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EDITORIAL

As the Coronavirus (COVID-19) pandemic sweeps across the world, it causes widespread concern, fear, and stress to the patient who needs elective surgery. COVID-19 is spreading like an uncontrolled fire. Laparoscopic Surgeons are at the highest risk of contacting this virus. There is a particular need for protection in the operation theaters and proper management of gas due to pneumoperitoneum leaking with smoke viral DNA and carcinogens present in surgical smoke. The need to safeguard themselves and their patients has prompted the laparoscopic surgeons to develop their protocols to tide over the pandemic situation. Although there has been a shift of available resources from elective surgeries to the management of COVID-19 cases, specific surgical emergencies need immediate management. Amidst the corona crisis, surgeons have to take care of the issues and safeguards associated with laparoscopic surgery.

Higher concentrations of particulate matter laparoscopic surgery produces more particulate matter than open surgery, increasing the risk of viral transmission. The high particulate matter is mostly attributed to:

- Electrosurgical devices employed
- Low-gas motility of pneumoperitoneum
- Gas expulsion through ports or trocars

When used during laparoscopic procedures, it will effectively and efficiently remove smoke from the peritoneal cavity. So, the surgeon can have enhanced visualization of the surgical site safety from COVID-19 and improved air quality. Therefore, the whole surgical team should wear personal protection equipment, including:

- Use of laparoscopic smoke evacuation system
- Disposable surgical caps
- Medical protective mask (N95)
- Surgical shield uniform
- Disposable medical protective uniform
- Disposable latex gloves
- Full-face respiratory protective devices
- Powered air-purifying respirator

Laparoscopic surgery during a pandemic comes with multiple threats for the surgical team. Therefore, it is crucial to take measures for the safeguard of colleagues, family, and friends. Although these measures are definitely going to increase the cost of surgery but for the wellbeing of health professionals this is necessary.

I request all of you to please ***stay safe*** and ***protect*** yourself, your family, and your patient.

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ORIGINAL ARTICLE

Ten-point Strategy for Safe Laparoscopic Cholecystectomy: A Prospective Study

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Abstract

Aims/objectives: To devise a 10-point strategy for performing safe laparoscopic cholecystectomy (LC), share experience of 8,000 patients without any conversion to open procedure by adopting the strategy, and assess its effectiveness.

Materials and methods: A total of 8,000 patients were prospectively analyzed during 2007 to 2017. A point was assigned to a specific finding intraoperatively. Patients were divided into three groups based on the points. Anatomical variations, time of surgery, intraoperative/postoperative complications were plotted for three groups, and statistical significance was calculated.

Results: In this study, 63.5% of patients were female. No case of conversion to open cholecystectomy (OC) was found. The youngest and oldest patients were 2 and 109 years old, respectively. Mortality, negligible morbidity, or significant complications were not observed. Group I (1–4 points) had high-risk patients, and lowest safety, and group III (8–10 points) had low-risk patients, and highest safety, and group II (5–7 points) had with equivocal numbers.

Conclusion: Laparoscopic cholecystectomy was performed keeping these 10 points in mind with patience and precautions. Chances of conversion to open surgery can be reduced to zero, with minimal complications. The study suggests that in case of difficult anatomy, go gentle and slow to safeguard from injuries.

Keywords: Cholelithiasis, Conversion to open, Gallbladder stones, Laparoscopic cholecystectomy.

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Introduction

Gallbladder (GB) diseases are few of the commonest biliary tract diseases[1,2] and surgical conditions requiring intervention worldwide.[3,4] Laparoscopic cholecystectomy (LC) was introduced nearly 3 decades ago, and since then, it has become the gold standard;[5,6] nearly 90% cholecystectomies are laparoscopically performed.[7,8] Patient- or surgeon-related multiple factors can lead to various complications and conversion to open cholecystectomy (OC).[4,9,10] An OC is often performed for patients with GB mass or suspicion of GB malignancy, late third trimester of pregnancy, previous upper abdominal surgeries, >60 years of age, male sex, diabetes, history of endoscopic retrograde cholangiopancreatography, dilated common bile duct (CBD), and GB status; it is also performed when the laparoscopic approach fails.[7,11,12] Despite the experience, complication rates are higher with LC than OC, but those with OC are increasing due to decreased exposer to open procedure.[7,8,13,14]

During laparoscopic procedure, complication rates can be reduced with proper care and caution.[11,15] As a surgeon's experience increases, complication and conversion rates decrease.[11,16]

This study aimed to share the experience of surgeons while performing safe LC and points to consider in order to decrease complication and conversion rates.

Materials and Methods

This is a prospective study of LC performed in 8,000 patients by a chief surgeon and under his supervision during 2007 to 2017 at SMS hospital, Jaipur, India. The SMS hospital's surgical center performs cholecystectomy using laparoscopy, except for few special cases where OC is beneficial. The center has eight surgical units, and the study was conducted by one unit only. In this unit, nearly 15 laparoscopic cholecystectomies are performed per week. Approval was obtained from Institutional Ethical Committee before initiating the study.

Most of the patients were admitted for elective procedure. Patients with symptoms of acute cholecystitis were either operated within 2–3 days of presentation or 6 weeks after the resolution of symptoms. Detailed history of the onset of symptoms, duration, and progression was obtained. Patients were subjected to routine blood tests, including complete blood count, liver function test, kidney function test, serum electrolytes, HIV, HBSAg, HCV, bleeding time, clotting time, prothrombin time, and the international normalized ratio. Serum amylase and lipase were evaluated to rule out pancreatitis, and serum alkaline phosphatase was evaluated to rule our biliary obstruction. Imaging studies, such as ultrasonography (USG), were performed. In some doubtful cases, magnetic resonance cholangiopancreatography (MRCP) and computed tomography scans were performed to look for other pathology. Those detected with CBD stones in USG were subjected to MRCP and endoscopic retrograde cholangiopancreaticography (ERCP) for stone clearance and operated after 6 weeks.

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Patients were monitored postoperatively for hospital stay, pain, nausea, vomiting, oral intake, and other complications.

Ten-point Strategy

A ten-point strategy was devised to perform LC based on visible anatomy on entering the abdomen; points were assigned as shown in Table 1. After creating pneumoperitoneum and placement for camera port, peritoneal cavity was properly inspected to rule out other pathology. Remaining ports were then placed, and a patient was positioned in slight right lateral and head up position. Gallbladder fossa was inspected after removing or retracting omentum and gut from the fossa. First, we examined the CBD for proper visualization; three points were assigned if surgery was expected to be performed safely. If the CBD was not visualized, no points were assigned. Presence of adhesions led to non-visualization of the CBD. If the CBD was visualized after the dissection of adhesion, three points were given. Based on the ease of dissection, adhesions were categorized as minimal and dense. The CBD is the most important duct that needs to be protected, and its safety is paramount because most dreaded complication of cholecystectomy is the CBD injury; thus, most weightage was given to the CBD by assigning three points. Second, Rouviere sulcus was considered. If the dissection was possible above the sulcus, one point was given. If the sulcus was not visible due to adhesions or absence but safe dissection was possible by holding the infundibulum/Hartman pouch, then one point was given. Third, while holding the infundibulum/Hartman pouch, the anatomy of cystic duct and artery and Calot's triangle was assessed. Presence of aberrant artery or variations in cystic duct and artery were confirmed. If the two structures were seen entering GB on inspection, then one point was assigned. If there were variations in anatomy or if the two structures were not visible clearly due to adhesion or variation, no point was assigned. Fourth, after confirming the above parameters, dissection of the Calot's triangle was initiated. Anterior dissection was initiated first in the majority of the patients to clear Calot's triangle. It included dissection around the cystic duct and artery and lymph node (LN) of Lund while clearing the peritoneum and soft fibrofatty tissue around the duct and artery. Posterior dissection was similarly followed to dissect the peritoneum and soft fibrofatty tissue to clear the duct and artery. If the two structures were clearly visible and free of fibrofatty tissue, Calot's triangle was considered cleared and two points were assigned. If due to adhesions or anatomical variation Calot's triangle was not cleared as described, no point was assigned. Fifth, posterior dissection was extended further toward cholecystic plate.

Table 1: Ten-point distribution

CBD visualized	3
Dissection above Rouviere sulcus	1
Two structures entering into GB, cystic duct, and cystic artery exposed	1
Calot's triangle clear	2
1/3 of cholecystic plate cleared	2
Elephant head appearance	1
Total	10
1–4	Low safety
5–7	Equivocal safety
8–10	Safe cholecystectomy

One-third of cholecystic plate was cleared by rule in all patients, and two points were assigned. If one-third cholecystic plate was not cleared, no point was assigned. Sixth, following all the aforementioned dissection, a rule was made to lift and gently pull the infundibulum to give it an appearance of Lord Ganesha or elephant head; seeing this sign, one point was assigned. If the Lord Ganesha sign was not there due to adhesions or obliteration of Calot's triangle, no point was assigned.

In all the patients, these 10 points were collectively calculated, and the three groups were made. In group I with 1–4 points, the surgery was considered risky; in group II with 5–7 points, the surgery was considered somewhat risky; and in group III with 8–10 points, the surgery was considered safe.

Results

Throughout the study, no significant complications were recorded. Tables 2 and 3 show age and sex distribution in all the three groups. Table 4 shows various etiologies for which LC was performed. Not a single case of conversion to OC was found. Complications that occurred while performing the surgery and the subsequent treatments are discussed in Tables 4 and 5.

Complication were divided into intraoperative and postoperative periods. No mortality occurred, and morbidity was negligible.

Different variables were analyzed and compared considering the three groups. Anatomical variations (Table 5 and Fig. 1), such as presence of adhesions, obliteration of Calot's triangle, contracted GB, presence of mucocele, and free-floating GB, were analyzed.

Table 2: Distribution of age according to three groups

	Mean age	
Total points	*Mean*	*SD*
1–4	34.51	12.06
5–7	31.09	10.09
8–10	32.72	11.64

Table 3: Distribution of sex according to three groups

	Sex			
Total points	*Male*	*(%)*	*Female*	*(%)*
1–4	176	2.2	384	4.8
5–7	392	4.9	640	8
8–10	2,352	29.4	4,056	50.7
Total	2,920	36.5	5,080	63.5

Table 4: Diagnoses included in study

Diagnoses	*Group I (1–4)*	*Group II (5–7)*	*Group III (8–10)*
Acute cholecystitis (ACC)	80	160	100
Chronic cholecystitis (CCC)	400	320	1,120
Gallstone pancreatitis (GSP)	80	160	480
Empyema (EMP)	0	320	640
Symptomatic GB stone (SGBS)	0	80	960
Asymptomatic GB stone (AGBS)	0	0	1,360
GB polyp (GBP)	0	0	1,040

Table 5: Anatomic variation

Variation	*Group I (1–4)*	*Group II (5–7)*	*Group III (8–10)*	*χ^2 test with 2° of freedom*	*p value*
No adhesions	0	160	3216	885.483	0.0000 (s)
Minimal adhesions	160	330	992	211.961	0.000 (s)
Dense adhesions	400	320	80	3390.843	0.000 (s)
Calot's triangle obliterated	320	240	160	1888.098	0.000 (s)
Contracted GB	280	200	160	1637.966	0.000 (s)
Mucocele	80	240	440	253.480	0.000 (s)
Free floating GB	0	320	320	83.333	0.000 (s)

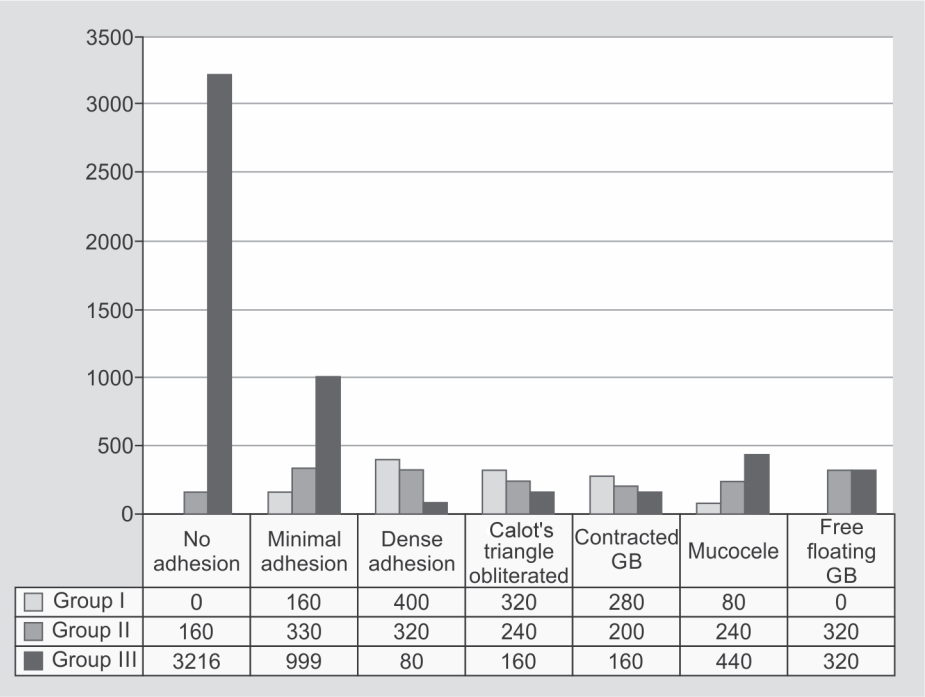

Fig. 1: Showing anatomic variation

Table 6: Duration of surgery

Duration	*Group I (1–4)*	*Group II (5–7)*	*Group III (8–10)*	*χ^2 test with 2° of freedom*	*p value*
<45 minutes	0	160	5,200	2977.907	0.000 (S)
45–90 minutes	160	640	1,200	877.656	0.000 (S)
>90 minutes	400	240	0	3938.844	0.000 (S)

The timing of surgery was evaluated to know which group needed more time for safe surgery (Table 6 and Fig. 2).

Intraoperative complications were evaluated in the three groups as shown in Table 7.

This ten-point strategy was followed in all the surgeries. So, in cases of difficult anatomy, the surgeon slowly and gently performed the surgery to properly delineate the anatomy. These 10 points can be followed, and injuries can be safeguarded.

Comparing the three groups, maximum number of patients with complicated anatomy were present in group I followed by group II, whereas group III included most patients with simple anatomy. Group I needed more time to perform the surgery safely because of the presence of complicated anatomy; in this case, group I was followed by group II. Maximum number of surgeries in group III were performed within stipulated time of 45 minutes.

Analyzing the complication rates in all the three groups showed that group I had maximum number of cases with complications and group III had the least number of complications, whereas group II was in-between. This shows that if LC is performed considering the aforementioned steps and the 10-point strategy, the surgery would be safe. Also, as the points go up, the chances of safe surgery go up (Table 8).

Discussion

The present study shows the author's experience as a chief surgeon performing LC, in a teaching hospital, over a period of 10 years.

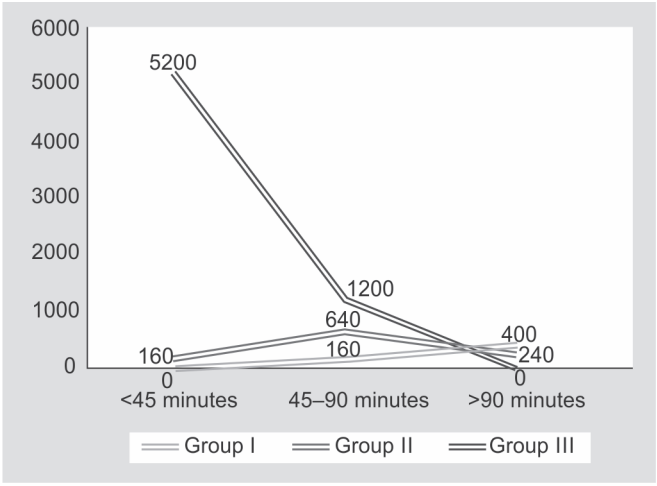

Fig. 2: Duration of surgery

Table 7: Intraoperative complications

	Groups		
Complications	*1–4*	*5–7*	*8–10*
Perforation of GB	147	63	30
Stones spilled	80	0	80
Spilled bile	80	80	80
Soiling of wound by bile/stones	166	83	71
Slipped cystic duct ligature	16	10	0
Cystic artery bleeding	28	13	2
Bowel injury	0	0	0

Chi-square = 147.323 with 12° of freedom; $p = 0.000$ (S)

Table 8: Postoperative complications

	Groups		
Complications	*1–4*	*5–7*	*8–10*
Excess pain	131	100	82
Prolonged drainage	20	3	0
Prolonged ileus	0	0	0
Nausea/vomiting	160	330	962
Subhepatic collection	5	6	3
Wound infection	163	81	13
Postoperative fever	81	81	87
Jaundice	0	0	0
Retained stones	4	4	0

Chi-square = 622.554 with 16° of freedom; $p = 0.000$ (S)

While performing the surgery, it is suggested that a surgeon follows the ten-point strategy and goes step by step and in case of difficult anatomy, performing the dissection gently and slowly to delineate anatomy and safeguard from injuries is advisable. By this approach, even the GB with the most difficult anatomy can be removed with laparoscopy without converting it into OC.

Laparoscopic cholecystectomy has become the gold standard for the removal of GB.[17] With increased use of LC, it is obvious that certain complications rarely seen with OC are more frequent with LC. These complications included intestinal and vascular injuries from trocar or Veress needle insertion and major bile duct injuries.[18–20]

This study also shows that if LC is performed with patience, complication rates can be reduced to minimal and conversion rates can be reduced to zero.

Bile duct injury is one of the most dreaded complications during LC than in OC.[21–23] In the infancy of LC, a CBD injury occurred more frequently during LC than OC. Although the incidence of CBD injury during LC is no longer as high as it was initially, it still exceeds that of OC (0.1–0.5 in LC vs 0.2% in OC).[24] Risk factors for a CBD injury are lack of experience (learning curve), misidentification of biliary anatomy, intraoperative bleeding, lack of recognition of anatomical variation of biliary tree, and improperly functioning instruments. Other factors are acute and chronic cholecystitis, empyema, long-standing recurrent disease, advanced age, obesity, and previous surgery.[24,25] Considering the factors, in mind we assigned three points in the strategy.

There are few steps that need to be followed during LC to avoid complication rates. The critical view of safety introduced by Professor Steven Strasberg is one of the important landmarks. Several studies confirm that using these techniques routinely eliminates chances of complication, such as CBD injury. Clearing the fibrofatty tissue from Calot's triangle, freeing up the lower third of the GB from the liver bed/cystic plate, and confirming that the only two structures are seen entering the GB are three requirements for the critical view of safety. No tubular structure duct should be clipped and divided unless the critical view of safety is achieved.[26,27]

Always use 30° telescope with HD camera or good endovision system.[28] While entering the port, first visualize where and how the CBD is located (create a rough image in mind).[29] Retraction of fundus applies a firm cephalic and lateral traction on the fundus and infundibulum, respectively, so that the cystic duct is perpendicular to the CBD.[29] Separation of omental adhesions—Always from the CBD toward fundus.[30] Use cystic LN of Lund as valuable landmark for identifying cystic artery. Use Rouviere's sulcus as valuable anatomical landmark for LC.[31] Always dissect near the GB. Perform anterior dissections for ease of process or on complementary basis but as a rule, always do perform posterior dissection before clipping of cystic artery and duct.

Perform posterior dissection with clearance of cholecystic plate at least 5 cm. The GB–duct junction is fully mobilized to give the "elephant head" appearance. Clarify Calot's triangle.[30] Check again and again, to delineate the curvature of infundibulum and cystic duct for removing the possibility of CBD. Any vessel that pulsates before cutting is hepatic artery, and the one which pulsates after cutting is cystic artery. Follow Strasberg's rule of "Critical View of Safety". Clear the stones from the cystic duct. Apply clips on cystic duct and artery separately and never together. Cut cystic duct and artery using only scissors and not any kind of energy sources. If bleeding occurs then keep your patience; never use any type of energy sources until the clearance of structures. It is better to stop the bleeding using gauze piece, wait patiently. Always recheck the area of the CBD after removal of GB (to see any bile leek, bleeding, or even clip dislocation). Use cholangiogram or indocyanine green (ICG) dye in doubt, if facilities are available. Perform partial cholecystectomy and save the life of the patient instead of risking it, whenever there is a doubt.[32] Never hesitate to convert into open surgery whenever necessary; the life of a patient is worth more than a surgical challenge.[26,33–37]

Conclusion

The study reveals the experience of surgeons of performing LC step by step by considering the aforementioned 10 points. Moreover, the study suggests that in case of a complicated anatomy, surgeons should be gentle and slow during the dissection and reconsider the 10 points to delineate proper anatomy and safeguard from injury.

This study suggests that if LC is performed with precaution and patience, the chances of conversion to open surgery can be reduced to zero. Meticulously performing the surgery reduces complication rates to minimal. When cholecystectomy is performed with due care, caution, safety, and standardized techniques, complications can be reduced.

This study has discussed a ten-point strategy along with some simple steps to perform LC safely. The study suggests that every surgeon must include these steps in their practice.

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ORIGINAL ARTICLE

Retroperitoneal Single-port Donor Nephrectomy through Lumbotomy Incision: An Experience of 30 Cases

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Abstract

Introduction: Over the years, laparoscopic donor nephrectomy (LDN) has evolved as a preferred alternative to open-donor nephrectomy (ODN). Laparoscopic donor nephrectomy can be performed either by transperitoneal or retroperitoneal route. Retroperitoneoscopic live donor nephrectomy (RPLDN) results in less analgesic requirement, decreased hospital stay, and better cosmetic acceptance by the donors. Lumbotomy incision has been thought to be an ideal approach without any muscle being cut but is limited by the amount of space in open surgery.

Materials and methods: Between November 2014 and September 2016, 350 donor nephrectomies were performed at our department. All the surgeries were performed by a single surgeon. Thirty patients consented for translumbar RPLDN out of the 82 donor nephrectomies assigned to that particular surgeon. Visual analog scale (VAS) was used to evaluate the severity of pain on postoperative day (POD)0 and POD1.

Results: Mean age of donors was 44.7 ± 11.4 years, M:F ratio 9:21. Average duration of surgery was 170.33 ± 52 minutes. Four patients (13.3%) had double renal arteries and one patient had double renal vein. In one patient, retrieval was performed by an open approach. No patient had surgical site infection. Most patients (28/30) had a VAS score of <4, and did not require any additional analgesics beyond POD0.

Conclusion: Single-site translumbar RPLDN is a feasible alternative approach to the donor surgery.

Keywords: Laparoscopic, Lumbotomy, Retroperitoneal, Single port.

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Introduction

Renal transplantation is the preferred treatment for patients with end-stage renal failure.[1] Outcomes after transplantation are superior with the use of live-donor kidneys as compared with those from deceased donors but require a healthy person to undergo an invasive procedure.[2] A lot of progress has been made in the recent years to minimize the discomforts associated with donor nephrectomy. Laparoscopic donor nephrectomy (LDN) was first introduced by Ratner et al in 1995 to reduce morbidity associated with the open procedure which was the gold standard for kidney retrieval from living donors at that time.[3] Over the years, LDN has evolved as a preferred alternative to open-donor nephrectomy (ODN) as the latter procedure results in a protracted convalescence[4] and has a high incidence wound-related morbidity.[5] Both a recent meta-analysis[6] and systematic review[7] have suggested that LDN results in fewer complications, shorter hospital stay, and faster return to work compared with ODN. Laparoscopic donor nephrectomy can be performed either by transperitoneal or retroperitoneal route. The transperitoneal route of performing donor nephrectomy has been classically described as it provides a larger working space but the retroperitoneal procedure has the advantages of no risk to intra-abdominal organs and direct access to the renal artery/vein.[8–10] Retroperitoneoscopic live donor nephrectomy (RPLDN) results in less analgesic requirement, decreased stay, and better cosmetic acceptance by the donors.[11–14] But it has the disadvantage of a muscle cutting/splitting incision for the retrieval of donor kidney in addition to the multiple ports. Lumbotomy incision has been thought to be an ideal approach to reach kidneys without any muscle being cut but is limited by the amount of space in open surgery. A single-port RPLDN performed through lumbotomy incision can provide a nearly ideal approach to donor kidney. Single-site surgeries have been shown to further hasten the recovery after surgery in a number of procedures including donor nephrectomy as they reduce the pain associated with the procedure. There have been limited successful reports of retroperitoneoscopic laparoendoscopic single-site nephrectomy (LESS).[15] However, the present study provides the first experience in the literature of performing a single-port RPLDN through lumbotomy incision.

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Conflict of interest: None

Materials and Methods

Donors

Selection Criteria

Between November 2014 and September 2016, 350 donor nephrectomies were performed in our department. Preoperative donor evaluation included medical, surgical, and psychosocial suitability for live kidney donation. Renal imaging like renal angiography and differential renal function scan was performed in each patient. Patients with body mass index (BMI) of >30 were not considered for RPLDN for the initial experience. No patient had history of any previous retroperitoneal surgery. All the patients received cefazolin 1 g 30 minutes before the start of the procedure.

All the surgeries were performed by a single surgeon to eliminate the learning curve bias. Thirty patients consented for translumbar RPLDN out of the 82 donor nephrectomies assigned to that particular surgeon. Patients were explained about the risks/benefits associated with single-port retroperitoneal donor nephrectomy through lumbotomy incision. In postoperative period, all patients were administered tramadol thrice daily and then as required. Visual analog scale (VAS) was used to evaluate the severity of pain on postoperative day (POD)0 and POD1.

The study was approved by the Institutional Ethics Committee.

Single-port Retroperitoneal Translumbar Donor Nephrectomy

Patients were placed in full lateral position and retroperitoneum accessed with a non-muscle cutting approach.[16] Once the retroperitoneum was entered, Gerota's fascia was opened as far as possible and lower pole of kidney is reached. Dissection was carried out anterior to psoas till ureter and gonadal vein were identified in the retroperitoneal fat.

An Alexis wound retractor was applied to the incision with a sterile surgical glove rolled over the inner ring of the retractor, so that the fingers project out of the outer ring of the Alexis wound retractor, creating an airtight retroperitoneal compartment. Three fingers of the glove were used to insert one 10 mm camera port, one 10 mm working port, and one 5 mm working port and pneumoretroperitoneum obtained.

Further dissection was carried out laparoscopically. Ureter was lifted off the retroperitoneal tissues and gonadal vein was dissected till its drainage into renal vein avoiding injury to the ureter and its adventitia and ligated. Gonadal artery if encountered was also ligated. As one reached renal hilum, pulsations of renal artery could be seen and lumbar vein was visualized in front of the artery. Lumbar vein was controlled after which renal artery was seen which was dissected till its origin. After that, tissue around the renal vein was dissected and adrenal vein was identified.

At this stage, lower pole of the kidney was separated from the peritoneum when the kidney which was hanging from the peritoneum started to fall down. Dissection was carried out on the surface of kidney to free it from the surround fat till renal vein was seen anteriorly. Adrenal vein was identified and divided, adrenal gland was dissected and separated from the upper pole of the kidney and left *in situ*.

Ureter was divided once the kidney and renal vessels were free.

Renal artery and renal vein were separately ligated with two Hemolok clips each as is the usual practice at our center and cut with scissors. Kidney was retrieved into the Alexis wound retractor, and taken out with the retractor.

Results (Table 1)

Mean age of donors was 44.7 ± 11.4 years, majority of the donors were females (M:F 9:21) as is usual trend at our center. Average duration of surgery was 170.33 ± 52 minutes, the duration of surgery decreased with increasing experience. Majority of nephrectomies were left sided (LT:RT 26:4).

Four patients (13.3%) had double renal arteries and one patient had double renal vein. In one patient, retrieval was performed by an open approach after extending the upper part of the incision. This patient had bleeding from avulsion of a small tributary at the base of right renal vein after completion of dissection. No blood transfusion was required in any patient. Peritoneum was breached in three patients but the peritoneal rent was closed after removing the Alexis port and surgery was completed retroperitoneally. No patient had surgical site infection and none had postoperative hernia or bulge at operative site till the last follow-up. Additional 5 mm port for retraction was required in the two of the first three cases, but subsequent cases were completed without any additional port. Most patients (28/30) had a VAS score of <4, and did not require any additional analgesics beyond POD0. Patients were started orally on the same day and could ambulate comfortably on the next day.

Table 1: Results

Mean age (years)	44.7 ± 11.4
M:F	9:21
BMI (kg/m^2)	21.72 ± 3.57
Side (LT:RT)	26:4
Duration (minutes)	170.3 ± 52
WIT (minutes)	4.71 ± 1.2
Kidney wt (g)	131.6 ± 25.5
Analgesic requirement (mg)	370 ± 105
VAS POD0	4.83 ± 1.73
VAS POD1	3.0 ± 1.23
Hospital stay (days)	2.6 ± 0.6

Discussion

The first experience of laparoscopic nephrectomy using a single incision was reported in three patients in 2007.[17] The attractiveness of single-site approach later led to many reports of living donor nephrectomies via LESS surgery.[18–20] All these were performed using the transperitoneal approach in comparison to the traditional retroperitoneal route for ODN. Most reports of serious complications following LDN are related to the transperitoneal approach causing bowel/visceral injuries or intestinal obstruction. Therefore, an ideal approach to the donor surgery should be a retroperitoneal approach. A non-muscle cutting single-site incision will not only avoid immediate and long-term intraperitoneal complications but also reduce pain associated with the operation. With this in mind, lumbotomy approach was used to perform the single-site nephrectomy in the living donors at our center.

As hypothesized, the main benefit of this approach in our experience was early convalescence. This was possible as the approach through the lumbar fascia avoids muscle cutting or splitting resulting in less postoperative pain, which impacts analgesic requirements and the hospital stay. Single-site surgery has been shown to be less painful than multiple ports approach for donor nephrectomy in a recent Cochrane review as well.[21] Shoulder pain due to irritation of diaphragm by carbon dioxide gas was expectedly absent in this group of patients leading to a more comfortable postop recovery.

The retroperitoneal technique also reduces the risk of intraperitoneal injury and leads to faster recovery of gastrointestinal function as was seen in our study too.[22] It helps to resume early oral feeding and reduces risk of intestinal adhesion[23] and is also beneficial for patients with the history of previous abdominal surgery. Retroperitoneal technique has less deleterious effect on ventilation and hemodynamic parameters that can be problematic with rising intra-abdominal pressure in transperitoneal approach.[24]

Reports in literature have shown the retroperitoneal approach has a shorter time to renal artery control[25] which helps in early control of any major bleeding.

Single-site surgery usually requires special ports and angulated instruments which has actually limited the popularity of procedure due to higher costs and increased surgical difficulty. Most of the commercially available ports have a small opening in the abdominal wall which leads to clustering of instruments. Angulated instruments were devised to circumvent this but they increase the difficulty associated with this approach. The average size of retrieval incision in this series was 7 cm and the Alexis port assembly covered this incision and provided a wider space for motion of instruments. There was less fighting as the entry point of instruments being mobile, it provided a wider range of motion as compared to commercially available ports. No special instruments were required with this assembly and routine laparoscopic ports and instruments were used which has significant cost benefits to the patient over commercially available single ports.

Most of the previously described retroperitoneal techniques use balloon dilatation to create retroperitoneal space[26,27] but with the translumbar approach, pneumoretroperitoneum could be reliably made under vision by using open surgical instruments.

There have been concerns about retroperitoneal approach to prolong the operative time in donor surgery and prolonged lateral positioning may lead to neural injuries. In our series, the time taken to completion in initial few cases was higher but the average of 170.3 $\pm$ 52 minutes compared favorably with transperitoneal cases at our center. The learning curve with retroperitoneal donor nephrectomy has been shown to be short in a retrospective review of 120 cases where operative times improved rapidly after performing 30 procedures.[28] It has been shown in various studies that retroperitoneal approach leads to decreased operative time as time required to mobilize colon is saved and with a single-site approach, time taken to place ports and later close them is avoided.[29]

The homemade port assembly used in this series comprising of Alexis wound retractor with a surgical glove, is cost-effective and easy to use. The glove sustained the standard intra-abdominal pressure without any incidence of rupture. This assembly has been used in few other studies which have documented its effectiveness.[30]

Limitations of Technique/Study

There may be difficulty initially in approaching lumbar fascia through this incision for the inexperienced as it is not a popularly used approach. The working space is a bit limited as is any retroperitoneal approach but Alexis assembly with a glove adds to the space and is usually adequate unless the patient is small in size. The limitations of the study include early experience with a small sample size and that no comparison has been done with the standard transperitoneal approach. However, a randomized control trial is already underway at our center to assess the outcomes of this approach.

Conclusion

Single-site translumbar RPLDN is a feasible alternative approach to the donor surgery and can avoid the inherent risks associated with the transperitoneal technique. It has the potential to further reduce the pain associated with the donor nephrectomy operation.

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ORIGINAL ARTICLE

Laparoscopy-assisted Approach for Meckel's Diverticulum in Pediatric Age

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Abstract

Background: Meckel's diverticulum (MD) is the most common congenital gastrointestinal tract (GIT) anomaly, with incidence approximately 2–4%. It is usually asymptomatic and it is usually discovered accidentally during laparotomy or presenting with complication as perforation, bleeding, and bowel obstruction. The surgical treatment of MD includes exploratory laparotomy with either diverticulectomy or segmental small bowel resection.

Materials and methods: A retrospective review performed for the cases of MD operated by laparoscopy-assistedexcision of the diverticulum in Zagazig University Hospital and International Medical Center Jeddah, during the period from November 2012 to October 2018, all data regarding patients' demographics, clinical features, diagnostic tests performed, histopathology reports, operative time, conversion to laparotomy, hospital stay, and complications were analyzed.

Results: This study includes 17 patients with MD who underwent laparoscopy-assisted excision of MD. The median age of the patients was 8.3 years. The male to female ratio was 11:6. Lower GIT bleeding was the most common presenting symptom. All patients were subjected to a laparoscopy-assisted excision. Four patients underwent wedge excision and 13 patients underwent segmental bowel resection.

Conclusion: Laparoscopy-assisted resection of MD is safe, simple, and inexpensive. Moreover, it avoids the risk of intra-abdominal contamination.

Keywords: Bleeding per rectum, Children, Laparoscopy, Meckel's diverticulum.

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Introduction

Meckel's diverticulum (MD) is one of the most common congenital anomaly of the gastrointestinal tract (GIT), with incidence approximately 2–4%.[1,2]

It arises from remnants of the omphalomesenteric duct, which connects the midgut to the yolk sac in the fetus, and usually undergoes complete involution between the fifth and sixth weeks of gestation as the bowel return back normal anatomical position.[3]

Meckel's diverticulum mostly is asymptomatic and it is usually an incidental finding when laparotomy is performed for other abdominal conditions but can be presented by intestinal obstruction, intussusception, gastrointestinal bleeding, diverticulitis, or perforation.[4]

Surgical treatment of MD involves laparotomy with either diverticulectomy or segmental small bowel resection. Recently, some authors have described the use of laparoscopy as minimally invasive for the resection of MD.[5,6]

Materials and Methods

A retrospective review was performed for the cases of MD treated surgically by laparoscopy-assisted excision of the diverticulum in Zagazig University Hospital and International Medical Center Jeddah between January 2010 and December 2017.

All of the following data were collected and analyzed: patients' demographics, clinical features, investigations, histopathology reports, operative time, any operative or postoperative complications, and duration of hospital stay.

Operative Procedure

Laparoscopy-assisted excision of MD was performed through three or two ports. After general anesthesia with endotracheal intubation, a 5 mm port for the camera was placed through the umbilicus using open technique. Another two 5 mm working ports were placed, one in the suprapubic region and one in the left iliac fossa, after creation of pneumoperitoneum with an insufflation of 0.5 L/minute to a maximum pressure of 10–12 mm Hg. Exploration of the small intestine was performed by 2 a traumatic grasper to identify the MD.

The MD was dissected from the mesentery and was grasped with a traumatic forceps passed through the umbilicus (Figs 1 and 2).

The umbilical incision was extended and the diverticulum was brought out from the umbilicus. We perform wedge resection in case of long diverticulum and narrow base but in case of short diverticulum and broad base we performed bowel resection and anastomosis, in one case, the resection was performed using a linear stapler device, the anastomosed bowel was returned back into the abdomen, and the umbilical wound was closed.

Results

This study includes 17 patients with MD who underwent laparoscopy-assisted excision of MD. The median age of the patients

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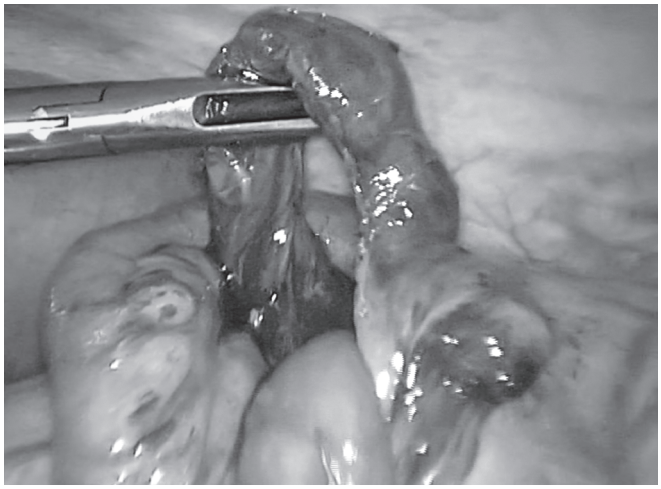

Fig. 1: Meckel's diverticulum with its tip attached to the cecum

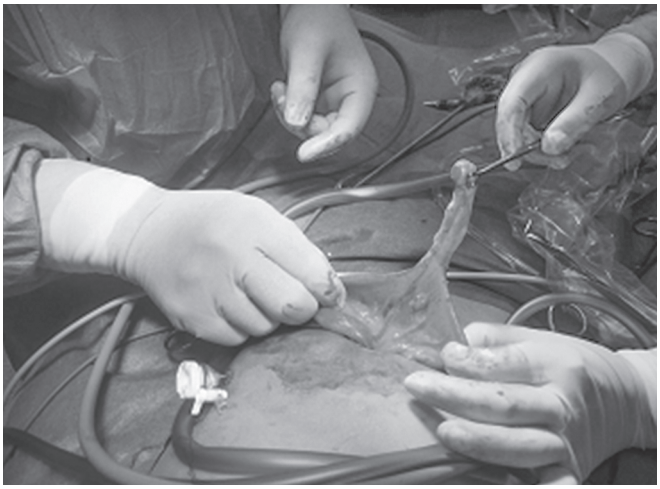

Fig. 2: Meckel's diverticulum exteriorized from the umbilicus

Table 1: Demographic data and presentations

	Number	*Percentage*
Mean age	8.3 years	
Male	11	64.7
Female	6	35.2
Rectal bleeding	11	64.7
Acute appendicitis	3	17.6
Intestinal obstruction	2	11.7
Chronic abdominal pain	1	5.8
Meckel's scan	13	76.4
CT	3	17.6
Abd US	4	23.5

was 8.3 years (range 5–14 years). The ratio of male to female was 11:6 (Table 1).

All patients were operated by a laparoscopy-assisted excision. Four patients underwent wedge excision and 13 patients underwent segmental bowel resection, in 1 patient, the resection of the diverticulum was performed with a linear stapler. Eleven patients had painless rectal bleeding, while one had chronic abdominal pain, and the CT study showed cystic mass attached to the umbilicus. Three patients were presented by picture similar to acute appendicitis and CT showed picture of acute appendicitis with dilated bowel loop in these cases the tip of the MD was inflamed and attached to the cecum and compressing the bowel (Fig. 3), and in one case the tip was perforated and forming inflammatory mass around the cecum (Fig. 4) and two patients were presented by intestinal obstruction (Fig. 5).

Meckel's scan was performed for 13 cases and was sensitive in 82.3% (Fig. 6).

The mean operative time was 71.4 minutes (ranges from 65 to 115 minutes). There was no intraoperative or postoperative complications, except for one patient, whose initial exploration was negative but the patient rebleed again after discharge and readmitted and diagnostic laparoscopy was repeated and the MD was identified and resected. Two patients had low-grade fever on the second day that was from minor atelectasis and resolved spontaneously with conservative treatment (Table 2).

Histopathology of the specimens showed ectopic gastric mucosa in 12 patients, and focal ulceration in 4 of them (Table 3).

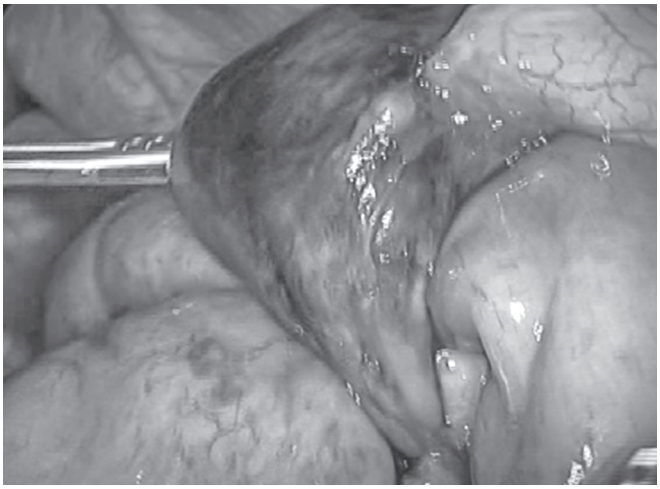

Fig. 3: Meckel's diverticulum forming inflammatory mass attached to the cecum

The median hospital stay was 3.8 days (range 4–7 days).

Discussion

Recently, the use of laparoscopy in pediatric surgery has much more increased.[7,8]

Complicated MD can be presented at any age. Infants and children are at highest risk, and >50% of symptomatic Meckel's diverticula occurring in children <2 years. Also, younger children (<4 years) are most commonly present with obstruction, as opposed to older patients who tend to present with bleeding.[9]

In our study, the most common presentation was bleeding and, the median age at diagnosis was 5.4 years (range 5–14 years). In a study performed by Palanivelu et al.,[5] the age ranges from 6 to 43 years. Also, Rho et al.[10] reported an age ranges from 7 days to 19 years.

Tc99m pertechnetate scan has been the investigation of choice in children with MD containing heterotopic gastric mucosa (HGM).[10] Premedication with histamine-2 blockers or proton-pump inhibitors has been described to increase the diagnostic accuracy of the scan, the reported sensitivity of the Meckel's scan ranges from 60 to 90% with the specificity ranges from 90 to 98%.[10,11]

Menezes et al.[11] published a retrospective study and assessed the sensitivity of the Meckel's scan in patients with severe GIT

Fig. 4: Perforated Meckel's diverticulum

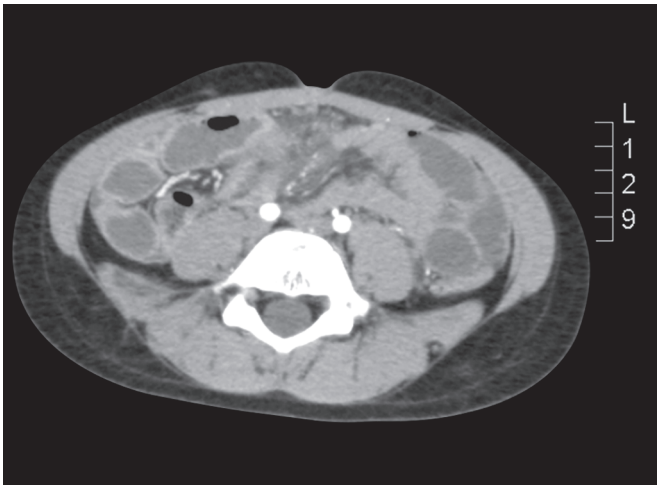

Fig. 5: Computed tomography scan showing irregular thick wall fluid collection with inflamed mesenteric fat plan (complicated urachal cyst vs Meckel's diverticulum)

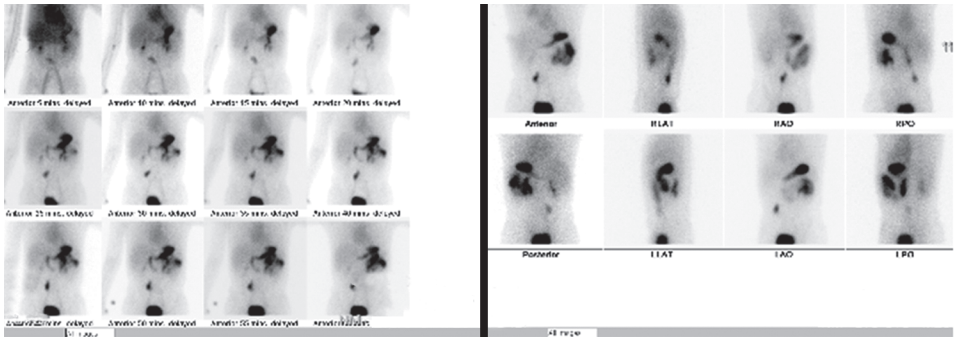

Fig. 6: Ectopic uptake of Tc99 by Meckel's diverticulum

Table 2: Types of surgery and complications

	Number	*Percentage*
Type of surgery		
Wedge resection	4	23.5
Segmental resection	13	76.4
Complications		
1—Conversion to minilaparotomy	1	5.8
2—Reexploration	1	5.8
3—Adhesive intestinal obstruction	1	5.8

Table 3: Histology results

Histology	*Number*	*Percentage*
Ectopic gastric tissue	14	82.3
Ectopic pancreatic	1	5.8
Gastric and pancreatic	2	11.7

bleeding. They report a sensitivity of 66.6% with a false-negative rate of 33.3%. In our study, MS was positive in nine patients (75%). False-negative results may be due to the absence of ectopic gastric mucosa, insufficient gastric mucosa to capture Tc99, or "wash out" phenomenon caused by accentuated intestinal transit time.[11]

In our study, Meckel's scan was the first choice in cases presented by lower GIT bleeding which has been performed in 13 patients and was positive in 10 (76.9%) cases with bleeding per rectum and one case of chronic recurrent abdominal pain.

CT scan has been performed in three cases, one case who was presented by chronic abdominal pain and showed periumbilical mass that could be urachal cyst.

The other two cases were presented by acute abdominal pain and were diagnosed as acute appendicitis, so in the three cases, CT did not confirm the diagnosis.

The incidence of heterotopic mucosa in MD varies from 15 to 50%. Shalaby et al.[12] reported that the incidence of HGM in MD was 77.8% in symptomatic and is much higher than asymptomatic cases of MD.

In our study, the incidence of ectopic gastric mucosa was 82.3%. This result could be attributed to the high incidence of bleeding MD in which the HGM varies from 80 to 100%.[12]

As Meckel's scan has false-negative and -positive rates, laparoscopy may have a great value for the diagnosis and surgical treatment.

The use of laparoscopy for the treatment of MD was first described by Attwood et al.[13] who did laparoscopy-assisted diverticulectomy using a linear stapler device. Also it can be performed with the application of Roeder's loop on the base of the diverticulum, or with resection and intracorporeal suturing.[5,12–15]

The advantage of laparoscopy-assisted excision of MD includes exteriorization of the bowel through the umbilical wound and palpation on the base of the diverticulum for the presence of ectopic mucosa, also the intestinal anastomosis can be performed

outside of the abdomen which is easy and associated with less risk for intra-abdominal contamination, also direct palpation on the base of the diverticulum and measurement of the height/diameter (HD) ratio could assist the plan of the surgical resection.[6,12,16]

In order to achieve proper surgical plan, some authors studied the relationship between the location of ectopic gastric mucosa in the diverticulum and the external appearance of diverticulum and they conclude that in cases of long diverticula with a H/D ratio of >1.6 the heterotopic mucosa is only located in the distal area; so in these cases, simple diverticulectomy has been recommended. And in case of broad base or short diverticulum, resection of segment of the bowel containing the MD and an end-to-end anastomosis is preferred.[16] In our study, we did resection anastomosis in 13 patients and wedge resection in 4 patients. In one case, we did laparoscopy-assisted diverticulectomy using linear stapler device was performed. It has been reported that adhesive intestinal obstruction is the most common complication after a Meckel's diverticulectomy, which occurs in 5 to 10% of the cases.[12,13] In a study performed by Chan et al.,[6] 20 patients underwent laparoscopy-assisted excision of MD and reported that none of the patients were readmitted for rebleeding or developed adhesive intestinal obstruction. In our series, we have conversion to minilaparotomy in one patient and reexploration in one patient in which the first diagnostic laparoscopy was negative and reexploration was performed due to recurrent lower GIT bleeding, and one patient develop adhesive intestinal obstruction which was managed by conservative treatment.

The limitation of the study is being retrospective in nature and small number of cases.

Conclusion

Laparoscopy-assisted resection of MD is minimally invasive, simple, and safe procedure that avoid the risk of intra-abdominal complication from bowel resection and anastomosis.

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RESEARCH ARTICLE

Comparison Objective Structured Assessment of Camera Navigation Skills Score—Pre- and Post-training Intervention

Hariyono Winarto[1], Kade Yudi Saspriyana[2], Aria Kekalih[3]

Abstract

Aim: Inexperienced operating assistants are often tasked with the important role of handling camera navigation during laparoscopic surgery. Incorrect handling can lead to poor visualization and increased operating time. The objective of this research was to examine benefit of camera navigation training in laparoscopic used pelvic box based on Objective Structured Assessment of Camera Navigation Skills (OSA CNS) assessment and explore factors correlated to difference skill after training.

Materials and methods: An experimental study (pre–post interventional study) was conducted at the training room of Indonesia Clinical Training and Education Centre (ICTEC) Faculty of Medicine Universitas Indonesia-Dr. Cipto Mangunkusumo Hospital (CMH), on December 2018 to January 2019. Participants were Obstetrics and Gynecology resident Medical Faculty of Universitas Indonesia. We did evaluation before training and 1, 2, 3 weeks after training used OSA CNS. Data analysis used paired-*t* test.

Results: There were significant increasing OSA CNS score after camera navigation training used pelvic box. Average OSA CNS score before training and 1, 2, 3 weeks after training were 15.00 ± 2.03, 17.60 ± 2.69, 16.36 ± 1.84, 17.80 ± 2.26, respectively. Optimum duration of OSA CNS evaluation was 3 weeks after the training. Female gender and low experience were two factors influence camera navigation skill after the training.

Conclusion: Laparoscopy camera navigation training used pelvic box could be applied to support residency program curriculum and there were increasing camera navigation skills after training used pelvic box. Female gender and low experience were factors significant correlate to training outcome of camera navigation skill used pelvic box.

Clinical significance: Camera navigation training used pelvic box is a critical component for teaching safe endoscopic practices in our Ob/Gyn residency training program.

Keywords: Camera navigation in laparoscopy, Objective structured assessment of camera navigation skills, Training.

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Introduction

Laparoscopy surgery was becoming as one of the alternatives in gynecology surgery and have more benefits compared to open laparotomy. Laparoscopy technique needs specific skills rather than open laparotomy: camera navigation, orientation and depth of object in two dimension, hand–eye coordination, and good tissue handling.[1,2]

Curriculum guidance for Obstetrics and Gynecology residents emphasize that all off the members must be proficient to a number of laparoscopic procedures. But in other situation, they faced problems of teaching hospital condition related to restrict of services in the operating theater due to efficiency of hospital budget, decrease medical error based on hospital accreditation programs, and also related to ethical issue due to direct training to the patient.[3–5]

Laparoscopic surgery demands very specific skills and capabilities that require initial learning of cognitive and motor skills followed by refinement of those skills. The prerequisite for skilled laparoscopic work includes: (1) Depth perception. The surgeon is required to maneuver, tissues and instruments in a three-dimensional environment with two-dimensional view. (2) Adjustment to fulcrum effect. This creates conflict between visual and proprioceptive feedback. (3) Hand–eye coordination; (4) Bimanual manipulation; (5) Handling of laparoscopic instruments; and (6) Ambidexterity. Training in pelvic box can be used to fulfill all of those prerequisites' laparoscopic skills.[6–8]

Camera navigation in laparoscopy is often considered as a simple task and is handled by the less experienced, such as medical students or junior residents. It is, however, a complicated task, requiring specific psychomotor and visuospatial skills. Inappropriate handling of the camera results in poor visualization, which can lead to longer operating time; surgeon frustration; and can, most importantly, compromise patient safety. An assessment tool was created, inspired by the Objective Structured Assessment of Surgical Skills (OSATS) assessment tool, with five items scored on 5-point scales with anchors in the middle and at the ends. The tool named as Objective Structured Assessment of Camera Navigation Skills (OSA CNS). The evaluation cover view completion, horizontal alignment, scope orientation, instrument collision, and autonomy. Nilsson stated that minimally score of OSA CNS was 14 to achieve good result in camera navigation.[4,6]

Several factors could influence laparoscopic training outcome, such as age, gender, and interest to laparoscopy itself. Level of

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laparoscopic education, level of laparoscopic experience, and level of laparoscopic knowledge were factors related to training outcome based on fundamental laparoscopic surgery curriculum.[5]

The aim of this study is to investigate the comparison of camera laparoscopy navigation skill based on OSA CNS before and after the training, and to explore correlation between age, gender, interest, level of laparoscopic education, level of laparoscopic experience, and level of laparoscopic knowledge to difference of camera navigation skills after the training. It was novel research due to limited study focused on laparoscopy training program for residency curriculum, especially for camera navigation. In practical setting, camera navigation in teaching hospital often perform by resident and play an important role to support safety laparoscopic procedure.

Materials and Methods

Study design was experimental study (pre–post interventional study) conducted at the training room of Indonesia Clinical Training and Education Centre (ICTEC) Faculty of Medicine Universitas Indonesia-Dr. Cipto Mangunkusumo Hospital (CMH), on November 2018 to January 2019. Participants were resident of Obstetrics and Gynecology at basic level and work in operating theater. Inclusion criteria were member of residents of Obstetrics and Gynecology, and willing to sign acceptance letter. Exclusion criteria were unable to attend whole research procedure. Sample size was 23 samples, use formula:

$$n_1 = n_2 = \left(\frac{(Z_{\pm} + Z_{\cdot})\mathrm{SD}}{(X_1 - X_2)} \right)^2,$$

$Z_\alpha = 95\% = 1.96$; $Z_\beta = 80\% = 1.24$; SD = 0.5 (Nilsson); $X_1 - X_2 = 0.3$. Samples collection used consecutive technique method.

All samples filling in questionnaire about personal data (age, gender, level of residency), level of laparoscopic education, level of laparoscopic experience, and level of laparoscopic knowledge. Level of laparoscopic education and laparoscopic experience were based on fundamentals laparoscopic surgery criteria. Educational level categorized as none, level I, level II, level III, level IV, and level V. Experience level classified as low, average, and superior. Laparoscopic knowledge was based on Websurg Winner Project questionnaire that focused on laparoscopic camera equipment and anatomy landmark. The outcome is ≥90 (good) and <90 (poor). Interest to laparoscopy measure by Intrinsic Motivation Inventory (IMI) Scale, divided to interested in (score >6) and not interested in (score ≤6).

Initial camera navigation evaluation performed used adult pelvic box; laparoscopy camera manufactured by B-Braun (Fig. 1). All these navigations were recorded. Laparoscopy camera navigation training done for about 2 hours. Samples train about laparoscopy camera equipment, how to do appropriate camera navigation, and practice used pelvic box. Post-training evaluation was used the same task of pre-training evaluation (Fig. 2). Evaluation done in 1 week, 2 weeks, and 3 weeks after training. Assessment tool used OSA CNS, consist of five field of evaluation: view completion, horizontal alignment, scope orientation, instrument collision, and autonomy (Fig. 3). Each item with range score 1–5. This evaluation performed by two Oncology Gynecology Consultants who are as advanced laparoscopy trainer. Data are tabulated and analysis used paired-*t* test of SPSS statistics 20. Flowchart of the research is in Flowchart 1.

Results

Patient characteristic shows in Table 1. Interest to laparoscopy and level of laparoscopic knowledge are not further analysis for correlation to difference skill after training. It caused by homogeny data.

All of OSA CNS scores after training show significance difference compared to before training score. Three weeks duration after training reveal best optimum time to evaluate camera navigation skill after training (Table 2). Table 3 points out the difference score between three times of evaluation. Table 4 presents gender and level experience are two factors correlated to difference skill after training.

Discussion

Surgical simulation teaching has become an important training component for many residency programs across all surgical disciplines. After SAGES launched the FLS program in 2004, the American College of Surgeons (ACS) joined SAGES in 2005 for a joint educational effort to establish standards for fundamental skills and knowledge necessary to care for patients undergoing laparoscopic surgery. The growing number of minimally invasive procedures and the need to teach and assess these procedures

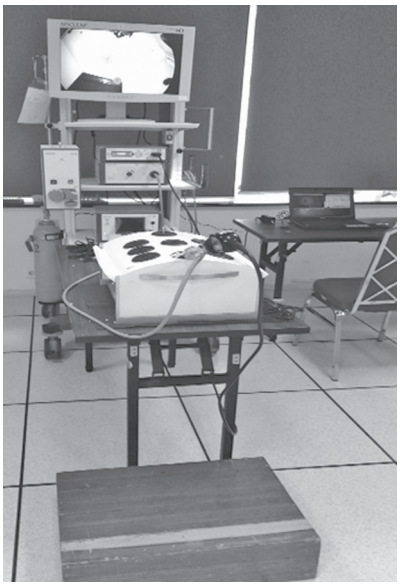
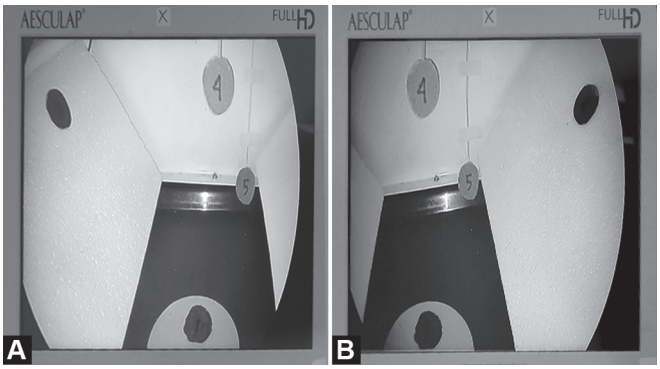


Fig. 1: Pelvic box and laparoscopic camera



Figs 2A and B: Camera navigation task in the pelvic box

in a simulated setting have been recognized by general surgery residency training programs.[1,4,5]

Live operating theaters should not be the place to start learning surgical skills but rather to consolidate them. Gynecologist should reach competency before operating on a live patient. This may be achieved by training on dry and wet laboratory. Assessment of trainees at the end of a laparoscopic course should cover both knowledge and skills. It can appear overwhelming for a surgical novice to assist during surgery for the first time, and the unfamiliar environment can assumedly compromise focus on the role as an assistant.[9]

In our study, all samples did not have any interest to laparoscopy before the training. And, all of the samples showed level of knowledge below than 90. Therefore, we did not proceed further analysis for correlation to camera navigation skill after training. On the contrary, we revealed significant difference of OSA CNS score. The IMI is a multidimensional measurement device intended to assess participants subjective experience related to a target activity in laboratory experiments. It has been used in several experiments related to intrinsic motivation and self-regulation. The instrument assesses participants' interest/enjoyment, perceived competence, effort, value/usefulness, felt pressure and tension, and perceived choice while performing a given activity, thus yielding six subscale scores. Meta-analytic study by Scheifele and Krapp about the impact of student interest to learning achievement showed there was other factors that could influence good learning achievement. These factors were motivational factors.[10] Peyton's four-step approach is becoming more prevalent in medical education. Peyton's four-step approach consists of the following four clearly defined instructional steps: (1) The teacher demonstrates the skill at his normal pace without any comments ("Demonstration"); (2) The teacher repeats the procedure, this time describing all necessary substeps ("Deconstruction"); (3) The student has to explain each substep while the teacher follows the student's instructions ("Comprehension"); (4) The student performs the complete skill on his own ("Performance"). This Peyton's four-step approach explained contradictive result of low knowledge level but there was increase of camera navigation skill after training used pelvic box in this study. Demonstration and deconstruction appear as important factor in transfer of camera navigation knowledge and skill in this research.[11]

Study by Nilsson stated that the technical aspects of camera navigation skills improve after simulation-based training, but they

1. View completion				
1	2	3	4	5
Frequently presents a peripheral part of the visualization field, with suboptimal size and/or have an unsteady hand		Can center, size and hold the visualization filed steady during most of the procedure		Able to appropriately size, center and hold the visualization field steady at all time
2. Horizontal alignment				
1	2	3	4	5
Repeatedly looses the horizontal alignment, and are not able to adjust the axis when necessary		Keeps the alignment most of the time, can to some extent correct the axis when the operating field moves		Keeps horizontal alignment and adjust the horizontal axis when the operating field moves
3. Scope orientation				
1	2	3	4	5
Troubles with finding and keeping the correct angle		Keeps an appropriate angle at most of the time		Angles the scope appropriately at all time
4. Instrument collision				
1	2	3	4	5
Frequent instrument collision due to inability to retract and interchange the laparoscope to avoid instrument collision		Avoid instrument collision most of the time		Avoids instrument collision by retracting and interchange the laparoscope at all times
5. Autonomy				
1	2	3	4	5
Surgeon repeatedly needs to guide and supervise to obtain a optimal operating field		Can navigate independently most of the time, but need some guidance		Is technical independent, and do not need guidance from the surgeon

Fig. 3: OSA CNS evaluation

Flowchart 1: Flow diagram of the research

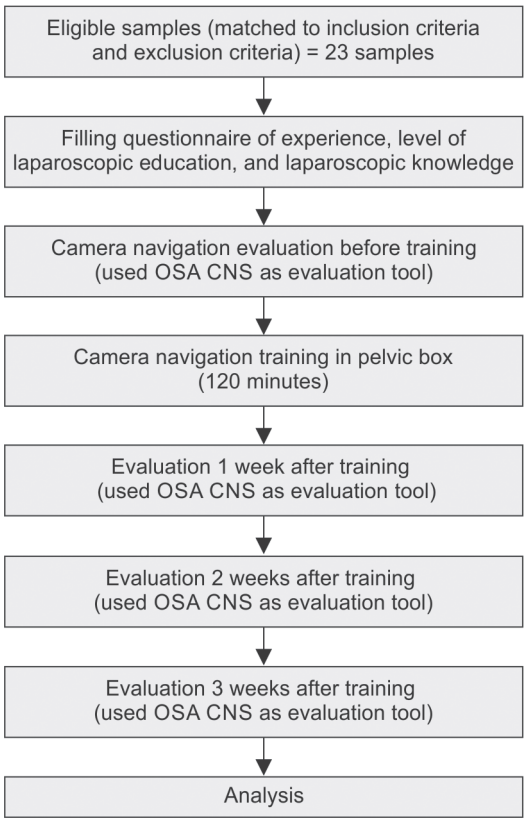


Table 1: Samples characteristic

Characteristics	*Description*
Age	29 ± 3.02
<31 years	16 (69.6%)
≥31 years	7 (30.4%)
Gender	
Male	15 (65.2%)
Female	8 (34.8%)
Interest	
Not interest	23 (100%)
Level of laparoscopic education	
None	16 (69.6%)
Level I	7 (30.4%)
Level of laparoscopic knowledge	
Score <90	23 (100%)
Level of laparoscopic experience	
Low	18 (78.3%)
Average	5 (21.7%)

Table 2: OSA CNS score pre- and post-training

OSA CNS score	*Average ± SD*	*p value*	*Difference*
Pre	15.00 ± 2.03	Reference	Reference
Post I	17.60 ± 2.69	<0.001	2.5 (−5 until 8.5)
Post II	16.36 ± 1.84	0.011	2 (−3 until 5.5)
Post III	17.80 ± 2.26	<0.001	3 (−4 until 6.5)

Table 3: OSA CNS score after training

		n	*%*
1-week post-training	Increase	18	78.3
	Decrease-stable	5	21.7
2-week post-training	Increase	17	73.9
	Decrease-stable	6	26.1
3-week post-training	Increase	19	82.6
	Decrease-stable	4	17.4

could not find a significant difference when examining transfer to the OR.[6] Systematic review by Zendejas et al. showed that virtual simulator training and box training result same outcome of effectiveness laparoscopic skill transfer. Box trainer provides better satisfaction and more time concise.[12] Loukas et al. also revealed same result in their study. Virtual simulator and pelvic box are equal in laparoscopic skill transfer, i.e., cutting, object transfer, and suturing.[13]

Others interest result in this study, we obtained about 21.7, 26.1, and 17.4% samples achieve decrease-stable OSA CNS score 1, 2, and 3 weeks after training, respectively. As aim of training, this decrease-stable score is an unexpected outcome. Study by Stucky et al. to evaluate surgeon's work-related symptoms revealed laparoscopy surgeons are significantly more likely to experience musculoskeletal symptoms than surgeons performing surgery. Back pain, neck pain, and arm/shoulder pain are the most anatomy site of musculoskeletal.[14] In other study by Huang and McGlothlin, concentration is an integral component of ergonomic condition in laparoscopy. Good concentration is parallel to optimal physical condition in laparoscopy.[14] In our study, fatigue factor probably factor lead to decrease-stable OSA CNS score.

We revealed female gender and low laparoscopic experience are correlated to low OSA CNS score after training. Donnon et al. in their study showed men are having good visuospatial skill than women in case of camera navigation and suturing. Laparoscopy needs good capability to interpret intra-abdominal three-dimensional to two-dimensional image on the monitor.[15] White and Welch in their study about correlation gender to laparoscopic skill mentioned the difference between men and women was occurring before training. Female recommended one-on-one instruction as the most important strategy of completing training outcome.[16]

Laparoscopic experiences are important factor to gain laparoscopic skill after training. This achievement related to exposure to laparoscopy before the training started. Louridas et al. forwarded that experience was factor correlated to accomplish successful laparoscopy training outcome.[17] As Dawe et al. stated laparoscopic skill of camera navigation and colonoscopy are related to previous experience.[18]

Limitation of this study where we did not compare between training used pelvic box and virtual simulation. We thought it was necessary to know effectively both of training modality in case of preparation all laparoscopic training tools for residency program. Other limitation in our study was did not consider fatigue as confounding factor.

Even with all the limitations, we feel a simulation program focused on teaching fundamental principles and techniques of camera navigation in laparoscopic is a critical component for teaching safe endoscopic practices in our Ob/Gyn residency

Table 4: Correlation between age, gender, level of laparoscopic education, and level of experience to camera navigation skill difference pre- and post-training

		Skill difference			
		Median	*Minimum*	*Maximum*	*p value*
Age	<31 years	3.00	−1.00	6.50	0.893
	≥31 years	3.50	−4.00	6.50	
Gender	Male	3.00	−1.00	5.50	0.041
	Female	2.50	−4.00	6.50	
Level of laparoscopic education	None	2.75	−4.00	6.50	0.051
	Level I	3.50	2.50	5.50	
Level of laparoscopic experience	Low	3.00	−4.00	6.50	0.030
	Average	3.50	2.50	5.50	

training program. The growing demand for minimally invasive surgery from our patients, the constant evolution of endoscopic technology and techniques, the limitations of resident work week, and the diverse range of women's healthcare practices (both Obstetrics and Gynecology) that must be mastered in a 4 year training period are some of the challenges of training Ob/Gyn residents today.[19]

Conclusion

There was significantly different laparoscopy camera navigation skill after training used pelvic box and suggest 3 week duration as optimum time to evaluate training outcome. Female gender and low experience are factors that must notice in training setting to achieve optimum laparoscopy camera navigation training outcome.

Clinical Significance

Camera navigation training used pelvic box is a critical component for teaching safe endoscopic practices in our Ob/Gyn residency training program.

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RESEARCH ARTICLE

Predictors for Conversion to Open Appendectomy in Patients Undergoing Laparoscopic Appendectomy Based on Clinical Presentations on Ultrasonography Findings and Tzanaki's Scoring

Vaibhav Srivastav[1], Nandan Rai[2], Kajal Mishra[3]

Abstract

Background: Laparoscopic appendectomy (LA) may need to be converted to open appendectomy (OA) if intraoperative complications or severity of the disease hinders with a safe laparoscopic intervention. This may be in the form of abnormal position of appendix, adhesion due to previous inflammations, appendix mass, abscess, perforated appendix and diffuse peritonitis or other pelvic or right iliac fossa pathologies or technical problems, and lack of space for dissection. Even though these pathologies can be dealt with minimal access surgery, conversion to open surgery may become mandatory in a small number of cases. The presence of comorbidities is the independent factor related to conversion during laparoscopic appendicectomy.[1]

Materials and methods: The study was carried out in PG Department of Surgery, SRN Hospital associated with MLN Medical College, Prayagraj from September 2018 to September 2019 after approval from the ethical committee and after obtaining written and informed consent either from patient or their legal heir. The study was conducted on the patients admitted in the Department of Surgery, SRN Hospital, MLN. Medical College between September 2018 and September 2019 who underwent conversion appendicectomy. Patients were evaluated and their complete biodata were recorded after taking detailed history. Based on history, clinical examination, laboratory investigations, and ultrasound of abdomen and pelvis, appendicitis diagnosed. The parameters studied include age, sex, previous history of acute appendicitis any lower abdominal surgeries in the past, symptoms, duration of symptoms, sign, white blood cell (WBC) count, ultrasound abdomen and pelvis findings, American Society of Anesthesiologists (ASA) grading, and intraoperative findings including reasons for conversion.

Results: Multivariable analysis incorporating these factors available to the surgeon preoperatively identified advanced age, ASA score >2 points, severity of adhesion in ultrasonography (USG), significantly associated with conversion. These results highlight the complex nature of the decision to convert, in as much as baseline patient characteristics, disease severity, and surgeon factor each independently impact the probability of the successful laparoscopic procedure. Conversion in our study was significantly associated with comorbidities as out of 11 patients with comorbidities [6 hypertension (HTN), 4 diabetes mellitus (DM), 1 asthma], 10 (90.90%) were converted to OA with significant *p* value ($p = 0.00001$). Among nine patients with ASA grade >2 points, eight were converted to OA. Total leukocyte count was >12,000 in 25 patients (41.67%) out of which 9 patients (36%) were converted to OA. In this study, 21 patients (35%) had score ≤9, while 39 patients (65%) had score ≥10. Eleven patients (52.38%) were converted to OA out of 21 having score ≤9 in comparison to 1 patient (2.56%) out of 39 patients having score ≥10.

Conclusion: We identified preoperatively, predictors for conversion of LA to OA consisting of age ≥40, comorbidity, ASA grade >2 point, leukocytosis, right iliac fossa lump and Tzanaki's score <9 point. By using this, we proceed directly to OA under these circumstances may reduce operative time and expenses by conversion to OA.

Keywords: Appendectomy, Conversion, Predictors, Tzanaki's score.

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Introduction

Acute appendicitis is one of the most common differential diagnoses of acute abdomen and a common intra-abdominal condition requiring emergency surgery.[2] It can either be managed conservatively using Ochsner–Sherren regimen or operatively by laparoscopic/open appendectomy (OA).

Complicated appendicitis includes obese, older patients, and pregnant women.

In this era of advance technology and minimal access surgery, laparoscopic appendicectomy has gained much popularity owing to its suggested advantages like less postoperative pain, faster recovery, lower wound infection rates shorter hospital stay, and higher cosmetic satisfaction.[3] Laparoscopic appendicectomy may need to be converted to open appendicectomy if intraoperative complications or severity of the disease hinders with a safe laparoscopic intervention. This may be in the form of abnormal position of appendix, adhesion due to previous inflammations,

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appendix mass, abscess, perforated appendix and diffuse peritonitis or other pelvic or right iliac fossa pathologies or technical problems, and lack of space for dissection. Even though these pathologies can be dealt with minimal access surgery, conversion to open surgery may become mandatory in a small number of cases. The presence of comorbidities is the independent factor related to conversion during laparoscopic appendicectomy.[1]

Conversion from laparoscopic to open appendicectomy known as conversion appendicectomy (CA), further increases the operative time, along with loss of benefits of minimal access surgery. Therefore, developing a preoperative criterion to decide ideal operative approach for individual may be useful.

Materials and Methods

The proposed study titled "Predictors for conversion to OA in patients undergoing laparoscopic appendectomy (LA) based on clinical presentations, ultrasonography (USG) findings and Tzanaki's scoring" was carried out in PG Department of Surgery, SRN Hospital associated with MLN Medical College, Prayagraj from September 2018 to September 2019 after approval from the ethical committee and after obtaining written and informed consent either from patient or their legal heir.

The study was conducted on the patients admitted in the Department of Surgery, SRN Hospital, MLN Medical College between September 2018 and September 2019 who underwent conversion appendectomy.

Patients were evaluated and their complete biodata were recorded after taking detailed history. Based on history, clinical examination, laboratory investigations, and ultrasound of abdomen and pelvis, appendicitis diagnosed. The parameters studied include age, sex, previous history of acute appendicitis any lower abdominal surgeries in the past, symptoms, duration of symptoms, sign, white blood cell (WBC) count, ultrasound abdomen and pelvis findings, American Society of Anesthesiologists (ASA) grading, and intraoperative findings including reasons for conversion.

Results

In our study of 60 patients undergoing appendicectomy, conversion to OA occurred in 12 patients (20%). The conversion rate in this study much higher than other studies performed before because of small sample size of this study.

In our study, age group of 10–39 years had lower rate of conversion in comparison to age group of ≥40 years. Out of 60 patients, 12 patients converted to open out of which 8 patients (66.67%) were ≥40 years, with significant p value ($p = 0.000124$). A study conducted by Manuneethimaran et al.[4] shows almost similar age group (48 ± 16) associated with more conversion with significant p (<0.01) value. Other study by Antonacci et al.[5] had similar age group (36 ± 19.3) associated with more conversion with significant p (<0.001) value.

In our study, 38 patients (63.33%) were male, while 22 patients (36.67%) were female, out of which male patients had more conversion (21.05%) in comparison to female patients (18.18%) which did not have significant association ($p = 0.946606$).

Conversion in patients with comorbid conditions in our study had significant association as out of 11 patients with comorbid conditions [6 hypertension (HTN), 4 diabetes mellitus (DM), 1 asthma], 10 (90.90%) were converted to OA with significant p value ($p = 0.00001$) in Fisher's exact test. A similar study was performed by Antonacci et al.[5] in which conversion rate was high with significant p value ($p = 0.001$). Another study conducted by Suresh Kumar et al.[6] also has similar conversion in diabetic patient as 3 underwent conversion out of 12 patients of DM and 16% conversion in hypertensive patients.

Another predictor for conversion to OA in our study is ASA grade >2 points. Out of 60 patients, there were 51 patients (85%) with ASA grade 1 point, while 9 (15%) patients were ASA grade >2 point. Among nine patients, eight were converted to OA with ASA grade >2 point. There was a significant association with conversion of ASA grade to open procedure ($p = 0.001$). A similar study conducted by Wagner et al.[7] in which 12 patients (29.7%) out of 39 patients were converted to OA with ASA grade >2 points, which is significant with $p = 0.001$.

In our study, leukocyte count was >12,000 in 25 patients (41.67%) out of which 9 patients (36%) were converted to OA with significant p value ($p = 0.021947$) in comparison to normal leukocyte count. Study conducted by Manuneethimaran et al.[4] had the similar result the high WBC count is associated with higher conversion to open procedure with WBC count ($16,380 \pm 1,015$) having significant p value ($p \leq 0.01$).

Tzanaki's score is a diagnostic score which includes right iliac fossa tenderness, rebound tenderness, leukocytosis (>12,000), and USG finding. In this study, 21 patients (35%) had score ≤9, while 39 patients (65%) had score ≥10. There was 11 patients (52.38%) converted to OA out of 21 having score ≤9 in comparison to 1 patient (2.56%) having score ≥10. This shows significant association Tzanaki's score to more conversion in population having ≤9 score while less conversion in population having ≥10 score.

In our study, USG finding was included in Tzanaki's scoring system, so individual finding of USG is not significantly associated with conversion to open appendicectomy. In general, USG showing as appendicular mass, appendicular adhesion, pericecal adhesion, and perforation had higher impact on decision on conversion. Study by Suresh Kumar et al.[6] has similar result with association of USG finding.

Other clinical features, such as pain, fever, nausea, and vomiting, were not significantly associated with conversion in our study as statically insignificant value ($p \geq 0.05$). Manuneethimaran et al.[4] study having similar result to pain, fever, nausea, and vomiting is not a predictor with insignificant p value ($p \geq 0.05$) for conversion of LA to OA.

Discussion

In our study, by univariable analysis, a number of risk factors for conversion to OA were identified. These include advanced age, male sex, ASA score >2 points, higher leukocyte count, and severity of inflammation as shown in USG (pericecal adhesion, periappendicular adhesion, perforated appendix with peritonitis, gangrenous appendix).

Multivariable analysis incorporating these factors available to the surgeon preoperatively identified advanced age, ASA score >2 points, and severity of adhesion in USG are significantly associated with conversion. These results highlight the complex nature of the decision to convert, in as much as baseline patient characteristics, disease severity, and surgeon factors, as each independently impacts the probability of successful laparoscopic procedure. Thus, a careful assessment of the patient risk factors, blood investigations, and Tzanaki's scoring will help segregate patients into one group which can be safely taken up for laparoscopic appendectomies without much risk of conversion to OA and

another group that is predicted to have significant conversion rates, hence performing open appendectomies will bear better consequences.

Conclusion

We identified preoperatively, predictors for conversion of LA to OA consisting of age ≥40, comorbidities, ASA grade >2 points, leukocytosis, right iliac fossa lump and Tzanaki's score <9 points. By using this, we proceed directly to OA under the circumstances predicting higher risk for conversion of laparoscopic to open appendectomies, thereby reducing the cost, effort, and ensuring better patient outcome.

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RESEARCH ARTICLE

Single-incision Laparoscopy-assisted Appendectomy in the Pediatric Age Group: Our Experience

Charu Tiwari[1], Hemanshi Shah[2], Gursev Sandlas[3], Neha Sisodiya Shenoy[4], Suraj Gandhi[5]

Abstract

Background: Various methods of laparoscopic appendectomy have been described in children. We present the data of 50 children who underwent interval appendectomy at our institution by transumbilical single-incision laparoscopy-assisted appendectomy (SILAA).

Materials and methods: Fifty patients <12 years from June 2011 to June 2017 with inclusion criteria <12 years of age who were admitted with clinical features of acute appendicitis of >24–48 hours' duration; had abdominal ultrasound (USG) with appendicular diameter of >10 mm and good clinical response to initial management by intravenous antibiotics within 24–48 hours of admission were retrospectively analyzed. They underwent SILAA after 6 weeks. Under general anesthesia, an infraumbilical incision was made and umbilical tube was identified. A 5 mm camera port was inserted by open Hassan's technique. After visualizing the appendix, another incision was made adjacent to the port site on the left and a 5 mm instrument was introduced through this. The appendix was freed, mobilized, and delivered through the incision. Appendectomy was completed extracorporeally.

Results: The average age at presentation was 9.3 years. There were 18 females and 32 males. Two patients required conversion to open procedure in view of extensive adhesions and a short retrocecal appendix which was difficult to mobilize and exteriorize through umbilicus. The mean operating time was 30 minutes. There were no complications.

Conclusion: Single-incision laparoscopy-assisted appendectomy combines the advantages of both laparoscopic and open appendectomy and offers reduced operative time and less complications and reduced surgical costs in pediatric age group.

Keywords: Appendectomy, Laparoscopy, Pediatric, Single incision.

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Introduction

Appendiceal pathology accounts for approximately 15–20% of all abdominal surgical emergencies in the pediatric age group.[1–3] It has been regarded as the commonest indication for appendectomy in pediatric patients.[1,4,5] Appendectomy is performed by various techniques, such as open, laparoscopic assisted, laparoscopic multiport, and single-incision laparoscopic approach.[6] Laparoscopic appendectomy has been accepted as the gold standard for the management of appendicitis in children; its advantages over open appendectomy being less surgical trauma, less postoperative pain, fewer postoperative infections, shorter hospitalization, better cosmesis, and earlier recovery.[7]

The conventional laparoscopic appendectomy uses three ports for appendectomy. Appendectomy by a single incision is a further evolution toward minimally invasive surgery.[6] We present the data of 50 children who underwent interval appendectomy at our institution by transumbilical single-incision laparoscopy-assisted appendectomy (SILAA).

Materials and Methods

We present our experience with SILAA in 50 pediatric patients <12 years from June 2011 to June 2017.

Inclusion criteria were children <12 years of age who were admitted with clinical features of acute appendicitis of >24–48 hours' duration; clinical evidence of acute appendicitis, abdominal ultrasound (USG) with appendicular diameter of >10 mm, and good clinical response to initial management by intravenous antibiotics within 24–48 hours of admission.

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Patients who presented within 24–48 hours of onset of their symptoms, had uncomplicated appendicitis with appendicular diameter of 6–10 mm on USG, resolution of their symptoms with intravenous antibiotics within 24–48 hours of admission, and no recurrence of symptoms were excluded from this study. They were kept on vigilant follow-up. Patients presenting with appendicular perforation and abscess and having inadequate response to intravenous antibiotics within 24 hours of admission underwent emergency appendectomy and therefore excluded from this study.

All patients with acute abdominal pain with clinical diagnosis of acute appendicitis underwent abdominal USG to rule out complications, such as perforation or abscess. Appendicular diameter was assessed on USG. In equivocal cases, computerized

tomography was performed. Intravenous antibiotics were administered. All patients were clinically monitored for 24 hours for resolution of clinical signs (vomiting, fever, tachycardia, right iliac fossa tenderness). Patients showing clinical response within 24 hours were offered SILAA after 6 weeks.

Under general anesthesia, in supine position with the patient catheterized and strapped to the operating table, an infraumbilical skin fold incision was made and deepened. Umbilical tube was identified and a 5 mm camera port was inserted by open Hassan's technique. Capnoperitoneum was created and the pressure was maintained between 8 mm Hg and 10 mm Hg. Appendix was visualized. Another incision was made adjacent to the port site on the left and a 5 mm instrument was introduced through this. Appendicular adhesions were dissected and appendix was freed. If necessary, a third incision was made to introduce an additional instrument to aid dissection. The tip of the appendix was held by a grasper and delivered through the infraumbilical incision (Fig. 1). Appendectomy was completed extracorporeally. The incision was then closed in layers. Skin was closed with subcuticular sutures.

Results

A total of 50 pediatric patients underwent appendectomy with interval SILAA procedure. The average age at presentation was 9.3 years. There were 18 females and 32 males. All patients had clinical symptoms of acute appendicitis and responded to intravenous antibiotics. They were discharged after the resolution of the acute phase and underwent interval appendectomy after 6 weeks.

Only two patients required conversion to open procedure in view of extensive adhesions and a short retrocecal appendix which was difficult to mobilize and exteriorize through umbilicus.

The mean operating time was 30 minutes. The average length of postoperative hospital stay was 24–36 hours. There were no postoperative complications (Fig. 2).

Discussion

After its first description by Semm in 1983,[8,9] the conventional three-port laparoscopic appendectomy has gained worldwide acceptance among the pediatric surgeons.[8] This technique has been evolving since then and there have been several modifications in order to achieve better cosmetic results, reduction in costs, shorter recovery period, and less hospital stay.[8,10] These newer techniques are appendectomy by laparoscopy-assisted approach, two-port laparoscopic approach, transumbilical single-port laparoscopic conventional appendectomy, and transumbilical single-incision laparoscopy-assisted approach.[8,10]

Single-incision and single-port laparoscopic appendectomy uses all three ports introduced through the infraumbilical incision and appendectomy is performed as in the conventional three-port manner by performing endocorporeal laparoscopic appendectomy. The single-port laparoscopic appendectomy is a recent advance which uses a singleport with three or four internal lumens. However, it requires special modified instruments—the single-incision port, curved instruments, and expertise; this ultimately increases the cost of surgery, especially in developing countries.[6] The disadvantages of both these procedures as reported in the literature were longer operating time, clashing of instruments,[11] and increased cost of surgery;[12,13] the added disadvantage being cost of new instruments.

Single-incision laparoscopy-assisted appendectomy utilizes the umbilical incision to introduce a camera port and another conventional instrument to exteriorize the appendix through the umbilicus followed by extracorporeal appendectomy. It has advantages of better intra-abdominal visualization, less postoperative morbidity, and good cosmetic outcomes.[8] It is a safe, minimally invasive approach for interval appendectomy. It is a suitable surgical procedure for training laparoscopic abilities and also has low instrumentation requirements.[8] The procedure can be performed with the same conventional laparoscopic instruments avoiding the cost of new instruments.

This procedure was first described by Valla et al. in 1999 as umbilical one-puncture laparoscopy-assisted appendectomy and combines the advantages of laparoscopic surgery with those of open surgery.[8,14] Petnehazy et al. have suggested SILAA to be a better approach for appendectomy in obese children as well.[15]

Moreover, in an interval appendectomy, the surgery is performed once peritoneal contamination has been resolved,

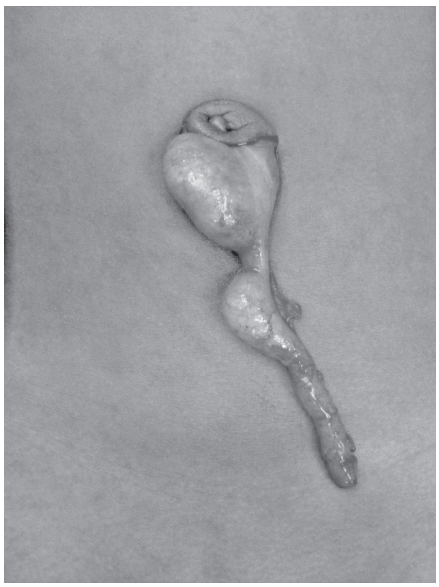

Fig. 1: Intraoperative image shows the appendix with part of cecum delivered through the infraumbilical incision

Fig. 2: Postoperative image of the umbilicus

potentially resulting in fewer postoperative complications of bowel obstruction, wound infection, fistula formation, intra-abdominal abscess, and bowel injury due to difficult dissection.[16] It is more cost-effective as it requires less numbers of trocars and surgical instruments compared to conventional three-port laparoscopy.[13,17,18] In children, the distance between appendix and umbilicus is shorter and the abdominal wall is more flexible making it easier to exteriorize the appendix through the umbilicus than in adults.[19]

The major disadvantage of SILAA is in terms of comfort and ergonomics.[20] The ability to triangulate the instruments around the target is lost because all instruments and cameras are inserted through the same incision.[20] However, with increasing exposure and experience with this technique, the operating time can be reduced significantly.[20]

Conclusion

Reduced-port and single-incision laparoscopic techniques have become popular in recent years for appendectomy. Single-incision laparoscopy-assisted appendectomy combines the advantages of both laparoscopic and open appendectomy and offers reduced operative time, early postoperative recovery, shorter duration of hospital stay, less complications, and reduced surgical costs in pediatric age group.

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CASE REPORT

Laparoscopic Heminephroureterectomy in Infants Weighing Less Than 10 Kilograms: The Two Peculiar Cases

Marianna Iaquinto[1], Maria-Grazia Scarpa[2], Roberto De Castro[3], Daniela Codrich[4], Edoardo Guida[5], Alessia Cerrina[6], Federica Pederiva[7], Maria A Lembo[8], Jurgen Schleef[9]

Abstract

Aim: We report two peculiar cases of laparoscopic heminephrectomy in infants weighing less than 10 kg with megaureter of nonfunctioning renal upper pole.

Cases description: A 6-month-old boy, with history of upper pole pyo-hydroureteronephrosis managed by percutaneous nephrostomy, was affected in the left side; while a 17-month-old girl, with history of abdominal mass then proved to be a giant megaureter of nonfunctioning renal upper pole, was affected in the right side and she was previously treated for primitive obstructive megaureter (in the lower pole). Laparoscopic heminephroureterectomy with a transperitoneal approach was performed. Mean length of surgery was 160 minutes. We reported no conversion to open surgery neither intraoperative bleeding/urine leakage. Mean hospitalization duration was 5 days. The reoperation rate was 0%. In both cases at preliminary follow-up, we reported a good outcome.

Conclusion: Laparoscopic heminephrectomy is considered a technically challenging procedure, especially for small infant but, according to our experience, it is safe and effective if performed in pediatric centers with high experience in minimally invasive surgery.

Keywords: Heminephrectomy, Infant weighing less than 10 kg, Laparoscopy, Megaureter.

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Background

Nowadays, minimally invasive surgery (MIS) is increasingly used, compared to open procedures, especially in pediatric urology.[1–4] Nevertheless, few reports exist regarding the experience in infants under 2 years old or weighing less than 10 kg, particularly at risk of conversion and/or complications.[5–9] We report two peculiar cases of laparoscopic heminephroureterectomy in infants of this risk group with megaureter of nonfunctioning renal upper pole.

Case Descriptions

Case 1

A male infant with prenatal diagnosis of moderate left hydroureteronephrosis and suspicion the of duplex renal system (DRS). At birth, the echography confirmed the presence of left DRS with upper pole (UP) hydroureteronephrosis; he was followed by nephrologists with ultrasound (US) controls, always stables, and voiding cystourethrography (VCUG) at 4-month-old, showing the absence of vesicoureteral reflux (VUR). He was asymptomatic until the age of 5 months, when he came to the hospital emergency with high fever and inappetence. Left UP pyohydroureteronephrosis was diagnosed (Fig. 1), managed by percutaneous nephrostomy placement and intravenous antibiotic therapy. During the recovery, a descending pyelography was performed by the nephrostomy that showed no passage of contrast into the bladder (Fig. 2). After 1 month, a dynamic renal scan (Mag3) was performed: bilateral DRS with ectopic megaureter (MU) in left nonfunctioning UP was described.

Case 2

A female infant with prenatal diagnosis of severe right hydroureteronephrosis, confirmed at birth. Voiding cystourethrography excluded VUR and dynamic renal scan (Mag3)

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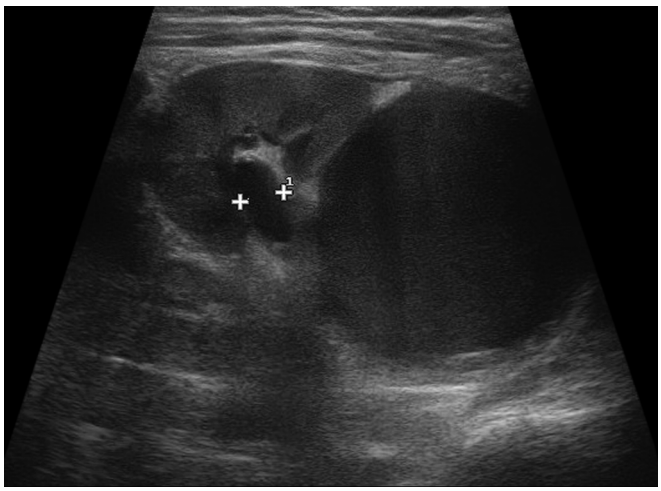

Fig. 1: Ultrasound view when the left upper pole pyo-hydroureteronephrosis was diagnosed in Case 1

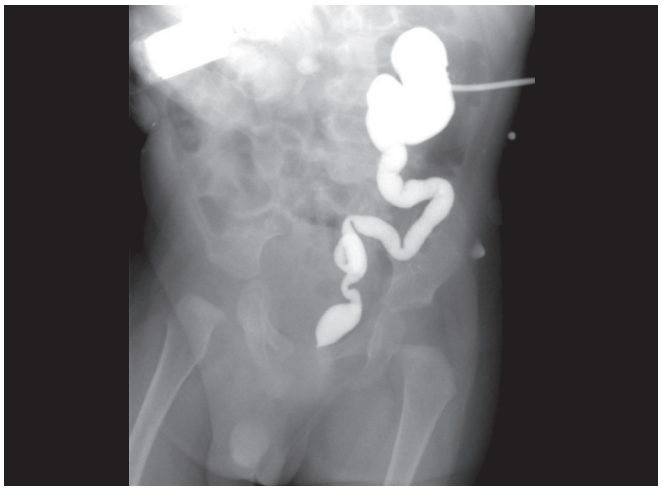

Fig. 2: Descending pyelography, performed by the nephrostomy in the Case 1, showed no passage of contrast into the bladder

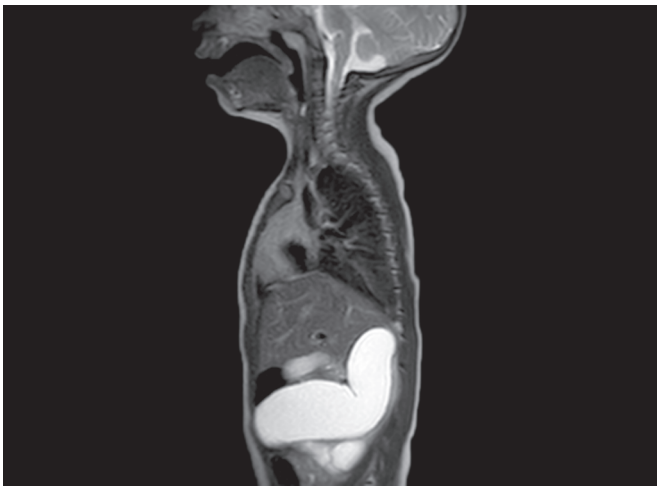

Fig. 3: In Case 2, the uro-magnetic resonance imaging showed a giant megaureter (with a maximum diameter of 5 cm) of a renal non-functioning upper pole

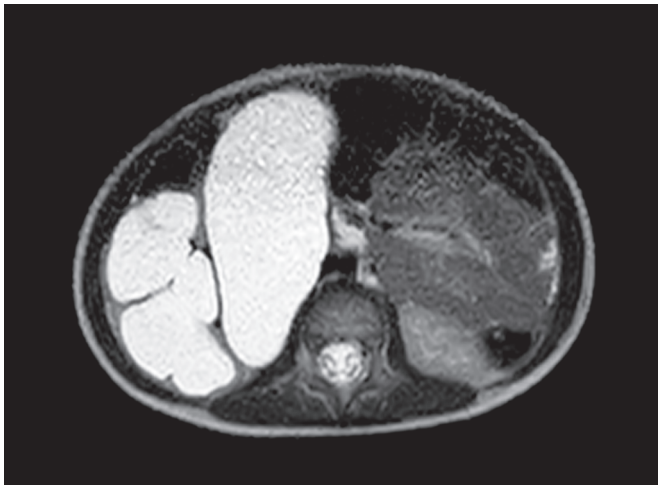

Fig. 4: In Case 2, the uro-magnetic resonance imaging showed a giant megaureter (with a maximum diameter of 5 cm) of a renal non-functioning inner pole

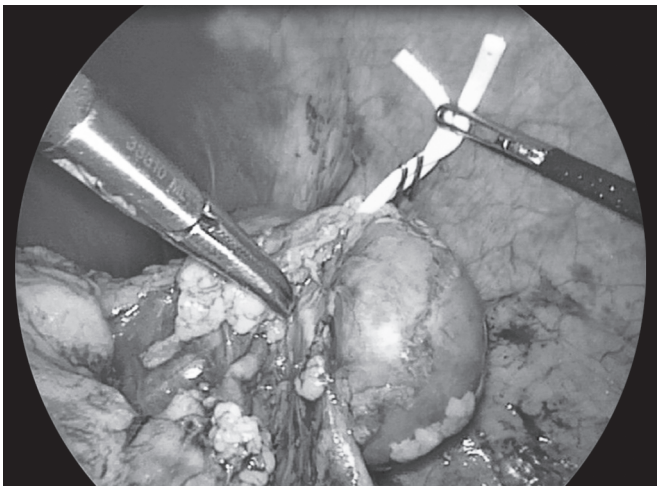

Fig. 5: Intraoperative view of the renal lower pole hilum isolation and preparation for passing behind it the upper pole megaureter

underlined right primitive obstructive megaureter (POM). Given the progressive hydroureteronephrosis, when she was 4-month-old, a double J stent was put in a single right ureteral orifice. The US controls showed an insufficient drainage of the urinary tract by the JJ stent, in a patient with respiratory distress. We performed a right ureterostomy, with a good outcome. At 11 months of age, ureteral right reimplantation was performed (Cohen procedure). Because of persistent hydronephrosis at US controls, associated with a palpable masse, in an asymptomatic patient, an ascending pyelography was performed, showing a good outcome of the POM and no communication with the mass. An extrarenal cystic mass, in particular a cystic lymphangioma, was suspected. Finally, uro-magnetic resonance imaging (uro-MRI) showed a giant MU (with a maximum diameter of 5 cm) of a renal nonfunctioning UP (Figs 3 and 4)—doubt about an incomplete DRS or ectopic giant MU.

The patients underwent heminephroureterectomy for their upper urinary tract duplication anomaly (Case 1: 6-month-old—8 kg; Case 2: 17-month-old—9.8 kg).

In both patients, the procedure started with a retrograde endoscopic LP ureteral catheterization, followed by a transperitoneal approach in a semilateral decubitus. Four trocars for the right side were used, while three for the left side, with a 10 mm/30° laparoscope and CO_2 insufflation at a maximum pressure of 8–10 mm Hg. The ipsilateral colonic flexure was mobilized, thus exposing Gerota's fascia. The UP ureter was identified, freed from the lower ureter without compromising his blood supply and dissected distally as far as possible, achieving a nearly complete ureterectomy. It was then passed behind the renal hilum; this step is technically the most difficult part of the procedure and often time-consuming. The UP vessels were ligated by clips, only after identifying the blood vessels to both renal systems (Fig. 5). The last step consisted to transect the renal UP parenchyma following demarcation resulting by the vascular ligation (Fig. 6). We used a special hemostatic device (LigaSure) for dissection and parenchymal section. Finally, we removed the specimen through the 10 mm umbilicus port and we have not left an abdominal drain.

In Case 1, despite the numerous adhesions due to the UP pyohydroureteronephrosis, the MU and the hypoplastic UP were successfully removed. The ectopic MU was isolated as far down as possible and ligated with Endoloop, leaving an ureteral stump of

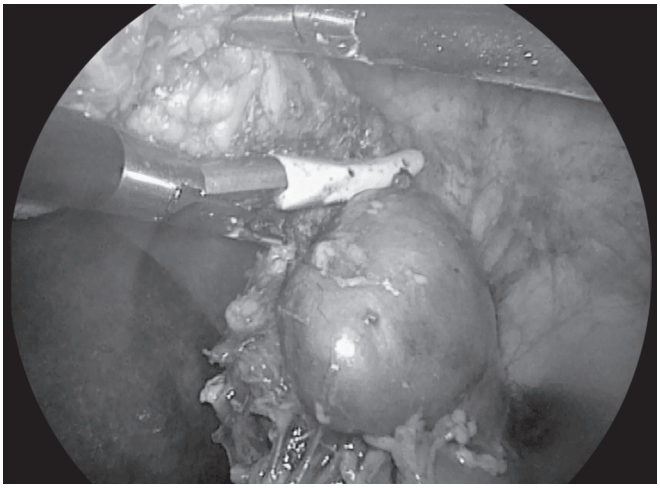

Fig. 6: Intraoperative view of the upper pole renal parenchyma transection, following the demarcation after vascular control

about 3 cm. In Case 2, the giant MU of an incomplete DRS, severely compressing the LP pelvis and very adherent to the twin ureter and the adjacent structures, was completely removed with the hypoplastic UP.

Mean length of surgery was 160 minutes, including cystoscopy. We reported no conversion to open surgery neither intraoperative bleeding/urine leakage. Postoperative analgesia included paracetamol every 6–8 hours and Ketorolac as needed. The Foley catheter was removed on postoperative day 2. We had a minor complication (fever) in Case 1, with no effect on the outcome. Mean hospitalization was 5 days. In both cases at preliminary follow-up (mean 9 months), we reported a good outcome with normal US controls and no loss of renal function on the residual kidney moiety.

Discussion

Duplex renal system is one of the most common congenital renal tract abnormalities. The majority of cases are clinically silent or diagnosed incidentally during imaging studies and no treatment is necessary. While, if DRS is associated with VUR, ectopic ureter, ureterocele, ureteral obstruction, and symptoms occur (hydronephrosis, UTI, incontinence), a surgical treatment might be necessary.[4,10–12] In 1993, Jordan and Winslow successfully carried out the first laparoscopic transperitoneal (TP) heminephrectomy in a 14-year-old child.[13] Thereafter, this approach, compared with open surgery, became very popular in pediatric urology, reporting less postoperative pain, shorter hospitalization time, better cosmetic effect, and faster return to full physical activity in the child.[12,14–16]

In the same year, 1993, the first laparoscopic urological procedure in a small infant (8-month-old) was described by Koyle et al. They concluded that the laparoscopic approach in this specific group of patients is feasible and reproducible; however, it is a challenging procedure with a higher incidence of morbidity.[2]

Laparoscopy in small infants requires special care and has a steep learning curve. It is highly important for conversion rate and its potentiality to develop complications (nonspecific laparoscopic complications, attributable to the insufflation of gas or due to instruments, and specific surgical complications).[17,18] In particular, laparoscopic heminephrectomy is more technically difficult and requires more experience compared with the nephrectomy due to the likelihood of complications such as hematoma, urinoma, and the risk of the residual pole pedicle injury.[12,19,20]

Laparoscopic heminephrectomy can be performed with transperitoneal, lateral, or posterior retroperitoneoscopic approaches.[6,14,21] In addition, robot-assisted approach is reported in the literature.[11]

The limited working space and, consequently, the peritoneal tear risk are the main disadvantages of a retroperitoneal approach.[6] Wallis et al. described a 15.4% conversion rate and 40% of functional loss on the residual kidney moiety after retroperitoneal heminephrectomy. Therefore, they supported the use of open procedures in children under 1 year.[5] Castellan et al. reported that 80% of all complications occurred in patients under 1 year, with a 12.5% conversion rate, so they recommended the TP approach in this group of patients.[6] Miranda et al. described a series of seven TP heminephrectomies, without complications, in children under 2 years.[22] Leclair et al. reported in 21% of the patients, using retroperitoneal approach, conversion to open surgery, significantly related with the patient's young age.[16]

The advantages of using the TP laparoscopic approach include achieving larger working space with excellent renal exposure and easier access to the upper pole.[23,24] Also, this approach allows the surgeon to perform a complete ureterectomy when needed.

In our cases, we performed heminephrectomies transperitoneally, first of all for patients' age and weight, and also because of the history of infection (UP pyohydroureteronephrosis) in Case 1 and the huge MU in Case 2.

Laparoscopic heminephrectomy is usually carried out with three or four ports.[12,19,23,25,26] It is useful to insert the fourth trocar on the right side for the liver retraction and for better exposure of the renal upper pole. For untrained pediatric urologists, the use of four ports in laparoscopic heminephrectomies was recommended for both right and left sides.[12] We used four trocars for the right side and three trocars for the left one.

Intraabdominal organ injuries and adhesion formation are the major risks of the TP approach, related to bowel mobilization.[3] However, we reported no digestive postoperative complications.

Some authors, to verify the integrity of the parenchymal resection edge and the possibility of urine leakage, inject methylene blue dye into the catheter positioned in the ureter of the normal functioning moiety. In our cases, we did not consider it necessary, given the excellent view of renal demarcation after vascular control.

In our technique, using a special device (LigaSure) has proven to be an effective aid to make a delicate dissection and parenchymal section.

According to us, more studies are necessary, in the near future, to evaluate the outcomes of minimally invasive surgery (MIS) among neonates and small infants and, for them, laparoscopy should be considered an additional alternative in hands of expert pediatric surgeons able to manage every complication, if needed.

Conclusion

Minimally invasive urological procedures in neonates and small infants are technically challenging, requiring patient special care and surgeon expertise. However, based on our experience, we validate that such procedures can be safely performed with good outcomes and the TP approach is the most indicate to reduce the conversion and complication rate in this group of patients.

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CASE REPORT

Laparoscopic Retrieval of a Migrated Intrauterine Contraceptive Device

Eftekhar Hassan Al-Ojaimi[1], Shafeeqa Ali Ebrahim[2]

Abstract

Introduction: Intrauterine contraceptive device (IUCD) migration consequent to perforation of the uterus is not very common, but is one of the more serious complications.

Case descriptions: We described two cases of migrated IUCD, at two distinct sites in the pelvic cavity, one was located in the pouch of Douglas embedded behind the left ovary and tube which was adherent to the posterior uterine wall and another was in the left mesovarium between the ovary and the tube. Both IUCDs were successfully removed laparoscopically without any complication.

Conclusion: Migrated IUCDs should always be removed once the diagnosis is made to prevent serious complications. Laparoscopic approach is a successful and preferred choice of treatment in selected cases.

Keywords: Intrauterine device, Laparoscopy, Migration, Uterine perforation.

World Journal of Laparoscopic Surgery (2020): 10.5005/jp-journals-10033-1409

Introduction

Intrauterine contraceptive device (IUCD) is one of the most widely used forms of contraception, predominantly in the developing countries. This method has the benefits in terms of affordability, as also being very effective, long-lasting, and reversible but it is not risk free. Insertion of an IUCD is associated with some complications like cramping abdominal pain, irregular and sometimes heavy vaginal bleeding, expulsion, and even serious complications, such as infection and pelvic inflammatory disease, retraction back to the cervix or uterine cavity, and subsequent uterine perforation.[1,2] The incidence of uterine wall perforations is estimated to be around 0.2–9.6 per thousand insertions.[2] A migrated IUCD can be found in different positions in the pelvic or abdominal cavity, which may cause different complications and morbidities or may be asymptomatic. Herein, we presented two cases of migrated IUCD, at two distinct sites in the pelvic cavity, who underwent successful laparoscopic procedure with IUCD removal.

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Case Descriptions

Case 1

A 28-year-old para 2 with 2 living issues presented with lower abdominal pain, dull aching in character, for 4 months and stated that she was not able to feel the IUCD thread for 14 days prior to presentation. She had the IUCD inserted 2 years ago, 1 month after her second delivery during the lactational period. The IUCD thread could not be visualized on per speculum examination. On per vaginal examination, cervical motion tenderness was elicited with nodularity and tenderness felt in the pouch of Douglas. The patient underwent ultrasonography and the IUCD was located in the pelvis with minimal free fluid outside the uterine cavity. The patient was then subjected to a laparoscopic examination. Following general anesthesia, pneumoperitoneum was established and three ports were made. A subumbilical incision was made for the primary port and a 10 mm cannula placed for the laparoscope. Another two 5 mm secondary ports were put in the right and left lower quadrants for the accessory instruments. In laparoscopy, Nova-T type IUCD along with the string was seen in the pouch of Douglas embedded behind the left ovary and tube which was adherent to the posterior wall of the uterus (Fig. 1). The adhesions were released and the IUCD was

Fig. 1: Nova-T type intrauterine contraceptive device along with the string in pouch of Douglas

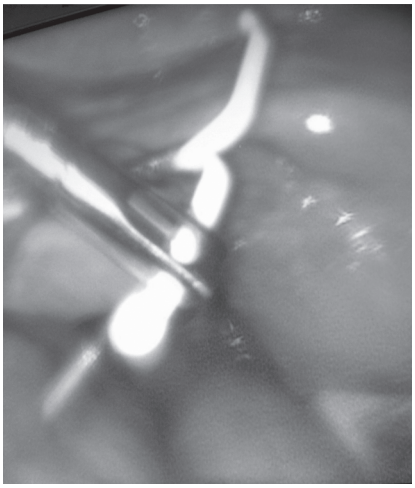

Fig. 2: Nova-T type intrauterine contraceptive device embedded in the left mesovarium between the ovary and tube

subsequently grasped and removed. The procedure was uneventful and the patient was discharged the next day.

Case 2

A 39-year-old para 5 with 4 living issues presented with severe chronic pelvic pain and deep dyspareunia for the last 2 months. She had an IUCD inserted one and a half years ago toward the end of the menstrual cycle. On per speculum examination, the IUCD thread was not seen. By ultrasonographic examination, the IUCD could not be localized inside the uterine cavity. Plain X-ray was performed and it showed the IUCD toward the left side of the pelvis outside the uterus. Laparoscopic removal of the IUCD was planned. The procedure was performed as mentioned above in Case 1. On laparoscopy, Nova-T type IUCD was seen in the pelvis embedded in the left mesovarium between the ovary and the tube (Fig. 2). The IUCD was grasped and gently removed without complication. She had uneventful recovery and was discharged home same day.

Discussion

During the insertion of IUCDs, perforation of the uterine wall is an uncommon but a very serious complication. The IUCD is usually known to perforate either the fundus, body of the uterus, or wall of the cervix. Uterine perforation can be complete or only partial. A complete perforation is when all uterine layers (endometrium, myometrium, and serosa) are perforated, as in both the cases described here. Less commonly, a partial perforation occurs, where the IUCD penetrates only the myometrial layer of the uterine wall. While the primary cause is usually idiopathic, uterine perforation can be associated with operator inexperience, IUCD, and patient-related factors. The design and structural characteristics of the IUCD together with the nature and rigidness or malleability of the inserter are the IUCD-related factors. Patient-related factors include the parity, size of the uterus and position (acutely anteflexed or retroflexed uterus), undiagnosed pregnant uterus, timing of the insertion (early in the postpartum period, lactation, or postabortion), former uterine operations, and congenital uterine or cervical anomalies are all important determinants of potential perforation. In a case–control analysis, lactating women had >10-fold risk of perforation at the time of IUCD insertion than non-lactating women.[3,4] Hypoestrogenic state with consequent thinning of the wall of uterus and accelerated involution of the uterus during the period of lactation could have been most likely the causes of perforation in our first patient.

Uterine perforations are reported to mainly occur in the early post-insertion period, specifically during the immediate 6 months,[4] but there have been case reports of perforation seen several years after insertion.[5,6] Subsequently, the IUCD can migrate into the neighboring organs or the abdominal cavity. Trauma during the insertion procedure itself, and along with the effect of chronic inflammatory reaction that causes erosion of the device through the uterine wall, can be thought to be the mechanism of IUCD migration. Delayed symptoms are presumed to be secondary migration with associated inflammatory process. Movements of the omentum may be a reason of migration of the IUCD to an adjacent organ. Migration can also be due to the growing uterus in unintended pregnancies and tubal ectopic pregnancy. The various locations where the perforated IUCDs have been found include the omentum (in 26.7%), pouch of Douglas (in 21.5%), lumen of the colon (in 10.4%), uterine myometrium (in 7.4%), broad ligament (in 6.7%), free within the abdominal cavity (in 5.2%), serosa of small intestine (in 4.4%), serosa of the colon (in 3.7%), and mesentery (in 3%).[7] The perforated IUCDs have also been found migrated to the stomach,[1] colon,[8–10] bladder,[11,12] retroperitoneum,[13] and even next to the iliac vein.[14] The location of the IUCD in our second patient, embedded in the mesovarium, appears to be particularly uncommon.

Some of the patients have symptoms and/or signs suggestive of perforation such as difficulty with the insertion procedure, resulting in pain or vaginal bleeding but others may remain asymptomatic for years. Therefore, perforation should be suspected whenever the woman presents with an unintentional pregnancy or has come for removal of the IUCD and on examination, the thread cannot be seen. Ultrasonography is preferred as a first-line radiological investigation, to locate the IUCD. When an ultrasound is inconclusive, plain anteroposterior abdominal X-ray is usually performed, to confirm if the device is in the pelvis. A suspected visceral involvement may need further evaluations with computerized tomography or magnetic resonance imaging.[15]

Once confirmed that the IUCD is outside the uterus, the decision to leave it alone or intervene to remove the device must be made. In symptomatic patients, as in both cases presented here, all clinicians agreed that IUCD surgical removal should be performed. However, in asymptomatic patients, there still remains a controversy. Markovitch et al. advocated that, although in symptomatic patients perforated IUCD should be removed surgically, in asymptomatic patients, under certain situations, conservative management may be of benefit.[16] The World Health Organization (WHO), however, has recommended that any displaced IUCDs should be removed, so as to prevent complications secondary to intraperitoneal adhesion formation or migration into surrounding organs.[17] Demir et al. reported that, in cases of intra-abdominally displaced IUCD, laparoscopic removal must be the preferred choice.[18] Grimaldo Arriaga et al. also encouraged immediate removal of the IUCD from the peritoneal cavity either by laparotomy or laparoscopy, along with prophylactic antimicrobials for colon preparation before elective surgery, as IUCD translocated to the peritoneal cavity may incite peritoneal or omental adhesions, uterocutaneous fistula, volvulus, and bowel perforation, which may lead to a significant morbidity.[19]

Furthermore, in deciding whether to intervene in patients who have been asymptomatic, one should consider the risks of conservative management including migration to more critical locations with subsequent need for a complicated surgery, chances of intra-abdominal abscess formation, psychological problems the patient may have, knowing about a foreign body inside her abdomen, and finally, the medicolegal consequences of a delayed management. All these supported the WHO recommendations of early surgical removal of all extrauterine IUCDs, in both symptomatic and asymptomatic patients.

Both laparotomy and laparoscopic surgeries are being performed for IUCD removal in the cases with the device migration. Laparoscopy is a preferred method as it is a minimally invasive procedure and has less complications and a shorter period of hospitalization compared to laparotomy. But laparoscopic removal is not always possible.[7] In the study of Gill et al., laparoscopic removal was successful in 64.2% of all included cases of migrated IUCDs.[7] The main reasons of not performing laparoscopy or converting it to laparotomy were adhesions and severe abdominal sepsis. Luckily in our both patients, we were able to safely remove the IUCDs laparoscopically without complication.

In conclusion, the possibility of perforation of the uterus should be considered in any woman who has an IUCD and the strings cannot be located, whether symptomatic or not. Surgical removal of the device, after the diagnosis is made, is recommended to prevent any subsequent serious complications. Laparoscopy is obviously preferable to laparotomy and our cases demonstrated that in selected patients, missing IUCD can be appropriately managed by laparoscopy without complication.

Ethical Approval

All procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent to Participate

Informed consent was obtained from both patients included in the study.

Informed Consent to Publish

The informed consent was obtained from both patients to publish their case.

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CASE REPORT

Laparoscopic Retrieval of a Displaced Intrauterine Device Presenting as Umbilicus Sinus

Diwakar Sahu[1], Kislaya Kumar Sao[2], Shiv Shankar Dubey[3]

Abstract

Aim: To report a case of displaced intrauterine device (IUD), having unusual presentation, and signify the role of laparoscopy in the surgical management of migrated IUD.

Background: The IUD is a popular family planning method worldwide. Intrauterine device migration into the peritoneal cavity is a serious complication and requires surgical removal in the majority of cases. In most of the reported cases, retrieval was performed through laparotomy. Moreover, cases which were attempted laparoscopically, many of them later converted to open. Also, previously published articles have mentioned migration of IUD into rectosigmoid, urinary bladder, small intestine, iliac vessels, and other sites. Ours is a probably first reported case of displaced IUD presenting as discharging umbilical sinus and surgical retrieval performed via laparoscopic approach.

Case description: A 28-year-old woman presented with pain and discharge from umbilicus. Investigations revealed displaced IUD at the level of umbilicus. Patient underwent laparoscopy surgery and found to have displaced IUD, embedded in-between omental adhesion to umbilicus. Entire surgery was carried out laparoscopically and IUD removed. Patient had uneventful recovery after surgery.

Conclusion: Uterine perforation following IUD insertion is a rare but potentially serious complication. Accurate preoperative localization of displaced IUD is obligatory and helpful. Current practice is to surgically remove all displaced IUDs. Laparoscopic approach appears to be safe with advantage of faster recovery and good cosmesis.

Clinical significance: Our article will provide insight in erratic presentation of displaced IUD and further augment the role of laparoscopy in the management of such cases.

Keywords: Copper-T, Intrauterine device, Laparoscopy.

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Background

Intrauterine device (IUD) is one of the most preferred contraception methods used worldwide due to low cost, reversibility, and long-lasting effect. Intrauterine device displacement and migration into the peritoneal cavity is a known and grave complication. The frequency of uterine perforation and IUD displacement ranges from 0.2 to 9.6 per thousand insertions.[1] Displaced IUD is a surgical emergency and requires prompt removal soon after diagnosis. Conventional approach is through laparotomy but numerous recent reports have described laparoscopy as a preferred technique.[2,3]

To the best of our knowledge, we report the first case of an IUD displacement presenting as umbilical sinus and was managed successfully using laparoscopic approach.

Case Description

A 28-year-old woman, parity and gravid 2, presented with pain and discharge from umbilicus since 3 months. Discharge was intermittent, serous in nature, mild in quantity and associated with throbbing pain, and erythema around umbilicus. Patient had a history of IUD (Copper-T A380) insertion 3 years ago, but strings were missing since 8 months. Patient underwent ultrasound and X-ray abdomen which showed foreign body at the level of umbilicus (Fig. 1). Routine blood investigation was performed which were within normal limit. She was subjected to laparoscopy surgery which showed omental adhesion just beneath umbilicus. Adhesions were released partially, revealing Copper-T entangled within adhesions. Further sharp and blunt dissection was carried out, thereby removing Copper-T (Fig. 2). No complications occurred during or after surgery and patient discharged on day 3 postoperatively. Patient follow-up period was uneventful.

Discussion

Intrauterine devices are effective and reversible contraceptive method, especially in developing countries. Though considered safe, IUD insertions are associated with several complications, such as abdominal pain, infection, ectopic pregnancy, menorrhagia, and uterus perforation.[2] Displaced IUDs may lead to perforation of adjoining organs, such as rectum, colon, small intestine, urinary bladder, and very rarely appendix.[4–6] Migration of IUD

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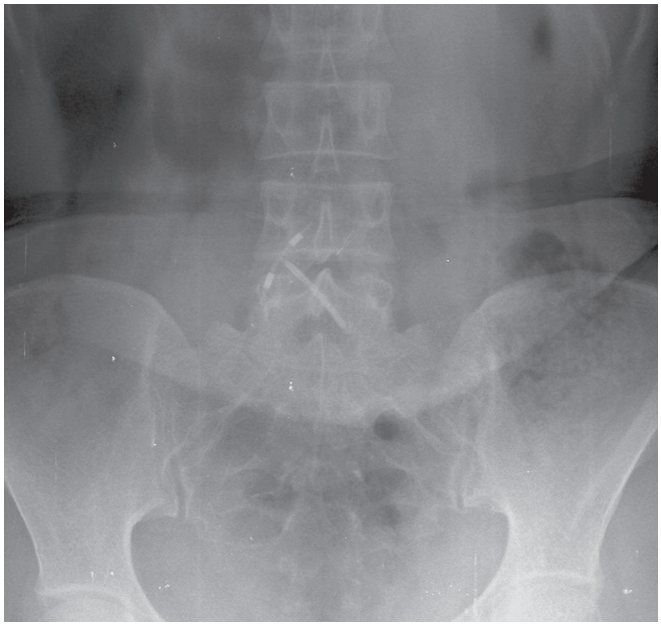

Fig. 1: X-ray abdomen showing displaced IUD at level of umbilicus

can be caused by traumatic insertion and chronic inflammation leading to erosion of uterine wall. Several factors may augment this migration which includes experience of operator, timing of insertion, congenital uterine anomalies, parity, and the position of the uterus.[7,8] Intrauterine device insertion should be avoided during early postpartum period, in lactating mothers and just after abortion as uterus is in the state of involution.

A literature review by Gill et al. stated that displaced IUDs have been found in many locations, most common being omentum (26.7%), followed by pouch of Douglas, colonic lumen, myometrium, broad ligament, free within the abdomen, and small bowel serosa.[8] In the present article, site of dislocation was just below umbilicus, in-between omental adhesion. Migrated IUD leads to foreign body reaction, thereby causing subumbilical inflammation and serous discharge.

Diagnosis is accomplished mainly by gynecological examination, ultrasound, and abdominal X-ray. CT scan is not necessary in all cases but it provides precise information, especially relation of IUD with migrated organ.[3] As all IUDs are radiopaque, plane abdominal radiography is the preliminary method of evaluation. Precise location of IUD preoperatively with appropriate imaging will help in surgical planning and also predict the complexity of surgery.

The management of intraperitoneal IUDs in asymptomatic patients is somewhat controversial. The World Health Organization recommended that displaced IUDs should always be removed to prevent possible complications that can occur due to intraperitoneal adhesion formation or migration into adjacent organs.[9]

The standard management for a migrated intrauterine contraceptive device (IUCD) is surgical removal, either open or via laparoscopic approach. A review article by Mosley et al. revealed that majority (93.0%) of reported cases were attempted laparoscopically; however, 22.5% of these were converted to open procedures.[7] The rate of conversion was found to vary according to the site of the displaced IUD. However, it must be noted that their review only included cases in which the IUD was located within the peritoneal cavity; cases with penetration into adjacent organs were excluded. With advances in laparoscopy, these situations are being increasingly managed with minimally invasive techniques. Moreover, it is now considered as the first line of treatment in patients with a suspected migrated IUD.[2,6,8] Laparotomy has many disadvantages, such as longer period of hospitalization, bigger scar formation, and has limited view during the surgery. Laparoscopy can overcome all these drawbacks and provide safe approach for dealing such cases.

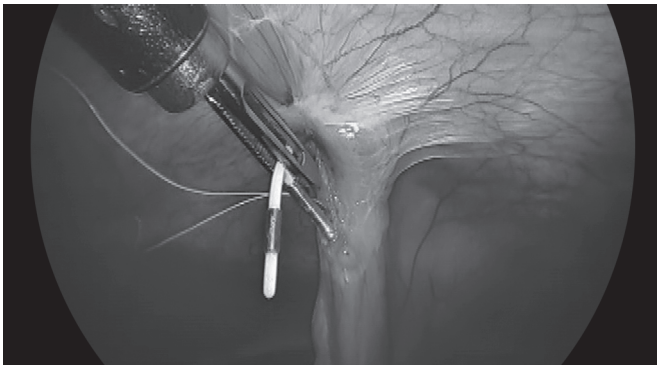

Fig. 2: Intraoperative image showing retrieval of IUD

Conclusion

Intrauterine contraceptive devices are the most popular form of reversible contraception. Uterine perforation following IUD insertion is a rare but potentially serious complication. Accurate preoperative localization of displaced IUD is obligatory and helpful. Current practice is to surgically remove all displaced IUDs. Laparoscopic approach appears to be safe with advantage of faster recovery and good cosmesis.

Clinical Significance

Our article will provide insight in erratic presentation of displaced IUD and further augment the role of laparoscopy in the management of such cases.

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Total Laparoscopic Pancreaticoduodenectomy: A Single-center Experience of 33 Cases in Patients with Periampullary Tumor—Lessons Learnt

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Abstract

Introduction: The introduction of minimally invasive procedures has revolutionized surgical practice worldwide. However, its application to total pancreaticoduodenectomy since its inception in 1994 by Gagner and Pomp has elicited reluctance and skepticism due to the need for expertise, advanced laparoscopy skills, long operative time, difficulty in adhering to oncological principles of resection, and high rates of conversion to open surgery.

Materials and methods: A retrospective review of 33 patients who underwent total laparoscopic pancreaticoduodenectomy at a tertiary care center in Mumbai from May 2015 to December 2019 was performed. All cases were operated by the principal investigator. Patients with malignancy on final histopathology report were included in the study. Patients with involvement of major vessels on preoperative contrast-enhanced computed tomography scan, distant metastasis, and contraindication to general anesthesia were excluded from the study. Perioperative data were collected and analyzed.

Results: Thirty-three patients were operated for total laparoscopic pancreaticoduodenectomy. The average operative time was 330 minutes. Only one patient required conversion to open surgery and postoperative blood transfusion. The resection margins were negative in all the patients with an average lymph node retrieval rate of 12 nodes. There was no postoperative mortality.

Conclusion and clinical significance: Total laparoscopic pancreaticoduodenectomy is a safe and feasible procedure with standard laparoscopic setup in patients with malignant periampullary disease.

Keywords: Laparoscopic pancreaticoduodenectomy, Minimally invasive pancreaticoduodenectomy, Minimal invasive surgery.

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Introduction

The introduction of minimally invasive procedures has revolutionized surgical practice worldwide. However, its application to total pancreaticoduodenectomy since its inception in 1994 by Gagner and Pomp[1] has elicited reluctance and skepticism due to the need for expertise, advanced laparoscopy skills, long operative time, difficulty in adhering to oncological principles of resection, and high rates of conversion to open surgery. Initially, case series were limited to high-volume centers with the availability of advanced laparoscopic setup. We report a series of total laparoscopic pancreaticoduodenectomy for periampullary tumors at a tertiary care institute in Mumbai.

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Materials and Methods

A retrospective review of 33 patients who underwent total laparoscopic pancreaticoduodenectomy for periampullary malignancy from May 2015 to December 2019 was performed. All cases were operated by the principal investigator after confirmation of periampullary tumor. Patients with malignancy on final histopathology report were included in the study. Patients with involvement of major vessels on preoperative contrast-enhanced computed tomography scan, distant metastasis, and contraindication to general anesthesia were excluded from the study. Preoperative ERCP-guided biliary stenting was performed in patients with cholangitis and those who required optimization for surgery ($n = 16$). Perioperative data were collected and analyzed. Preoperative variables included age, gender, American Society of Anaesthesiologists (ASA) classification of anesthetic risk,[2] and indication for surgery. Intraoperative variables included operative time, blood loss, and transfusion requirements. Postoperative complications were assessed during the duration of stay till discharge. Pancreas-specific complications were assessed and graded according to the recommendations of the International Study Group on Pancreatic Surgery.[3] Pathological staging and margin status were determined from final histopathology reports.

Operative Procedure

Patients were operated in the split-leg supine (French) position under general and epidural anesthesia with the operating surgeon standing between the legs of the patient.

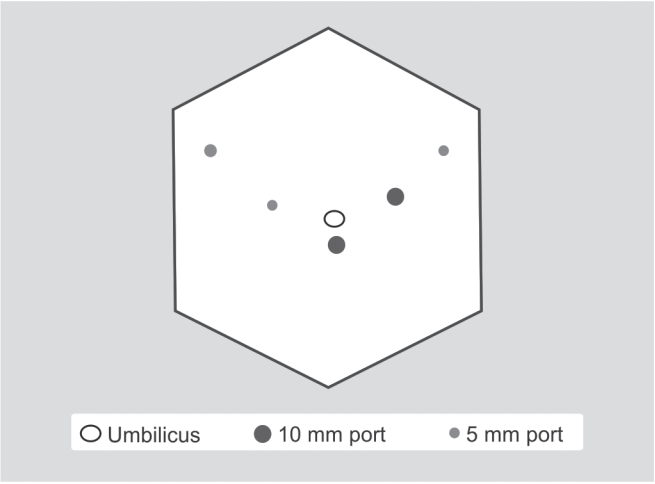

Fig. 1: Port placement

Procedure

A 10 mm port is inserted via an infraumbilical vertical incision for 30° laparoscope by open method (Fig. 1). After creation of pneumoperitoneum, the remaining ports (with little variation depending upon the height of the patient, contour of abdomen, and subcostal angle for ergonomic intracorporeal suturing) were inserted under vision and a thorough examination of the abdomen for metastasis on all visible peritoneal and visceral surfaces was performed. Gallbladder was held retracted superolaterally. The lesser sac was entered by making a window in the gastrocolic ligament and the pancreas examined. The hepatic flexure of colon was then mobilized. The duodenum was kocherized to identify the inferior vena cava and the aorta. Superior mesenteric vein (SMV) was traced and a plane created between the neck of pancreas and the SMV. Lymphoareolar tissue in the lesser omentum and the porta hepatis was dissected to identify the common hepatic artery and common bile duct and bared. The Calot's triangle was dissected to identify the cystic artery and the duct, both clipped and cut. After dissecting the vessels of the lesser curvature of the stomach, distal one-third of the stomach was transected using Endo-GIA stapler. Gastroduodenal artery was identified and ligated after ruling out aberrant vascular anatomy. Pancreas was transected at the junction of neck and body with ultrasonic shear. The duodenojejunal flexure was mobilized and the jejunum was divided 10–20 cm distal to it. The cut distal end of the proximal loop was brought to the right below the mesenteric vessels. The head of pancreas and the uncinate process were separated from the SMV with the help of ultrasonic and bipolar diathermy from caudal to cranial with confirmation of hemostasis at every step. The dissection cranially included the baring of the portal vein and of the common bile duct up to the level of cystic duct clearing all lymphovascular tissues. Common hepatic duct was transected above the level of the insertion of cystic duct. In preoperatively stented patients, the stent was removed and sent for culture. The gallbladder was not disconnected from the hepatic bed as it is used as the retractor to visualize the hepatic duct. The specimen was bagged and parked on side. The distal pancreas was dissected posteriorly from the SMV and the splenic vein for about 3 cm to facilitate anastomosis. The loop of the jejunum was brought retrocolic and hepaticodochojejunal anastomosis was performed with PDS 4.0 continuous sutures first placed posteriorly from medial to lateral followed by anterior layer in a similar manner, which avoids purse string effect on the anastomosis. The site for pancreaticogastrostomy was marked higher on the body of the stomach and anterior gastrotomy was performed opposite to it. The pancreatic stump was brought inside a smaller posterior gastrotomy so as to have a snug placement of pancreas inside stomach which was sutured with continuous sutures with 2.0 silk leaving at least 1 cm of pancreatic stump inside the stomach. The anterior gastrotomy was closed with 2.0 silk in two layers (Table 1). Gastrojejunal anastomosis was performed with 3.0 mersilk in two layers. The nasojejunal tube for feeding was placed across the gastrojejunal anastomosis. Hemostasis was confirmed and drains placed in Morrisons pouch and in pelvis. The port of optical port was widened and the specimen extracted. Closure of all ports and the infraumbilical incision was performed with non-absorbable sutures. Patients were extubated postoperatively and shifted to ICU for observation.

Table 1: Frequency of pancreaticoenteric and pancreaticogastric anastomosis

Anastomosis	*Frequency*
Pancreaticojejunal (dunking)	8
Pancreaticojejucal (duct-to-mucosa)	14
Pancreaticogastric (dunking)	11

Perioperative Care

All patients received epidural analgesia infusion for three days postoperatively. Nasogastric tube was removed on postoperative day 1 and nasojejunal tube test feed was administered. A clear liquid diet was begun on postoperative day 3 and oral diet advanced as tolerated. Abdominal drain was removed on postoperative day 5 if the output continued to be low volume and serous nature. Patients received routine antibiotic cover and prophylactic anticoagulation for deep venous thrombosis. Subcutaneous octreotide was continued until patients were started on orals.

Results

Thirty-three patients were operated for total laparoscopic pancreaticoduodenectomy with age of patients varying from 45 to 67 years. There were 13 males and the average BMI of the study group was 28.3. Nine patients were diabetic and eight patients were smokers who had ceased when getting prepared for the surgery. Eighteen patients had presented with cholangitis and were stented preoperatively. Eleven patients were preoperatively nutritionally resuscitated with nasojejunal feeds. All patients were provided with preoperative chest physiotherapy.

Three patients with higher BMI required additional ports for retraction which aided completion of the procedure laparoscopically. The final histopathological diagnosis was periampullary adenocarcinoma in 22 patients, distal cholangiocarcinoma in 11 patients. The resection margins were negative in all the patients with an average lymph node retrieval rate of 12 nodes. There was no postoperative mortality (Table 2).

Postoperative complications noted in this study were hematemesis due to stress gastritis in two cases diagnosed with gastroscopy, superficial surgical site infection in two cases, and grade A pancreatic fistula in three cases. All cases were managed conservatively. The range of hospital stay for these patients was 8–19 days (longer stay for pancreatic fistula).

Table 2: Operative outcome

Parameter	*Operative outcome*
Conversion to open surgery	1
Operative time (range in minutes)	200–390
Estimated blood loss (range in mL)	110–350
Transfusion requirement	1
Margin negative	33
Number of lymph nodes retrieved (range)	12–16
Reintervention	2 patients OGD scopy

OGD, oesophagogastroduodenoscopy

Discussion

The enthusiasm for minimally invasive hepatopancreaticobiliary surgeries has been encouraging. The laparoscopic approach for pancreaticoduodenectomy, however, has received much criticism in view of long duration of surgery, need for laparoscopic expertise, long learning curve, and the frequent need for conversion to open. Experience in this field of surgery is limited due to complexity of the procedure leading to several reports of laparoscopic-open hybrid surgeries. Also, the need for an advanced laparoscopic setup, robotic assistance, and hemostatic instruments discourages its widespread applicability.

In this case series, we have operated on 33 patients with routinely available laparoscopic instruments, ultrasonic shear and electrocautery for dissection and hemostasis at a civic run hospital. In our experience, the need for laparoscopic expertise is a must. With a good clarity and knowledge of anatomical details, the procedure can be performed in basic well-equipped surgical setup. We have noted a decline in duration of surgery with increasing experience in the procedure while adhering to oncological principles of resection. An improvement in operative time was similarly reported in case series by Kendrick and Cusati (7.7 hours for the first 10 patients to 5.3 hours for the last 10 patients)[4] and Kim et al. (9.8–6.6 hours).[5] Although robotic surgery does offer an advantage of more precise surgery with better maneuverability of instruments, it is time-consuming, expensive, and often unavailable to surgical setups in developing nations.

As we progressed from one case to another, we noticed some technical difficulties in performing pancreaticoenteric anastomosis that we tried to overcome by altering the methods of anastomosis. In the initial eight cases, we used a pancreaticojejunal dunking anastomosis. However, it was difficult to do the same with soft pancreas, where duct to mucosa pancreaticojejunal anastomosis was performed in 14 patients with a dilated pancreatic duct. The pancreatic duct was cannulated with a 6-Fr feeding tube in eight patients, however in six patients, the feeding tube could not be passed, hence was cannulated with outer sheath of intravenous catheter which is shorter in length and stiffer. In seven patients, the pancreatic duct could not be identified, possibly due to temporary sealing effect of ultrasonic shears and hence pancreaticogastric dunking anastomosis was performed. The pancreaticogastric anastomosis is technically easy to perform laparoscopically as compared to other pancreatic anastomosis, hence we followed the same in subsequent three patients too. There are numerous case series comparing the outcome of pancreaticoenteric and pancreaticogastric anastomosis by studying the rates of pancreatic fistulae.[6–8] We, however, are of the opinion that the most suitable anastomosis should be performed depending upon the consistency of the pancreas, size of the pancreatic duct, and expertise of the operating surgeon, and have therefore evolved our methods over time.

The magnified view offered by the laparoscopic approach along with better energy sources allows meticulous dissection and hemostasis thus limiting blood loss. Thus, in our operated patients only one patient required blood transfusion postoperatively who required conversion to open surgery due to hypervascularity due to history of cholangitis. A reduced mean blood loss (110 ± 22 mL) by minimally invasive approach has also been mentioned by Senthilnathan et al. in their experience of 130 cases of laparoscopic pancreaticoduodenectomy for malignant indications.[9]

Reoperation in the early postoperative period has been reported for indications of bleeding and obstruction. However, in our case series, no patient required reoperation and all complications were successfully managed conservatively.

The uncertainty of achieving a R0 resection with the laparoscopic approach is often cited as a disadvantage of the procedure. All our operated cases had tumor-free gross and microscopic margins supporting the oncological soundness of this procedure.

Limitations

Our study has the limitation of a small sample size and lack of comparison between the open and laparoscopic approach. We also emphasize the need of a long-term follow-up for tumor recurrence and disease-free survival.

Conclusion

Total laparoscopic pancreaticoduodenectomy is a safe and feasible procedure with standard laparoscopic setup in patients with malignant periampullary disease. Precision of dissection and hemostasis is better achievable with the magnified view of laparoscopy. Adequate resection of tumor is achievable by this approach if case selection is appropriate with thorough review of computed tomography of patients. Surgical expertise is required and key for favorable outcomes.

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We are thankful to our Dean for allowing us to publish the hospital data.

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COMMENTARY

A Surgery on Deep Infiltrating Endometriosis Involving the Rectum: A Debate Started 100 Years Ago between Cullen and Sampson

John L Yovich

Abstract

A recent randomized control trial reports at the 5 years postoperative stage for limited vs extended surgery involving the rectovaginal septum. For those gynecologists with advanced laparoscopy skills who have been reluctant to embrace the idea of complete bowel resections with reanastomosis, the study provides comfort in showing no difference in long-term outcomes between nodule excision and rectal resection. However, the study perpetuates the idea that all medical procedures have to be subjected to this type of statistical analysis, without any reference to the pioneers whose ideas formed the basis of current procedures as well as providing an understanding of the pathogenesis of the underlying disorder. The two gynecologists who first reported on the surgical management of this condition 100 years ago projected different ideas on pathogenesis as well as the appropriate surgical method to apply. Thomas Cullen and John Sampson should be acknowledged in any consideration of determining the appropriate procedure for this challenging disorder.

Keywords: Adenomyosis, Advanced laparoscopic surgery, Bowel resection, Deep infiltrating endometriosis involving rectum DIER, Endometriosis.

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Introduction

A recently reported randomized controlled study (RCT) regarding surgery for deep infiltrating endometriosis involving the rectum (DIER) showed no significant difference in long-term outcomes between nodule excision vs rectal resection.[1] The impressive study is reporting at the 5 years postoperative stage but has not actually advanced either the understanding of the underlying disorder nor its proper management. In part, this is due to a failure to consider historical aspects related to the two gynecologists who first reported on this disease, namely, Thomas Stephen Cullen (1868–1953) and John Albertson Sampson (1873–1946) and who expressed different views on its surgical management 100 years ago.

Thomas Cullen

Cullen graduated in Medicine in Toronto, Canada, in 1890, thereafter training as a gynecologist at the Johns Hopkins University 1891 but also spending time working as a pathologist in Gottingen, Germany, before returning to Johns Hopkins in 1893. However, the senior surgical position he had expected with Howard Kelly was deferred; hence he established a pathology laboratory, becoming the first Gynecological Pathologist in North America, while also practising as a gynecologist in private practice. He eventually gained the position as Head of Gynecology in 1919 after the retirement of Kelly and had the title of Professor of Clinical Gynecology, a position he held until retirement in 1939. Between 1894 and 1909, Cullen wrote four books on gynecological diseases that married histopathology with clinical symptoms and signs, one of which was adenomyoma of the uterus.[2] Subsequently, in 1914, he published on the specific subject of adenomyosis of the rectovaginal septum[3] as well as an accumulated experience in 2020 of his findings of extra-uterine adenomyosis, detailing 10 sites that he had personally documented.[4] However, the worst cases were those involving the rectovaginal septum, numbering 19 in total, and which led to its eponymous title "Cullen's Disease".

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With respect to the specific surgical procedure for DIER, Cullen stated "The removal of an extensive adenomyoma of the rectovaginal septum is infinitely more difficult than a hysterectomy for carcinoma of the cervix". In tackling this disease, Cullen believed that gynecologists should be trained as fully competent abdominal surgeons.[3,4] He stated: "Where the lumen of the bowel is greatly narrowed, a complete segment of the rectum should be removed with the uterus, and an anastomosis should be made." In such cases "surgeons should perform a "preliminary permanent colostomy… later the pelvic structures can be removed *en bloc*".[4,5]

However, despite Cullen's anatomical knowledge and surgical expertise, especially that involving bowel anastomoses,[3–5] he described some unpleasant complications that included vesicovaginal and rectovaginal fistulas. In this pre-antibiotic era, despite the advanced sterile surgical techniques practiced at the Johns Hopkins Hospital, most of the women who had complications died.[4,6]

John Sampson

Sampson's experience overlaps with Cullen in that he graduated from Johns Hopkins in 1899 then proceeded into residency in gynecology under Howard Kelly through to 1906, a period when

Cullen was teaching and provided mentorship. In this period at Johns Hopkins, Sampson published 17 articles and book reviews on various medical disorders, including gynecological subjects as well as surgeries on the pelvic ureter. In 1908, Sampson reviewed Cullen's book on Adenomyomata of the Uterus for Annals of Surgery, a book that undoubtedly captured his imagination and influenced his future research path. Thereafter, Sampson moved into private practice in Albany, New York, and was attached to Albany Medical College where he became Professor of Gynecology through to his retirement in 1945.

At Albany, Sampson developed our current understanding of the condition of endometriosis, including its pathogenesis. In 1913, he described vascular features related to uterine myoma and the unique venous drainage underlying abnormal uterine bleeding.[7] In 1918, he demonstrated a metastatic mechanism that can form the basis of a theory for endometriosis in unusual locations.[8] His better-known theory of an implantation mechanism following retrograde menstruation was a later idea published in 1927.[9]

Sampson also discussed the clinical management of adenomyosis involving the rectovaginal septum, with viewpoints contrary to those of Cullen. In 1921, he described operations on 23 cases of deep infiltrating rectovaginal endometriosis, concluding "I have never resorted to the extremely radical operations (referring to bowel resections). I have purposely kept close to the uterus, undoubtedly sometimes leaving adenoma in the rectal wall". All these cases had hysterectomy with bilateral salpingo-oophorectomy (strongly advising not to leave any ovarian tissue in order to ensure that the endometriosis tissue would regress). Sampson stated that "on the whole, the results have been quite satisfactory because the growth is usually only mildly invasive".[9]

Pathogenesis of Adenomyosis and DIE

As mentioned earlier, in 1918, Sampson demonstrated a metastatic mechanism[8] that, I believe, forms the basis of a theory for endometriosis in unusual locations, including the cul-de-sac as an extension from areas of adenomyosis in the posterior uterine wall.[9] It also explains the mechanism for the formation of adenomyosis within the uterus when the protective "anemic zone" of venules is disrupted. In cases where the uterus is distorted by either being deeply retroverted and retroflexed, particularly if it also included myomata, this predilects to the formation of adenomyosis in the posterior wall.[7] Sampson described these underlying uterine features in two-thirds of his cases of DIER. His better-known theory of implantation following retrograde menstruation was a later idea published in 1927[8] and which, while explaining the majority of peritoneal endometriosis, does not really explain DIER or endometriosis located in unusual, even extrapelvic sites. The latter are, to my mind, well explained by the metastatic process, and such needs to be understood when undertaking surgical corrections. This means the surgical procedure should include ventrosuspension of the uterus and remove all leiomyomata along with resection of adenomyoma in addition to *en bloc* excision of the rectovaginal nodules.

Nodular Excision vs Bowel Resection for DIER

Having adopted laparoscopy in 1973, I attended the facility in Clermont-Ferrand, France, headed by Maurice Bruhat in the early 1980s to advance my skills. His vision included that gynecologists who would manage women with endometriosis should develop their laparoscopic skills to an advanced level and also be competent in the broader context of abdominal surgery in order to manage colorectal and urogenital aspects, as these areas were often involved.[10] Some of Bruhat's protégés have reached very high levels of expertise and undertake segmental bowel resections using linear and circular stapling devices.[11] However, I, along with most gynecologists who have advanced laparoscopy skills, shy away from resections, preferring to follow the advice of those like Jacques Donnez[12] that "at the level of the bowel, a ring of fibrosis may be left behind" without any future concern. The decision of which approach to follow must undoubtedly depend upon case numbers managed, as using the stapling device requires a practiced skill. Given that my group has recognized only 30 such cases over a 30 years period involving laparoscopic excisional surgery for around 4,000 cases of endometriosis and adenomyosis, the idea of developing competency with bowel-resection devices was simply too foreboding.[9]

Conclusion

This commentary is presented in response to the recent RCT study reported from France which applied advanced statistics to evaluate the surgical management of DIER – either by colorectal resection/re-anastomosis or by a more conservative surgical procedure involving nodular resection. The clinical outcomes were similar, undoubdtedly because the surgeons were each utilizing the procedure with which they were comfortable. Of course, I am very pleased that my conservative surgery was not found to be statistically inferior from those who undertook bowel resections, but I remain in admiration of their ability to avoid complications.

As a laparoscopic surgeon with 47 years of experience, I am also perplexed at the perceived need to subject every medical process and surgical procedure to an RCT while completely ignoring the historical evolution of the subject. With respect to the sister conditions of endometriosis and adenomyosis, I have always turned to John Sampson for the best advice; his descriptive articles from a century ago have been, for me, fully clarifying.

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I thank those colleagues who assisted me to establish advanced laparoscopic skills for treating the infertility-related conditions of endometriosis, adenomyosis and leiomyomata. Their patience and support have also enabled them to develop the necessary advanced skills for the preparation of young women undergoing fertility-related management. This was achieved by surrounding the patient with three gynecologists at different stages of career development (operator, assistant, and bottom-end manipulator) for advanced surgeries. This meant income opportunities were diluted but their names are reflected in our collaborative publications over these 40 years.

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