy 96%) than sonography or CT, with regard to hepatic status. Peritoneal masses were not detected by sonography or CT, while those were correctly identified by laparoscopy in eight of nine patients before surgery with no false-positives and one false-negative result, giving a sensitivity of 89%, specificity of 100%, and accuracy of 98%.

An additional study by Dagnini et al.[22] supports laparoscopy as an effective procedure in the staging of esophageal cancer before the therapeutic intervention, with false-negative findings estimated at 4.4%.

Gastric Cancer

Neoadjuvant chemotherapy preceding definitive surgical resection has improved survival among gastric cancer patients with tumors (T3-T4N1), as reported by studies.[23]

In those trials, the benefit of survival was derived by gastric cancer patients with locally advanced tumors or lymph node metastases; however, the 5-year survival rate is poor in the presence of unresectable disease or disseminated metastases (<20%). Hence, it is vital to identify patients of gastric cancer who may benefit from neoadjuvant chemotherapy and those with advanced or metastatic tumors who are not likely to benefit from therapeutic laparotomy.[24]

Several investigators reported that diagnostic laparoscopy has an accuracy of 89 to 100% for staging, aids in the identification of occult metastasis or unresectable disease, and helps to avoid nontherapeutic laparotomy in 13 to 57% of gastric patients despite a negative preoperative imaging workup.[25,26]

There has been reported uniquely high sensitivity (90 to 96%) of diagnostic laparoscopy for identifying metastasis to liver, peritoneum, and lymph nodes as compared with either ultrasonography (23–37%) or CT (28–52%). Diagnostic laparoscopy with the US further improves identification of liver metastasis and peritoneal lavage cytology enhanced identification of occult peritoneal metastasis by 10–15% in pancreatic cancer.[26]

Therefore, laparoscopy can now play a pivotal role in the management of gastric cancer by accurately defining those patients who are suitable for immediate gastric resection and lymphadenectomy or patients with the advanced local disease who may benefit from preoperative neoadjuvant chemotherapy. Gastric serosal infiltration, metastases in lymph nodes, adherence to adjacent structures, peritoneal carcinomatosis, ascites and the presence of liver metastases are the inherent characteristics to evaluate in the staging of gastric cancer.

The distinction between local and disseminated disease is essential, and knowledge of these parameters dictates the most appropriate intervention.[27]

Possik et al.[28] reported from a cohort of 360 patients that laparoscopic examination assessed tumor fixity in 255 patients and had a sensitivity of 87% for the detection of hepatic metastases and 83% for peritoneal dissemination.

Kriplani and Kapur et al.[29] found a comparable laparoscopic staging accuracy of 92%, with laparoscopy predicting resectability in 87% of patients studied. Several investigators have identified the usefulness of staging Laparoscopy as a necessary adjunct to radiography and sonography. The results suggest that laparoscopic staging may obviate exploratory surgery in a significant group of patients.[30]

Burke et al.[31] published their study of 111 gastric cancer patients who were judged to be free of metastatic disease by pre-operative CT underwent laparoscopy, which diagnosed metastatic disease in 32 patients with an overall accuracy of 94%.

Ribeiro et al.[32] demonstrated a utility of peritoneal lavage with laparoscopy while staging gastric cancer in patients since the data is easily available and enhances the accuracy of laparoscopy. They also showed that peritoneal cytology is useful in the identification of patients at high risk for peritoneal recurrence since it is of great value in detecting the microscopic intra-abdominal spread of gastric cancer.

Pancreatic Adenocarcinoma

Fifteen to forty percent patients with pancreatic cancer where tumors are reckoned resectable are found to have unresectable tumors because of extension of local tumor or presence of metastasis, despite advances in pre-operative imaging [including CT, endoscopic ultrasonography (EUS), MRI, positron emission technology (PET)]. Findings associated with metastatic cancer at the time of staging laparoscopy are large size of the tumor, adenocarcinoma of the pancreas as opposed to periampullary cancer or duodenal cancer, body and tail location, and preoperative serum levels of CA 19-9 higher than 150 U/Ml.[33]

Diagnostic laparoscopy has a median sensitivity (range), specificity, and accuracy of (93–100%), 88% (80–100%), and 89% (87–98%) respectively in the identification of unresectable, imaging-occult pancreatic adenocarcinoma. Total 5–7% of patients assumed to have resectable tumors on diagnostic laparoscopy are found to have unresectable tumors on open exploration, which may be ascribed to the occult vascular invasion, fixed tumors or presence of lymph node metastasis. Laparotomy with negative findings can avoid 4 to 36% patients, but not all cases.[33]

On combining with LUS, the diagnostic accuracy of diagnostic laparoscopy increases by 12–14%; albeit few surgeons and centers have the equipment and the skills necessary for the interpretation of LUS images. Identification of occult metastasis can be further improved with peritoneal lavage cytology in 7–15% of patients, but it is hindered due to the time constraints and unavailability of expert cytopathologists.[34]

John et al.[35] in their prospective trial of 40 patients, demonstrated that Staging laparoscopy is essential in the detection of occult intra-abdominal metastases and that LUS improves the accuracy of laparoscopic staging with potentially resectable pancreatic and periampullary cancer.

Jiminez et al.[36] found that laparoscopy diagnosed unsuspected metastases in 31.2% of patients with pancreas cancer, thus avoiding nontherapeutic Laparotomy. Reddy et al.[37] suggested that unresectable disease can be detected by staging laparoscopy in 20–48% of patients felt to be resectable by CT scan.

Conlon et al.[39] have reported an accuracy rate of 98% for staging laparoscopy in pancreatic cancer. In a series of 115 patients, they delineated good results in detection of extrapancreatic tumor extension where only six patients (9%) were deemed unresectable on laparotomy out of 67 patients with resectable disease on laparoscopy.

The need for a prophylactic bypass is an additional consideration regarding staging laparoscopy for pancreatic cancer. On examination of a prospective cohort of 155 patients with unresectable pancreatic adenocarcinomas who did not undergo enteric or biliary bypass at the time of laparoscopic staging, Espat et al.[39] identified only three patients who required surgical bypass. Endoscopically placed stents achieved biliary decompression in these patients. They proposed advocating surgical biliary bypass just for patients with obstructive jaundice who fail endoscopic stent placement and open gastroenterostomy in patients who have a confirmed gastric outlet obstruction.

Laparoscopy has a significant contribution to the proper management of patients with pancreatic cancer, by abolishing nontherapeutic laparotomy and redirection

of treatment plans and therefore, increased efficiency of resource utilization.

HEPATOBILIARY MALIGNANCIES

Primary Liver Tumors

In patients with primary liver tumors, staging laparoscopy is indicated when pre-operative imaging is suggestive of resectable disease and an adequate hepatic reserve. Diagnostic laparoscopy with LUS permits evaluation of entire hepatic parenchyma and permits identification of the size, location, and some liver tumors along with potential vascular invasion, even though the incidence of peritoneal metastasis in uncommon among these patients.

Nontherapeutic laparotomy can be avoided in 25–40% of patients by combining diagnostic laparoscopy and LUS since it has a sensitivity of 63–67% for the identification of unresectable disease in patients with liver cancer. For lesions larger than 2 cm, diagnostic laparoscopy with LUS has a sensitivity of 96–100% over triphasic CT which is 35–40% sensitive. Although on diagnostic laparoscopy, there can be false negatives in 5 to15% of primary liver tumors.[13,14]

Biliary Tract Tumors

In nearly all patients with gallbladder cancer, hilar cholangiocarcinoma, or extrahepatic bile duct tumors without substantiation of unresectability or metastatic disease on preoperative imaging, staging laparoscopy may be indicated. The utility of diagnostic laparoscopy may be limited to those with T2–T3 cholangiocarcinoma due to the increased availability of EUS, since most patients with T1 cancers have a resectable disease.

In patients with gallbladder cancer and cholangiocarcinoma, diagnostic laparoscopy has a diagnostic accuracy of 48–60% and 53–60%, respectively.[13,14] An enhancement in the overall yield and accuracy may be achieved by combining diagnostic laparoscopy with LUS.[40]

A study by D'angelica et al.[41] of 410 patients with radiographically resectable hepatobiliary malignancies was completed in 73% of patients and, in 84 (55%) of the 153 evaluated patients, SL identified the disease that precluded resection.

Hemming et al.[42] studied 168 patients who underwent laparoscopic staging for malignant tumors (chiefly hepatobiliary tumors) in the abdomen and reported 1.8% overall complication rate and no mortality. Several studies suggest that laparotomy can be avoided in a significant number of patients with hepatobiliary cancer when the disease is non-resectable on diagnostic laparoscopy. In-patient stay can be reduced by avoiding laparotomy, which may normally average 5–6 days post-laparotomy when compared with 1.5 days after laparoscopy.

Colorectal Cancer

Diagnostic laparoscopy may infrequently benefit patients with primary colorectal cancer without any evidence of systemic metastasis, essentially because of its low yield in the identification of occult or subclinical metastasis but also because of a preference to undergo colectomy (laparoscopic or open) with intent for cure or alleviation of bleeding, obstruction or perforation.

Diagnostic laparoscopy with intraoperative ultrasonography can be of paramount utility for the identification of the number and location of hepatic metastases and to rule out peritoneal or extrahepatic disease in patients of colorectal cancer with isolated liver metastases and no evidence of extrahepatic disease. A nontherapeutic laparotomy can be avoided in 25–45% if a staging laparoscopy is performed for these indications.

Diagnostic laparoscopy with LUS has a higher sensitivity and specificity of 98–99% to identify occult hepatic metastasis and to evaluate the porta hepatic and celiac lymph nodes with other GI cancers.[13,14]

In a study by Jarnagin et al.,[43] out of 104 patients underwent MIS staging, 25% of patients with the potentially resectable disease were found to have a disease at laparoscopy which precluded resection. Laparoscopy predicted an overall resectability in 68% of patients and avoided unnecessary laparotomy in 54%. An increased rate of resectability and reduced cost of hospitalization was observed in the group of patients who underwent laparoscopic staging.

Rahusen et al.[44] reported a 38% yield of staging laparoscopy showing unresectability. Later, those results were confirmed by Thaler et al.[45] that identified a 25% yield of SL in identifying radiographically occult disease which led to the decision of resection or no resection.

LYMPHOMA

Since the last 1960s, staging laparotomy was recommended for patients with Hodgkin's disease and some patients with Non-Hodgkins lymphoma to identify the patients who were potentially curable with radiotherapy, and to precisely plan the fields of radiotherapy.[46]

With the introduction of CT scan and CT-directed percutaneous biopsy, development of combination chemotherapy, progressive use of combined modality therapy, recognition of morbidity due to laparotomy and an emerging role of laparoscopy in new and recurrent lymphadenopathy, in staging of patients with histologically confirmed lymphoma and assessment of the response to treatment, the role of laparotomy has been reduced. A particular indication for laparotomy is where the percutaneous biopsy has yielded inadequate information.

A sampling of retroperitoneal lymph nodes, hepatic biopsy and direct visualization of the abdominal cavity in association with bone marrow aspiration or biopsy may accomplish laparoscopic staging.

Routine laparoscopic staging for Hodgkin's disease has shown unsuspected hepatic involvement in 6% of patients and occult splenic involvement in 13% and has allowed stage upgrading in 23% of patients undergoing laparoscopic evaluation. Involvement of the liver was present in 20% of patients of Non-Hodgkin's lymphoma, which further proves the greater systemic involvement of this type of lymphoma.

Conlon et al.[30] reported a series of 55 laparoscopic procedures performed in patients with diagnosed or suspected lymphomas, in which the use of laparoscopy in the diagnosis of abdominal lymphomas was established. Patients undergoing radiotherapy and chemotherapy for lymphoma may be reassessed using laparoscopy for a second evaluation when imaging studies suggest recurrence in the abdominal cavity, as an addition to initial staging and diagnosis.

Minimally invasive procedures for lymphoma may offer a mean to minimize the interval between diagnosis, restaging, and beginning of chemo-radiotherapy when indicated, although this was not evaluated in prospective studies. Reduced pain, reduced inpatient hospital stay, sooner resumption of normal activities and ability to initiate chemotherapy earlier than after laparotomy make laparoscopy a better choice in the diagnosis and staging of a patient with lymphoma.[47]

GYNECOLOGIC MALIGNANT DISEASE

Application of staging laparoscopy in gynecological malignancies has a promising future and is expected to metamorphose numerous aspects of its management.

Ovarian Cancer

Historically, laparoscopy was used for patients with ovarian cancer in one of two settings:[48,49]

- Before the initiating chemotherapy in patients whose initial laparotomy was believed to be inadequate
- For reevaluation procedures to determine whether patients had persistent disease after completing their primary chemotherapy.

Ozols et al.[50] reported a 55% false-negative rate for laparoscopy compared with laparotomy and underscored the need for laparotomy in patients who appear disease-free at laparoscopy.

Endometrial Cancer

In 1998, the staging of endometrial cancer changed from a clinical to a surgical system. Peritoneal washing, removal of the uterus and adnexa, and retroperitoneal lymph node sampling are done under surgical staging. Laparoscopic-assisted surgical staging has been proposed as an alternative to laparotomy by combining operative laparoscopy and vaginal hysterectomy, for patients early stage endometrial carcinoma.

Assessment of the intraperitoneal cavity, sampling through peritoneal washings and definite removal of the adnexa are possible in surgical laparoscopy.[49]

Clinical outcomes and hospital charges were compared by Gemignani et al.[51] for 320 patients with endometrial cancer staged by laparoscopy versus traditional laparotomy. An incidence of fewer complications, shorter inpatient stay, and overall reduced hospital charges was observed in patients who underwent laparoscopy in comparison to those who underwent laparotomy. There was no statistically significant difference noted in the recurrence rates between the two groups.

Port-site recurrence

There was an initial concern of higher rates of port site recurrence after staging laparoscopy despite the association of the procedure with a low (1–2%) rate of major morbidity.

Dobronte et al. first reported a case of port-site tumor recurrence 2 weeks after laparoscopy in a patient with malignant ascites.[52] Albeit there has been no documentation of increased port site recurrence following staging laparoscopy as compared with laparotomy, with improved expertise and use of an impervious barrier bag for organ retrieval.

Hence, it may be concluded that laparoscopic staging appears safe from an oncologic point of view, since port site implantation is uncommon, differs from traditional open surgical incision recurrence and reflects biological behavior of the diseases instead of the type of surgery.

CONCLUSION

In spite of currently available standard radiological tests such as USG, CT and MRI which are useful in staging the abdominal malignancies, a significant percentage of cases prove to be inoperable because of metastatic or locally advanced disease. Hence diagnostic/staging laparoscopy is very useful in preventing non-therapeutic laparotomies in these patients and also helps in appropriate palliation of symptoms.

CLINICAL SIGNIFICANCE

Diagnostic laparoscopy helps in accurate staging of the tumor, avoidance of non-therapeutic laparotomies in patients with metastatic disease and thus, decreasing the morbidity in such patients. It also helps in the selection

of appropriate neoadjuvant therapy in advanced or metastatic disease, in palliation of symptoms, and an assessment of treatment response in the patient.

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RESEARCH ARTICLE

Laparoscopic versus open Varicocelectomy: An Observational Study

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ABSTRACT

Background: Varicocele is a collection of abnormally dilated, tortuous veins. A clinical varicocele is found in about 15% of all adult males, up to 35% of men who present for infertility evaluation and as many as 81% of men with secondary infertility, with a marked left-sided predominance. It is the most common correctable cause of male infertility.

Methodology: This study was conducted in the postgraduate department of surgery, Government Medical College, Srinagar for 2 years from December 2010 till May 2013. This was a prospective study and a total of 100 patients with clinically significant varicocele were included in this study. Patients were divided into two groups. Group A comprised of 50 patients who underwent open surgery, and group B comprised of 50 patients who underwent a laparoscopic approach.

Results: In our series of 100 patients, the minimum age was 10 and maximum was 50 years, eighty six had scrotal pain, 81 had testicular swelling and 25 patients presented with infertility, the operation time for laparoscopic varicocelectomy 48 minutes (mean) and in open surgery was 57 minutes (mean), We observed that postoperative analgesic requirement was almost equal in both groups,average hospital stay of 35.6 hours and 50.6 hours were observed in laparoscopic and open groups respectively.

Conclusion: In our study of 100 patients it was observed that the results of laparoscopic varicocelectomy were comparable to open technique with minimum morbidity, shorter hospital stay and with the advantage of treating bilateral varicoceles without any additional incisions. Also, laparoscopic varicocelectomy produces better overall patient satisfaction and hence can be considered as a preferred surgical technique although sperm analysis results were the same in both methods.

Keywords: Laparoscopic, Infertility, Varicocelectomy.

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INTRODUCTION

Varicocele is a collection of abnormally dilated, tortuous veins.[1] A clinical varicocele is found in about 15% of all adult males, up to 35% of men who present for infertility evaluation, and as many as 81% of men with secondary infertility, with a marked left-sided predominance.[2-4] It is the most common correctable cause of male infertility. Several non-randomized studies have suggested that repairing a clinically palpable varicocele in the presence of abnormal semen analysis results in improvement of parameters and pregnancy rates. As most adolescent varicoceles are asymptomatic and many are discovered on routine physical examination, therefore true incidence of varicocele is much higher than expected. The introduction of radiographic diagnostic studies and scrotal ultrasound has allowed for improved diagnosis and further characterization of varicocele. According to the criteria proposed by the World Health Organization (WHO 19853),[3] varicoceles are categorized as grade I–when the impulse of dilated veins appear over scrotal skin with Valsalva maneuver but without venous tortuosity. Grade II–when a palpable tortuosity and an impulse are found with Valsalva maneuver. Grade III–when a palpable tortuosity without abdominal straining is noted during the physical examination.

Different approaches have been applied for the treatment of varicocele including open surgery, sclerotherapy and, recently, laparoscopy. In this study, we evaluated and compared the operative time, sperm parameters and complications in the postoperative period between laparoscopic and conventional methods for high open ligation of varicocele.

METHODOLOGY

This study was conducted in the postgraduate department of surgery, Government Medical College Srinagar for 2 years from December 2010 till May 2013. This was a prospective study and a total of 100 patients with clinically significant varicocele were included in this study. Patients were divided into two groups. Group A comprised of 50 patients who underwent laparoscopic surgery and group B comprised of 50 patients who underwent an open approach. Majority of patients were in the age group ranging from 12 years to 36 years (average 24 years)

in Group A and 10 years to 36 years (average 23 years) in group B. Majority of patients presented with complaints of swelling in the left hemiscrotum, detected incidentally. Dragging sensation in the scrotal region was the second most common complaint. Few of the patients who were above 25 years of age presented with primary or secondary infertility. The diagnosis was established mainly by clinical examination and scrotal ultrasound. Majority of patients had a unilateral varicocele (77% in Group A and 79% in Group B). The diagnosis was confirmed by Doppler in all cases. Semen analysis was performed in patients presenting with infertility at least twice preoperatively and every 6 months postoperatively for 18 months.

SURGICAL TECHNIQUE

Laparoscopic Varicocelectomy

Patients were operated in supine position under general anesthesia. A urinary catheter was inserted after the induction of anesthesia to evacuate the bladder or the patient was asked to void just before shifting to the operation room. Post induction nasogastric tube was passed to decompress the stomach. A veress needle for the creation of pneumoperitoneum was introduced through a small infra-umbilical incision. Then, the abdomen was inflated with CO_2 gas, the pressure maintained between 12–14 mm Hg. The head end of the bed was lowered 150 to 300 to displace the bowel away from the lower quadrants of the abdomen. Veress needle was replaced by 10 mm trocar and cannula after enlarging the skin incision. 10mm telescope was inserted through the 10 mm trocar. Under direct vision, 2nd and 3rd trocars (10 mm and 5 mm) were bilaterally introduced through the incisions located in the 2/3rd distance from umbilicus to anterior superior iliac spine. Grasper and scissors were used to put two perpendicular incisions into the peritoneum overlying the internal spermatic veins. The vascular mass was lifted to separate arterial and lymphatic components from the veins. Then, the veins were ligated by clips or by intracorporeal knotting. After verifying the hemostasis, trocars were removed and incision sutured. Antiseptic laparoscopic dressings were applied.

Open Surgery

Open high ligation of testicular veins was done under spinal or general anesthesia. A small muscle splitting incision made at the level of the anterior superior iliac spine, and the retroperitoneal space was entered, with the peritoneal envelope swept medially to identify the internal spermatic vessels. These vessels were ligated and divided. Great care was taken to preserve testicular artery. The external spermatic fascia was sutured, and the wound was closed in layers. The antiseptic dressing was applied.

AIM AND OBJECTIVES

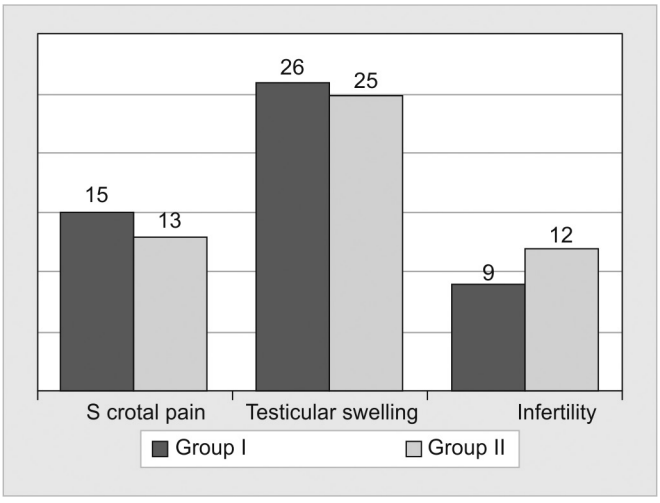
To compare the outcome of laparoscopic with open varicocelectomy in terms of;

- Operative time.
- Complications.
- Improvement in semen analysis after 3 months.
- Analgesic requirement.
- Hospital stay.

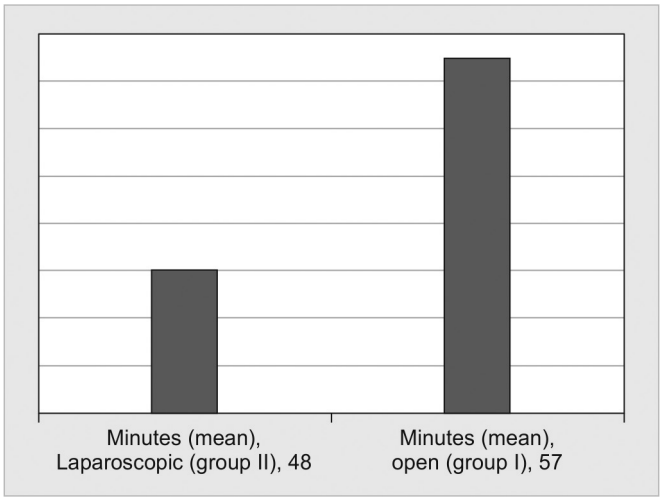
RESULTS

Group A consisted of 50 patients who underwent laparoscopic varicocelectomy; indications for varicocelectomy were the same in all groups and included infertility, scrotal pain, and documented abnormalities in sperm parameters (Graph 1).

The operation time was calculated from trocar insertion to trocar extraction and skin closure for laparoscopic varicocelectomy, and from incision to skin closure in open varicocelectomy (Graph 2).



Graph 1: Presentation in both groups



Graph 2: Duraton of surgery

Intraoperative Complications

In both the groups, no vascular or intestinal complications occurred. Conversion from laparoscopic to open approach due to hemorrhage or other causes did not occur either.

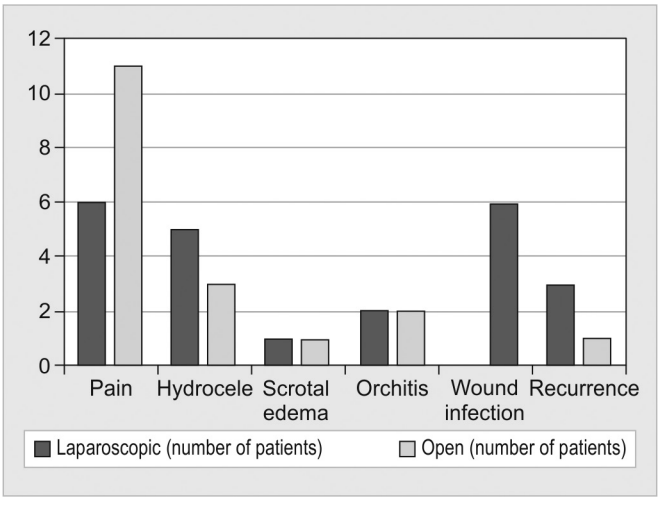
Postoperative Complications

Six patients in laparoscopic and eleven patients in open surgery suffered from persistent pain, one in group A and one patient in group B developed scrotal edema, five patients in group B and three in group A developed hydrocele which was treated by rest, nonsteroidal anti-inflammatory drugs, and scrotal supports. Recurrence was more in group B, and the patients underwent open Varicocelectomy under GA. No hernias occurred after laparoscopic varicocelectomy. In group A, there were 6 patients with wound infection, all of which were managed by medical therapy (Graph 3).

DISCUSSION

There are different surgical methods for varicocele treatment. The first surgical method for varicocele was explained by Celsus in the first century (ipsilateral orchidectomy which consisted of an atrophic testis).[5] The technique of laparoscopic varicocelectomy has gained wide acceptance since its introduction by Winfield and his colleagues in 1991.[6] Reports have suggested that laparoscopic approach not only carried lesser morbidity, less postoperative pain, early return to routine work but also had the same success rate as open procedures.

The most effective and least invasive method is yet unknown. We compared open varicocelectomy under GA with the laparoscopic approach. We found that although the two methods had comparable results, regarding and complications and laparoscopic method was not superior.



Graph 3: Varicocelectomy complications with different surgical methods

The fear of disfiguring scar, prolonged hospital stay, the double incision for bilateral varicocele and associated prolonged postoperative pain and the longer duration to return to normal activity had been the major concern of most of the patients undergoing open varicocelectomy.

In our series of 100 patients the minimum age was 10 and maximum was 50 years (Table 1) in a comparative study conducted by Bebars et al. the age of patients in laparoscopic group was 8–39 years (mean 21.3) and it was 8–42 years (mean 24.4) in open varicocelectomy group.[7] Lynch WJ et al. reported the age range of patients in open group 25–48 years and in the laparoscopic group it was 23–49 years.[8] Age group of 16–54 years was reported by Hagood.[9]

In our study of 100 varicoceles patients, 86 had scrotal pain, and eighty one had testicular swelling and 25 patients presented with infertility (Graph 1 and Table 2) similar observations were made by Al-Shareef et al.[10] and reported that in 26 varicoceles who were treated by laparoscopic ligation of internal spermatic veins under general anesthesia. Twenty-one patients had either scrotal discomfort or painful swelling and four patients presented with infertility.

The operation time was calculated from trocar insertion to trocar extraction and skin closure for laparoscopic varicocelectomy 48 minutes (mean) and in open surgery was 57 minutes (mean) (Graph 2 and Table 3). The average operating time for laparoscopic varicocelectomy after the training period has been completed was 44 minutes in series by Garridoa et al.[11] In a study by Matsuda et al., the operating time for laparoscopic varicocelectomy reported was 35–135 minutes (mean 85 minutes).[12]

In our study instead of demand analgesic, we gave every patient in both the groups, injection diclofenac sodium on 12 hourly bases to make patients pain free on the day of surgery. However, from the 1st postoperative day, it was given on demand. We observed that

Table 1: Age distribution of patients in our study

Age in years	*Group A*		*Group B*	
	No.	*Percentage (%)*	*No.*	*Percentage (%)*
10–19	10	20	12	24
20–29	27	54	22	44
30–39	11	22	9	18
40–49	2	4	7	14
Total	50	100	50	100

Table 2: Presentation in both groups

	Group A		*Group B*	
Presentation	*No.*	*Percentage (%)*	*No.*	*Percentage (%)*
Scrotal pain	15	30	13	26
Testicular swelling	26	52	25	50
Infertilitty	9	18	12	24

Table 3: Duration of surgery

Laparoscopic (Group B)	48 minutes (mean)
Open (Group A)	57 minutes (mean)

the postoperative analgesic requirement was almost equal to available series in the literature recurrence was observed in one patient during the follow-up period. Shamsa et al.[13] reported recurrence in 2 (6.7%) patients of the laparoscopic group, but it was not observed in patients who underwent open varicocelectomy. Watanabe et al. reported 6.1% recurrence in 33 patients with bilateral laparoscopic varicocelectomy. They mentioned a recurrence rate of 12% in 50 patients with unilateral varicocelectomy by high retroperitoneal method.[14]

The hydrocele is another complication of varicocelectomy (Graph 3, Table 4). The incidence of this complication is 0.3% to 40.4% as reported by Kočvara et al.[15] Etiology of post varicocelectomy hydrocele is ligation of the lymphatic vessels that are colorless and sometimes are mistaken for veins.[16]

The improvement in the quality of semen was analyzed and compared with the pre-operative semen analysis (Tables 5 and 6). Preoperative semen analysis was done 1 week before surgery, and then postoperative semen analysis was advised 3 months after varicocelectomy. In the present series, we found that the mean improvement in sperm concentration was 8.9 million/mL. The mean percentage of improvement in sperm motility was approx. 5.5%. The average decrease in abnormal forms was 5%. Similarly, Gouda El-labban[6] reported significant improvement in semen parameters in both laparoscopic and open groups. Al-Kandari et al. found that improvement in sperm motility and/or concentration was comparable and observed in 65%, 67%, and 76% of the open, laparoscopic, and micro-surgical groups, respectively. Also, the pregnancy rate at 1 year was not significantly different and was 28%, 30%, and 40% in the three groups respectively.[16]

We observed that in the laparoscopic group an average hospital stay of 35.6 hours which was significantly less than the open surgical group with an average hospital stay of 50.6 hours (Graph 4 and Table 7). Gouda El-labban[6] in his comparative study observed that patients in open varicocelectomy stayed in the hospital much longer than the laparoscopic group with an average of 3 days versus 1.5 days respectively. Osman et al. reported that the postoperative hospital stay was 52 hours and 8.4 hours in open and laparoscopic varicocelectomy group respectively.[17] Podkamenev et al. reported average hospital stay of 3 days for laparoscopic varicocelectomy versus 7 days for open varicocelectomy.[18] Similarly, Bebars et al. observed longer postoperative hospital stay in open as compared to laparoscopic varicocelectomy group and it was 3.5 (2-8) days versus 1.3 (1-3) days.[7] Ogura et al. also observed the shorter length of hospital stay for the laparoscopic patients than for the open surgery group (0.97 vs 1.42 days, p = 0.0078).[19] Zain H Al-Sharief et al. in their series reported hospital stay of 2 days versus 5 days in laparoscopic varicocelectomy and open varicocelectomy,

Table 4: Varicocelectomy complications with different surgical methods

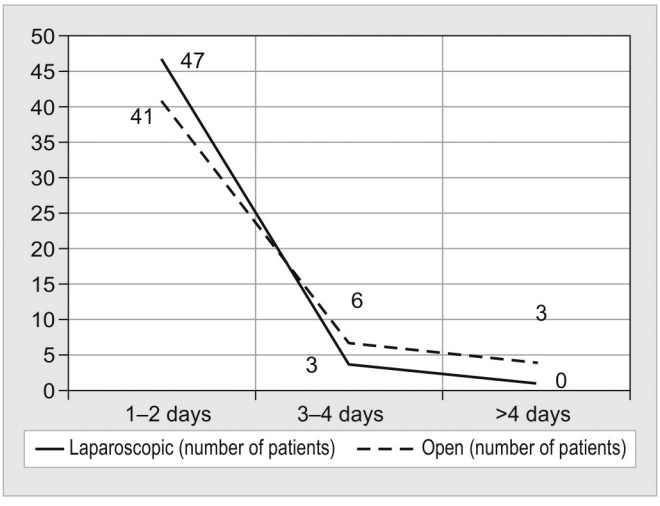
Complication	*Laparoscopic (number of patients)*	*C*
Pain	6	11
Hydrocele	5	3
Scrotal edema	1	1
Orchitis	2	2
Wound infection	0	6
Recurrence	3	1

Table 5: Semen analysis results with different varicocelectomy methods

Laparoscopic Varicocelectomy	*Before treatment*	*After treatment*
Sperm count × 106/ml	52 ± 36	44 ± 30
Sperm motility %	70 ± 50	88 ± 80
Sperm morphology %	60 ± 50	77 ± 35

Table 6: Semen analysis results with different varicocelectomy methods

Open Varicocelectomy	*Before treatment*	*After treatment*
Sperm count, × 106/ml	46 ± 33	40 ± 36
Sperm motility %	47 ± 33	60 ± 42
Sperm morphology %	44 ± 39	51 ± 22



Graph 4: Hospital stay in days

Table 7: Hospital stay in days

Hospital stay	*Laparoscopic (number of patients)*	*Open (number of patients)*
1–2	47	41
3–4	3	6
> 4	0	3

respectively. In our series postoperative stay was comparable to other available series in the literature. It was observed that patients who were from city or nearby areas happily accepted early discharge from the hospital, whereas some patients from far-flung areas were mentally unprepared to get their discharge early. It was experienced that there was a need to motivate and tell patients about the real benefits of laparoscopic varicocelectomy including early discharge from the hospital.

CONCLUSION

In our study of 100 patients, it was observed that the results of laparoscopic varicocelectomy were comparable to open technique with minimum morbidity, shorter hospital stay and with the advantage of treating bilateral varicoceles without any additional incisions. Also, laparoscopic varicocelectomy produces better overall patient satisfaction and hence can be considered as a preferred surgical technique although sperm analysis results were the same in both methods.

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RESEARCH ARTICLE

A Decade of Laparoscopic Adrenalectomy in a Regional Center

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ABSTRACT

Aim: To evaluate the laparoscopic approach to adrenalectomy throughout a decade in a single area, focussing on complication rates and the effect of surgeon experience. Given the relative rareness and pathological heterogeneity of adrenal tumors, there is still some debate as to whether the laparoscopic approach is suitable for all situations. Initially, laparoscopy was not recommended for pheochromocytomas, because of the possibility of adrenergic crisis. Subsequent questions were raised as to its appropriateness for large tumors (>6 cm) and metastatic deposits due to the technical difficulty of dissection. There has also been an increased number of incidental tumors ('incidentalomas') discovered while imaging for other reasons (e.g., on CT or MRI).

Materials and methods: De-identified data was collected of all laparoscopic adrenalectomies within the last decade via electronic and physical chart review, in addition to review of pathology reports.

Results: Ninety-seven adrenalectomies were performed. The complication rate was 8%, and 40% of cases were incidentalomas. Tumor pathologies noted were: non-secretory adenomas (35%), aldosterone-secreting adenomas (18.6%), adrenal metastases (17.5%), pheochromocytomas (13.4%), simple cysts (4.1%) and other pathologies (11.3%). The most significant decrease in operative time was between 2005–2008 and 2009 (p <0.0001). No significant relationship between complications and size of a tumor, nor pathology of a tumor was found.

Conclusion and clinical significance: Laparoscopic adrenalectomy in this center has a complication rate similar to other published rates and appears to be a safe procedure for large tumors and various pathologies. There is also a demonstrable effect of surgeon experience on operative time.

Keywords: Adrenal, Adrenalectomy, Cohort, Endocrine, Laparoscopic, Retrospective.

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INTRODUCTION

Adrenal tumors are a rare and distinctly heterogeneous group of tumors. They can be differentiated by area of origin within the adrenal cortex or medulla; the degree of their symptoms or; into benign and malignant. For most tumors, the laparoscopic approach has been established as the mainstay of treatment.[1,2] Still, there are a number of questions which have arisen in regards to when this approach is appropriate.

Laparoscopic adrenalectomy has been well established for benign cortical tumors, pheochromocytomas, and metastases. The only limiting factor for laparoscopy in these pathologies is the size of the lesion, with the limit being around 12 cm. There is still ongoing debate about the use of laparoscopy in adrenal carcinoma, with some authorities stating that only open technique should be used. Some data suggest that patients do better in terms of overall and disease-free survival with open adrenalectomy.[3] The major risks contributing to the morbidity of the laparoscopic approach are open conversion, long operative time and increased blood loss.[4] A large tumor size (defined as >6 cm) is found in the literature to be feasible and safe, but possibly with increased operative time and blood loss.[5-8] The other question for the laparoscopic approach is concerning the pathology of the lesion. In the case of malignant tumors, there has been a question of seeding the tumor or spillage if the tumor capsule is broken. It has shown to be effective in some studies, but the decision to convert to an open should be made early to avoid these consequences.[9,10] There have also been a number of studies looking into the effectiveness for metastatic deposits of the adrenal gland.[11,12]

Even though one of the two cases reported in Gagner's original 1992 paper describing laparoscopic adrenalectomy was a pheochromocytoma, for some time it was disputed whether this was a safe approach.[13,14] The pneumoperitoneum and possible increased handling of a tumor holds risks of the hypertensive crisis, for which invasive arterial pressure monitoring and treatment such as nitroprusside may be warranted. Subsequent studies have determined that the laparoscopic approach has equivalent if not better blood pressure stability.[15]

A more novel indication for laparoscopic adrenalectomy is that of the adrenal incidentaloma. With the increasing availability of imaging, there has been an increase in the proportion of adrenal lesions diagnosed incidentally. Adrenalectomy has been recommended for tumors greater than 4 cm due to the risk of malignancy.[16] The slightly increased use of partial adrenalectomy for small adrenal tumors has raised questions about whether asymptomatic tumors should be resected.[17-19]

The overall objective of this study was to retrospectively evaluate the laparoscopic treatment of adrenal tumors in Townsville, Queensland for the last 10 years. Specifically, we determined how many laparoscopic adrenalectomies were performed; what percentage of these belonged to particular pathological groups (aldosteronoma, pheochromocytoma, Cushing's' disease, adrenal metastasis, incidentaloma, cyst) and what the complication rate was in this area (including conversion to open). We also examined whether operative time decreased with surgeon experience and whether the laparoscopic approach is appropriate for tumors >6 cm, metastases, pheochromocytomas, and incidentalomas <4 cm. The indications for surgery were collected (incidentaloma or symptomatic) and the number of partial adrenalectomies.

MATERIALS AND METHODS

De-identified data were collected of all laparoscopic adrenalectomies performed in one geographic area for the last decade. Cases which were converted to open were included in the study and the data collected included patient demographics (age, gender), length of stay, complications, pathology (benign or malignant tumor) and operative time. Operative time was considered as a knife to skin time until time to end of the closure. Both suspected pathology (preoperative diagnosis) and definitive pathology as per final report were collected. Tumors which were discovered as an incidental finding on imaging were determined to be incidentalomas. Data was collected from electronic medical records, physical charts, and pathology reports.

Microsoft Excel was used to collate data, and statistical software Statistical Package for the Social Sciences (SPSS) version 21 was used for analysis. Data where appropriate are presented as percentages. Normality of data was determined using the Shapiro-Wilk Test, with data being non-parametric, Man–Whitney tests and Kruskal Wallis Test were employed to determine differences between two groups and more than two groups respectively. Association between categorical data was determined using the chi-squared test, with a p value of < 0.05 considered as statistically significant.

Ethics for both sites included in this study (Townsville Hospital and Mater Hospital Townsville) was obtained from the Human Research Ethics Committee for each site. All data were collected in a de-identified manner

RESULTS

Over the last decade, 97 adrenalectomies were performed on 44 (45%) males and 53 (55%) females with a mean age of 54.5. The oldest patient was 89 years old, and the youngest was 22. The breakdown of pathologies is reported in Table 1, showing that the most common pathology was the non-secretory adenoma. Total 40% of cases were incidentalomas. Approximately, 92% of cases had no complication. The most common complication was damage to other organs (4.1%), with open conversion, intraoperative bleeding and postoperative bleeding only occurring once each (~1.0%). There was one instance of high blood pressure and heart rate intraoperatively during manipulation of a pheochromocytoma.

Statistical analysis as detailed above showed that the most significant decrease in operative time was comparing 2005–2009 ($p < 0.0001$). Significant decreases were also seen when comparing 2005–2008 operative times to 2010–2011 ($p < 0.005$), 2012-2013 ($p < 0.01$) and 2014–2015 ($p < 0.005$).

On examination of tumour pathology reports, 36.4% were <4 cm size; 28.4% were 4–6 cm size; and 33% >6 cm size. Total 13% of tumors <4 cm had complications as did 10% of tumors >6 cm, with 4 to 6 cm having only 4%. The only case of open conversion was in the >6 cm group. Incidentalomas and pheochromocytomas had the same rate of complication as this general group of adrenalectomies. Metastases had a 14% complication

Table 1: Breakdown of pathology

Pathology	*Number of cases*	*Percentage of total cases (%)*
Non-secretory adenoma	34	35.1
Aldosterone secreting adenoma	18	18.6
Adrenal metastases	17	17.5
Pheochromocytomas	13	13.4
Other †	11	11.3
Simple cyst	4	4.1
Adrenal cortical carcinoma	3	3

† Other pathologies: schwannoma (2), multinodular adrenal cortical hyperplasia, adrenal hemorrhage, ganglioneuroma, hemangioma and myelolipoma

rate and adenomas a 10%. Chi-squared analyses showed there was no relationship between complications and size of a tumor, nor pathology of a tumor. Four cases (~4%) were partial adrenalectomies, of which one was an incidentaloma. Complication rates were exactly equal for cases in the public or private hospital. 6% of cases predicted a pathology which was different on the final pathology.

DISCUSSION

Published complication rates range from 7.5–12%,[20-22] so a complication rate of 8% is comparable to the lower end of this range. It is also interesting to note that there was no difference between public and private complication rates.

Looking at the data for the operative time it is clear that as the number of cases performed by surgeons in this area increased, there was a decrease in operative time, particularly after 2008. Other procedures have been analyzed to look at the learning curve, including laparoscopic cholecystectomy,[23] laparoscopic colorectal surgery,[24] laparoscopic inguinal hernia repair[25] and laparoscopic fundoplication.[26] These studies all measured operative time and complication rate to determine a learning curve expressed as a number of cases before stabilization of these two variables. As an exercise, measuring the learning curve of a procedure is potentially useful for training purposes, but also is useful from a health economics perspective as operating theatre costs are likely higher during the learning phase.[27] In this study, half of the complications documented were within the first three years of adrenalectomy, before the significant decrease in surgeon time. Therefore, it would seem that the complications and operative time stabilized after 2008. Because the number of cases each surgeon performed per year was not recorded, we cannot express this as a number of cases. However, the same surgeons were operating for the whole decade and so we can say that there was a demonstrable learning curve.

The data in Table 2 shows the complication rate for each size group of a tumor. As there was no significant difference in complication rates between the three categories of tumor size it supports the idea that both small and large tumors can be approached laparoscopically. Despite early concerns about the feasibility and safety of approaching large tumors laparoscopically, our findings are backed up by a number of more recent papers and supports the growing body of evidence stating that a large tumor size is not an absolute contraindication to laparoscopy.[5-8]

Quite a large number (40%) of cases were incidentalomas, demonstrating how increasing usage of broader imaging modalities (such as high-resolution CT) have changed the caseload for adrenalectomies.[28] There was also no significant difference in complication rate for different tumor pathologies, which would indicate that it is safe to use the laparoscopic approach for metastatic tumor deposits and pheochromocytomas. Interestingly there was one case of high blood pressure and heart rate when operating on a pheochromocytoma, demonstrating that despite the laparoscopic approach being the most appropriate[14,29] the risk of an androgenic crisis must be mitigated.[14,15] There were also a small number of tumors where the final pathology did not match the expected pathology, mostly where asymptomatic tumors were predicted to be adenomas and had different characteristics after microscopic pathological examination (e.g., ganglioneuroma, pheochromocytoma, metastatic deposit).

There were only a small number of partial adrenalectomies in this study, and they were not predominantly used for incidentalomas. While Kaye, Storey 19 strongly support increased use of partial adrenalectomy for small tumors, it has not become common practice in most places, as demonstrated by the small number of cases in this study. While there is an increasing number of studies supporting the use of partial adrenalectomy as it retains functional adrenal tissue[30-33] there are still instances where it is seen to be less effective[34] which may explain why it remains a less common procedure.

Table 2: Tumor size and complications

Tumour size	*Number of cases*	*Number of complications*	*Complication rate for size group (%)*
<4 cm	32	4	13
4–6 cm	25	1	4
>6 cm	29	3	10

CONCLUSION AND CLINICAL SIGNIFICANCE

Overall, the results of this study add to the current body of research demonstrating that the laparoscopic approach to adrenalectomy is safe and effective in a variety of tumor sizes and pathologies. It also neatly demonstrates diminishing operative time as surgeon experience increased over a decade, demonstrating a considerable learning curve in performing this procedure. While there are now moves towards retroperitoneal and other novel approaches, it is useful to evaluate the usefulness of the standard laparoscopic approach now that it is possible to look at data over longer periods of time.

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RESEARCH ARTICLE

Laparoscopic Repair of Non-midline Abdominal Wall Hernia: Retrospective Analysis of Cases done by a Single Surgeon in the Past Four Years

[1]Jitendra Kumar, [2]Rajni Raina

ABSTRACT

Aim: Abdominal wall ventral hernias are either midline or non-midline. Non-midline abdominal wall hernias are not a common entity and even rarer is a lateral ventral hernia. Laparoscopic management of these hernias are surgically challenging, and outcomes are unpredictable. This study aims to evaluate and analyze the results of laparoscopic repair of comparatively rare non-midline hernias done at the tertiary teaching hospital in the span of last four years.

Material and methods: For this retrospective descriptive study, from record file, all cases of laparoscopic ventral hernia repair done in the last four years (from 01/01/2012 to 01/01/2016) by the main author at Lady Hardinge Medical College screened and out of these, total of thirteen cases (n-13) of non-midline ventral hernia selected for their data analysis.

Results: Out of total thirteen cases (n = 13), a large percentage was of female gender (76.92%), their mean age of the patients were 43 +/- 9.30 years. (SD = 11.41). Range 24–64 years. Most of the patients were overweight with mean weight was 72.846 kg. (SD = 13.369). Mean operating time were 78.84 minutes (SD = 22.62) (range 60-120 minutes). One patient (7.69%) had developed chronic infected discharging sinus which ultimately required removal of mesh. Same and only patient in our series reported recurrence which makes an overall percentage of recurrence 07.69%.

Conclusion: Even though non-midline abdominal wall hernias are comparatively atypical in its presentation and challenging for the laparoscopic surgeon, overall patient's epidemiology, the surgical outcome in term of recurrence and complications are not much different.

Clinical significance: Presentation of a non-midline hernia is atypical and surgically complex which require an experience to handle it.

Keywords: Complex hernia, Non-midline ventral hernia, Lateral abdominal wall hernia, Non-midline incisional hernia, Laparoscopic ventral hernia repair.

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INTRODUCTION

Abdominal wall hernia represents the hernias coming out through defects in the abdominal wall fascia and muscle through which intra-abdominal or pre-peritoneal contents protrudes out. It can be either spontaneous or as a consequence of past surgery involving incision of the abdominal wall. Most of the time abdominal wall hernia tends to originate out of the midline probably through linea alba or weak midline vertical scar.[1] Although abdominal wall hernias in its mid-line anatomical location whether spontaneous or incisional are very common, non-midline abdominal wall hernias are comparatively rare entity and even rarer is spontaneous lateral abdominal wall ventral hernia.[2]

Even though non-midline or lateral abdominal wall hernias are rare occurrences and its management and outcome is not as simple as other ventral abdominal wall hernias, available data's or literature in respect of this is very limited. Even textbooks have not dedicated any separate chapter in respect of non-midline or lateral abdominal wall hernias.[3]

In 1992, Leblanc first reported the repair of abdominal wall ventral hernia by laparoscopic route. He performed the surgery using four to five port and all repairs were made using 1-mm-thick expanded polytetrafluoroethylene patches inserted intraperitoneally and stapled to the anterior abdominal wall over the defects, making use of intra-abdominal pressure to secure the repair.[4] Since then laparoscopic repair of ventral abdominal wall hernia has evolved rapidly and now been considered as well accepted and preferred approach for management of abdominal wall ventral hernia.[5]

MATERIALS AND METHODS

For this retrospective descriptive study, the record of all cases of non-midline ventral hernia repaired laparoscopically by the main author himself during the period from

1 January 2012–1 January 2016 has been screened. Total of thirteen cases (n = 13) of a non-midline hernia found to be eligible for study in term of detail availability of case record. Apart from demographic and clinical profile, e.g., age, sex, weight, symptoms and its duration, comorbidity, past history of surgery; total duration of surgery (from making first incision to taking last suture), all intra and postoperative events, e.g., size and location of defect, intra and postoperative different complications, follow up period and reported recurrence looked in to and evaluated in detail.

Surgical Techniques

All cases were done as an elective case at Lady Hardinge Medical College and Smt. S.K. Hospital, New Delhi. For preoperative preparation, all patients were made medically fit in term of any associated medical comorbidities, diabetes control, cessation of smoking, weight reduction, etc. Operative techniques followed according to SAGES guideline and adhered to standard protocols based on different recommended trials.[6-8] All cases were done under general anesthesia. All cases involving hernia below umbilical line had been routinely catheterized after induction of anesthesia and catheter was removed soon after completion of surgery. Strict antiseptic and aseptic protocols have been followed.

The procedure starts with the creation of pneumoperitoneum by a close technique using veres needle mostly at palmer point or infra/supra umbilical location depending on the location of a hernia. First port inserted blindly and rest of the port under camera vision. In all cases, three ports, one camera 10–11 mm and two working port of 5 mm has been used. Placement of ports depends on site of a hernia. Mostly port has been placed on the lateral side of the abdomen with camera port in the center and at the possible distant location from defect area.[9] After a thorough inspection of inside the abdomen first thing we do is adhesiolysis using electrocautery or a harmonic scalpel. A lot of patience and precautions are required for this step to prevent complication like bowel injury. Then reduction of the abdominal contents from the hernia sac performed gently and carefully. We do not close the defect or approximate its margin by any means, rather we pull the redundant sac and tack this to adjoining normal abdominal wall as this helps in reducing the dead space and preventing the postoperative seroma formation.

After removal of fatty deposits around the defect and thorough hemostasis, we measure defect size to plan the placement of adequate size of mesh. As per recommendation mesh should be of a size which can overlap beyond 5 cm. of defect margin.[9] In cases where mesh had to place over the defect situated near the iliac or pubic bone in the lower part of abdomen we reflected the peritoneum after dissecting it and mesh been tacked over ligament or in some case over bone. In upper abdominal hernia defect, we dissect the falciform ligament to place the mesh in subcostal region properly. In our all cases we used composite (coated polypropylene, proceed) mesh.

During defect size measurement and fixation process of mesh, as per recommendation, we reduce the intra-abdominal CO_2 pressure to 5–7 mm of Hg. We fixed the mesh with four quadrants trans fascial suture and circumferentially double crowning with non-absorbable titanium tack (Protack, Covidien).[10] Again after being assured about hemostasis and other intra-abdominal findings, we remove the trocars under vision and suture the 10 mm port site with port closure needle in two-layer while rest of the port been closed with only one layer of skin closure. We usually place large cotton ball compression elastic pressure dressing over the large defect thinking to reduce postoperative seroma. Postoperatively for inspection of port site wound and hernial site, we removed the dressing of the wound after 48 hours.

RESULTS

During four years, 13 cases of nonmidline abdominal wall hernia found to be operated by the main author. Out of thirteen cases, ten (76.92%) were female, and three (23.07%) were male with their mean age of 43 +/– 9.30 years (SD = 11.41). The range for age were 24–64 years. Mean weight of the patients were 72.846 kg (SD = 13.369) in range of 52–98 kg (Table 1).

The average duration of hospital stay for the patients were 6.61 days (SD = 4.17) in range of 3–19 days. Average follow-up periods were 21.15 months (SD = 11.857) in range of 1–40 months (Table 1)

All patients were having a common complaint of swelling, with five patients (38.46%) having pain along

Table 1: Epidemiological parameters and different time durations for patients

Parameters	*Range*	*Average/Mean*	*Std. deviation (SD)*
Age (in years)	24–64	43 +/– 9.30	11.41
Sex		Female = 10 (76.92%) and Male = 3 (23.07%)	
Weight (in kg.)	52–98	72.846	13.369
Duration of symptoms (in months)	03–108	30.157	
Duration of hospital stay (in days)	03–19	6.61	4.17
Follow-up period (in months)	01–40	21.15	11.857

with swelling, five patients were having complete reducible swelling, six (46.15%) patients presented with partially reducible swelling and only one patient (7.69%) presented with non-reducible swelling. Mean duration of symptoms were 30.15 months within a range of three months to hundred and eight months (Table 2).

Among all patients (n = 13) six patients (46.15%) have got associated comorbidities out of which two were suffering from hypothyroidism, one hypertension along with hypothyroidism, one hypertension with dyslipidemia, one diabetes mellitus type–II and another one having hypertension. Rest of the patients (53.84%) were not having any associated comorbidities.

Out of total 13, 8 patients (61.53%) have got history of past surgery among which 5 (38.46%) were having lower abdominal surgery [LSCS–2 (15.38%)], LSCS with open appendicectomy–1 (07.69%), open appendicectomy–1 (7.69%), lap. Oophorectomy –1(07.69%) and three (23.07%) had history of upper abdominal surgery (lap. cholecystectomy–1 (07.69%), small open epigastric hernia repair-1 (07.69%), exploratory laparotomy for appendicular perforation peritonitis-1(07.69%). Five (38.46%) patients were not having any history of surgical intervention in the past.

Among all operated cases, anatomical location of a hernia in five cases (38.46%) were at lower part of abdomen (right lower hypogastrium and right iliac fossa–3 (23.07%), left lower–2(15.38%), another five (38.46%) found to be on upper part of abdomen (right subcostal and subxiphoid–1(07.69%), right upper abdomen–39 (23.07%), left upper abdomen–1 (07.69%) and three (23.07%) were on the line of umbilicus-left side–2 (15.38%), right side–1 (07.69%). All the larger size hernias were on the right lower abdomen. Out of thirteen patients, five (38.46%) were having tender swelling on physical examination.

As expected in non-midline or lateral hernias, size of defects was of comparatively smaller diameter. Average size of defect was 06.661 cm,^{2} (range of 2.5 cm^2–35 cm^2). The largest defect found in a patient with a large hernia involving right subcostal and lumbar area. Intra-operatively, out of total thirteen patients two patient has finding of another defect which was far laterally placed than original defect. One patient with a hernia at right hypogastrium had got defect at right iliac fossa and another patient with a hernia at right lower abdomen got defect of size 0.5 x 0.5 cm at the lateral border of rectus near the semilunar line which could be a Spigelian hernia. The average size of mesh used was of diameter of 140 cm.^{2} in range of 120 cm^2–225 cm.^{2} Mean duration of operating time were 78.84 minutes (SD = 22.62) in range of 60 to 120 minutes (Table 1).

Out of total thirteen patients, five (38.40%) complained mild to moderate pain while two (15.35%) had severe and prolonged pain postoperatively. One patient (7.69%) developed acute retention of urine in the immediate post-operative period. Four patients (30.76%) developed mild to moderate seroma, and one (7.69%) developed hematoma at hernia site postoperatively. All of these resolved spontaneously within three months follow up period. Two patients (15.38%) has got cellulitis around 10 mm port site with the consequent discharge of pus. Out of these two patients, one (7.69%) had developed chronic infected discharging sinus which ultimately required re-surgery and removal of mesh. Probably this was the reason, recurrence of a hernia happened in this patient only (Table 3).

Table 2: Important clinical feature

	Signs and Symptoms	*Percentage*
1.	Swelling	
	Reducible	38.46
	Partially reducible	46.15
	Non-reducible	07.69
2.	Pain	38.46
3.	Anatomical location	
	Above the line of umbilicus	38.40
	Around the line of umbilicus	38.40
	Below the line of umbilicus	23.07

DISCUSSIONS

Finding of only thirteen cases of non-midline ventral abdominal wall hernia during four years at tertiary care teaching institute itself suggests that it is not a common type of a hernia. Maybe this is the reason availability of studies or reports in respect of a non-midline hernia is very sparse and whatever literature available is of a limited number of series and sporadic case report.[1-3] Shortage of literature is not only limited to research

Table 3: Operative details including complications

Parameters	*Average / Range / % of total patients*
Operative time (in minutes)	78.4 (60 – 120) S.D. = 22.62
Defect size	Average = 6.661cm.^{2}
– Diameter	Smallest (0.5 × 0.5) cm. /
– (vertical x horizontal)	Largest (7 × 5) cm.
Complications	
1. Mild to moderate pain	38.40%
2. Severe and prolonged pain	15.35%
3. Acute retention of urine	07.69%
4. Seroma	30.76%
5. Hematoma	07.69%
6. Cellulitis	15.38%
7. Discharge	15.38%
8. Required mesh removal	07.69%
9. Recurrence	07.69%

articles but, even textbooks are also missing any chapter or topics on this subject.

Therefore because of very little availability of report in respect of a non-midline hernia we tried to compare our results and other outcomes with studies reported in term of laparoscopic ventral hernia in general also. However, all the available reports unanimously considered non-midline or lateral hernias as a more complex variety of abdominal wall hernia in term of its repair as well as unpredictable surgical outcome.[11]

In our series, we have got a common epidemiological trend of the patient's parameter as compared to other reported series of cases of laparoscopic ventral hernia repair.[11,12] Most of the patients were overweight which supports the literature explaining its relation with a spontaneous ventral hernia. Comparatively this cohort has got larger share of patients with the comorbid condition which again corroborating with past studies reported comorbid condition as a frequent association with abdominal wall hernia.[12.]

In our series, we got more percentage of painful or tender swelling as a clinical presentation in comparison to a series of another laparoscopically repaired midline ventral hernia repair. Average hospital stay for all patients of this series was also comparatively longer and was maximum for the patient who reported recurrence. Moreno-Egea et al. reported in their study titled Midline versus non-midline laparoscopic incisional hernioplasty: a comparative study, published in journal Surg Endosc. In March 2008 that non-midline hernias are associated with more preoperative pain, require more analgesics and required a more extended hospital stay than the midline incisional hernias.[13] The only explanation to this is comparatively narrow neck and sideway protrusion of sac with the more applicable constricting force of lateral abdominal wall musculature. Although it needs to be verified with further studies.

In our studies, anatomical location of a hernia was equally on upper and lower half while whatever little available studies found a location of non-midline hernias are little more common in the lower half of the abdomen.[3] However, in our series average size of the lower abdominal wall located hernia were much larger and at the lateral edge of the rectus muscle. Although, right now it will be too early to comment on that.

Another important finding was the presence of another unsuspected defect far lateral to an original defect in two patients (15.38%) of this series. It justifies the reports of many studies which has supported the laparoscopic repair of ventral hernia repair, that can cover these sort of unsuspected defect also and prevent recurrence.[5,10]

Average time taken for surgery in our series were 78.4 minutes which was little more than average operative time reported by another series.[14,15] It may be due to the complexity of a non-midline hernia and individual surgeon experience. Different postoperative complications in our series seem to be of the little higher side it may be due to small sample size and complexity of non-midline hernia.[13,15,16.]

One patient was required for removal of his mesh due to infection and not responding to other conservative management. Same and only patient in our series reported recurrence which overall percentage would be 07.69%. In most of the series recurrence rate reported are between about four to seven percent which is quite comparable to our result.[14-17.]

Most of the reported studies found a reduction in the duration of operating time and surgical complications with an increase in the experience of a surgeon. The same thing is true here with author's finding, as apart from a reduction of the time duration of surgery with experience, one patient with a spontaneous right subcostal hernia which has got recurrence was a first patient of this series of non-midline ventral hernia.[17]

CONCLUSION

Even though non-midline abdominal wall hernias are comparatively uncommon and surgically challenging, overall their epidemiological profile, presentation, complications, and recurrences are not much different than those of midline ventral hernias.

CLINICAL SIGNIFICANCE

Non-midline abdominal wall hernia even at its early stage presents in more symptomatic manner, and because of its rarity and complexity an experienced surgeon must supervise the beginners.

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REVIEW ARTICLE

Laparoscopic Port Closure Techniques and Incidence of Port-site Hernias: A Review and Recommendations

[1]Mohammed Arifuzaman, [2]Asna Samreen

ABSTRACT

Minimally invasive surgeries have dawned a new era in surgical practice, cosmesis and safety. These have been heralded as one of the best surgical methods to treat a multitude of surgical disorders. Though the term minimally invasive seems attractive, in the real sense of the word, these surgeries are minimal access surgeries and do require incisions for trocars. The wounds must be closed appropriately to prevent the incidence of port-site hernia. Though rare, port-site hernias can cause considerable morbidity. Most of these are seen in the midline, particularly around the umbilicus, but there are reports of herniation at laterally placed ports. The accepted surgical practice is to close the fascial layers at all midline laparoscopic ports. There is a multitude of ways in which the ports can be closed. This article aims to review the various port closure techniques practiced by different surgeons and institutions to and reflect upon the pathophysiology of port-site hernia and recommendations to minimize them. Systematic research of the literature was performed using PubMed, Cochrane database, Google scholar and ClinicalKey. Different port-site closure techniques are described and analyzed. Though not one technique has been found to be superior to the other, all of them have their pros and cons. All of them produce similar results, and it is upon the discretion of the surgeon to accept any one of these methods. The authors have also tried to provide recommendations to minimize the incidence of port-site hernias.

Keywords: Laparoscopic hernia and port-site closure techniques, Port-site closure, Trocar site hernia.

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INTRODUCTION

Throughout our history, the abdominal surgical procedures have been performed through large incisions. Most of which were concurrently associated with multiple morbidities which include postoperative pain, wound infections, wound dehiscence, longer hospital stay and a higher incidence of incisional hernias.[1] With the advances in surgery, incisions started to get smaller, and it was not very late until laparoscopic procedures were introduced in the early 1930s, when Ruddock, an American surgeon described laparoscopy as diagnostic procedure superior to Laparotomy.[2] The modern era of laparoscopic surgery is widely accepted to have commenced from September 12, 1985, when Professor Mühe of Böblingen[3] performed the first laparoscopic cholecystectomy (LC) in Germany. The procedure has been widely accepted and has become a gold standard for surgical management of cholelithiasis.[4]

There are various access techniques used for the creation of a pneumoperitoneum in laparoscopic surgery. They can be widely classified into open access, closed access, and advanced techniques.

Open Access

This is a direct entry into the abdomen under vision without the creation of a pneumoperitoneum, and the insufflator is connected once the blunt trocar is inside the abdominal cavity. Various techniques include Hasson's technique, Scandinavian technique and Fielding technique.[5-7]

Closed Technique

Veress needle, named after Janos Veress, is used in this technique to create a pneumoperitoneum first. This is a blind technique and is widely practiced.

Advanced Techniques

These include single incision laparoscopic surgery (SILS) and natural orifice transluminal endoscopic surgery (NOTES).

Peritoneal Healing and Adhesions

All the above techniques require an opening of the parietal layer of the peritoneum to access the intraperitoneal

structures. Parietal defects are covered by mesothelial stem cells within 5–6 days in case of parietal peritoneum.[8] The total time for repair may take from 8 days–2 weeks. At sites of peritoneal cautery and suture repair, deep submesothelial hemorrhage and necrosis prolong the duration of inflammation, and hence the collagen deposition is delayed, and healing is not seen even after 3 weeks.[8,9] This delay in healing can be attributed to the development of adhesions and port-site hernias. Adhesions form when two injured peritoneal surfaces are opposed Lamont et al. Surgical insult to tissues results in relative or absolute ischemia which leads to local persistence of the fibrin matrix. This is replaced by vascular granulation tissue which consists of macrophages, fibroblasts, and giant cells. Eventually, the adhesions mature into fibrous bands often containing small nodules of calcification. Hence the development of intraperitoneal adhesions is a dynamic process where the surgically traumatized tissues which are in apposition bind through fibrin bridges which become organized by wound repair process often supporting a rich vascular supply as well as neuronal elements.[8] The fibroblasts contribute collagen which stabilizes the adhesions and promotes vascular in growth.

Pathogenesis of Hernia Development After Peritoneal Injury

Fear[10] first reported a trocar site hernia in his large series on laparoscopic gynecological diagnosis. While this complication has been recognized for a long time, it's significance is becoming more important as more and more patients are being treated for this. The term trocar site hernia was defined by Crist and Gadacz[11] as a hernia developing at a cannula insertion site. A port-site hernia following laparoscopic surgery is less common compared with an incisional hernia occurring after open surgery.[12,13] One study evaluating the risk for a late-onset hernia following a variety of open and laparoscopic surgeries reported incidences of an incisional hernia at 1.9 and 3.2 percent at two and five years after laparoscopic surgery, respectively.[14] By comparison, the incidence of an incisional hernia for open surgery was 8 and 12%, respectively.

Port Closure Techniques

It is recommended that all 10–2 mm trocar sites in adults and all 5-mm port-sites in children be closed, incorporating the peritoneum into the fascial closure.[15] Shaher[16] classified the different port-closure techniques into three categories:

- Techniques that use assistance from inside the abdomen (requiring two additional ports);
- Techniques that use extracorporeal assistance (requiring one additional port); and
- Closure techniques that can be performed with or without visualization (no additional ports)

MATERIALS AND METHODS

A literature search was performed for the articles related to port closure techniques in laparoscopic and robotic surgeries on Pub Med, Cochrane database, Google Scholar and Clinical key. The keywords used were port-site closure, trocar site hernia, laparoscopic hernia and port-site closure techniques. Prospective and retrospective case series, randomized trials, literature reviews, and randomized animal studies of trocar hernias on abdominal wall defects from gynecologic, urologic, and general surgery literature were reviewed.

RESULTS

Various techniques and associated hernia rates:

Standard Closure Through Skin Wound[17,18]

- This method incorporates direct visualization of the defect through the skin wound After the pneumoperitoneum has been released and the port removed.
- The fascial edges are grasped with a Kocher or Allis clamp, and the various layers are sutured together with a simple or figure-of-eight suture (Fig. 1). This tends to be difficult in obese patients with a large breadth of subcutaneous fat. Every attempt should be made to include all fascial layers and the peritoneum in the closure. It can be difficult to include the peritoneum when dealing with patients of moderate to high body mass index (BMI). In some cases, the skin incision may have to be enlarged to permit adequate closure.

Port-site Closure using Modified Aptos Needle

Ahmed et al.[19] used the Lasheen needle, which is a curved needle with a length which varies from 10 to 15 cm (Fig. 2). It has two sharp pointed ends and a hole at the middle of its length, through which the thread (No. 0 Vicryl) is passed. The loaded needle was passed in one edge of the port wound at the subcutaneous pre-fascial plane to come out of the skin about 2 cms from the wound edge. At this point, the edge of the externalized thread within the wound edge was held, and the direction of the needle reversed to come out through the other wound edge about 2 cm lateral. Now the needle direction was reversed, and the needle came out through the wound itself with the other end of the thread externalized through the trocar wound. In the end, both the ends of the thread were inside the wound edge. The strands were tied, and the knot lay directly on the anterior abdominal sheath (Fig. 3). This study was

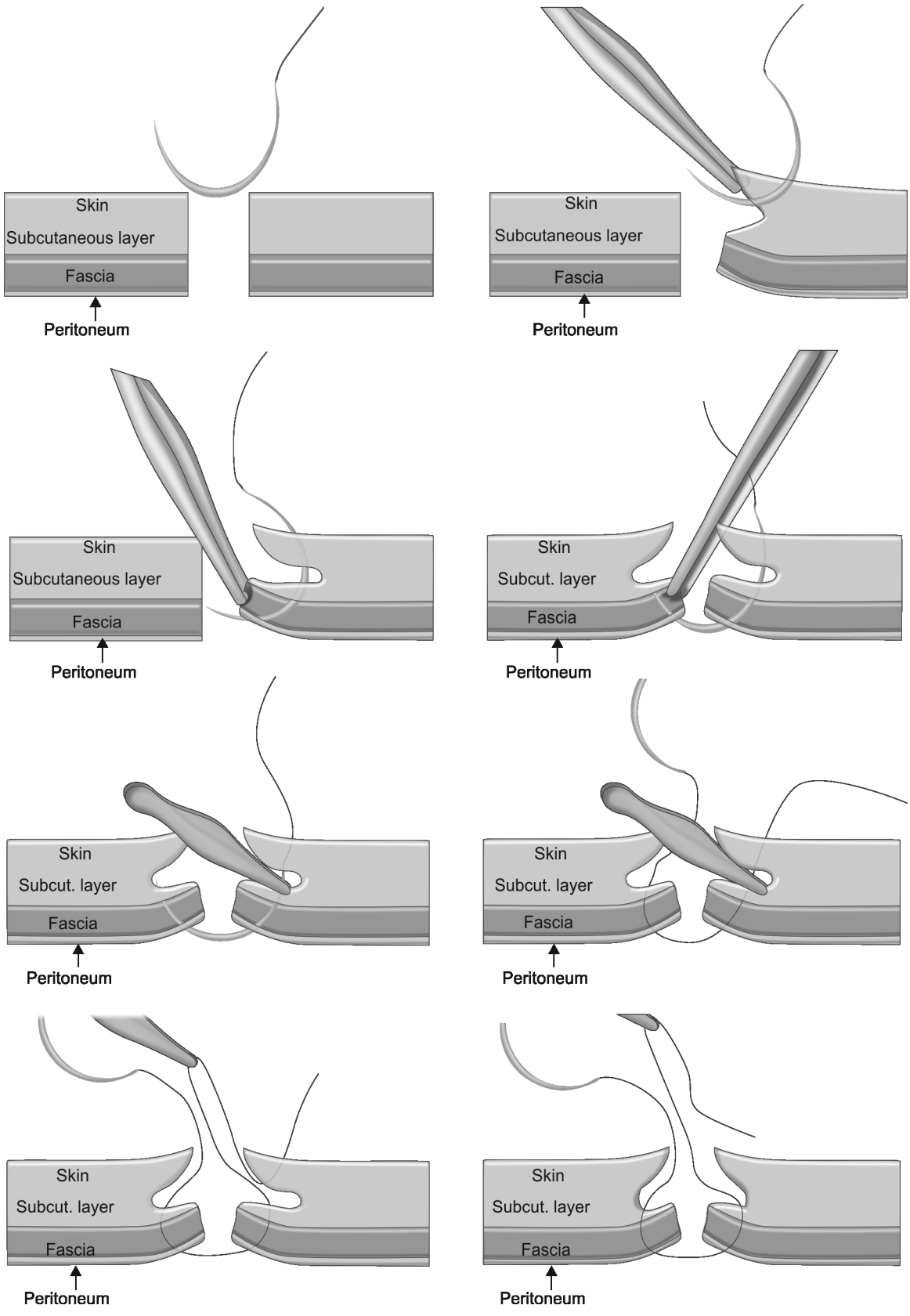


Fig. 1: Standard closure through skin wound

performed on 100 patients, and all were subjected to laparoscopic cholecystectomy. The follow-up period was from 4–32 months (mean 2 years). No port-site hernias were reported during the follow-up period. Surgical wound infection was reported in 3 patients (3%).

Skin Hooks

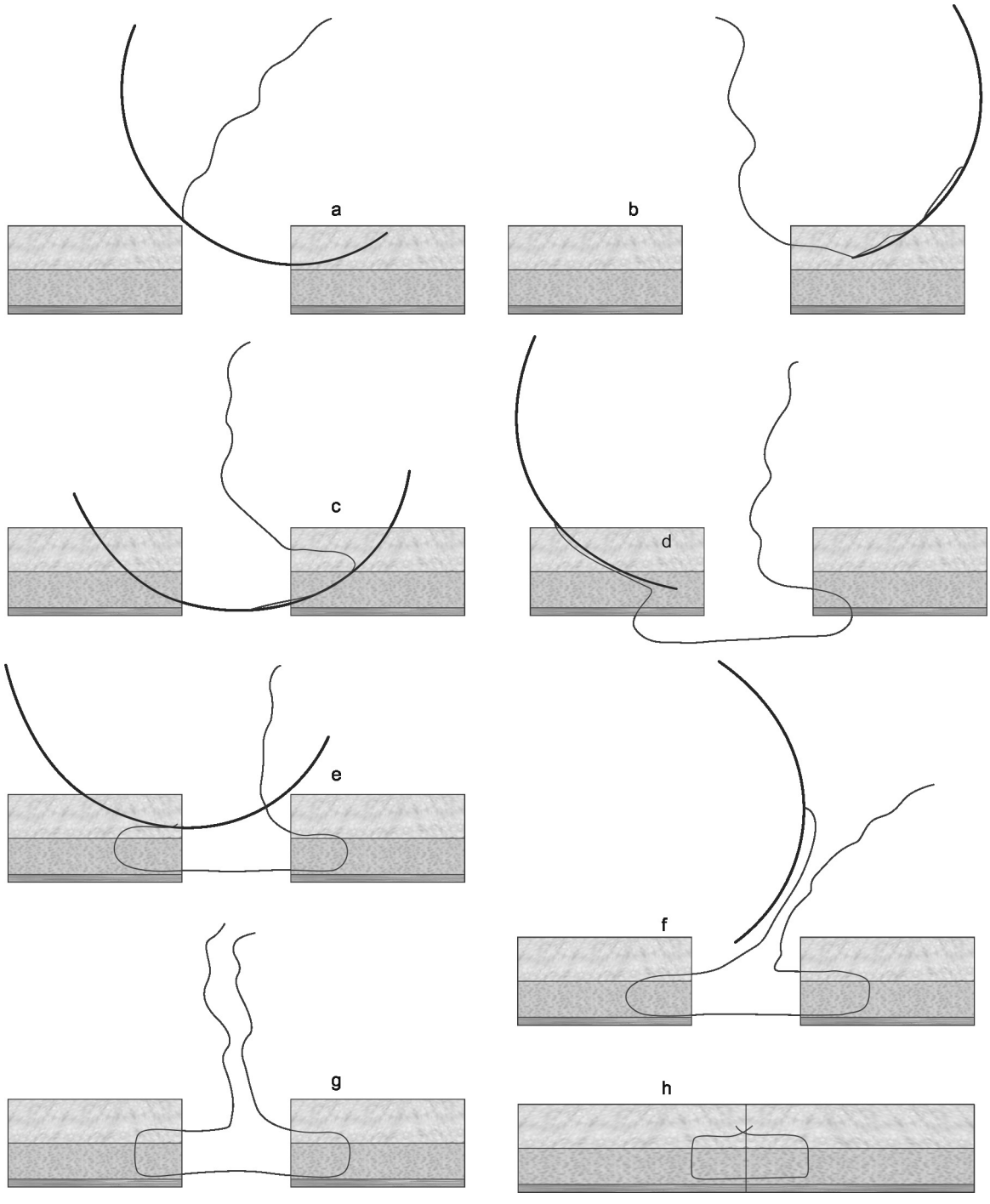
Shah[20] reported the use of skin hooks at the edges of 10 mm and 12 mm ports in laparoscopic upper and lower gastrointestinal surgeries. The skin hooks taut the edges of the skin wound, giving better visualization for suturing

the defect under vision (Fig. 4). They report the use of this technique in over 12 laparoscopic procedures over 7 years without a single port-site hernia.

Fig. 2: Lasheen needle. It is a curved needle; its length ranges from 10 to 15 cm. It has two sharp pointed ends and a hole at the middle of its length, through which the thread (No. 0 Vicryl) is passed.

Carter–Thomason Needle-point Suture Passer[21]

The Carter–Thomason needle-point suture passer functions as both a needle and a grasper, which allows for performing laparoscopic directed fascial and peritoneal closure. It uses a 2.7 mm diameter grasping tool with a single-action jaw. The device introduces the suture through the muscle, fascia, and peritoneal layers under direct laparoscopic vision drop the suture pick it up at the opposite side of the opening and are withdrawn grasping the suture (Fig. 5). The surgeon completes the mass closure of the layers by tying the suture below the skin.



Fig, 3: Steps of lasheen needle closure technique.

Pneumoperitoneum is maintained. The closed peritoneal layer is viewed through the laparoscope, and palpation of the closure ensures that the fascial layer is completely occluded. The author reports the use of this technique in more than 200 advanced laparoscopic techniques without a single case of port-site hernia. And also been introduced, that is Carter–Thomason II, which offers better and faster closure (Fig. 6). It has a 15 mm and 10 mm suture guides and a suture passer. The suture passer useful in obese patients.

Endo Close Instrument[22]

Del Junco M published a study, where the efficacy of WECK EFx™ Endo Fascial Closure System (EFx) (Fig. 7) was compared with the Carter–Thomason CloseSure System® (CT) for the closure of laparoscopic trocar site defects created by a 12 mm dilating trocar. Weck EFx is a fascial closure system where an absorbable suture is passed in the suture retrieval system once it is introduced in the port-site and deployed with the wings which lock in the abdominal wall. The sutures are fully inserted into the guide channels and locked. The retriever is then removed and the same process continued on the other side. The wing shield is the collapsed once the slide lock is repositioned and the device removed from the defect. Both the ends of the suture are then tied, and the knot buries deep in the fascial layer. This study was performed in cadavers and reportedly better results were obtained with EFx than CT in terms of time needed for closure, safety, and facility.

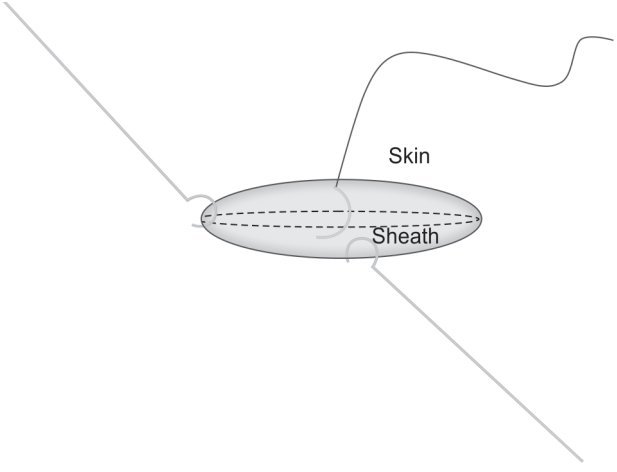


Fig. 4: Skin hooks taut the sheath and facilitate easy passage of sutures

Fig. 6: Carter–Thomason II port-site closure device is an improved version of the carter

Veress Needle for Port-site Closure[23]

Kotakala and Mishra conducted a retrospective study of 500 patients who underwent various Laparoscopic procedures from 2006–2015 in which the port-sites of 10 mm or greater were closed with a novel technique using only the veress needle. A loop is created with a suture thread in the cannula of veress needle through and through the whole length of the cannula. Another suture, which will be used to close the port-site, is introduced in the tip of the cannula for about 2 cm and held in place with a finger. This Veress is now passed from the external skin wound of the port-site and the suture left in the abdomen under the vision of the laparoscope. The Veress is removed and introduced through the other edge of the wound, and the fascial insertion site is about 2 cm lateral to the previous Veress insertion.

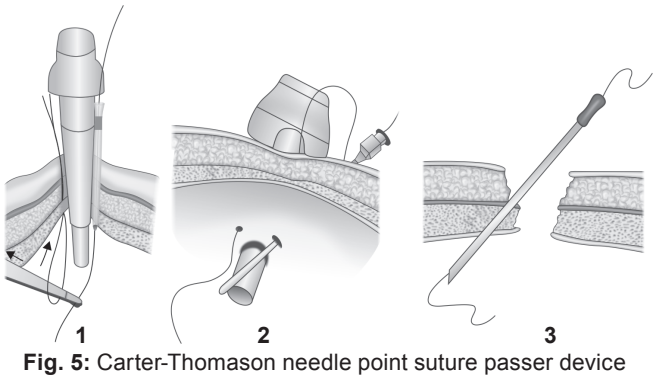


Fig. 5: Carter-Thomason needle point suture passer device

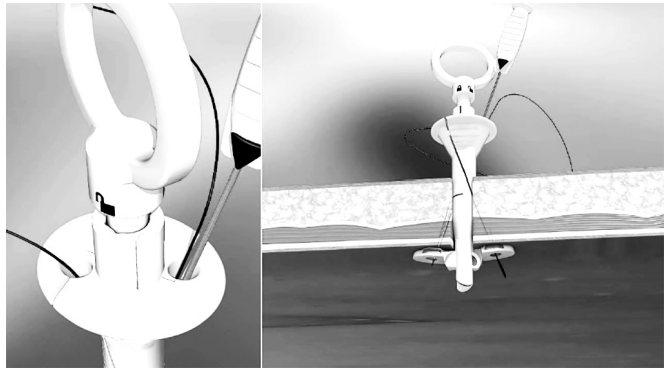


Fig. 7: WECK EFx™ Endo Fascial Closure System (EFx)

The suture end is held in the loop of the thread which is in the Veress and is pulled out through the skin incision and tied externally under vision. They report no incidence of port-site hernia or any other complications.

Maciol Suture Needle Set

Contarini[24] used these needles (Fig. 8). This is a set of three needles, two black handled introducers, one curved and one straight and a golden retriever. The introducer needle passes the suture into the peritoneal cavity from the subcutaneous tissue. The retriever needle (with a barb) is then passed into the peritoneal cavity on the opposite side of the defect to retrieve the suture and then pulled back through the tissue. This procedure is performed under the telescopic visualization before trocar withdrawal and does not require enlargement of skin incision.

Hypodermic Needles

Chung[25] used hypodermic needles as a conduit for threading the suture through the fascia. They reported used this technique in more than 150 patients without a single complication.

Five mm Trocar Technique

Chapman et al.[26] used the 5 mm telescope to inspect the defect from the inside of the abdomen and then a hemostat was passed through the incision. Under laparoscopic vision, the peritoneum and the rectus sheath are grasped and pulled through the incision and facilitates the passage of the needle.

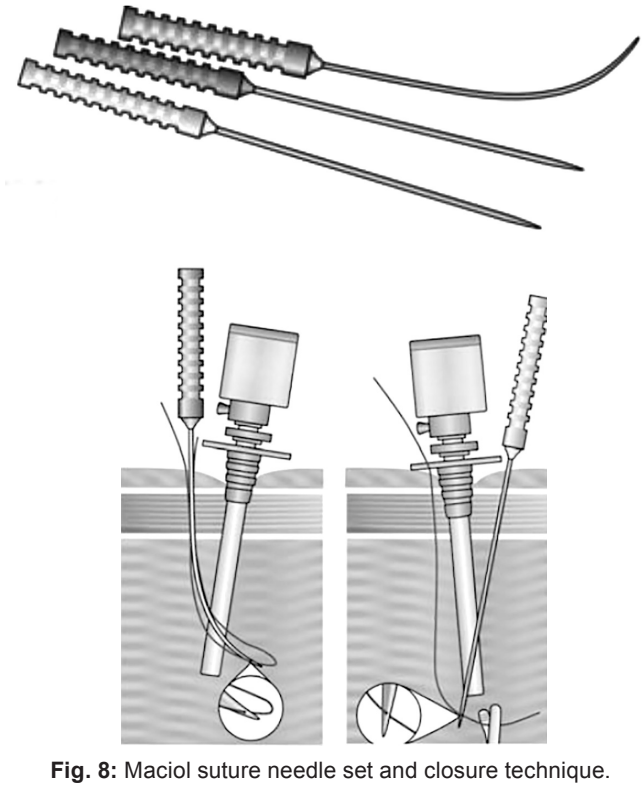


Fig. 8: Maciol suture needle set and closure technique.

Suture Carrier

Jorge et al.[27] and Li and Chung developed this carrier which made use of the vertical space. This is a hook suture carrier which is modified from a simple hook retractor which has an eye in the tip through which suture can be threaded (Fig. 9). The edge of the fascia is lifted vertically using a hook retractor, and the suture carrier is partially inserted to catch the peritoneum and fascia under direct vision, piercing it from the lower surface. The 0-polypropylene suture is then fed into the eye of the carrier and brought beneath the fascia. The suture is then passed from the edge of the opposite end of the wound with the carrier and takes a stitch from inside to outside. After that, a knot is tied on the surface of the port-wound.

Using 2 S Retractors

Homayara Haque[28] used 2 S retractors for suture placement at a port-site under direct visualization. In this technique, one S retractor was introduced into the peritoneal cavity and supports the abdominal wall (Fig. 10). Second S retractor retracts the skin, fat, and muscle in the opposite direction exposing the fascia. A needle-suture is then used to take a bite in the fascia, and this process is repeated in the opposite edge of the wound using the same needle-suture. The two ends are tied and fascia is closed. They reported the use of this technique in 100 patients with no complications during a mean follow-up of 6 weeks and a 12-month annual follow-up.

Lasheen looped needle

Lasheen et al.[29] used two looped needles for laparoscopic port closure (Fig. 11). First looped needle and slowly absorbable suture no. 0 (braided coated glycolide homopolymer violet) inside it are passed through the skin about 2 cm from one side of the trocar site and appears from the abdominal cavity. The second

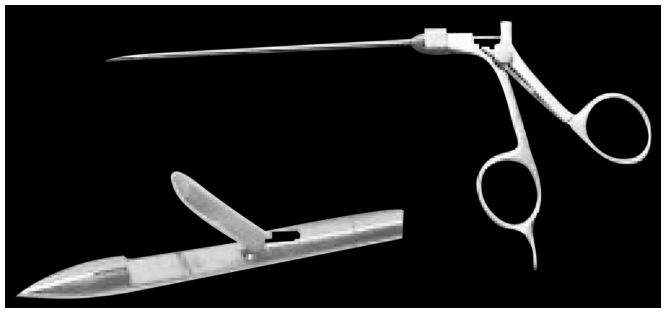


Fig. 9: Single jaw action suture carrier

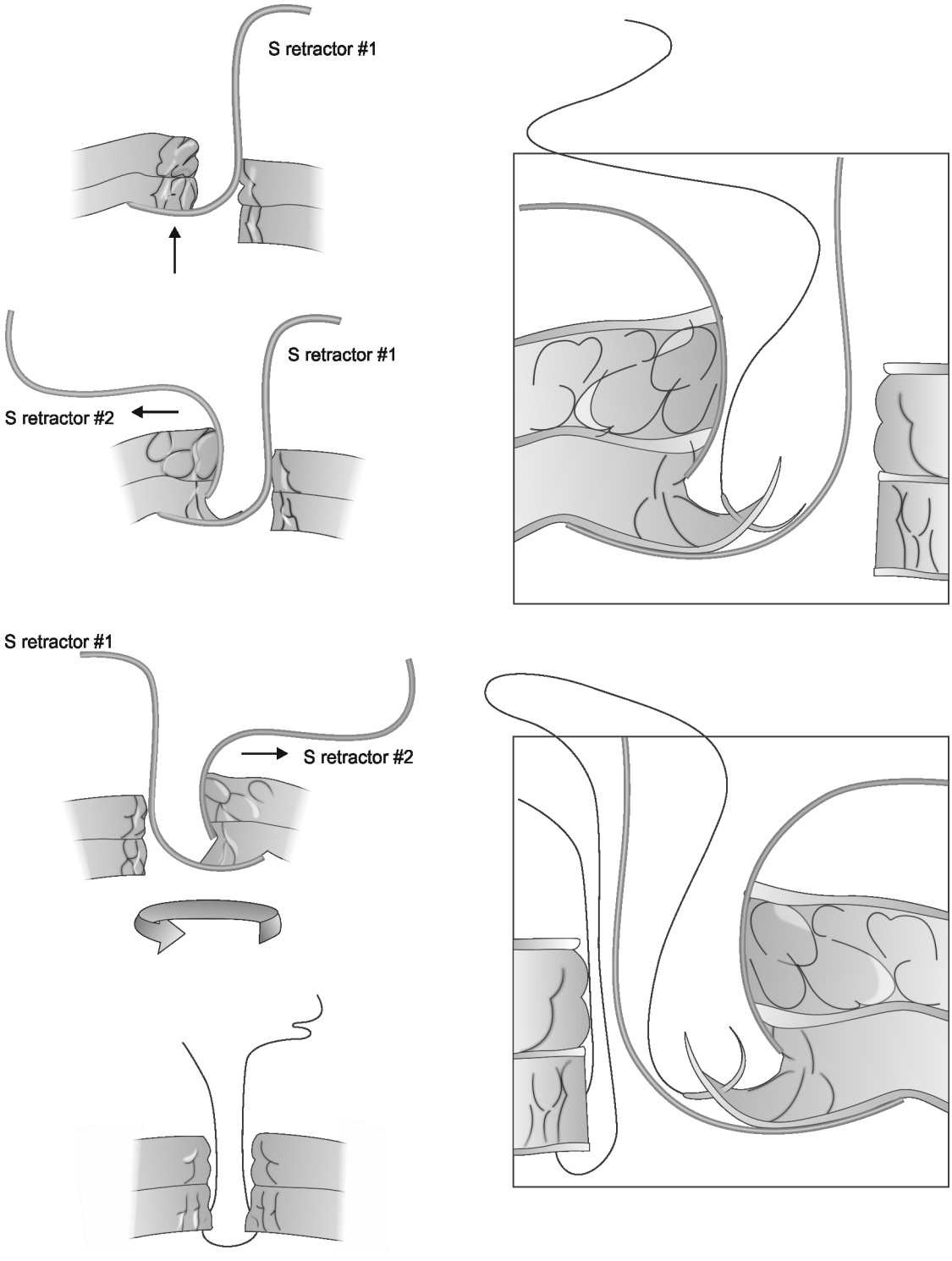


Fig. 10: Technique using 2 S-retractors for suture placement underdirect visualization to secure the abdominal wall fascia and peritoneum

looped needle then passes through the skin about 2 cm from another side of the trocar site to appear from the abdominal cavity. Then, the thread end from the first needle is fed into the loop of the second needle and the stent withdraws to hold the thread end inside the needle. The stent of the first needle is pushed to make the thread free through the loop (Fig. 12). Then, both needles with thread are withdrawn until the needle tips appear at the subcutaneous plane. The trocar sheath is removed, and both needles are redirected and pushed through the subcutaneous plane to bring the two ends of thread at the port wound. Both thread ends are detached from the looped needles and held by tissue forceps and tied after removal of the laparoscopic port. They reported the use of this technique in 87 patients of laparoscopic cholecystectomy and no port-site hernias were reported during a mean to follow-up of 18 months.

Port Plug

A bioabsorbable hernia plug (Fig. 13) is used in the trocar site with the help if bioabsorbable hernia plug device. Moreno et al.[30] used this technique in a pilot study on 17 patients undergoing laparoscopic surgery. The mean follow-up was 14.6 months, and no complications were reported. Different methods of placement of the hernia plug are show in Figures 14 and 15.

DISCUSSION

Meticulous closure of laparoscopic ports is pertinent to prevent the occurrence of port-site incisional hernia, incorporation of bowel in port-site closures, and their complications. Inadequate suturing of the fascial defect, infection, or suture disruption may lead to an incisional hernia or ascitic fluid leakage in the case of patients with cirrhosis.

The incidence of port-site hernia has been reported at about 0.23% at the 10 mm port-site, 1.9% at the 12 mm port-site. Most of the studies have reported hernias in port size 10 mm or higher.[31,32] The 5 mm port has shown a very low incidence of port-site hernias.

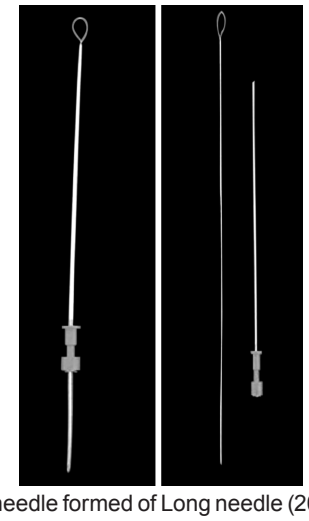


Fig. 11: Looped needle formed of Long needle (20 cm outer sheath) and metal stent (25 cm put inside the outer sheath needle) has large loop (plastic wire).

Classification

Port-site hernias can be classified into:

- *Early o*nset: occurring within 2 weeks of surgery with dehiscence of fascial planes and peritoneum. These present most commonly with small bowel obstruction.
- *Late-onset:* Occurring after 2 weeks with dehiscence of the fascial plane with intact peritoneal hernia sac. Around 12.50% of these present with intestinal obstruction.
- *Special:* Which presents with dehiscence of the whole abdominal wall.[33]

Port-site Hernia Pathogenesis

Various factors play a role in the pathogenesis of a port-site hernia:

- *Large trocar size:* Trocar size and access technique used can affect the rate of hernia formation. Port-site hernia is related to more complex procedures that require

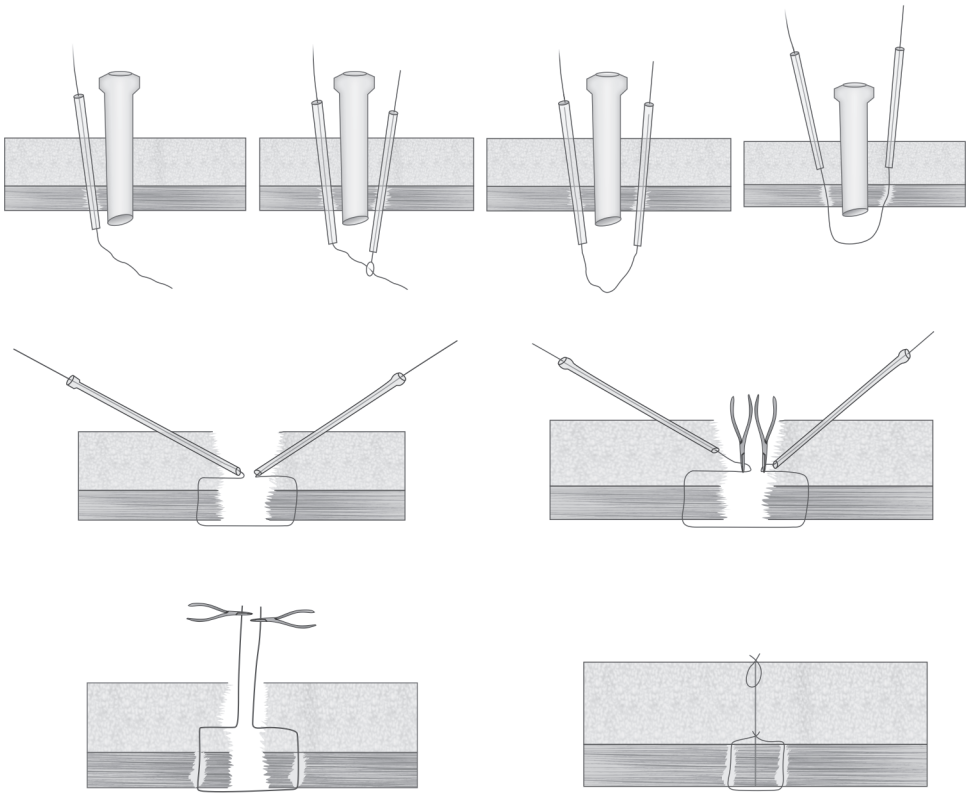


Fig. 12: Steps of closure using the looped needle

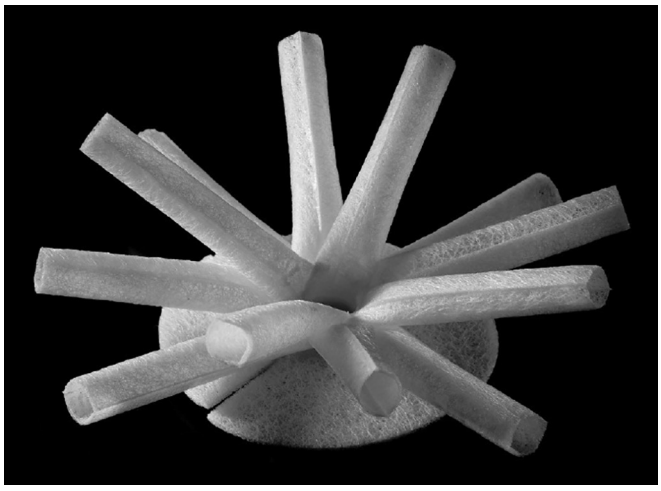


Fig. 13: Bioabsorbable hernia plug

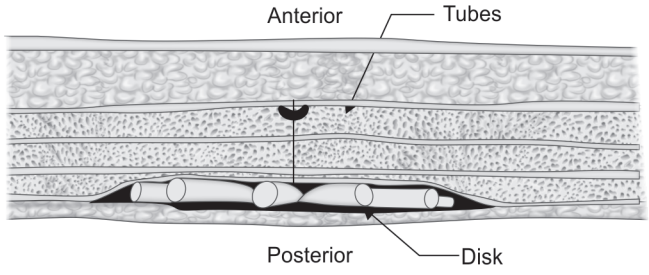


Fig. 15: Placement method 2 of bioabsorbable hernia plug –The disk and tubes are placed against the posterior wall of the defect. The defect can be closed with sutures. Care should be taken to ensure that the disk is placed flat

multiple ancillary ports and larger diameter ports used for specimen removal and stapling device.[34]

- Single-incision surgeries have an increased risk of hernia development than multi-port laparoscopy[35] probably because they rely on a larger port.
- The use of port devices designed to minimize the leakage of insufflated air like fascial screws also contributes in increasing the size of the incision and may also lead to facial tissue damage, thereby increasing the risk for a port-site hernia.
- Incomplete closure of fascia at the trocar site.
- *Midline trocars:* Uumbilical sites are more common.[36,37] In a survey American Association of Gynecologic Laparoscopists reported that an umbilical hernia was the most common which was 75.70% and lateral hernias were reported at 23.70% of 152 trocar site hernias.[38]
- Trocar site hernia incidence was higher in closed laparoscopy (Veress needle technique).[39]
- Stretching of the port-site for retrieval might lead to an extension of the fascial defect and can be a significant risk factor.[40]
- The partial vacuum created while withdrawing the port may draw the omentum and the intestines into the fascial defect.
- Although not statistically significant, higher body mass index was related to higher trocar site hernias in one study.[41]

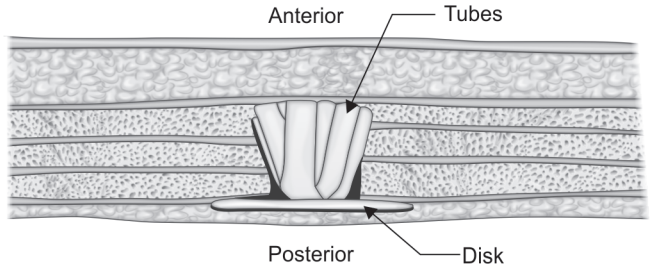


Fig. 14: Placement method 1 of bioabsorbable hernia plug–The disk is placed against the posterior wall of the defect and tubes fill the void space of the defect. It has to be ensured that the disk is placed flat

- In patients with morbid obesity, the risk of preperitoneal hernias was higher because of the thicker preperitoneal space and raised intra-abdominal pressure.[42]
- Postoperative port-site wound infection is one important factor predisposing to the development of port-site hernia.[43]
- Trocar type is also important in the development of port-site hernia. Blunt (conical, pyramidal, radially dilating, nonbladed) have been shown to produce reduced length and surface area of fascial defects over bladed or cutting trocars in animal studies with muscle splitting instead of cutting.[44,45]
- Extensive manipulation of the trocar site may lead to the widening of the port-site incision. Fascial and peritoneal stretching seen in specimen removal, multiple re-insertions of the port, higher surgical difficulty leading to increased torque and force on the fascia and prolonged operative time.
- Pre-existing fascial defects–It was found in a study by Ramachandran that 18%, of the 2100 patients undergoing laparoscopic procedures, had pre-existing umbilical fascial defects. These defects were repaired, and no relation was found between pre-existing fascial defects and development of a hernia. In contrast, in a report on 1300 laparoscopic cholecystectomies, Azurin[46] reported that 9 out of 10 port-site hernias developed in patients who had been diagnosed with a pre-existing hernia preoperatively, despite intraoperative repair. These patients had umbilical closure with figure-of-eight polyglycolic acid sutures. When a hernia was symptomatic or identified preoperatively, it was repaired at the time of surgery with nonabsorbable, interrupted sutures. Hence the trocar sites of pre-existing hernias must be carefully examined to confirm adequate closure.

The Advantage of One Entry and Closure Technique Over Other

A Cochrane review from 2008 that evaluated different entry techniques reported no advantage in using any single technique over another to prevent major complications.[47]

They did not report data relating to laparoscopic trocar hernias.

One randomized trial conducted an intraoperative evaluation of laparoscopic closure techniques. Elashry et al.[48] studied the closure of 95 twelve-mm trocar port-sites in 32 patients and compared the Carter-Thomason (CT-NP) needlepoint suture device (CooperSurgical, Inc, Trumbull, CT) with the Maciol suture needle set (Specialty Surgical Instrumentation, Nashville, TN), eXit disposable puncture closure device (Progressive Medical, St. Louis, MO), the Endoclose device (Covidien Surgical, Norwalk, CT), a 14-gauge angiocatheter, Lowsley retractor (CS Surgical Inc, Slidell, LA) with hand-sutured closure, and standard hand-sutured closure. They found that the CT-NP device was faster (mean time 2.5 minutes) and had secure closure confirmed digitally and endoscopically. They, however, did not follow their patients for hernia development. This study was underpowered, and hence no definitive conclusions could be made about the benefit of one closure type over another in hernia development.

Patient Presentation

The incidence can be said to be underestimated, as the patients present only if they are symptomatic. The real incidence, however, can be established only if an abdominal CT-scan will be done for each patient operated with a laparoscopic approach, which is overburdening to the patient as well as the health-care system. The usual hernia contents are omentum and to a lesser degree, small bowel.

Richter's hernia occurs when a part of the bowel wall that is the antimesenteric border, herniates through the port-site. The incidence of Richter's hernia was about 47.50% in early onset hernias in one study and they typically present with nausea, vomiting, pain and abdominal distention.[33] Computed tomography and gastrointestinal contrast studies have been used to aid the diagnosis of trocar site hernias.[49]

Whether to Close or Not

A study by Singal et al.[50] a total of 200 non-obese patients, who were posted for various laparoscopic procedures, were prospectively studied. They were divided into two groups and with group A receiving only skin closure without fascial closure and group B receiving both fascial and skin closure, of the 10 mm port. The 5 mm ports were closed only with skin closure. They found no significant difference between the groups in terms of port-site hernia, bleeding and infection rates. Blunt 10 mm trocars were used in all the patients. Bladeless trocars have been shown to atraumatic, and they split, rather than cut the muscle fibers upon entry.[51] Liu used non-bladed trocars and concluded that it helps in the creation of ports with the smallest dissection without bleeding or cutting the muscle fibers.[52] This splitting of abdominal wall musculature by trocar allows the surgeon to forego closure of small fascial defects. Bladeless 12 mm visual entry trocars have also been shown to produce no intraoperative bowel or vascular injuries, no mortality and extremely low rate of trocar site hernia of 0.2%.[53] Single-incision laparoscopic surgeries are finding greater acceptance among the surgeons and patients due to better cosmetic outcomes. These depend heavily on the 12 mm ports, for visualization and instrumentation. A study suggests that single incision laparoscopic surgery has a higher incidence of port-site hernia when compared to conventional laparoscopy.[54] Studies have also shown a higher incidence of port-site hernia in cases of single incision robotic procedures.[55]

With the multitude of port entry and closure techniques, it will be an uphill task for the surgeon to familiarize with all the techniques. Every entry technique comes with its own set of advantages and disadvantages. Similarly, the closure techniques also have their pros and cons. It is prudent on the part of the surgeon to decide upon the preferred technique. The bladeless, blunt and radially dilating trocars have been proven to be superior in various studies.[51-53]

All the 10 mm and 12 mm ports should ideally be closed otherwise the morbidity associated with the port site hernia will adversely affect the expected benefits of the intended minimally invasive surgery.

Regarding the port closure, the authors would like to present a few recommendations, after reviewing various articles on entry and closure techniques, which would help to minimize the risk of port site hernia development.

- Obese patients pose a problem due to the thickness of the abdominal wall and long needle carriers may be needed to secure proper closure.[19]
- Ports which are 10 mm and higher, either midline or lateral, must be closed at the level of fascia.[29,56]
- The use of minimal necessary ports. Neudecker et al. had shown that port site complications were increased with increased number of ports.[56]
- Port closure should incorporate both fascia and peritoneum.[56]
- The 5 mm ports may generally be closed at skin level but in case of enlargement of the fascial and/or peritoneal defect during the surgery, mostly due to more time-consuming procedures or those which require extensive manipulation must be closed at fascial level too.[57]
- The midline port sites in all patients must be closed using standard methods through the skin wound particularly if it is enlarged due to tissue retrieval.[58]

- It would be advisable to view the abdominal side of each wound, wherever possible, during fascial closure via the laparoscope.[62]
- Use of excessive torque or levering must be avoided as this may lead to enlargement of the fascial defect.[60]
- Trocar insertion in an oblique fashion or a Z-tract may reduce hernia formation by putting the external and internal defects at different levels.[63]
- Percutaneous surgical system use in place of a standard port is advisable if the port is being used only for minimal instrumentation.[64]
- Use the smallest diameter ports necessary.[65]
- Desufflate the abdomen carefully while port removal as the escaping CO2 tends to draw the omentum and bowel into the port site. This is called chimney effect. This can also be seen during specimen removal.[62,66]
- Ideally, the 5 mm ports must be removed under the vision of the laparoscope to prevent the chimney effect.[62,66,67]
- The abdomen can be shaken before removal of the ports to dislodge any omentum por bowel adherent to the port sites.
- Palpate the abdomen before closure to identify any unrecognized or preexisting hernial defects that may require repair.
- Presence of incidental paraumbilical or umbilical hernias necessitates enlarging the incision and performing a formal umbilical herniorrhaphy and a patch may sometimes be required.[64]

CONCLUSION

Port closure is one of the most pertinent steps of a minimal access surgery and closure has to be achieved in all the ports which are 10 mm or greater. Care must be taken to inspect the 5 mm ports and closure achieved in case where excessive leverage or torque has come into play. Any of the abovementioned port closure methods may be utilized. The ideal technique in the view of the authors are those that are inexpensive, require minimal additional instruments, require minimum skill, are easy to learn, can produce reproducible results and most importantly, must produce minimal to no port site hernia. The classical suture passer, veress needle or their basic modifications might come close to the ideal port closure technique.

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CASE REPORT

A Rare Case of Falciform Ligament Abscess with Unknown Etiology

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ABSTRACT

The incidence of a falciform ligament is very rare. Because of the rarity of the condition and sparsity of available literature, it's very difficult to diagnose this condition preoperatively. In this case, a 65-year-old lady had presented with pain in epigastrium and vomitings for 3 days. All blood investigations were normal except serum Alkaline phosphatase (ALP) and serum gamma-glutamyl transferase (GGT) which were 141 IU/L and 275 U/L respectively. USG revealed only chronic cholecystitis. On diagnostic laparoscopy, falciform ligament abscess was detected which was adequately drained. The patient responded well with the drainage without recurrence till date. Laparoscopic cholecystectomy was also done in the same sitting.

Keywords: Cholecystitis, Diagnostic laparoscopy, Falciform ligament abscess.

List of Used Abbreviations: ALP–Alkaline phosphatase, CECT–Contrast enhanced computed tomography, DNB–Diplomates of national board, ECG–Electrocardiography, GGT–Gamma-glutamyl transferase, PAC–Pre-anesthetic clearance, RBS–Random blood sugar, SGOT–Serum glutamic oxaloacetic transaminase, SGPT–Serum glutamic-pyruvic transaminase, USG–Ultrasonography

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Conflict of interest: None

INTRODUCTION

The falciform ligament helps in holding the liver in place by attaching it to the anterior abdominal wall. It is composed of two layers of peritoneum closely united together which might provide potential space for infection. Its free edge contains the round ligament (ligamentum teres) and the paraumbilical veins between its layers. This sickle-shaped ligament (Latin-falciform means sickle) is remnant of the fetal umbilical vein and derivative of the embryonic ventral mesentery.

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The incidence of the falciform ligament is very rare. Only a few cases have been reported till date. The pathophysiology of abscess formation in falciform ligament is not very well understood. Preoperatively diagnosis of this condition is difficult. A case of falciform ligament abscess misdiagnosed as acute cholecystitis in our hospital is reported here.

Clinical Case Presentation

A female patient aged 65 years admitted in Mata Chanan Devi hospital with a complaint of pain in epigastrium and vomitings for 2 to 3 days.

The pain was severe, sudden in onset, constant, radiating to back and not related to the meal—no previous history of such type of pain. There was no history of fever, jaundice, breathing difficulty or any trauma to chest and abdomen. There was no history of surgery in the past. The patient was nonalcoholic and not a diabetic or hypertensive and had no other major illnesses.

The patient was afebrile, pulse rate was 82/minute and blood pressure was 118/74 mm of Hg. The abdomen was tender in the epigastrium and right hypochondrium. There was no palpable mass. As per history and clinical examination, a provisional diagnosis of acute cholecystitis was made.

Complete blood count, RBS, serum electrolytes, urea, creatinine, amylase, lipase, bilirubin, SGOT, SGPT, chest X-ray, ECG were normal. Serum ALP was mildly raised(141 IU/L) GGT was raised (275 U/L). USG findings were suggestive of chronic cholecystitis with cholelithiasis.

Provision diagnosis of acute cholecystitis was made while USG findings were not in favor. After PAC patient underwent diagnostic laparoscopy. On operation, the falciform ligament was bulging and was firm in consistency (Fig. 1). On aspiration, the purulent material came out (Fig. 2). All purulent material was drained by giving a cruciate incision and wound was irrigated adequately with normal saline (Fig. 3). Laparoscopic cholecystectomy was done. HPE confirmed the diagnosis of chronic cholecystitis with cholelithiasis. The patient responded well. She was discharged on after 2 days. The patient was followed up for 60 days. There were no symptoms suggestive of recurrence.

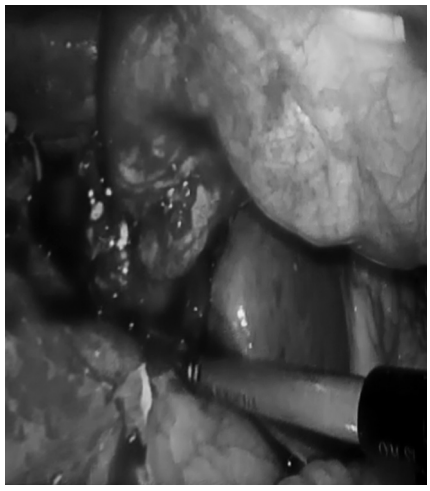

Fig. 1: Intraoperative image showing bulging falciform ligament

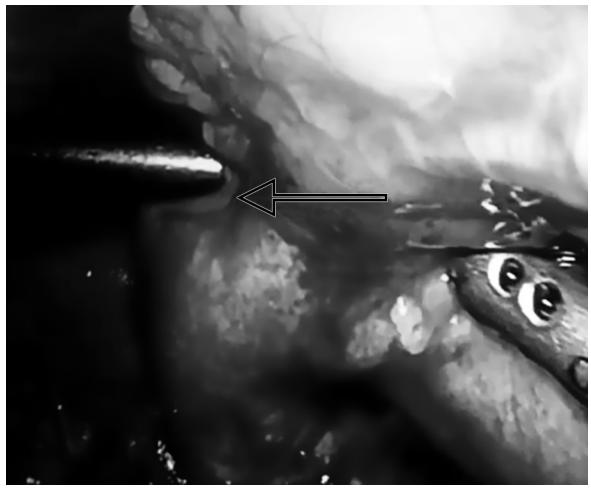

Fig. 2: Intraoperative image showing purulent material on aspiration

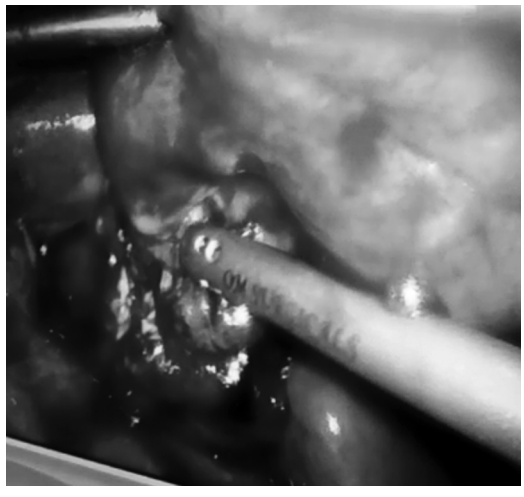

Fig. 3: Intraoperative image showing cruciate shaped incision was given

DISCUSSION

Surgical lesions of the falciform ligament are rare. Clinically, they present most often as a cystic abdominal mass and less often as an abscess.[1] Very few cases of this condition have been reported worldwide. One such case was reported in the patient suspected of acute cholecystitis clinically, but computed tomography revealed a cylindrical mass in the anterior abdomen with the possibility of a hepatic abscess. On laparoscopy, falciform ligament abscess was found. It was drained at the same time. After two months there was a recurrence of the abscess of falciform ligament secondary to acute calculous cholecystitis.[2] Other few cases of this condition have been reported in the setting of rupture of the gangrenous gallbladder,[3] portal pyemias,[4,5] post omphalitis,[6,7] post pancreatitis,[8] and infected ventriculoperitoneal shunt.[9] There is one case of an isolated falciform ligament necrosis presenting as acute abdomen has also been reported.[10,11]

Accurate preoperative diagnosis of falciform ligament abscess could not be made in cases as reported in the literature. Since exact etiopathology is still poorly understood, a strong index of suspicion is needed for early diagnosis and management of this condition. It has been observed that infection can extend from liver, gallbladder or umbilicus to the falciform ligament.[2-6] Though in this case it was found that gallbladder was not acutely inflamed and no infective lesion was present in the abdominal cavity. Here, relationship with chronic cholecystitis could not be established. In previously reported cases treatment with percutaneous drainage and antibiotics was tried but resulted in recurrence.[2-6] This might be explained by the scarcity of the vascular network inside the ligamentous structure that hampers exposure to the circulation of antibiotics.[6] So percutaneous drainage is not a preferred treatment option for this condition.

CONCLUSION

A high index of suspicion is needed to diagnose this condition. Typically it presents with pain in the epigastrium or right hypochondrium, with or without fever, leucocytosis and palpable abdominal mass. USG is not

much useful. CECT may help in reaching to the diagnosis. Diagnostic laparoscopy is an investigation of choice. It is diagnostic as well as therapeutic for this condition. Though percutaneous drainage of falciform ligament abscess was tried in few cases, patients had a recurrence in all the cases. But laparoscopic abscess drainage and debridement of the falciform ligament with post operative antibiotic coverage are sufficient to treat this condition.

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CASE REPORT

Vesicouterine Fistula Laparascopic Repair: A Case Report

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ABSTRACT

Vesicouterine fistula (VUF) is a rare variety of female genito-urinary fistula. It comprises 1–4% of all urogenital fistulas. Most of these fistulas are due to complications of the lower segment cesarean section (LSCS). The incidence of this fistula is increasing all over the world because of the increasing prevalence of cesarean section. Patients may present with urinary incontinence, hematuria, cyclic menouria, amenorrhea and also first trimester abortions. Two early diagnosis and repair of VUF has become the need of the hour. Different approaches for surgical repair of VUF include transabdominal (including transvesical and transperitoneal); transvaginal approach; laparoscopic and robotic. Laparoscopic VUF repair results in reduced patient morbidity and shorter hospital stay without compromising the results. So laparoscopic repair may be a more attractive treatment option for patients with postcesarean VUF.

Keywords: Cyclic menouria, Laparoscopic approach, Vesicouterine fistula.

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Introduction

Vesicouterine fistula (VUF), an abnormal communication between bladder and uterus; is a rare variety of urogenital fistula. It occurs mostly due to iatrogenic causes, most common being cesarean section done in cases of obstructed labor.[1] Excessive bleeding during cesarean section or inadequate bladder dissection may also add on to the etiology of vesicouterine fistula being formed. The incidence of vesicouterine fistula being 1–4% is currently on the rise due to the rise in cesarean section rates worldwide. Patients may present with urinary incontinence, hematuria, cyclic menouria, amenorrhea and also first trimester abortions.[2] Early diagnosis and repair of VUF has become the need of the hour.

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CASE PRESENTATION

A 31-year-old P2L[2] female presented to gynae outpatient department (OPD) with complaints of passing of blood in urine since last 20 days and watery discharge per vaginum since then. She gave a history of cesarean section done at a district hospital in v/o non-progress of labor with h/o excessive bleeding during surgery. The patient was managed with uterotonics and blood transfusions. She had had a history of one previous normal vaginal delivery 8 years back. Since the last 20 days, she gave a history of hematuria and fever for which she was catheterized at a private hospital and also managed on iv antibiotics was then referred to the higher center for management. USG and Contrast MRI was done at our center which showed 1.7 cm vesicouterine fistula in the lower uterine segment with a urinary bladder full of blood clots (Figs 1 and 2).

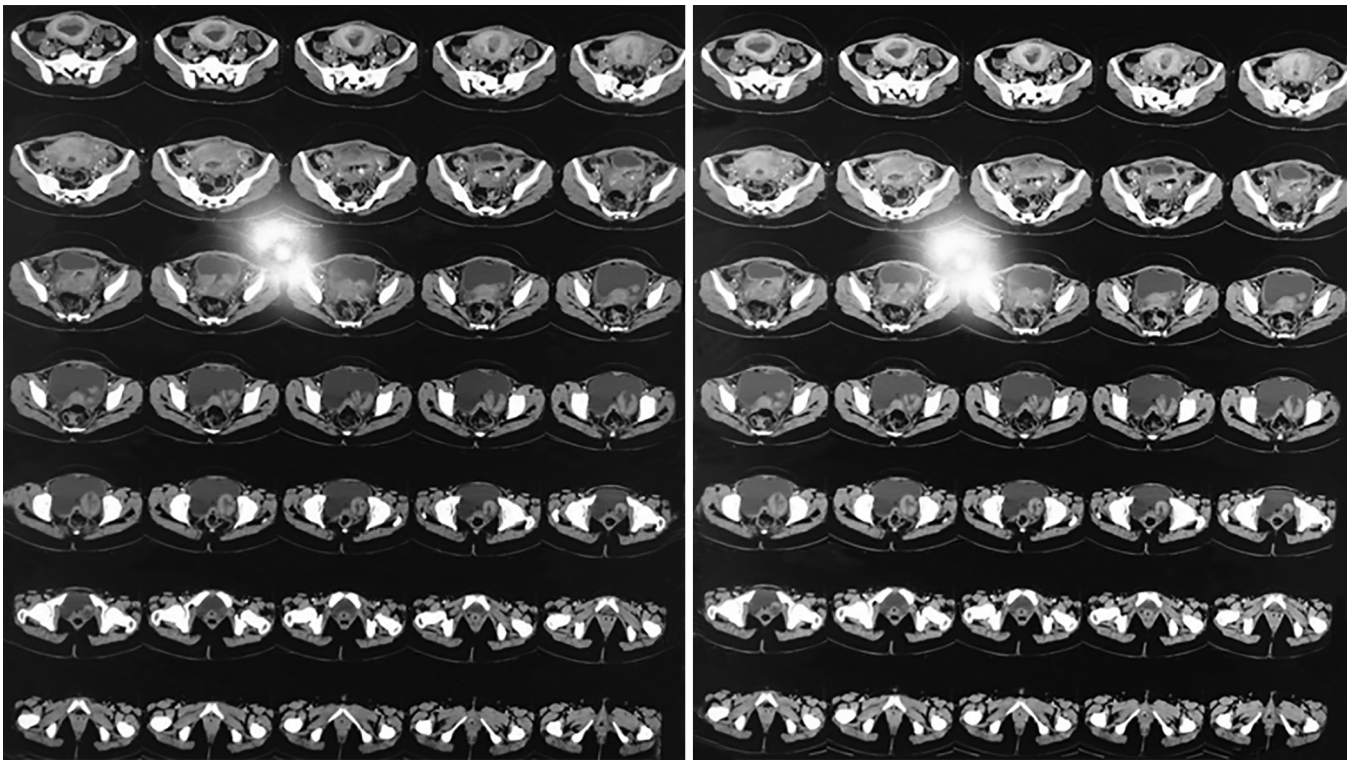
The patient was counseled and admitted for surgical repair. The decision for surgery was taken as the patient had persistent fever and hematuria. All relevant and necessary investigations and pre-anesthetic workup done. Under combined anesthesia, the fistulous tract was identified via cystoscopy, and the ureteric catheter was passed from the bladder into the uterine cavity coming out through cervix. Cystoscopy showed that the fistula was supratrigonal. Laparoscope introduced with two accessory ports. Adhesiolysis and cystotomy done (Figs 3 and 4).

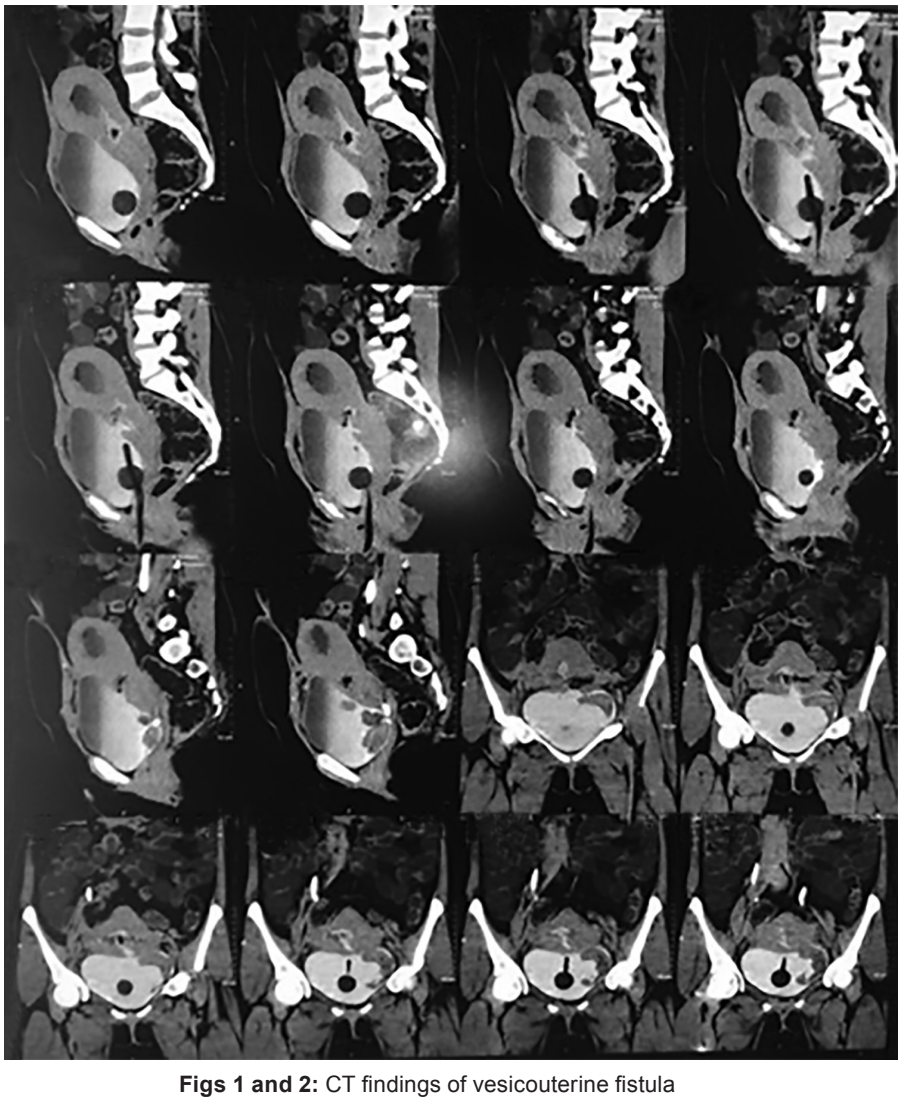
Placental tissues and membranes were found in the bladder (Fig. 5). Bladder repair was done in 2 layers. Also, the uterine defect was repaired in layers. The integrity of bladder repair was checked with the filling of the bladder with 200 mL of normal saline mixed with methylene blue (Figs 6 and 7).

Post-op period was uneventful. The patient was discharged with a catheter-in-situ. The patient was followed up after a month when her catheter was removed and ultrasound done again which showed no rent.

DISCUSSION

A VUF is a rare variety of urogynaecological fistula and a rare complication of second stage LSCS or cesarean increased blood loss or inappropriate bladder dissection. According to history, the first case of VUF was reported in 1908. Patients of VUF may present with urinary





Figs 1 and 2: CT findings of vesicouterine fistula

Fig. 3: Identification of fistulous tract

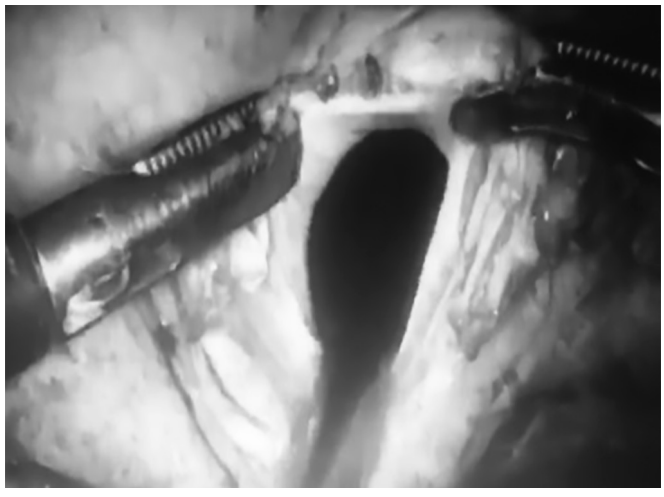


Fig. 4: Fistulous tract

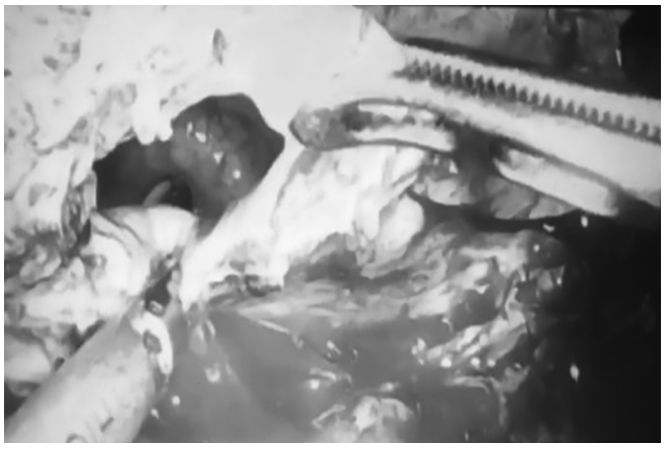


Fig. 5: Placenta and tissues found in bladder

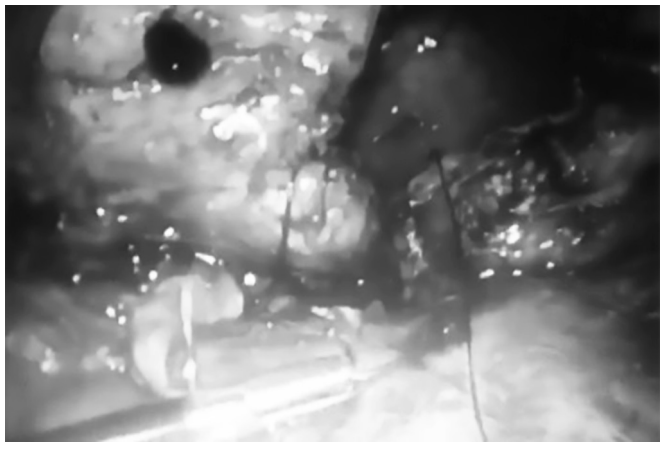


Fig. 6: Bladder repaired in 2 layers of vesicouterine fistula

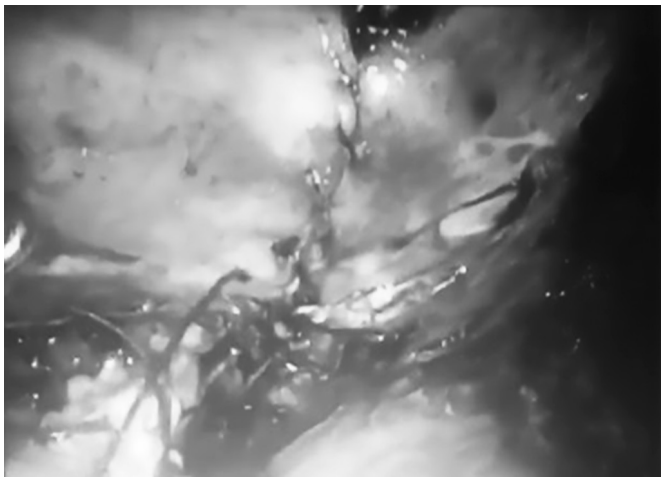


Fig. 7: Bladder after VUF repair

incontinence which may or may not be associated with hematuria; cyclic menouria, amenorrhea and also first trimester abortions. Depending upon menstrual flow VUF can be classified as type 1 with menouria, type 2 with menouria and vaginal flow, type 3-with normal vaginal menses. Most patients present early with post-operative complications. Some may present late with urinary incontinence; recurrent UTI, secondary infertility and amenorrhea. The variant of VUF associated with urinary continence is called Youssef syndrome in which uterine cervix become competent, and the opening of the fistulous tract is above the cervical OS.[3]

Diagnostic modalities include ultrasound, cystoscopy, cystography, and CT/MRI. Conservative management including continuous bladder drainage with antibiotics and anticholinergics is usually recommended if the patient is in the early postpartum phase or small fistulae. However success rates of conservative management being only 5%. Also, the usual recommendation is to delay surgery up to 3 months to allow spontaneous closure of fistula, involution of uterus likely rates of inflammation. Currently, successful VUF cases have been reported with early surgical management. Different approaches for surgical repair of VUF include vaginal approach, transvesical, transperitoneal, laparoscopic and robotic. Nowadays, modern minimally invasive techniques are stealing the show, and therefore laparoscopic repair of VUF has become popular. The laparoscopic technique of VUF repair offers advantages as quicker convalescence, shorter hospital stay and better

cosmetics with similar success rates to open surgery. The credit for better visualization and magnification also goes to the laparoscopic repair of VUF.

CONCLUSION

A vesicouterine fistula is an uncommon complication of second stage cesarean sections. Patients may present early or late with urinary incontinence, hematuria, cyclical menouria, amenorrhea. Diagnostic modalities being USG, CT/MRI, cystoscopy. Early and laparoscopic repair of VUF is advocated with advantages of quicker recovery, and a shorter hospital stay; less morbidity and better cosmesis for the patient.[4]

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News and Events

Convocation of New Members of World Association of Laparoscopic Surgeons on 14th February 2019 at Pacific Hotel, Gurugram, Haryana, India

List of Distinguished Life Members of World Association of Laparoscopic Surgeons

A Mohamad Sayed Ahmad Alfaki (Qatar)
A Yasemin Karageyim Karsidag (Turkey)
Abayneh Admassu Abayneh (Ethiopia)
Abdel Kato Sebbaale (Uganda)
Abdel Rahman Hassan Abu Sabei (Qatar)
Abdelhay Mohamed Ahmed Ali (Ireland)
Abdelmonim Bashir Yagoub Ali (Sudan)
Abdolmajid Ghaedizadeh (Iran)
Abdolreza Pazouki (Iran)
Abdul Haque Ansari (KSA)
Abdul Kareem Jabbar Ghadhban (Iraq)
Abdul Kato Sebbaale (Uganda)
Abdul Sattar Paigham (Afghanistan)
Abdullab Abdulwahid Salman (Iraq)
Abdullab Sh.AM (Kuwait)
Abel Alejandro Garibaldi (USA)
Abhijit Biswas (India)
Abhishek Kakkar (India)
Abi Sukrisno (Indonesia)
Abiye Hailu Gebre-Ab (Ethiopia)
AboulMahsen (Saudi Arabia)
Adeyeni Oladeji Laosebikan (Canada)
Aditomo Widarso (Indonesia)
Adnan Fatih Esen (Turkey)
Ah See Ng (Malaysia)
Ahmad Aurngzab (Pakistan)
Ahmad Chammat (Saudi Arabia)
Ahmad Nabil M Khafagy (Uganda)
Ahmed Abdul-Khalik Zahab (KSA)
Ahmed Alwan Kareem (Iraq)
Ahmed Eltigani E Hussain (Ireland)
Ahmed Fakhri Omer (Iraq)
Ahmet Batki (Turkey)
Ahmet Hamdy Dabash (KSA)
Ahmet Hulusi Teksen (Turkey)
Ahujakumar (India)
Ajay Padmakar Chodhary (India)
Alaa AK Mohammed (UAE)
Alaa Mohsin Mohammad (Iraq)
Alemseged Janka Dube (Ethiopia)
Alexandre MS Roque Ambrosio (Portugal)
Ali Mohammed Mahmnd (UAE)
Ali Raza Brohi (Pakistan)
Ali Riza Sozenoglu (Turkey)
Alice M Salvador (Philippines)
Alireza Khalaj (Iran)
Allah AK Mohammed (UAE)
Alparslan Baksu (Turkey)
AM Abdulrahman Al-Zakari (UAE)
Amaechi Francis Neozi (Nigeria)
Amani Ahmed Mohamed Ali (UAE)
Amardeep Singh Bansal (India)
Aminur Rahman (India)
Amir Abbas Manouchehri (Iran)
Amir Vejdan (Iran)
Amit Hindurao Sardesai (India)
Amru Sofian (Indonesia)
Anas Yousif Yakoob (India)
Andhra Narasimha Reddy (India)
Anisha Kellogg (India)
Anita Roy (India)
Anjali Kumar (India)
Anjila Yakalage Barreira Amaral (Portugal)
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Araz Asi Mahmud (Iraq)
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Archana Jain (India)
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Bhoopinder Jit Kaur (India)
Bhupesh Dayal (India)
Bhushan Kumar (India)
Bichhanda Krishna Mohanty (Botswana)
Bilal Mohid Baker (Jordan)
Billur Demiro Gullari (Turkey)
Birendra Kumar (India)
Brijesh Kumar Sharma (India)
Bulent Arici (Turkey)
Bulent Kars (Turkey)
Bulent Tekin (Turkey)
C Anthony Okonkwo (Nigeria)
Calderon Maria (Philippines)
Carlo Cajes Gurrea (Philippines)
Chandra Prakash Jain (India)
Chee Fah Chia (Taiwan)
Chetna Gulabani (India)
Chittapu Pardha Saradhi Rao (India)
Chittapu PSR Rauf (Republic of Maldives)
Christopher Ekwunife (Nigeria)
Cromwell HM Mwakirungu (Kenya)
Daljit Kaur Uppal (India)
Danish Javed (India)
David Kiragu (Kenya)
Deb Narayan Samanta (India)
Deepa Malhotra (India)
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Dharam Paul (India)
Dharmendra Prabhat Sing Parmar (India)
Dheeraj Mulchandani (India)
Dutta Siva Sankar (India)
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Duzgun Korkmaz (Turkey)
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Ekaterina Vasileva Kaloyanova (UAE)
Elif Meseci (Turkey)
Eman Mohammed kasim (Saudi Arabia)
Emel Turkoglu (Turkey)
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Eser Evrim Eren (Turkey)
Esra Esim Bugukhayrak (Turkey)
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Gulten Gurgan (Turkey)
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Hadi Touzandehjani (Iran)
Haider Abid Aun Ali Al Zubaidy (Iraq)
Haider Hasan (Iraq)
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Juvvadi Srilatha (India)
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Kamal Abdel Gadir Mohamed (KSA)
Kandung Bowoleksono (Indonesia)
Kazim Qiamuzzama (India)
Kesavakrishna Brundavanam (India)
Khalaj Aligeza (Iran)
Khalaz ARMD (Iran)
Khaled Ahmad Kayed (UAE)
Khalifa Ali Al Jabri (Oman)
Khalil Yahia Mohamad (UAE)
Kiran Noshar Mevawalla (India)
Kirana Bala Dash (India)
Kishore Kumar Satpathy (India)
Koka Sreedevi (India)
Koray Ozbay (Turkey)
Krishna Mohan (USA)
Kulwant Rai (India)
Kunigal A Shivakumar (UK)
Kushum Sharma (India)
Lale Wetherilt (Turkey)
Lameck Zimba (Zambia)
Lateefa Abdulla Al Naeemi (UAE)
Latifa R Al Buainain (Baharin)
Latitha Kamini (India)
Laurent Marcel Hochart (Canada)
Lawa Hussein Abdulla (Iraq)
Leo Francis Nuval Aquilizan (Philippines)
Leonie-Martha Okaraga (Nigeria)
Lilly Kutty Benny (India)
Liqaa Reyadh Al-Khuzaee (Iraq)
Lovina SM Machado (Oman)
Luset Ince Koparan (Turkey)
Ma Ana Capucao Pangan (Philippines)
Madhu Sinha (India)
Madhulika Sinha (India)
Madhuri Prakash (India)
Magdi Ahmed Lolah (Egypt)
Magdi Genawi Ali (Ireland)
Mahavir Prasad Beniwal (India)
Mahesh Kumar Thakur (India)
Mahesh Man Pradhan (Nepal)
Mahesh Mishra (India)
Mahesh Prasad Khakurel (Nepal)
Mahinda Amarasiri Mallawatantri (Nepal)
Mahmoud Fellah Jahromi (Iran)
Mahmoud Honarmand (Turkey)
Mahmud Aurangzeb (Pakistan)
Makkar Mulkh Raj (India)
Manawor Ahsan (India)
Manoj Sukanraj Jain (India)
Mansour Amin Mohammd Al (Saudi Arabia)
Manvita Mahajan (India)
Maria Louroes Baricaua Escobar (Philippines)
Maria Nellbvezz C Candelario (Philippines)
Marie Victoria Gantiago (Philippines)
Marlieg Meshki (Iran)
Mary Anne Que Villarin (Philippines)
Mebratu Gember Tegesn (Ethiopia)
Meet Verm (India)
Mehmet Baki Senturk (Turkey)
Mehmet Guler (Turkey)
Mehmet Kaplan (Turkey)
Melek Buyukkinaci (Turkey)
Melike Batukan (Istanbul)
Mete Isikoglu (Turkey)
Michael Emefiele Aziken (Nigeria)
Minakshi Mishra (India)
Mohadmmad Nadeem Aslam (Pakistan)
Mohadmmad Rahim Bhurgri (Pakistan)
Mohamad Sabri B Hassan (Malaysia)
Mohamed Abdul Adim Elgabroun (Libya)
Mohamed Ali Hegazy (Saudi Arabia)
Mohamed Yehia Khalil (Qatar)
Mohammad Nadeem Aslam (Pakistan)
Mohammad Zarin (Pakistan)
Mohammd Abdul (Saudi Arabia)
Mohammd Ahmed Abdulla Eltom (Sudan)
Mohammd Ahmed Bella (Saudi Arabia)
Mohammed Hasan Jaafar (Iraq)
Mohammed Hussain (Iraq)
Mohd Niyaz (India)
Mohd Shafi Niaku (India)
Mohd. Omar Almoghanam (Saudi Arabia)
Mohd. Shakir Huwaish Alkoubaisy (UAE)
Mohini Raghvendra Goswami (India)
Mohmoud M Abdulrazek (Egypt)
Mohsen Aminpour (Iran)
Mohsin Hayder Kassar (Yemen)
Mokhtar Ali Mohamed Hassan (UAE)
Monika (India)
Mrinal Param Kinkar (India)
Muftah Abdulla Suwan (Libya)
Muhammad Abdullah Hussein (Iraq)
Muna Ahmed Al-Shehhi (UAE)
Munevver Hosgor (Turkey)
Munir Ahmad Rathore (United Kingdom)
Munirathnasri Nagappa (India)
Munther Moh. Adnan halabi (Syria)
Murat Mehmet (Turkey)
Muraveva Natalia (Russia)
Mustafa Mohd. Ramdam Bulugma (Libya)
Mutasim suleiman Daffalla (Ireland)
Muthukumarassamy Rajakannu (India)
Nada Abidalhur Alebrahimi (Iraq)
Nadia Tarak Barakat (Iraq)
Nadire Sevda Idil (Turkey)
Naimaa Khatoon Chaudhary (India)
Naimaa Khatoon Chaudhary (India)
Nand Kishore Prasad Singh (India)
Nandan Krishana Mohan (India)
Narender Kumar Parasher (India)
Nargis Harbans Sinjagil (KSA)
Natalia Muraveva (UAE)
Nausheen Fatma Mawal (India)
Navaneethan Sivarajasingam (Sri Lanka)
Nayantara Bijral (India)
Nazek Habeeb Al Salman (UAE)
Nazik Salameh Amarin (Jordan)
Needet Sver (Turkey)
Neeko Inees Chiriyankandath (India)
Neelam Vinay (India)
Neerja Sharma (India)
Neriman Basak Baksu (Turkey)
Nermin Kosus (Turkey)
Nese Yucel (Turkey)
Nicola Deeb Farah (Israel)
Nidal Jalal Arafat (Jordan)
Nilgun Kustarci (Turkey)
Nishat Mustafa Khan (Saudi Arabia)
Njila Yakalage Barreira Amaral (Portugal)
Nocola Deeb Farah (Israel)
Norman Oneil Machado (Oman)
Nzayisenga Jean Baptiste (Zambia)
Obote Wilson Williams (Uganda)
Oktay Erdener (Turkey)
Okunweme Ohiosimuan (Nigeria)
Oladapo Sunday Sotiloye (Nigeria)
Omar Abd Daim (Syria)
Omar Birol Durukan (Turkey)
Omar Eltigani Ibrahim (Sudan)
Omer Abbas Ramzi (Sudan)
Omertalipturhan (Turkey)
Omkar Prasad Sisodia (India)
Osama Elsayed Ammar (Saudi Arabia)
Osama Saied Algohary (KSA)
Ozgur Dogan (Turkey)
Ozlem Ozgur Gursoy (Turkey)
Oznur Gokcen (Turkey)
Pablo A. Candelario (Philippines)