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Editorial

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Dear Friends,

Everyday new advancement is happening in the field of minimal access surgery. Recently infrared imaging has created a big revolution in the safety and diagnosis of laparoscopic surgery. All the new camera is now developed to determine the potential role of infrared imaging as a tool for localizing anatomic structures and assessing tissue viability during laparoscopic surgical procedures. These images are capable of defining biliary anatomy, detecting filling defects, and identifying injuries to the biliary tract. Seeing CBD anatomy in laparoscopic cholecystectomy, dissection of the ureter with visualization of complete ureter, identification of sentinel lyph node, perfusion of tissue and assessment of bowel perfusion are now performed with the aid of this infrared imaging system. Inexperienced laparoscopists were asked to localize and differentiate structures before dissection using the visible system, and then using the infrared system has a great difference. All the recent studies demonstrate that infrared imaging may improve the differentiation and localization of anatomic structures and allow assessment of physiologic parameters such as perfusion not previously attainable with visible laparoscopic techniques. It may thus potentially be a powerful adjunct to laparoscopic surgery. The laparoscopic infrared imaging system is a feasible method of blood vessel detection in laparoscopic procedures. The use of an infrared imaging system is very useful in blood vessel detection in laparoscopy and has the potential to enable safer surgery and reduced operative time. Infusion of indocyanine green to enhance imaging with the standard laparoscopic view is rapidly becoming popular to allow real-time vessel mapping during many laparoscopic procedures. In the coming issues of WJOLS we are going to publish a complete technique of using this technique and their advantages.

We also want to let our reader know that the World Congress of Laparoscopic Surgeons under the aegis of World Association of Laparoscopic Surgeons is going to be held on the 10th and 11th of October 2020. This multispecialty conference of the World Association of Laparoscopic Surgeons helps the delegates increase their knowledge of laparoscopic surgery, robotic surgery, endoscopic, and minimally invasive surgical techniques. I invite all of you to unite for the 8th International Conference of World Association of Laparoscopic Surgeons. This conference on minimal access surgery will convene hundreds of surgeons, gynecologists, urologists, and pediatric surgeons from every corner of the world.

We look forward to getting to know you as, together, we lead the way in shaping the future of minimally invasive surgery.

RK Mishra
Editor-in-Chief

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World Laparoscopy Hospital
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ORIGINAL ARTICLE

Laparoscopic Management of Polypoidal Lesions of the Stomach

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Abstract

Aim: Our aim was to study the feasibility of a laparoscopic approach in the management of polypoidal lesions of the stomach.

Materials and methods: We present a review of laparoscopic management in polypoidal lesions of the stomach in four patients. All patients underwent routine preoperative workup along with esophagogastroduodenoscopy, biopsy, and contrast-enhanced computed tomography (CECT) scan of the abdomen. Three patients underwent wedge resection of the stomach using a laparoscopic linear stapler and one underwent laparoscopic anterior wall gastrotomy with polypectomy.

Results: Of four patients, three were males and one was female in the age range of 40–60 years. Presenting symptoms ranged from generalized weakness, episodes of intermittent vomiting, dyspepsia, and weight loss. Common sites involved were fundus and body of the stomach in three patients and antrum in one patient. Surgery via a laparoscopic approach was the mainstay of the treatment. Final histopathology revealed gastrointestinal stromal tumor (GIST) in three patients and adenomatous polyp in one patient. Patients diagnosed with GIST were further referred to a medical oncologist for mutational analysis and adjuvant therapy. All patients are on regular follow-up postoperatively.

Conclusion: Asymptomatic, polypoidal lesions of the stomach can present with occult GI bleeding or gastric outlet obstruction. The main point to be taken into consideration in treating large-sized polyps is the selection of management option (endoscopic vs laparoscopic). Laparoscopic excision is a better alternative to treat giant polyps considering the size, location, and potential for malignancy, as opposed to an endoscopic approach.

Keywords: Adenomatous polyp, Gastric outlet obstruction, Gastric polyp, Gastrointestinal stromal tumor, Hyperplastic polyp, Laparoscopic anterior wall gastrotomy.

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Introduction

Polypoidal lesions of the stomach are broadly defined as locally elevated lesions protruding into the gastric lumen, a heterogeneous group of epithelial and subepithelial lesions that vary in histology, neoplastic potential, and management, usually small and asymptomatic (>90%). Symptoms produced by polypoidal lesions are vague and nonexistent until complications arise such as bleeding, anemia, obstruction, or abdominal pain.[1] They are discovered incidentally on endoscopic examination in about 2–5%.[2] The frequency of polyps is increasing with the widespread use of endoscopy for diagnosis and treatment.

Epithelial polyps (hyperplastic, fundic gland, and adenomatous) are the classic gastric polyps, but clusters of endocrine cells (carcinoids), infiltrates (xanthomasand lymphoid proliferations), or mesenchymal proliferations [GIST, leiomyoma, and inflammatory fibroid polyps (IFPs)] may create a mucosal protrusion.[3]

Symptomatology depends upon the size, multiplicity, location, and character of the lesions. Meticulous endoscopic examination, accurate biopsy, histopathologic evaluation, and periodic follow-up examinations are critical.

Materials and Methods

We present a review of laparoscopic management of four cases of polypoidal lesions of the stomach who presented in our center from December 2017 to December 2018. All patients underwent routine preoperative workup along with upper GI endoscopy and a CECT scan. Three patients underwent wedge resection of the stomach using a laparoscopic linear stapler and one underwent laparoscopic anterior wall gastrotomy with polypectomy under general anesthesia. Workup and management of all four patients are depicted in Table 1.

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Surgical Technique

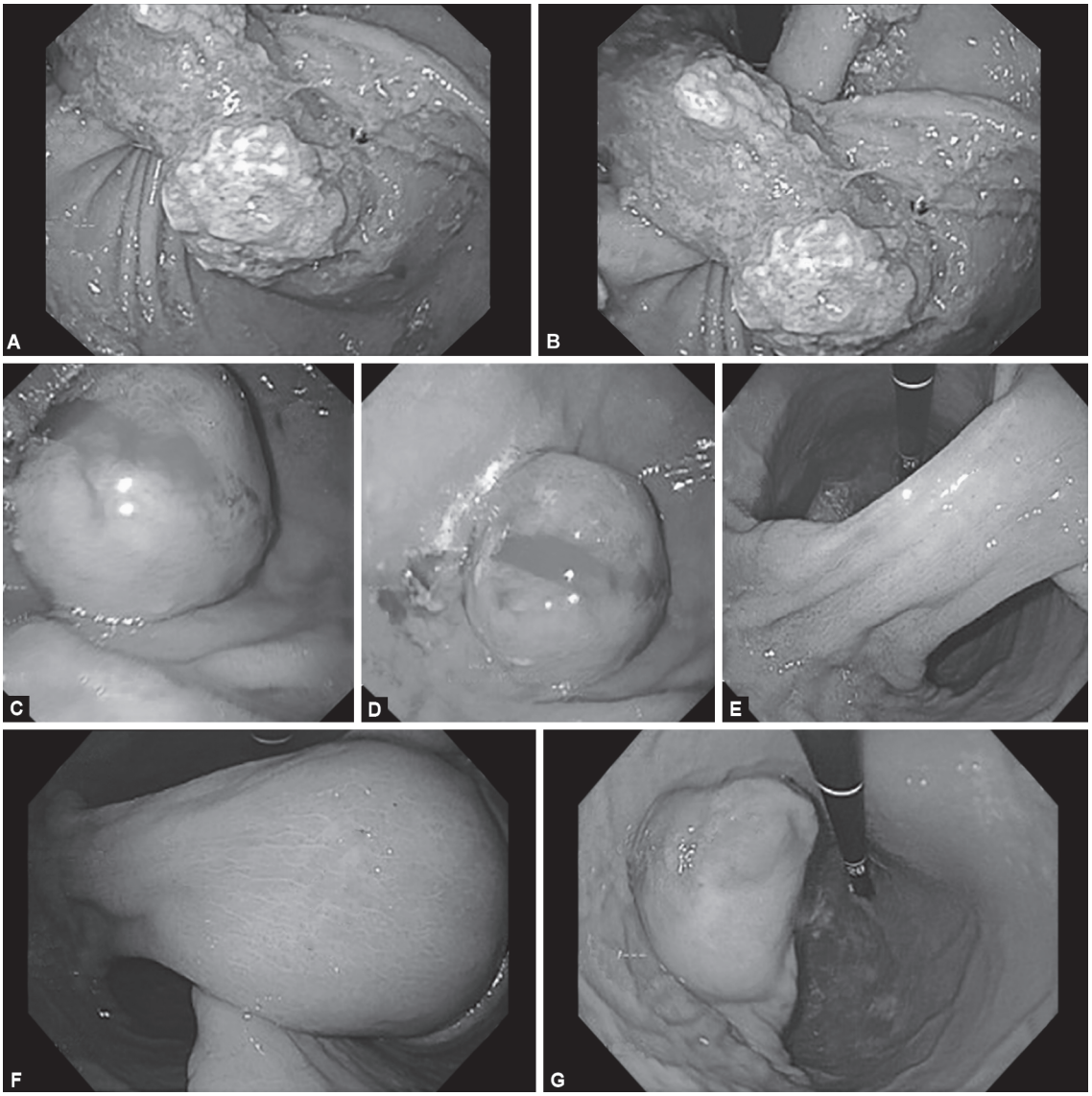
Port positions and basic steps:

Laparoscopic wedge resection of the stomach using linear staplers (three patients):

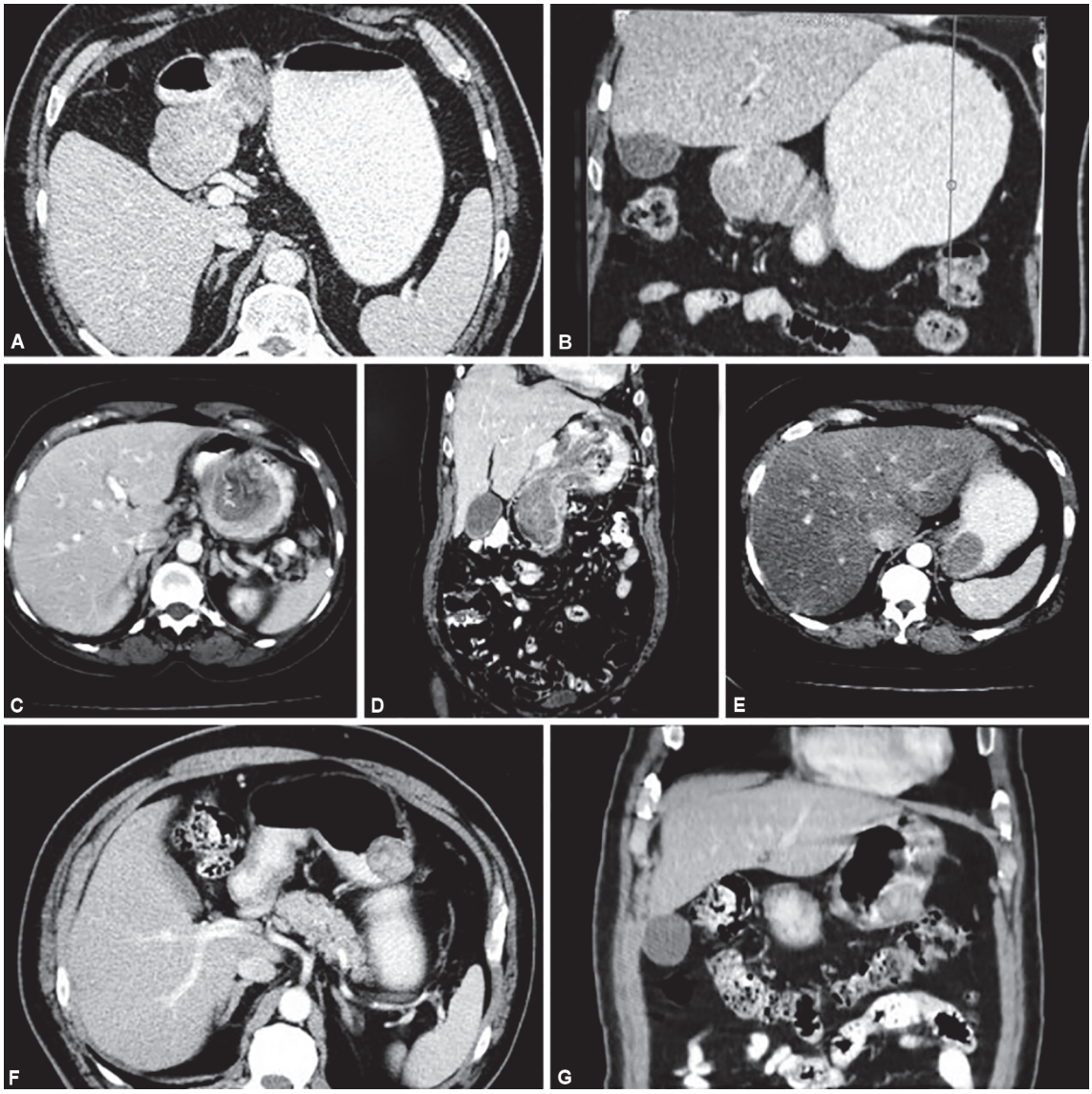
- Ports: 10 mm umbilicus (camera), 12 mm (working) left mid-clavicular, two 5 mm in both anterior axillary lines (working and for traction). Pneumoperitoneum created using open insertion technique and pressure maintained at 12 mm Hg.
- After identifying lesser sac and greater curvature, short gastric vessels were divided with harmonic. Intraluminal tumor

Table 1: Workup and management in our four patients

	Workup	*In three patients (2M, 1F)*	*In one patient (1M)*
1	OGD scopy findings (Fig. 1)	3–3.5, 4, and 4.5 cm single sessile polyp arising from the fundus and proximal body near greater curvature of the stomach in three patients respectively	Large, single, mobile, pendunculated polyp in antrum with thick stalk in mid-body, prolapsing into part 1 of duodenum causing intermittent gastric outlet obstruction, with solid food residue in fundus and body
2	Biopsy report	Gastric submucosal lesion? GIST in all three patients	Tubulovillous type of adenomatous polyp
3	CT scan findings (Fig. 2)	Single, soft tissue attenuating lesion of respective dimensions arising in fundus and proximal body near greater curvature of the stomach with no evidence of LNs or surrounding tissue involvement	An enhancing polypoidal mass in the gastric antrum, extending and prolapsing into the proximal duodenum, 7.8 × 4 cm, without calcifications, necrosis within. Adjoining fat planes well maintained with no evidence of perigastric adenopathy. The stomach distended with food residue
4	Surgical procedure undertaken	Laparoscopic wedge resection of the stomach using linear stapler	Laparoscopic anterior wall gastrotomy with polypectomy
5	Final histopathological examination (HPE) report	Gastric GIST in all three patients	Adenomatous polyp with no evidence of malignancy (Fig. 3)



Figs 1A to G: Preoperative esophagogastroduodenoscopy (OGD scopy) pictures



Figs 2A to G: Computed tomography (CT) images

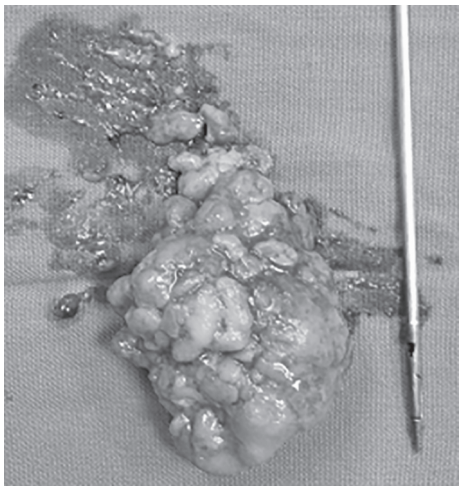


Fig. 3: Adenomatous polyp (operative specimen)

identified on posterior wall along the greater curvature. Intraoperatively, upper GI endoscopy was done to ensure adequate margins all around the tumor.

- Wedge resection done using three staplers (2 purple 60, 1 blue 45) and suture line further reinforced with mersilk 3-0. Specimen was delivered under direct vision *via* minilaparotomy incision.

Laparoscopic anterior wall gastrotomy with polypectomy (one patient):

- Ports: 10 mm umbilicus (camera), 12 mm (working) left mid-clavicular in line with umbilicus, two 10 mm in both subcostal regions (working and for traction). Pneumoperitoneum created using open insertion technique and pressure maintained at 12 mm Hg.
- Fundus and greater curvature freed by dividing short gastric vessels with thunder beat. Anterior wall of the stomach opened in mid-body close to the attachment of tumor between two silk stay sutures. 7 × 4 cm pedunculated polyp everted out

and resected with adequate margins by firing linear staplers at pedicle base in the body of the stomach. Reinforcement vicryl sutures placed around the staple line.
- Ryle's tube (RT) position was confirmed and gastrotomy closed in two layers with continuous ethibond and silk sutures. Specimen was delivered under direct vision by increasing left 12 mm port.

In all cases, hemostasis was confirmed at the end of the procedure, and the 10 and 12 mm ports closed under direct vision.

Results

Of the four patients, three were males and one was female in the age group of 40–60 years. Presenting symptoms in all ranged from generalised weakness, episodes of intermittent vomiting, dyspepsia, and weight loss. Common sites involved were fundus and the body of the stomach in three patients and antrum in one patient.

Table 1 gives the details regarding esophagogastroduodenoscopy (OGD scopy), biopsy, CT scan findings, surgical procedure undertaken, and final histopathological diagnosis in our four patients. Postoperatively, our patients received IV antibiotic and PPI for 5 days. All had good postop recovery with uneventful course and were discharged on soft diet by day 8.

Histopathologic slides were evaluated by the same pathologist and patients are on regular follow-up with yearly check upper GI endoscopy. Patients with GIST were referred to a medical oncologist for mutational study and adjuvant therapy.

Discussion

Giant polypoidal lesions of the stomach are uncommon, and detection of polyps at upper gastrointestinal endoscopy is usually an incidental occurrence (2–5%).[4] Research reports showed that the polyps occurred equally in males and females and that two-thirds occurred in the age group above 60 years.[5]

Histologically, they are classified as hyperplastic,inflammatory, adenomatous, and fundic gland polyps. Hyperplastic polyps are the most common, accounting for 85–90% of all cases. Adenomas account for only 5–10%, and less than 1% of these lesions are reported to have malignant changes.[6] While gastric polyps are commonly asymptomatic, they can cause dyspepsia, epigastric pain, or present with complications such as bleeding due toulceration, anemia, and gastric outlet obstruction.

Rate of malignant transformation depends on size and histology. Fundic gland and IFPs have virtually no malignant potential. The risk of malignancy has been reported to be 0–8.6% (mean 2.1%) for hyperplastic polyps, approximately 5% for tubular adenomas and 28.5–40% for villous adenomas. So definite histopathological diagnosis is vital and mandatory.[7]

Gastrointestinal stromal tumors are rare tumors of the digestive tract, with an incidence of about 1.5 per 100,000/year (50–60% in the stomach). The average age of occurrence is 60–65 years with equal gender distribution. Majority are CD117 positive, but 5% are negative and diagnosis is confirmed by immunohistochemistry tests that identify CD117 or DOG1. They arise from interstitial cells described by Cajal and are characterized by mutations of C-KIT and PDGFRA genes which help in precise diagnosis and targeted treatment.

Surgical resection is the mainstay for nonmetastatic tumors, most commonly in the form of a wedge resection. Treatment of GIST requires a multidisciplinary team approach consisting of pathologist, radiologist, surgeon, and oncologist.[8]

Basic treatment of polypoidal lesions of the stomach is excision, either endoscopic or surgical. Surgical treatment is recommended in polyps greater than 2 cm, sessile polyps, and failure of endoscopic treatment.[9] Incidence of gastric outlet obstruction due to polyps is unknown, with only few cases reported in the literature.[10]

Conclusion

Though rare in occurrence and majority being asymptomatic, polypoidal lesions of the stomach can present with anemia, occult GI bleeding, or gastric outlet obstruction. We presented a review of four cases of polypoidal lesions of the stomach with special attention toward their management via a laparoscopic approach. The main point to be taken into consideration in treating large-sized polyps is the selection of management option (endoscopic or laparoscopic). Because of their malignant potential, histopathological evaluation is mandatory.

The main disadvantage of endoscopic methods is the risk of incomplete tumor resection. Also, the procedure becomes difficult with an increase in polyp diameter and complications such as bleeding and perforationmay occur.

So, it seems that laparoscopic excision is a better alternative to treat such polyps, considering the size, location, and potential for malignancy, as opposed to an endoscopic approach.

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ORIGINAL ARTICLE

Evaluation of Abdominal Malignancies by Minimal Access Surgery: Our Experience in a Rural Setup in Central India

Meenakshi E Yeola[1], Dilip Gode[2], Akshay K Bora[3]

Abstract

Introduction: A diagnostic surprise or finding a tumor unresectable at laparotomy is an undesirable situation for every surgeon. A surgeon should never regret for having done a laparotomy on a patient which otherwise was avoidable. Many surgeons worldwide have had challenging experiences of facing an uncertain diagnosis or staging of abdominal malignancies. History-taking, physical examination, laboratory tests, and advanced noninvasive imaging studies might provide some help but are insufficient for accurate diagnosis and staging of abdominal tumors.

Aim: To assess the role of diagnostic staging laparoscopy in abdominal malignancies.

Objectives: To evaluate the role of laparoscopy as a diagnostic tool in abdominal malignancies. To compare the findings of laparoscopy with noninvasive imaging modalities. To assess the efficacy of laparoscopy as a definitive tool in the evaluation of staging and operability before definitive intervention.

Materials and methods: This is a prospective observational study with a sample size of 250 patients. The study duration was 3.5 years from July 2013 to October 2016 and was conducted at Acharya Vinoba Bhave Rural Hospital (AVBRH), Sawangi (Meghe), Wardha.

Results: Due to the use of diagnostic laparoscopy, out of 250 cases of abdominal malignancies, in 120 (48%) patients, nontherapeutic laparotomy could be avoided.

Conclusion: This study highlights the emphatic utility of diagnostic laparoscopy procedures in staging and management of abdominal malignancy. Laparoscopic evaluation of a patient with intra-abdominal malignancies is a desirable tool against imaging modalities in improving the detection of metastatic disease and accurate staging of the disease process.

Keywords: Diagnostic, Laparoscopy, Metastatic, Nontherapeutic laparotomy, Unresectability.

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Introduction

A proper diagnosis, pretherapeutic staging for assessment of resectability in abdominal malignancy, is important to select the patient for appropriate treatment strategies. Identifying tumors that are not surgically resectable is the most important issue at hand. Performing laparotomies in patients with nonresectable abdominal tumors may increase mortality and morbidity, and cost as well as affect quality of life in the remaining lifetime.[1]

The magnified view offered by the laparoscope enables the surgeon to detect small liver, peritoneal, and omental metastases that are not visible with current noninvasive imaging modalities.

If the distance between the tip of the telescope and object is 5 cm, we get a six times magnification. If it is 15 cm, the magnification is 2.2 times, and if it is 33 cm, we can see the same size object.[2]

If laparoscopic findings result in an unresectable disease, then further management can be planned, such as neoadjuvant chemotherapy, radiotherapy, etc. Laparoscopy can give a tissue diagnosis and include a biopsy where the definitive treatment or surgery is not possible. Obtaining biopsies of organs, lymph nodes, and suspicious lesions during laparoscopy is an important part of the diagnosis and staging of malignancies.

Thus, it is recommended that diagnostic laparoscopy for staging of abdominal malignancy be performed in cases where resectability is doubtful in spite of preoperative imaging, or at the time of planned laparotomy.[3]

Many authors have stressed the importance of laparoscopic ultrasonography during diagnostic laparoscopy for abdominal malignancy. Ultrasonography during laparoscopy gives the surgeon information that otherwise would not be obtained from laparoscopic visual exploration. Lesions deep in the parenchyma of an organ, especially solid organs such as the liver and pancreas, can be identified by ultrasonography. Invasion of a tumor into other structures, such as major vessels, can also be evaluated, thus determining that the tumor is not resectable in a patient who otherwise might undergo laparotomy.[3]

Since the introduction of laparoscopic staging, lavage of the peritoneal cavity has been added to the procedure. Free cancer cells found in the peritoneal lavage fluid are thought to induce or indicate early peritoneal seedling with subsequent peritoneal metastases.

Diagnostic laparoscopy can be beneficial to the patient in avoiding unnecessary surgery, unnecessary delay in diagnosis and treatment, and in shortening the operative and hospitalized periods.

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The usefulness and efficacy of laparoscopy as a preoperative tool in the management of intra-abdominal malignancy for diagnosis, evaluation, staging, and therapeutic assessment are the areas which need appraisal and analysis to standardize the procedure and bring into a more frequent use.

This study explores the applications of laparoscopy with imaging studies in staging and diagnosis of abdominal malignancy and its advantages over only imaging studies and conventional laparotomy, and it seeks to suggest implementation of a defined protocol in mandating diagnostic laparoscopy as a necessary diagnostic tool before an explorative laparotomy.

Aim and Objectives

To assess the role of diagnostic staging laparoscopy in abdominal malignancies. To evaluate the role of laparoscopy as a diagnostic tool in abdominal malignancies. To compare the findings of laparoscopy with noninvasive imaging modalities and assess the efficacy of laparoscopy as a definitive tool in the evaluation of staging and operability before definitive intervention.

Materials and Methods

This study was a prospective observational study. The study was conducted in the Department of Surgery, AVBRH, Sawangi (Meghe), Wardha. The sample size taken was 250. It was calculated according to the formula stated below:

$$\text{Sample size } n = \frac{Z^2 \times p \times (1-p)}{d^2}$$

n = sample size, Z = standard normal distribution = 1.96, P = expected beneficial population = 20%, d = absolute precision = 5% points (15%–25%), and $N = (1.96 \times 1.96) \times 0.2 \times (0.8)/(0.05 \times 0.05) = 245.86 = 246$

The ethical committee clearance was taken. The duration of the study was 3.5 years (July 2013–October 2016).

Inclusion Criteria

Patients of abdominal malignancies who were fit for anesthesia and had given consent for the procedure.

Exclusion Criteria

Patients with prior multiple surgeries, gross ascites, ASA grade >III, performance scale: Karnofsky grade <50.

Tools and Methods

Diagnostic laparoscopy, various imaging modalities (USG/CT/MRI), histopathological/cytological examination, intraoperative findings. The tools and procedures were standardized and were performed by a single operator from the concerned department.

Technique

As per the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) Guidelines. After complete history-taking and thorough clinical examination, patients with suspected abdominal malignancies were subjected to the following investigations.

Investigations

Hematological investigations, tumor marker, chest X-ray, abdomen USG, abdomen CT/MRI/MRCP, upper and lower GI endoscopy, biopsy, and histopathological examination.

Thorough evaluation of peritoneal surfaces, omentum, presence of ascitic fluid, supra/intrahepatic spaces, surface of the bowel, lesser sac, root of the transverse mesocolon, small bowel, ligament of Treitz, abdominal lymph nodes, paracolic gutters and pelvis, prior to any manipulation, ascites when present, fluid was sent for cytological examination, biopsies were done for any suspicious abdominal lesions, findings of laparoscopy and imaging modalities were correlated and further management of the patient was decided.

Observations and Results

This prospective study was carried out from July 2013 till October 2016. A total of 250 patients with abdominal malignancies were enrolled in the study. The observations have been shown in the form of charts and tables for ease of understanding as follows. Most of the cases were of colorectal malignancies followed by gastric malignancy. The mean age of presentation was 52 years, with a range between 16 years and 80 years. In our study, out of 250 patients, 175 (70%) were males and 75 (30%) were females. Among 250 patients, all patients presented with loss of appetite and weight, 204 (81.6%) presented with pain in abdomen, 124 (49.6%) with lump in abdomen, 110 (44%) with vomiting, 52 (20.8%) with jaundice, 91 (36.4%) with Malena, 79 (31.6%) with hematochezia, and 98 (39.2%) with altered bowel habits (Fig. 1).

The distribution of abdominal malignancies based on the type of cancer was as follows. Out of 250 patients, 105 (42%) patients were of colorectal malignancy, 67 (26.8%) patients were of carcinoma stomach, 23 (9.2%) patients were of biliary tract tumors, 9 (3.6%) patients were of hepatocellular carcinoma (HCC), 7 (2.8%) patients were of periampullary carcinoma, 19 (7.6%) patients were of carcinoma head of pancreas, and 9 (3.6%) patients were of ovarian malignancy. Six (2.4%) patients had presentation of metastatic disease with unknown primary. In these six cases, with the help of radiology, through endoscopic evaluation and tumor markers, tissue diagnosis could not be obtained, and the source of primary could not be detected. Out of five (2%) patients in other groups, one had duodenal malignancy, one had jejunal malignancy, one had ileal malignancy, and two cases were of undescended testis (abdominal) harboring malignancy. Out of 105 cases of colorectal malignancies, 54 (22%) cases were of carcinoma colon, including carcinoma appendix and caecum and 51 (20.4%) cases were of rectal malignancy. Out of 23 cases of biliary tract tumors, 15 (6%) cases were of gall bladder carcinoma, and 8 (3.2%) cases were of cholangiocarcinoma (Fig. 2).

The distribution of abdominal malignancies based on the radiological stage of the cancer was as follows. Out of 250 patients, 30 (12%) patients were in stage I, 122 (48.8%) patients were in stage II, 92 (36.8.8%) patients were in stage III, and 6 (2.4%) patients were in stage IV (Fig. 3).

The distribution of abdominal malignancies according to the stage of the cancer based on laparoscopy was as follows. Out of 250 patients, 12 (4.8%) patients were in stage I, 69 (27.6%) patients were in stage II, 77 (30.8%) patients were in stage III, and the remaining most of the patients were in stage IV, i.e., 92 (36.8%) (Table 1).

After comparing radiological and laparoscopic staging, after diagnostic laparoscopy, a considerable number of cases getting diagnosed at stage IV as the p value is quite significant. The sensitivity of diagnostic laparoscopy in the overall abdominal malignancy is 93.88%, specificity 54.44%, and diagnostic accuracy 68.91%. After comparing radiological and laparoscopic staging,

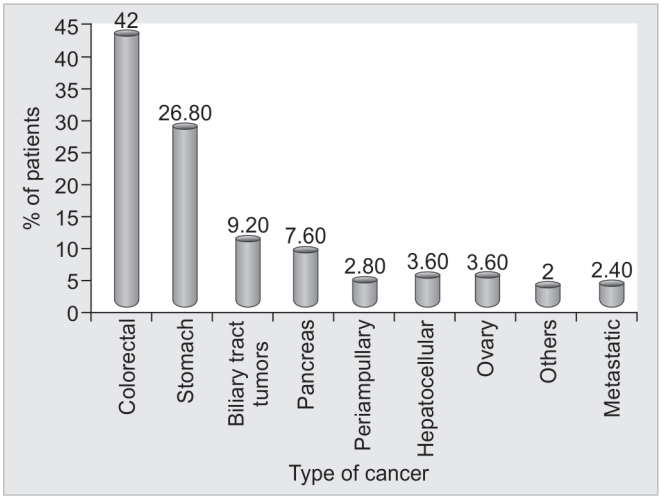


Fig. 1: Distribution of patients according to the type of cancer

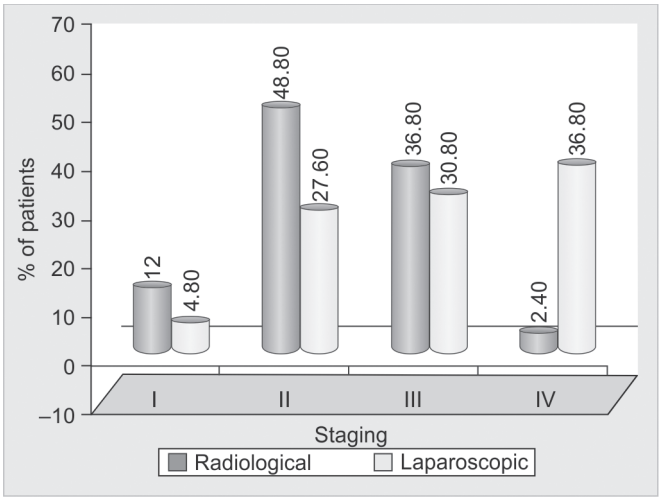
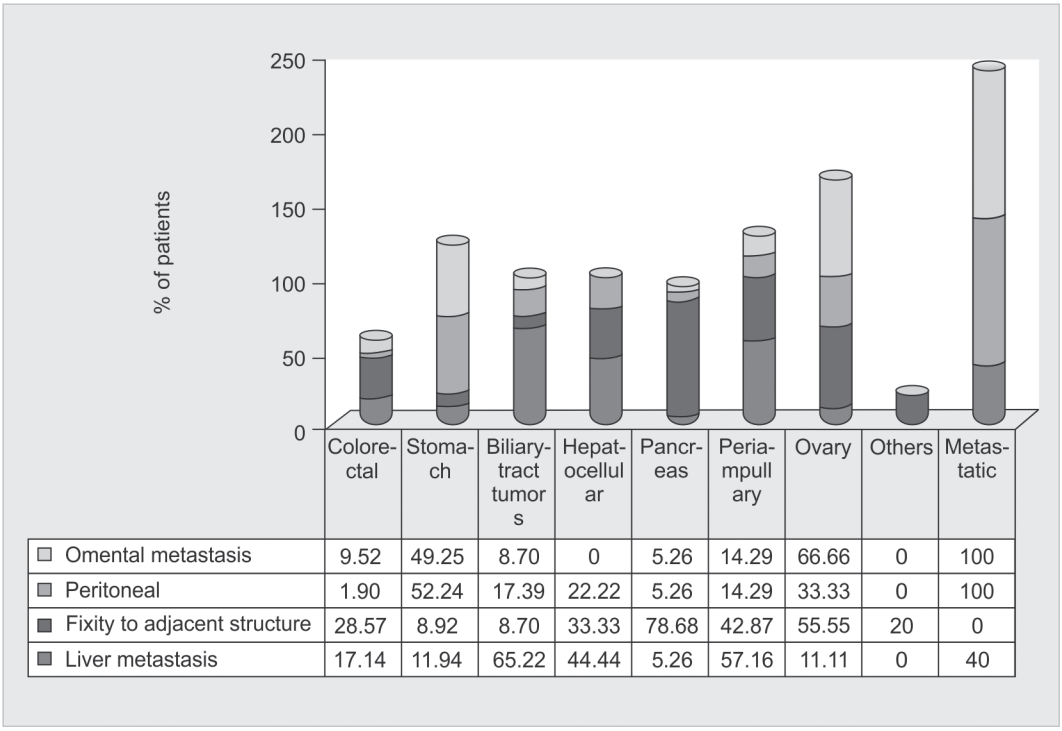


Fig. 2: Distribution of patients according to the radiological and laparoscopic stage of overall cancer patients



	Colorectal	Stomach	Biliary-tract tumors	Hepatocellular	Pancreas	Periampullary	Ovary	Others	Metastatic
Omental metastasis	9.52	49.25	8.70	0	5.26	14.29	66.66	0	100
Peritoneal	1.90	52.24	17.39	22.22	5.26	14.29	33.33	0	100
Fixity to adjacent structure	28.57	8.92	8.70	33.33	78.68	42.87	55.55	20	0
Liver metastasis	17.14	11.94	65.22	44.44	5.26	57.16	11.11	0	40

Fig. 3: Distribution of patients according to the reasons for unresectability

Table 1: Distribution of patients according to the radiological and laparoscopic stage of overall cancer patients

	Radiological		*Laparoscopic*		
Stage	*No of patients*	*Percentage*	*No of patients*	*Percentage*	*p value*
I	30	12	12	4.8	99.22 $p = 0.0001$, S
II	122	48.8	69	27.6	
III	92	36.8	77	30.8	
IV	6	2.4	92	36.8	

34.4% of cases were diagnosed as metastatic disease (stage IV) by diagnostic laparoscopy, which was understated by radiological imaging (Table 2).

Operability is with regard to the patient. If a malignant disease can be cured with a radical surgery, such a patient is said to be operable. If one cannot cure a malignant disease by a surgical procedure, it is called inoperable. Resectability is with regard to the tumor. A lesion or tumor is said to be unresectable if there is local fixity or neural/vascular encasement. In our study, the reason for unresectability was local tumor fixity to adjacent structures and neural/vascular encasement. Out of 105 patients of colorectal malignancies, 31 (29.52%) patients were unresectable. 10 patients

Table 2: Diagnostic accuracy

	Percentage	*95% confidence interval*
Sensitivity	93.88	87.15–97.72
Specificity	54.44	46.61–62.10
PPV	54.44	46.61–62.10
NPV	93.88	87.15–97.72
Accuracy	68.91	

underwent palliative colostomy/diversion procedures, followed by chemotherapy. Rest of the patients were subjected to chemotherapy directly. Out of 67 patients of carcinoma stomach, 40 (59.70%) patients were unresectable, and a palliative bypass was done in four patients. Rest of the patients were subjected to chemotherapy. Out of 23 cases of biliary tract tumors, 15 patients were of gall bladder malignancies, and all patients were unresectable. In gall bladder cancers, no further palliative procedure was done. All were subjected to chemotherapy. Out of eight cases of cholangiocarcinoma, two cases were subjected to biliary stenting, and six cases were subjected to percutaneous transhepatic biliary drainage (PTBD). Out of 19 patients of pancreatic malignancies, 16 (84.21%) patients were unresectable. One patient underwent palliative triple bypass procedure, and rest were subjected to chemotherapy. Out of nine patients ofHCC, 9 (100%) patients were unresectable. Out of seven patients of periampullary malignancies, six (85.7%) patients were unresectable. Two cases were subjected to biliary stenting, and four were subjected toPTBD. Out of nine cases of ovarian malignancies, 7 (77.77%) cases were unresectable and were subjected to chemotherapy. Out of five cases, in the miscellaneous group, palliative bypass procedure (gastrojejunostomy) was done for duodenal malignancy. As the total number of patients in stage III and IV were 169, of which, 77 were of stage III of which 24 were of colorectal and 22 were of gastric malignancy. Of the two malignancies in stage III, 19 patients of colorectal malignancy were resectable, and 11 of gastric malignancies were resectable being Stage IIIA—T3N1M0 disease (Tables 3 and 4).

In our study, a total of 139 patients were unresectable. The reason for unresectability was more than one of the above-mentioned causes in the same patient, i.e., a single patient can have liver metastasis with local fixity with peritoneal metastasis (Table 5).

Due to the use of diagnostic laparoscopy, out of 250 cases of abdominal malignancies, in 120 (48%) patients, nontherapeutic laparotomy could be prevented. In the rest of the unresectable patients, 19 patients were subjected to laparotomy for bypass procedures.

Discussion

Staging and Operability of Intra-abdominal Malignancies

Staging laparoscopy avoids unnecessary laparotomies and changes the therapeutic plan in a significant number of patients. It can be performed just before the planned surgery or as a separate diagnostic procedure. The laparoscopy indications in gastrointestinal cancers are changing fast, with ongoing new developments in cancer treatment and laparoscopic technology.[4]

Gastric Cancer

Diagnostic staging laparoscopy may aid in the more accurate staging of gastric cancers and guide appropriate treatment without the morbidity associated with exploratory laparotomy.[5] In our present study, a total of 67 patients of gastric malignancies who underwent diagnostic laparoscopy revealed peritoneal metastasis

Table 3: Distribution of patients according to unresectability

Type of cancer	*No of patients*	*Unresectable*	*(%) of unresectability*
Colorectal	105	31	29.52
Stomach	67	40	59.70
Biliary tract tumors	23	23	100.00
Hepatocellular	9	9	100.00
Pancreas	19	16	84.21
Periampullary	7	6	85.7
Ovary	9	7	77.78
Others	5	1	20.00
Metastatic	6	6	100
Total	250	139	55.3

Table 4: Distribution of patients according to the reasons for unresectability

Type of cancer	*No of patients*	*Liver metastasis*	*Fixity to adjacent structure*	*Peritoneal metastasis*	*Omental metastasis*
Colorectal	105	18 (17.14%)	30 (28.57%)	2 (1.90%)	10 (9.52%)
Stomach	67	8 (11.94%)	6 (8.95%)	35 (52.24%)	33 (49.25%)
Biliary tract tumors	23	15 (65.22%)	2 (8.7%)	4 (17.39%)	2 (8.70%)
Hepatocellular	9	4 (44.44%)	3 (33.33%)	2 (22.22%)	0 (0%)
Pancreas	19	1 (5.26%)	14 (78.68%)	1 (5.26%)	1 (5.26%)
Periampullary	7	4 (57.16%)	3 (42.87%)	1 (14.29%)	1 (14.29%)
Ovary	9	1 (11.11%)	5 (55.55%)	3 (33.33%)	6 (66.66%)
Others	5	0 (0%)	1 (20%)	0 (0%)	0 (0%)
Metastatic	6	2 (40%)	0 (0%)	6 (100%)	6 (100%)
Total	250	53 (21.2%)	64 (25.6%)	54 (21.6%)	59 (23.6%)

Table 5: Distribution of patients according to preventable laparotomy due to metastatic disease

Type of cancer	*Total patients*	*No of patients*	*Percentage*
Colorectal	105	21	20.00
Stomach	67	36	53.73
Biliary tract tumors	23	23	100.00
Hepatocellular	9	9	100.00
Pancreas	19	15	78.95
Periampullary	7	3	42.86
Ovary	9	7	77.78
Others	5	0	0.00
Metastatic	6	6	100.00
Total	250	120	48.00

in 35 (52.24%) and liver metastasis in eight (11.94%) patients and Omental metastasis in 33 (49.25%) patients. Unresectability was predicted in 40 (59.70%) patients with a diagnostic accuracy of 78.43%. Thus our study correlates with studies conducted by Burke et al.[6] Kriplani and Kapur[7], Leake et al.[8]

Pancreatic Cancer

Pancreatic adenocarcinoma, when diagnosed, has a dismal prognosis. Surgery is the only modality that can lead to cure; however, most patients present with inoperable disease. In our present study, 19 patients of pancreatic malignancies underwent preoperative laparoscopy after radiological investigations. CT could detect locally advanced disease in five (26.31%) cases. Laparoscopy detected metastatic disease in three (15.78%) patients and locally advanced disease in 13 (68.42%) patients. Unresectability predicted in 16 (84.21%) patients[9,10] thus avoiding laparotomy in 15 (78.94%) patients. The overall efficacy of laparoscopy was 38.09%. Out of 19 patients, three patients underwent Whipple's procedure, and one underwent triple bypass procedure. Preventable laparotomy in our study for pancreatic malignancy was 15 (78.94%) cases out of 19.[9,10,11]

Periampularry Cancer

In our present study, Seven patients underwent preoperative laparoscopy after radiological imaging. CT detected locally advanced disease in three (42.85%) cases. Laparoscopy detected metastatic and locally advanced disease in six (85.4%) patients predicting the resectability rate for periampullary cancers was 15.6%, avoiding laparotomy in three (42.85%) patients. The patient having resectable disease underwent Whipple procedure. Out of six unresectable cases, two had biliary stenting, one had PTBD, and three had undergone triple bypass procedure. The results are comparable with theabove-mentioned studies (Tables 6 and 7).[12,13]

Biliary tract tumors can be divided into two main categories: gallbladder cancers and cholangiocarcinomas. The two groups differ in their patterns of spread and prognosis.

Hepatocellular Carcinoma

The prognosis of patients with hepatocellular carcinoma (HCC) may be improved with the appropriate selection of treatment, which depends on the accurate identification of all hepatic lesions, including size, number, and location. Nontherapeutic laparotomy and its associated morbidity may be prevented by the detection of unresectable disease with SL. Since peritoneal disease is uncommon with HCC, surface laparoscopy may be less valuable compared with laparoscopic ultrasound.[2] Diagnostic laparoscopy

Table 6: Studies assessing the role of staging laparoscopy in colorectal tumors

Studies	*No. of patients*	*Unresectability (%)*
Rahusen et al.[17]	50	38
Jarnagin et al.[18]	104	14
Grobmyer et al.[19]	264	10
Present study	105	29.52

Table 7: Studies assessing the role of staging laparoscopy in biliary tract tumors

Studies	*No. of patients*	*Unresectability (%)*
Weber et al.[14]	100	35
Tilleman et al.[15]	110	41.8
Goere et al.[16]	39	36
Present study	23	100

is useful in the evaluation of the potentially resectable patient with HCC. Information obtained from laparoscopy may change the clinical management.[18] In our study, out of nine cases of HCC, four (44.44%) cases had intrahepatic metastasis, one (11.11%) patient had omental and peritoneal metastasis, and three (33.33%) cases had fixity to adjacent structures with vascular encasements. In HCC fixity to adjacent structures with vascular encasement in three (33.33%) patients that were diagnosed preoperatively on radiological imaging. Nontherapeutic laparotomies 100%. These findings correlate with Weitz et al.[20] Lai et al.[21]

Metastatic Carcinoma

Diagnostic laparoscopy is a safe, feasible, and accurate staging tool in patients with suspected radiological investigations suggestive of metastatic disease with unknown primary. In our study, six (2.4%) cases were of radiologically detected metastatic disease, whose diagnostic laparoscopy was suggestive of metastatic deposits over omentum and peritoneum (100%). Two (40%) cases had hepatic metastasis also. According to the study done by Marmor et al., diagnostic laparoscopy is a safe, feasible, and accurate staging tool in patients with suspected peritoneal metastases being considered for cytoreductive surgery and hyperthermic intraperitoneal chemotherapy.[22]

Peritoneal Lavage Cytology

The value of cytology of peritoneal lavage performed during laparoscopic staging of GI malignancies was evaluated in a large series of patients. The additional value of the lavage was defined as the number of patients in whom a positive lavage result adequately predicted irresectable disease in addition to the laparoscopy results. A positive lavage result could have additional value for laparoscopic staging only if it were a unique finding, without the presence of metastases or ingrowing disease. When the lavage results were combined with the laparoscopy results, the additional value of the lavage was not significant because in our study 109/250 patients (43.5%) with a positive lavage result also had metastases proven with laparoscopic staging. This result correlates with the study of Nieveen.[23]

In our study, there was upgrading of stage after diagnostic staging laparoscopy, and in 34.4% cases, metastatic disease could be diagnosed on laparoscopy that could not be detected on radiological imaging due to the smaller (subcentimetric) size of metastatic omental, peritoneal and hepatic deposits. Out of a total of 250 patients of abdominal malignancies, 139 (55.6%) patients

were diagnosed unresectable on laparoscopy. The reasons for unresectability were liver metastasis in 53 (21.2%), fixity to adjacent structures in 64 (25.6%), peritoneal metastasis in 54 (21.6%) and omental metastasis in 59 (23.6%) patients that could be diagnosed on laparoscopy. Thus 111 (44.44%) patients were subjected to definitive surgery depending upon the type of abdominal malignancy after diagnostic laparoscopy. Rest of the patients had undergone palliative management depending upon the type of malignancy and were subjected to chemotherapy. Because of the use of diagnostic staging laparoscopy, out of 250 patients, in 120 (48%) cases, nontherapeutic laparotomy could be prevented and could be subjected to further palliative management like chemotherapy without much delay and minimum morbidity. The advantages are very minimal procedure-related complications, no pain, faster recovery minimum morbidity, no mortality, no procedure-related adverse oncological effects. Out of 250 patients of abdominal malignancies, 109 (43.6%) patients had positive peritoneal cytology who also had metastases proven with laparoscopic staging. The sensitivity and specificity of laparoscopy in abdominal malignancies to detect resectable disease was 93.88% and 54.44%, respectively.

Conclusion

This study highlights the emphatic utility of diagnostic laparoscopy procedures in staging and management of abdominal malignancy. Laparoscopic evaluation of a patient with intra-abdominal malignancies is a desirable tool against imaging modalities in improving the detection of metastatic disease and accurate staging of the disease process.

Limitations of Study

Long-term follow-up of patients could not be done.

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RESEARCH ARTICLE

Hemorrhoidectomy with Harmonic Scalpel vs Conventional Hemorrhoidectomy

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Abstract

Background: Hemorrhoidal disease is one of the most frequently encountered anorectal conditions in the clinical practice. A variety of instruments including circular staplers, harmonic scalpel, laser, and bipolar electrothermal devices are currently used when performing hemorrhoidectomy grades III and IV.

Objective: This study compares outcomes between hemorrhoidectomy performed with harmonic scalpel and conventional methods.

Materials and methods: A prospective randomized study of consecutive 50 patients who underwent hemorrhoidectomy between January 2017 and October 2017. Patients were randomly enrolled in two different groups. Group I consisted of 25 patients who underwent hemorrhoidectomy using an ultrasonic scalpel device (harmonic) and group II with 25 patients who had conventional hemorrhoidectomy.

Results: The patients' demographics data and clinical characteristics were similar in both groups. The harmonic group had a shorter operation time, less postoperative pain, less postoperative bleeding, and shorter hospital stay.

Conclusion: Harmonic scalpel hemorrhoidectomy appears to be a better procedure for symptomatic grades III and IV hemorrhoids with ease of operating due to less bleeding, less postoperative pain, and patient acceptance. Long-term follow-up with larger scale studies is required.

Keywords: Harmonic scalpel, Hemorrhoids, Milligan–Morgan procedure.

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Introduction

Hemorrhoidectomy is the standard treatment for patients with grade III or IV hemorrhoids.[1] Milligan and Morgan open hemorrhoidectomy or Ferguson closed hemorrhoidectomy is still the gold standard for surgical treatment of symptomatic hemorrhoids.[2] However, both are associated with significant postoperative pain and complicaions such as urinary retention, constipation, postoperative bleeding, anal incontinence, and anal stenosis.[3]

As a result, various types of surgical equipment have been introduced to overcome the postoperative pain and bleeding.

The operative procedures vary from conventional cautery dissection to vessel-sealers, harmonic scalpels, laser hemorrhoidectomy, and stapling devices.

A harmonic scalpel is a device that simultaneously cuts and coagulates tissues by producing a vibration of 55.5 kHz. When compared with conventional electrosurgical devices, this ultrasonic cutting and coagulating device has advantages such as causing minimal lateral tissue injury 1–3 mm wide, less fumes, more localized impact,[4] better hemostasis, less stimulation to neuromuscular tissues, and local control of the surgical site compared to a hemorrhoidectomy performed with surgical scissors or monopolar electric cautery.[5]

The aim of this study was to analyze and compare between conventional hemorrhoidectomy and hemorrhoidectomy performed with harmonic scalpel.

Materials and Methods

A prospective randomized study involving 50 patients who were operated for symptomatic grade III and IV hemorrhoids, in Sabah Hospital, Kuwait, between January 2017 and October 2017.

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Patients were randomized into two groups: group I consist of 25 patients who had hemorrhoidectomy using harmonic scalpel and group II with 25 patients who had conventional hemorrhoidectomy.

All patients underwent preoperative lab tests, chest X-rays, electrocadiography, and urinanalysis and were admitted to the hospital the day before surgery. All patients were fully informed about the procedure and possible complications, and a written consent was given. All patients had a glycerin enema the night before surgery and prophylactic antibiotics were injected before surgery.

The outcome factors including intraoperative bleeding, postoperative pain (on VAS scale), postoperative bleeding, urinary retention, and anal stenosis were compared between the two groups.

All data were collected and analyzed using SPSS 2 version. Chi-square test and student *t* test were performed for comparison of groups. A p value <0.05 was considered as statistically significant.

Results

The mean age of patients who underwent harmonic scalpel hemorrhoidectomy and conventional hemorrhoidectomy was 30 ± 9.2 years and 35.8 ± 5 years, respectively. The mean hospital stays were 1 ± 0.1 days for group I and 2.5 ± 0.6 days for conventional hemorrhoidectomy.

The mean operating time of the harmonic scalpel group was 10 ± 0.7 minutes and 20.5 ± 2.2 minutes for conventional hemorrhoidectomy ($p < 0.05$). This difference was statistically significant and is shorter in the harmonic group.

There was no significant difference between group I and group II in terms of the number of excised hemorrhoids.

In the conventional group, one patient had minor bleeding on postoperative day 1; conversely in the harmonic group, no bleeding occurred for any patients.

One patient had urinary retention in group II and none from group I, the harmonic scalpel group.

No anal stenosis or incontinence was noted in either group.

The postoperative pain scores were 5.4 ± 0.5 vs 6.8 ± 1.2 on post operative day 1 (POD1) and 1.5 ± 1.2 vs 4.1 ± 0.6 on POD3 in the harmonic scalpel group and conventional hemorrhoidectomy group, respectively; these differences were statistically significant ($p < 0.05$) Table 1 and Figure 1.

Discussion

Hemorrhoidectomy is one of the most common surgical procedures performed in Al-Sabah Hospital, Kuwait.

Hemorrhoidectomy is the most effective and definitive treatment for symptomatic hemorrhoids.

Traditional hemorrhoidectomy techniques, including a Milligan–Morgan open hemorrhoidectomy and a Ferguson closed hemorrhoidectomy, are known to be very effective and appropriate treatment for grade III and IV hemorrhoids. However, the traditional surgical methods are accompanied by complications such as

Table 1: Outcome of harmonic scalpel hemorrhoidectomy vs conventional hemorrhoidectomy

Characteristic	*Harmonic scalpel group (25 patients) I group*	*Conventional hemorrhoidectomy group (25 patients) II group*	*p value*
Age	30.1 ± 9.2	35.8 ± 5	
Mean hospital stay (days)	1 ± 0.1	2.5 ± 0.6	0.025
Operating time (minutes)	10 ± 0.7	20.5 ± 2.2	0.043
Postoperative bleeding	0	1	
Urinary retention	0	1	
Anal stenosis	0	0	
Anal incontinence	0	0	
Postoperative pain 24 hours	5.4 ± 0.5	6.8 ± 1.2	0.032
Postoperative pain 48 hours	4.8 ± 1.4	6.5 ± 1.2	0.044
Postoperative pain 72 hours	1.5 ± 1.2	4.1 ± 0.6	0.022

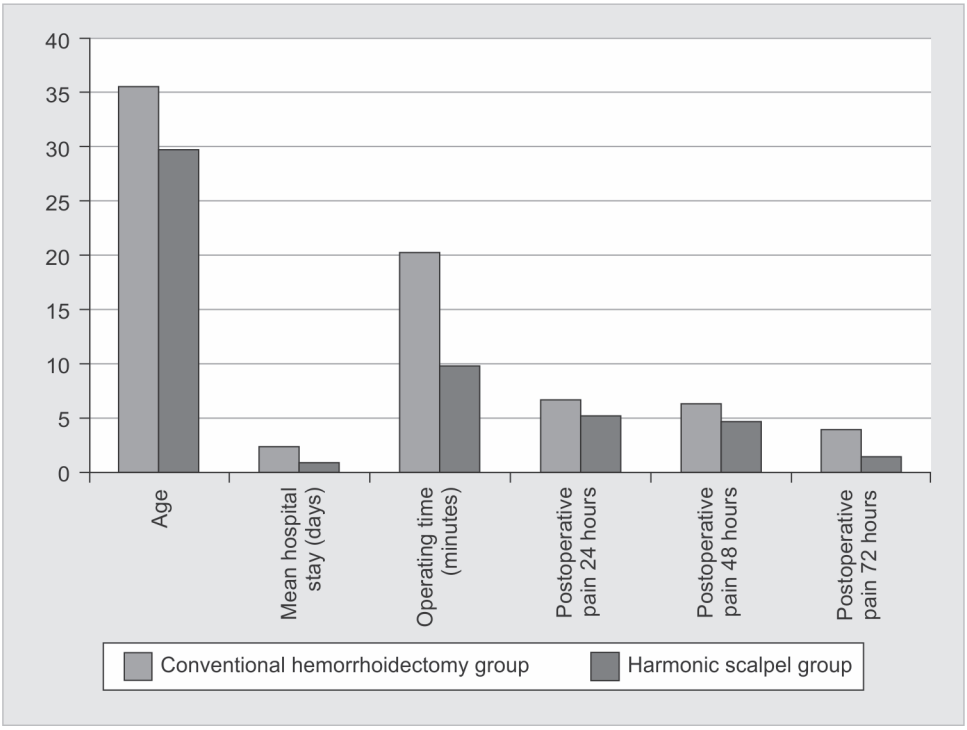

Fig. 1: Outcome of harmonic scalpel vs conventional hemorrhoidectomy

postoperative pain and bleeding.[6] Recently, hemorrhoidectomy done with newly developed equipment has been reported to result in less postoperative pain and bleeding, shorter operation times, and shorter hospital stays.[7–10]

The harmonic scalpel is an ultrasonically activated instrument with sound waves as its source of power, which vibrates at a rate of 55,000 times per second. It is known for its ability to coagulate small and medium-sized vessels; thus potentially it may minimize postoperative swelling and edema to the surrounding tissue.[11] The harmonic scalpel possesses the unique advantage of causing very little lateral thermal injury: <1.5 mm at the surgical site is translated into decreased postoperative pain.[12]

Pain following Milligan–Morgan procedure can be explained by positioning the ligature onto the vascular root of the hemorrhoid, while electrocautery and laser procedures cause significant heat damage to the sensitive perihemorrhoid area. Reduction of this heat is considered to be the main reason for decreasing the level of pain after harmonic scalpel hemorrhoidectomy. This study clearly demonstrates the superior pain control profile of harmonic scalpel in hemorrhoidectmy and less need for analgesics.

Another positive aspect of harmonic scalpel hemorrhoidectomy is good hemostasis. Harmonic scalpel has proved to be effective in larger blood vessels as explained by colorectal surgery.[13]

The harmonic scalpel hemorrhoidectomy requires patience for cutting tissues and for good hemostasis, since the ultrasonic scissors have a slower pace. It is important to avoid pulling the tissue during cutting. Pulling leads to cutting tissues without adequate hemostasis.

Conclusion

Harmonic scalpel hemorrhoidectomy is a safe and effective procedure with fewer complications compared to conventional hemorrhoidectomy. Long-term follow-up with larger-scale studies is required.

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RESEARCH ARTICLE

Factors Guarantee Competence of Laparoscopic Repair of Inguinal Hernia

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Abstract

Aim: To evaluate the impact of age, type of hernia, size of the mesh used, and fixation of the mesh on the competence of laparoscopic repair of inguinal hernia.

Materials and methods: Randomized controlled clinical study carried out from November 2016 to July 2017 in 98 patients with inguinal hernias admitted to surgery Department of Minia University Hospital. Patients were divided into two groups randomly. Group I includes 49 patients who underwent laparoscopic transabdominal preperitoneal (TAPP) hernioplasty and group II includes 49 patients who underwent laparoscopic totally extra peritoneal (TEP) hernioplasty with and without fixation of the mesh.

Results: Operative time in group I ranges between 40 minutes and 110 minutes with mean time of about 66.85 minutes, while in group II ranges between 20 minutes and 105 minutes with mean time of about 52.65 minutes. This difference was statistically significant. Pain was 8.2% in group I and 10.2% in group II. Scrotal edema was 0% in all patients in both groups. Urinary retention was 2% in group I and 4.1% in group II. Seroma was the same (6.1%) in both groups. Recurrence after 6-month follow-up was 2% in both groups. All recurrent cases are nonfixed.

Conclusion: There is no difference between TEP and TAPP, but TAPP technique appears to be superior to the TEP repair in patients undergoing unilateral inguinal hernia repair.

Clinical significance: The TEP approach can be offered to patients with bilateral and recurrent hernias. TEP procedure was associated with more adverse events during surgery but less postoperative pain, faster recovery of daily activities, quicker return to work, and less impairment of sensibility after 1 year.

Keywords: Inguinal hernia, Laparoscopic, Minia.

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Introduction

Inguinal hernias comprise approximately 7% of all surgical outpatient visits. Male-to-female ratio is 8:1. They affect 1–3% of young children. In men, the incidence rises from 11 per 10,000 person-years, aged 16–24 years, to 200 per 10,000 person-years, aged 75 years or above.[1]

Conventionally, there are two types of inguinal hernia: Indirect—a protrusion through the internal inguinal ring passes along the inguinal canal through the abdominal wall, running laterally to the inferior epigastric vessels. This is the more common form accounting for 80% of inguinal hernias, especially in children. It is associated with failure of the inguinal canal to close properly after passage of the testis *in utero* or during the neonatal period. Direct—the hernia protrudes directly through a weakness in the posterior wall of the inguinal canal, running medially to the inferior epigastric vessels. It is more common in the elderly and rare in children.[2]

Inguinal hernia repair is the most frequently performed operation in general surgery. The standard method for inguinal hernia repair had changed little over a hundred years until the introduction of synthetic mesh. This mesh can be placed by either using an open approach or by using a minimal access laparoscopic technique.[3]

Although open mesh-based tension-free repair remains the standard operation, laparoscopic hernioplasty in the hands of adequately trained surgeons produces excellent results comparable to those of open repair.[4–6]

The techniques of laparoscopic hernioplasty include TAPP, TEP approach, and intraperitoneal onlay mesh (IPOM) technique. The three techniques are based on the principles of using mesh prosthesis to cover the defect of the abdominal wall from inside.[7–9]

The advantages over conventional surgery are primarily pain reduction, shorter length of hospital stay, and faster resumption of usual activities. In addition, many studies also show lower morbidity rates and less impairment of the immune system.[10]

Disadvantages of the laparoscopic technique compared with conventional surgery include the higher operating room costs, time consuming specially in the early learning curve of the surgeons, and the need for general anesthesia.[11]

Objective

The purpose of this study was to evaluate the impact of age, type of hernia, size of the mesh used, and fixation of the mesh on the competence of laparoscopic repair of inguinal hernia.

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Materials and Methods

This is a randomized controlled clinical study carried out from November 2016 to July 2017 in 98 patients with inguinal hernias admitted to surgery department of Minia University hospital. Informed consent was taken. All patients were operated upon laparoscopically using prolene mesh. Patients were divided into two groups randomly. Group I includes 49 patients who underwent laparoscopic TAPP hernioplasty with fixation and without fixation of the mesh, and group II includes 49 patients who underwent laparoscopic TEP hernioplasty with and without fixation of the mesh. The mesh was in a size of 7.5 × 11 cm; doubling of mesh had been done in some cases, others tailoring of the mesh. Tailored corner of mesh was positioned infero-medially over the Cooper's ligament and pubic bone fixed using a secure strap, while the superior border of the mesh was fixed to posterior rectus and fascia transversalis in TAPP.

Demographic and clinical data were analyzed (age, type of hernia, operating time, size of the mesh, fixation of the mesh, length of hospital stay, recurrence, intraoperative and postoperative complications). Rules for preoperative correction of general diseases and precipitating factors of hernia recurrence were followed.

Patients were hospitalized the day before surgery and underwent routine preoperative evaluation including chest X-ray, ECG, laboratory studies, and abdominal ultrasound.

Prophylactic broad spectrum antibiotic (amoxicillin + clavulanic acid) was administered at the induction of anesthesia. Some patients were operated upon under general anesthesia others under spinal anesthesia (then converted to general anesthesia due to accidental opening of the peritoneum) with Foley catheter inserted in some cases of TAPP.

The postoperative care of laparoscopic patients immediately after the completion of the surgical procedure is important and includes appropriate monitoring during the early postoperative period usually in the recovery room to ensure a smooth transition from the anesthetic. Most patients require only routine assessment of vital signs. Acutely ill patients or those with significant cardiac or pulmonary disease will require invasive monitoring in an intensive care unit. Appropriate fluids should be administered with consideration to the extent of the dissection, unless there is a specific reason to leave the Foley catheter in place they should be removed.

Pain management following laparoscopy is generally easier than following other more invasive surgical procedures. Pain is generally much less with laparoscopy, one of the primary advantages of this approach. Postoperative analgesia may consist solely of oral medication. Advanced or lengthy procedures may be accompanied by more pain than simple procedures. Diaphragmatic irritation is an important source of postoperative pain and may lead to complains of shoulder or neck discomfort. By the postoperative first day, intensity of the surgical pain generally decreases significantly and at this point, patients can be maintained on oral pain medication exclusively.

Depending on the procedure, resumption of oral intake can begin sooner than with other types of surgery. Following laparoscopic hernioplasty liquids can be provided as soon as the patient awakens from the anesthesia or shortly thereafter, patients are advanced to a normal diet and prepared for discharge. Patients can generally return to work 48 hours after a laparoscopic hernia repair if they are not required to perform heavy lifting or straining. If the patient is doing well without complications, they may resume any heavy lifting, straining, or exercise two weeks after laparoscopic hernia repair. To avoid anxiety in patients, they should be forewarned about the possibility of CO_2 trapped in the scrotum, seroma formation, and discoloration of the scrotum and penis developing a few days after the operation.

Patients are discharged either on the day of operation or on the following day, others occasionally having to remain in hospital because of previous medical conditions. All repairs are reviewed in the clinic two weeks postoperatively and any early complications noted.

Ethical Approval

The title, aim, and plan of the study were discussed and approved regarding ethics of research in General Surgical Department, Minia Faculty of Medicine. Full written, informed consent was obtained from all participants. Manuscript was ethically conducted in accordance with Declaration of Helsinki.

Results

This study was conducted on 98 patients with inguinal hernia. All patients had laparoscopic surgical repair with prolene mesh. One female and 97 males suffering from inguinal hernia were included in the study with a mean age of 42.87 ± 15.02 years old (range 18–73 years) in group I, 36.3 ± 15.18 years old (range 18–77 years) in group II.

The side of hernia in group I was right in 28.6% of patients, left in 61.2% of them, and bilateral in 10.2%, while in group II 34.7% were right, 61.2% were left, and bilateral in 4.1%. The type of hernia in group I was direct in 31.5% of patients, indirect incomplete (pubonocele or funicular) in 59.2% of them, and indirect complete in 10.2%, while in group II 25.5% were direct, 64.7% were indirect incomplete (pubonocele or funicular), and indirect complete in 9.8% (Table 1).

Operative time in group I ranges between 40 and 110 minutes with mean time of about 66.85 minutes, while in group II ranges between 20 and 105 minutes with mean time of about 52.65 minutes. This difference was statistically significant (Table 2).

We used single mesh, doubled mesh, and tailoring of the mesh done in some cases. In group I, fixation of the mesh was done in 46.9% of the cases, while in group II fixation was done in 42.9% (Table 3).

Table 1: Patient's demographics

	Group I (TAPP) (n = 49)	*Group II (TEP) (n = 49)*	*p value*
Age: (years)			
Range	(18–73)	(18–77)	0.034*
Mean ± SD	42.87 ± 15.02	36.3 ± 15.18	
Sex			
Male	49 (100%)	48 (98%)	0.315
Female	0 (0%)	1 (2%)	
Side of the hernia			
RT	14 (28.6%)	17 (34.7%)	0.455
LT	30 (61.2%)	30 (61.2%)	
Bilateral	5 (10.2%)	2 (4.1%)	
Types of hernia			
Direct	17 (31.5%)	13 (25.5%)	0.793
Indirect incomplete	32 (59.2%)	33 (64.7%)	
Indirect complete	5 (9.3%)	5 (9.8%)	

*Statistically significant

Table 2: Operative time

	TAPP (n = 49)	*TEP (n = 49)*	*p value*
Operative time: (min)			
Range	(40–110)	(20–105)	<0.001*
Mean ± SD	66.85 ± 17.46	52.65 ± 16.54	

*Statistically significant

Table 3: Size and fixation of the mesh

	TAPP (n = 49)	*TEP (n = 49)*	*p value*
Fixation of the mesh			
No	26 (53.1%)	28 (57.1%)	0.685
Yes	23 (46.9%)	21 (42.9%)	
Size of the mesh			
Single	33 (67.4%)	41 (83.6%)	0.120
Doubled	5 (10.2%)	4 (8.2%)	
Tailoring	11 (22.4%)	4 (8.2%)	

Table 4: Postoperative complications

	TAPP (n = 49)	*TEP (n = 49)*	*p value*
Early postoperative complication			
Pain	4 (8.2%)	5 (10.2%)	0.727
Seroma	3 (6.1%)	3 (6.1%)	1
Scrotal edema	0 (0%)	0 (0%)	—
Urinary retention	1 (2%)	2 (4.1%)	0.558
Late postoperative complication			
Testicular pain	1 (2%)	1 (2%)	1
Testicular atrophy	0 (0%)	0 (0%)	—
Hydrocele	0 (0%)	0 (0%)	—
Recurrence	1 (2%)	1 (2%)	1

Table 5: Duration of hospital stay

	TAPP (n = 49)	*TEP (n = 49)*	*p value*
Discharge			
On the same day	46 (93.9%)	48 (98%)	0.307
On the next day	3 (6.1%)	1 (2%)	

Early complications include pain, seroma, scrotal edema, and urinary retention. Pain was 8.2% in group I and 10.2% in group II. Scrotal edema was 0% in all patients in both groups. Urinary retention was 2% in group I and 4.1% in group II. Seroma was the same (6.1%) in both groups. Late complications after 6 months include testicular pain, testicular atrophy, hydrocele, and recurrence. Recurrence after 6-month follow-up was 2% in both groups. All recurrent cases are nonfixed. Testicular pain was 0% in both groups. Testicular atrophy after 6-month follow-up was 0% clinically and by scrotal ultrasound early and late postoperative. Hydrocele was 0% in all patients (Table 4).

In group I, 93.9% patients discharged on the same day while in group II, 98% discharged on the same day due to ileus post-TAPP (Table 5).

Discussion

In our study, we compare factors that guarantee competence of laparoscopic repair of inguinal hernia including size of the mesh, fixation of the mesh, age of the patient, and type of hernia. Regarding size of the mesh, 7.5 cm × 11 cm was mainly used; tailoring of the mesh done in some cases and doubling of the mesh done in other cases.

In group I, we used TAPP technique for inguinal hernia; fixation of the mesh was done in 27 cases, no fixation was needed in 22 cases. Two cases recurred in nonfixed mesh. In group II, we used TEP technique for inguinal hernia; fixation of the mesh was done in 28 cases, no fixation was needed in 21 cases. Two cases recurred in nonfixed mesh. All recurrent cases converted to open tension free repair.

In TAPP, regarding size of the mesh we used 7.5 cm × 11 cm and only two cases recurred in nonfixed mesh (2%), contrary to our results, Kapiris et al. found in series of 3017 cases of TAPP from two centers over seven years, the recurrence was 5% in initial 325 cases when the mesh size was 11 cm × 6 cm. The mesh size was then increased to 15 cm × 10 cm and this decreases the recurrence to 0.16% for the rest of the cases on follow-up.[12] Sievers et al. after prospective study of 776 TAPP procedures found that the recurrence rate was 3.9%,[13] while Soltés et al. after 1058 laparoscopic hernioplasties TAPP done over a 10 years had an overall recurrence rate 0.96%, zero conversion rate, and size of mesh enlarged from 7.5 cm × 15 cm to 10 cm × 15 cm.[14] Also, Hussain et al. had a recurrence rate of 0.18% in their study done between September 1999 and July 2009, on more than 2000 patients who underwent transabdominal preperitoneal repair of groin hernia.[15]

Bátorfi concluded in their study which was done between March 1994 and February 1997 on 160 TAPP that in five cases (3.1%) early recurrences were considered to be caused by technical inexperience and/or too small prosthetic patch.[16]

Regarding operative time in group I ranges between (40 and 110 minutes) with mean time of about (66.85 minutes), contrary to our results, Soltés et al., over a period of 10 year period and 1058 laparoscopic hernioplasties done, had a mean operating time of 60 ± 24 minutes (30–175), with 46 ± 19 minutes in the last three years (last 541 patients).[14] In addition, the team of Bátorfi, in 11 years (1994–2005) carried out transabdominal preperitoneal herniorrhaphies in 964 patients and had an average operation time of 112 minutes (52–195), in monolateral hernias during the learning curve and this was reduced to 57 minutes (40–125).[16]

Regarding length of stay in group I, 93.9% patients discharged on the same day. Wilhelm et al. investigated 249 patients underwent TAPP procedures and they found that the second day after surgery was judged to be the ideal time point for discharge by 81% of all patients whereas previously that had only been possible in 5%. Accordingly, the postoperative length of stay (including the day of surgery) was significantly reduced from 4.2 ± 0.6 to 3.3 ± 0.6 days.[17]

Fixation of the mesh was done by secure strap in TEP 21 cases, nonfixation was done in 28 cases and in TAPP, fixation of the mesh was done in 23 cases, nonfixation was done in 26 cases; no recurrence occurs in fixed mesh. Contrary to our results, Craig Taylor et al. found that mesh fixation appears to be unnecessary in TEP repair of small hernial defects. It is associated with higher operative costs and an increased likelihood of developing chronic groin pain. The omission of mesh fixation did not increase the risk of early hernia recurrence.[18] Garg et al. conclude with reasonable confidence that TEP inguinal hernia repair performed without mesh fixation is safe and feasible with minimal recurrence rates.[19]

In addition, the patients in group II needed more pain medication immediately after the surgery than group I and urinary retention in group I 2% and in group II 4.1%. Increased postoperative

pain might lead to an increased incidence of urinary retention by increasing sympathetic tone causing urine retention. A second explanation for decreased urinary retention in patients in group II is that decreased pain leads to decreased use of postoperative analgesia. Mulroy hypothesized that increased postoperative pain might lead to an increased incidence of urinary retention by increasing sympathetic tone impeding urination.[20]

No incidence of hydrocele in both groups. Contrary to our results, Bátorfi in 11 years (1994–2005) and in 964 TAPP procedures found that sero-haematoma (86 = 7.1%) which is the most common mild complication did not occur after the introduction of routine preperitoneal drainage. Also, Bátorfi, between March 1994 and February 1997 on 160 TAPP found 20 (12%) cord/scrotal transient seromas–hematomas and 2 (1.2%) hydrocele.[16] However, Hussain et al. between September 1999 and July 2009 had a study on more than 2000 patients whom underwent transabdominal preperitoneal repair of groin hernia and a hematoma was reported in six patients (0.27%), with two patients (0.09%) needed blood transfusion whereas one patient needed re-exploration and four (0.1%) hydroceles were confirmed.[15]

The patients with mesh fixation had a significantly higher incidence of seroma formation than the patients with nonfixation of the mesh. The exact reason for this could not be ascertained. A possible explanation is irritation of the peritoneum by the metallic tacks, leading to more serum formation. Also, compartmentalization of the preperitoneal space by mesh fixation may lead to a delayed resolution of physiologic serous collection in the dissected space, with later presentation of seroma.[15]

We found that dissection was very difficult in long-standing hernia with more than one year complain. Thus, we prefer to do incomplete dissection from the start to decrease operative time, injury to cord structure, postoperative pain, urinary retention, hospital stay, and scrotal edema. In addition, as regards the left-sided hernia, we observed that the dissection was more difficult than right-sided hernia for the right-handed surgeon.

Conclusion

There is no difference between TEP and TAPP, but TAPP technique appears to be superior to the TEP repair in patients undergoing unilateral inguinal hernia repair.

Clinical Significance

The TEP approach can be offered to patients with bilateral and recurrent hernias. TEP procedure was associated with more adverse events during surgery but less postoperative pain, faster recovery of daily activities, quicker return to work, and less impairment of sensibility after 1 year.

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RESEARCH ARTICLE

Safety and Efficacy of Laparoscopic Appendectomy in Pregnant Females

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Abstract

Introduction: Laparoscopic surgery during pregnancy is contraindicated absolutely or relatively through the last decade; however, laparoscopic appendectomy (LA) is still performed in pregnant women.

Materials and methods: Thirty-one pregnant females with a diagnosis of acute appendicitis and managed with LA or OA in the emergency unit of the department of general surgery from June 2015 to December 2017.

Results: Eighteen patients underwent LA, while 13 patients underwent OA. No difference was noticed between both groups regarding the operative duration, and fetal and maternal outcomes. However, the group of LA had faster first flatus and shorter inpatient duration than the OA group.

Conclusion: Laparoscopic appendectomy is distinguished with efficacy and safety procedure throughout pregnancy and should be considered a good replacement for open appendectomy.

Keywords: Appendectomy, Appendix, Laparoscopy, Pregnancy.

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Introduction

Abdominal pain during pregnancy can be caused by variant obstetric and nonobstetric pathologies that made diagnosing of acute appendicitis during pregnancy quite a challenging problem. Limitations of CT scanning, physiological and anatomical changes during pregnancy like physiological leukocytosis that could be associated with pregnancy were also contributing factors for difficult diagnosis.[1]

Acute appendicitis is the most common nonobstetric condition requiring urgent surgical interference during pregnancy, with an estimated incidence between 0.05% and 0.13%.[2]

The rate of complicated appendicitis is much higher in pregnant women.[3] Delay in diagnosis increases the peril of complications to the mother and fetus when acute appendicitis is suspected and an aggressive approach is recommended.[4]

Laparoscopic appendectomy during pregnancy is recommended in the first and second trimesters. Regarding the third trimester, there are no clear guidelines for performing laparoscopic appendectomy.[5] The advantages of laparoscopic appendectomy over open appendectomy include less postoperative pain, early discharge, less risk for wound infection, and giving feasibility for laparoscopic abdominal exploration.[1,6]

In this study, we assessed the safety and efficacy of laparoscopic appendectomy in pregnant females.

Materials and Methods

This retrospective was carried out in the emergency unit of the General Surgery Department, Zagazig University from June 2015 to December 2017. Thirty-one pregnant women were included in the study. All of them were suffering from abdominal pain in the right lower quadrant with or without fever, suggesting acute appendicitis. All patients underwent perioperative obstetric consultation and fetal monitoring. Complete blood count and pelvi-abdominal ultrasound were carried out to confirm the diagnosis and assess pregnancy. All preoperative data including age, history of previous section, gestation age at operation, and accuracy of the diagnostic U/S were recorded. Also, all operative data including the surgery duration, return time to normal bowel movement, inpatient length, postoperative complications, and final pathology were recorded. Obstetric and fetal data including the incidence of preterm labor, delivery type, and fetal mortality were also recorded.

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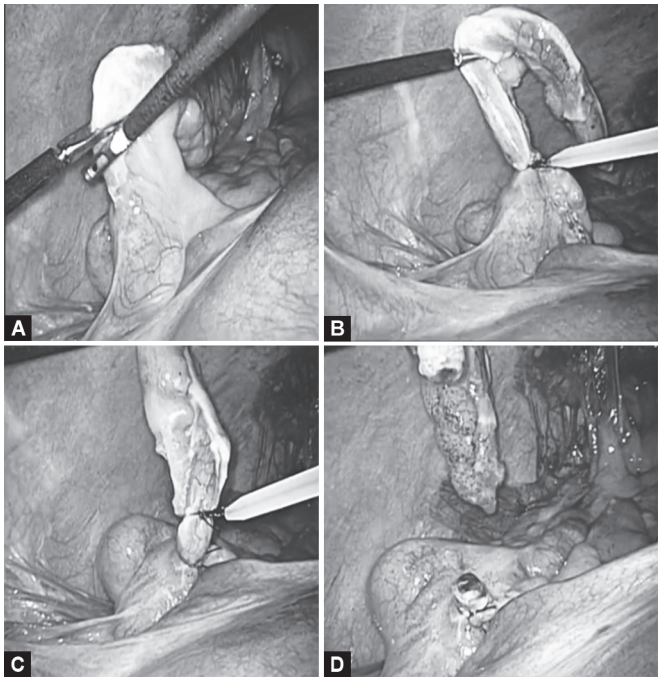
Laparoscopic Appendectomy Technique in Pregnant Females

The procedure was done in the supine position with a slight tilt to the left side (20–30°). The procedure was done under general anesthesia with maintained continuous end tidal volume CO_2 monitoring. Insertion of a Foley catheter was also done along with application of pneumatic compression devices on the legs. A prophylactic antibiotic was administrated. Also, prophylactic tocolysis was administrated. We performed the operation by insertion of three ports. The first one, a supraumbilical 10 mm port according to the size of the uterus (3–4 cm above the uterine



Figs 1A to D: Laparoscopic appendectomy in pregnant female. (A) Elevation of the appendix with 27 weeks gravid uterus; (B) Ligation of complicated appendix using endo-loop after devascularization of mesoappendix; (C) Ligation of the appendix using endo-loop; (D) Appendiceal stump after ligation of the appendix

fundus) for the camera, was inserted by open method (HASSON method) to avoid injury to the uterus. Another two working 5 mm ports were inserted on both sides depending on the gestation age. Pneumoperitoneum by CO_2 was adjusted to be (10–12 mm Hg).The appendix was elevated and the mesoappendix was divided using the bipolar diathermy or harmonic scalpel. The appendiceal stump was ligated using endo-loop or intracorporeal stitches. Retrieval of the appendix in a glove was done through the umbilical port site (Fig. 1). A drain was inserted to be removed after 1–2 days postoperative.

Statistical Analysis

Data are presented as means ± standard deviations. Groups were compared using the Mann–Whitney *U* test or χ^2 test, as appropriate. SPSS version 14.0 for Windows was used for all statistical comparisons, and we considered results to be significant at $p < 0.05$.

Results

Thirty-one pregnant patients were selected for our study. Eighteen patients underwent laparoscopicappendectomy (LA), while thirteen patients had an open appendectomy (OA). The mean age of the LA group was 26 ± 2.8 years and that of the OA group was 29.2 ± 3.2 years. There were no significant differences in the BMI or the gestation age at operation between the two groups. Regarding all patients, seven patients (4 LA and 3 OA) were in the 1st trimester, 16 patients (11 LA and 5 OA) were in the 2nd trimester, and eight patients (3 LA and 5 OA) were in the 3rd trimester. In all patients, preoperative ultrasound was done with a false positive rate (16.13%) and a false negative rate (12.9%) for all patients (Table 1).

Table 1: Preoperative demographic and clinical data

Perioperative data	*LA (18 patients)*	*OA (13 patients)*	*p value*
Age	18–29 (26 ± 2.8) years	23–35 (29.2 ± 3.2) years	0.7*
BMI	23.4 ± 3.1	23.1 ± 2.8	0.366*
Gestation age at operation	18.4 ± 6.2 weeks	18.6 ± 5.4 weeks	0.317*
1st trimester	4 (22.22%)	3 (23.08%)	0.342**
2nd trimester	11 (61.11%)	5 (38.46%)	
3rd trimester	3 (16.67%)	5 (38.46%)	
Previous CS	4 (22.22%)	7 (53.85%)	0.069**
Preoperative U/S	18 (100%)	13 (100%)	0.764**
False-positive	2 (11.11%)	3 (23.08%)	
False-negative	2 (11.11%)	2 (15.38%)	

**t* test *p* value
***Chi-square test *p* value

Table 2: The final histopathological diagnosis after operation

Trimester	*Final histopathology*	*LA (18 patients)*	*OA (13 patients)*	*X^2 p value*
1st trimester	Normal appendix	0	0	1
	Acute suppurative appendix	3	2	
	Complicated appendix	1	1	
2nd trimester	Normal appendix	1	2	0.338
	Acute suppurative appendix	7	2	
	Complicated appendix	3	1	
3rd trimester	Normal appendix	1	1	1
	Acute suppurative appendix	0	2	
	Complicated appendix	2	2	

Regarding the final histopathology of the appendix, in the laparoscopic cases normal appendix was presented in two patients, acute suppurative in ten cases, while complicated appendix was presented in six cases. In open cases, normal appendix was presented in three patients, acute suppurative in six cases, while complicated appendix was presented in four cases (Table 2).

The duration of surgery in LA in this study was 40 ± 18.4 minutes, and in the OA was 45 ± 15.6 minutes. The time of the first flatus and the time of starting oral fluid were earlier in LA. Postoperative complications occurred in three patients. One patient developed intra-abdominal abscess two weeks after a laparoscopic appendectomy. She was 25 years old with gestation age of 25 weeks, was treated with application of US-guided pigtail, and antibiotics. She completed her pregnancy and delivered a healthy male baby by C.S. Two patients developed wound infection after an open appendectomy, and it was managed with repeated dressing and antibiotics (Table 3).

In our study, there was no mortality and all patients had uncomplicated deliveries. One patient had a preterm labor of a healthy female baby that entered the incubator for two weeks and discharged without comorbidity. The two groups had the same results regarding the fetal outcomes with no problems or morbidity (Table 4).

Table 3: Operative outcomes of laparoscopic and open appendectomy during pregnancy

Outcomes	*LA (18 patients)*	*OA (13 patients)*	*p value*
Operative duration	40 ± 18.4 minutes	45 ± 15.6 minutes	0.284*
Time to 1st flatus	1.4 ± 0.5 days	2.7 ± 1.2 days	1*
Time to oral fluid	2.2 ± 0.4 days	4.1 ± 1.9 days	1*
Length of hospital stay	3.2 ± 1.8 days	5.9 ± 2.6 days	0.9*
Complications	1 (pelvic abscess)	2 (wound infection)	0.361**

*t test *p* value
**Chi-square test *p* value

Table 4: Obstetric outcomes of laparoscopic and open appendectomy during pregnancy

Outcomes	*LA (18 patients)*	*OA (13 patients)*	X^2 *p value*
Preterm labor	1 (5.56%)	0	1
CS delivery	13 (72.22%)	9 (69.23%)	0.856
Vaginal delivery	5 (27.78%)	4 (30.77%)	0.856

Discussion

The most common abdominal surgery during pregnancy for nonobstetric causes is acute appendicitis, and its incidence is similar to that in nonpregnant women; the diagnosis is difficult because of the physiologic and anatomic changes that occur during pregnancy.[8] The risk for appendicitis does not appear to be increased by pregnancy, but the incidence of perforated appendicitis in pregnant women is much higher than in the general population.[3] Complicated appendicitis can lead to maternal and fetal morbidity and even fetal loss, so pregnant women should undergo immediate surgery when appendicitis is suspected, regardless of the gestation age of the fetus.[9]

Acute appendicitis can present at any trimester but half of the cases can be seen at the 2nd trimester, an observation published by Kapan et al. In our study, more than half of the cases were presented in the 2nd trimester. But in a study by Kazar et al. and Mazze et al., they observed that the most accurate diagnosis for acute appendicitis was during the first trimester.[10,11]

It was known that the change in the physiology and the anatomy during pregnancy made the diagnosis of acute appendicitis more difficult in pregnant women.[7] The number of negative laparoscopic and open exploration rates during pregnancy ranges from 0% to 50% and 15% to 50%, respectively.[1] In our study, the negative appendectomy rate was 16.13% (five patients) and it was 11.11% (two patients) in LA and 23.08% (three patients) in OA. In a study by Jun Chul et al., the overall negative appendectomy rate was 9.8% (9.1% for the LA group and 10.3% for the OA group).[7]

In our study, there was no conversion of laparoscopic to open because the operation is done by a highly experienced laparoscopic surgeon. Walsh et al. reported 1% as the rate of conversion of laparoscopic to open appendectomy. In this study, none of our procedures converted from laparoscopic to open appendectomy.[12]

Diagnostic imaging studies are often used to clarify a confusing clinical picture. Ultrasonography is widely used as a first-line diagnostic test because of its safety for the mother and fetus and its relatively high sensitivity and specificity for many intra-abdominal processes. In our study, U/S was done in all patients; acute appendicitis was found in 77.78% (14 patients) in LA, and was found in 69.23% (nine patients) in OA. In a study by Chung et al., acute appendicitis was found in 15 (68.2%) patients in the LA group and 28 (71.8%) in the OA group.[7]

In the last decades, the treatment of choice for acute appendicitis during pregnancy was open appendectomy. But recently, laparoscopic appendectomy could be done in pregnant women with good maternal and fetal outcomes.[13] Our study supported the safety of LA; the outcomes of LA and OA were the same. Moreover, some proven advantages of LA, including better intraoperative visualization, decreased surgical trauma, decreased gravid uterine manipulation, shorter postoperative hospital stay, and faster return to work, maybe even more important in pregnant women.[14] In our study, the LA group had an earlier recovery of bowel function and shorter hospital stay.

Guidelines for laparoscopic procedures during pregnancy have previously been published by the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES)[15] and modifications were proposed by Moreno-Sanz et al.[16] A pneumoperitoneum pressure of 10–12 mm Hg is recommended as previous animal studies have demonstrated fetal hypercapnia and acidosis secondary to CO_2 pneumoperitoneum in pregnant females.[15] In our study, pneumoperitoneum was adjusted to 10–12 mm Hg throughout the duration of the operation.

It has been recommended to position the patient on her left side during surgery to prevent uterine compression of the inferior vena cava and to facilitate access to the appendix.[17] Morrell and colleagues[18] have suggested a lateral rotation of the operating table to displace the uterus for better venous return. In our study, all patients were placed in a supine position with a slight left side tilt (20–30°).

One of the most important concerns during LA in pregnancy is the potential risk of injury to the gravid uterus during ports insertion. The Veress needle or the Hasson open technique can be used to gain initial abdominal access. Even though complications have been described for all methods, spontaneous puncture of the uterus with a Veress needle is the most serious.[19] Friedman and colleagues[20] reported results in a young pregnant woman at 21 weeks' gestation who underwent LA for suspected appendicitis. Injury to the serosa of the gravid uterus with the Veress needle resulted in postoperative pneumoamnion with subsequent fetal loss. In our study, we insert the camera port supraumbilical 3–4 cm above the uterine fundus with open method (HASSON method) according to the SAGES guidelines for laparoscopy during pregnancy.[15]

Stasis of blood in the lower limbs is common during pregnancy, so pregnant women are at high risk of thromboembolic complications. According to the SAGES guidelines, pneumatic compression devices were recommended to be used during intraoperative and postoperative periods with early postoperative ambulation to prevent deep vein thrombosis in pregnant patients,[15] and this was applied in the study with no postoperative thromboembolic complications.

The risk of preterm labors with any operative interference during pregnancy was reported to be 10–15%. The same was observed after laparoscopic or open appendectomies that were reported by Kazar and Roslyn.[10] The overall rate of preterm labors was one patient (3.22%) in LA.

In conclusion, laparoscopic appendectomy is distinguished by safety and efficacy throughout pregnancy and associated with good maternal and fetal outcomes, similar to those of open appendectomy. In addition to all the advantages of laparoscopy, LA

is associated with shorter postoperative stay, earlier restoration of bowel function, and low incidence of trauma to the gravid uterus.

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RESEARCH ARTICLE

Is Laparoscopic Cholecystectomy Safe in Gombe, Nigeria?

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Abstract

Aim: This study compares the outcome of laparoscopic cholecystectomy (LC) and open cholecystectomy (OC) in terms of the duration of surgery, the length of hospital stay, the postoperative analgesia, and the postoperative complications, in order to determine the safety of LC in our center.

Materials and methods: This is a retrospective study. All patients who had cholecystectomy in Federal Teaching Hospital, Gombe, Nigeria, between January 2012 and December 2016 were studied. Their relevant data were obtained from the records and analyzed using SPSS version 20.0. *t* test was employed and a *p* value of <0.05 was considered to be significant.

Results: A total of 26 patients had cholecystectomy during the period—four of them were excluded, three had additional procedures while one had incomplete records. The female-to-male ratio was 1.2:1 and the mean age was 39 years. The indications for surgery were symptomatic gallstones in all patients except in one, which was for an acalculous cholecystitis. Fifteen (68%) patients had LC while seven (32%) had OC. The mean age for LC was 38 years and for OC it was 41 years. The mean duration of procedure was 73 (±17.4) minutes for LC and 92 (±28.0) minutes for OC. This was not statistically significant (*p* value = 0.066). The mean length of hospital stay for LC was 5.8 (±5.5) days and 10 (±8.5) days for OC, and was equally not statistically significant (*p* value = 0.433). There was no difference in postoperative analgesia, no surgical site infection or mortality recorded.

Conclusion: LC is very safe and has a good outcome in our environment despite our challenges.

Clinical significance: LC is still nascent and has not been studied in our environment. This study affirms the safety of this procedure, but fails to establish its superiority over OC.

Keywords: Cholecystectomy, Gombe, Laparoscopic, Nigeria, Open.

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Introduction

Cholecystectomy is the surgical removal of a diseased gallbladder and may be either LC or OC. LC is the gold standard and has revolutionized the treatment of gallbladder, since its introduction in 1987 by Mouret Philippe.[1,2] The advantages include reduced postoperative pain, rapid recovery, shorter hospital stay, early return to work, and better cosmetic outcome.[2,3] In the developed countries, LC is the procedure mostly performed and OC is often performed as a result of conversion from LC. This is not the case in the developing countries, where OC is mostly performed.[4,5] In Nigeria, LC is still nascent and not widely available. High cost, unstable power supply, lack of awareness, and inadequate expertise are some of the reasons. Despite the drawbacks, many centers in Nigeria have good outcome.[6–10] Laparoscopic surgeries in our center were initially done by the Department of Obstetric and Gynaecology for diagnostic purposes, until 2012, when therapeutic procedures were started with the assistance of a visiting general surgeon. We now have a trained general surgeon who does most of the laparoscopic procedures.

The aim of this study is to compare the outcome of LC and OC in terms of the duration of surgery, the length of hospital stay, the postoperative analgesia, and the postoperative complications, in order to determine the safety of LC in our center.

Materials and Methods

This is a retrospective study. All patients who had cholecystectomy in Federal Teaching Hospital, Gombe, Nigeria, between January 2012 and December 2016 were studied. Their relevant data were obtained from the records and analyzed using SPSS version 20.0. *t* test was employed and a *p* value of <0.05 was considered to be significant.

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LC was done under general anesthesia using a four-port system. Pneumoperitoneum was achieved with CO_2. A 10 mm umbilical port for the camera was inserted and a 10 mm port at the epigastrium under direct vision. The other two 5 mm ports at the right hypochondrial and iliac fossae were also inserted under direct vision. Clips were applied on the cystic duct and artery after dissection around the Calot's triangle. The gallbladder was retrieved via the epigastric port and sometimes, the bile was suctioned or the incision increased to help deliver the gallbladder. The OC was done conventionally under general anesthesia via the right subcostal incision. All patients received paracetamol and pentazocine injections postoperatively.

Results

A total of 26 patients had cholecystectomy during the study period. Four of them were excluded, three had additional procedures while one had incomplete records. Out of the 22 patients, 12 (54.5%) were females and 10 (45.5%) were males, with a female-to-male ratio of 1.2:1. The age range was 18–70 years and the mean age

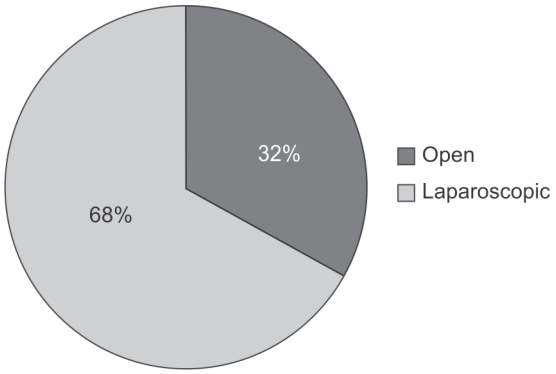

Fig. 1: Pie chart shows 68% of LC and 32% of OC

Table 1: Comparison of laparoscopic and open cholecystectomy in Gombe, Nigeria

	Laparoscopic	*Open*
Males	7	3
Females	8	4
Total	15 (68%)	7 (32%)
Age in years (mean)	18–53 (38)	30–70 (41)
Duration of surgery (minutes)	75.3	92.1
Hospital stay (days)	5.8	11
Postoperative analgesia	Pentazocine and PCM	Pentazocine and PCM
Postoperative complication	Paralytic ileus	Postoperative adhesion

was 39 years. The indications were for symptomatic gallstones in all patients except in one which was for an acalculous cholecystitis.

The LC were 15 (68%), of which seven were males and eight were females, while the age range was 18–53 years (mean = 38 years). The OC were seven (32%) with three males and four females, and the age was between 30 and 70 years (mean = 41 years) (Fig. 1). The duration of the procedure for LC was 45–105 minutes with a mean of 73 (±17.4) minutes, while for OC it was 60–135 minutes and the mean was 92 (±28.0) minutes, with a *p* value of 0.066, which was not statistically significant. The length of hospital stay was 3–14 days with a mean of 5.8 (±5.5) days for LC, while OC had a hospital stay of 4–23 days and the mean was 10 (±8.5) days. The *p* value was 0.433 and was equally not statistically significant (Table 1).

One patient in the LC group developed paralytic ileus postoperatively while one in the OC group developed postoperative adhesion. There was no conversion from LC to OC, no difference in postoperative analgesia, no surgical site infection noted, and no mortality recorded.

Discussion

The low volume of patients can be explained by the rarity of these cases in our environment.[11] Although the trend is changing, especially with the introduction of LC.[12,13]

The female-to-male ratio was 1.2:1 as against 5:1 seen in other studies.[11,12] This was surprising since gallstones were more common in females than in males. It could be that less females presented due to may be religious and/or cultural reasons. The mean age was 39 years as seen also in a study by Asuquo et al.[11] Symptomatic gallstones were the indication in all patients except in one which was for an acalculous cholecystitis. The same was also seen in a report by Afuwape et al.[9] The duration of LC was 73 (±17.4) minutes while OC was 92 (±28.0) minutes and was not statistically significant. The duration of LC was longer than 47 minutes recorded by Salam et al.[14] The prolonged duration was due to the learning curve and some technical issues, such as instrument malfunction and unstable power supply. However, it is comparable to other studies.[7,10] The mean length of hospital stay for LC was 5.8 (±5.5) days while for OC it was 10 (±8.5) days. This was longer than those seen in other studies[7,10,15] but shorter than 7.5 days seen in Afuwape et al.[9] Some centers perform LC as a day-case.[6,16] Being a new procedure, we were cautious to avoid rejection, hence the long duration of hospital stay.

All patients had paracetamol and pentazocine injections postoperatively and so there was no difference in the postoperative analgesia. There was no conversion to open in our study which was in keeping with a study by Ekwunife et al.[6] However, the conversion rate in other studies ranges from 1.9 to 9.1%.[7,17] There was no mortality as also seen in a report by Misauno.[7] The challenges we encountered, apart from those earlier mentioned, include lack of appropriate instruments, inadequate laparoscopic towers, and inadequate supporting staff. The limitations of this study include poor record keeping and low volume of patients.

Conclusion

This study did not establish the superiority of LC over OC, may be because it is still a new procedure in our environment. However, LC is very safe and has a good outcome in our environment, despite our challenges. Patient selection may have accounted for the favorable results. More surgeons should be trained in this aspect and we will recommend that it be integrated in the residency program.

Clinical Significance

LC is still nascent and has not been studied in our environment. This study affirms the safety of this procedure, but fails to establish its superiority over OC.

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REVIEW ARTICLE

Role of Robotic Surgery in Gynecologic Oncology in India

R Anjali

Abstract

Aim: This article aimed to study the role of robotic surgery in gynecologic oncology in India over the past decade.

Background: Different randomized and observational, retrospective and prospective studies that met the eligibility criteria were included. Various parameters were compared between robotic and laparoscopic surgeries. The different parameters evaluated in the studies were operative time, estimated blood loss, hospital stay, complications, conversion rates, so on and so forth. Nodal yield, vaginal margin and paracervical clearance were studied in a few of them. PubMed was the main search engine utilized for searching the study data.

Review results: After careful analysis of the data, it was noted that the complication rate, blood loss, and postsurgery hospitalization were significantly lower with robotics, whereas some inconsistencies were noted regarding the operating time.

Conclusion: India is notably at the brink of a revolution. The need of the hour is to make this new surgically innovative technology accessible to all—to the surgeons as well as the patients.

Clinical significance: Critical analysis of robotic surgeries in gynecology in Indian setting has been done. This would help in planning adoption and training of this upcoming domain.

Keywords: Da vinci robotic surgical system, Gynecologic oncology, Robotic surgery.

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Introduction

In recent times, through robotic surgery, medical quality of care has taken a giant leap towards the better though limited at present by cost factor. Robotic surgery has superseded laparoscopic surgeries due to various reasons such as 3D vision, tremor filtering, precise movements of the instruments with seven degrees of movement and many others. The state-of-art da Vinci robotic surgical system (DRS) heralds the beginning of a new era which could possibly mean the end of laparoscopic and open surgeries as we know them.

There are innumerable robots in the USA alone with an exponential rise in their utilization rates. Their popularity has also spread to Europe, Asia and Australia. Currently in India, robotic surgery is in the early developmental and adaptive phase. As per the data for this year, there are 19 robots in India—in New Delhi, Gurugram, Mumbai, Chennai, Nadiad, Bengaluru, and Hyderabad. The All India Institute of Medical Sciences, New Delhi, has contributed a lot to the progress in robotic surgery in our country. It was here that the first robotic prostatectomy in India was performed in July 2006.[1] From then on, the trend is catching on but financial constraint is the main limitation. The future prospects with new upcoming robots do sound promising.

Robotic Surgery vs Laparoscopic Approach

The major contributing factor to the unprecedented explosion in the use of robotic surgery is its unquestionable superiority over conventional laparoscopic surgery. It basically overcomes most of the limitations of laparoscopic surgery. It offers many advantages to the surgeon as well as the patient. Unlike laparoscopy (which has a disheartening learning curve), open surgeons can easily switch over to robotics due to its various advantages over other MAS (minimal access surgery). It offers a high degree of magnification; has a surgeon-friendly profile with better ergonomics; and has EndoWrist technology, which provides a whole range of movements with seven degrees of freedom; so on and so forth.[2] Owing to the aforementioned reasons, this master-slave surgical robot has widespread applications in all surgical fields, especially where intracorporeal suturing is required as it provides unmatched meticulous anatomy of the surgical field of interest. When a complex condition is encountered in clinical practice, it is our general tendency to avoid MAS and proceed with open surgeries. This is where the robots step in and prove as a very valuable tool for a better outcome with minimal chances of complication.

From a patient's point of view, owing to the higher cost one may feel that it is indeed a marketing strategy. But there are many evidence-based studies that establish advantages to the patient without any element of doubt. DRS needs smaller incisions, has lesser blood loss, shorter hospital stay and is associated with less pain.[3]

Initiation of Robotic Surgery

The DRS was brought into the market by Intuitive Surgical Systems, Inc., and was US FDA cleared for urologic procedures in 2001 and gynecologic surgery in 2005.[4] Urologists were the first among the medical fraternity to accept this technology whole heartedly; prostatectomy being the first surgery performed by them. Incidentally it still remains the most common procedure

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being performed with DRS. Department of Gynecology is not lagging behind with scores of surgeries being performed with robotic assistance, to mention among those are the gynecologic oncology surgeries. The utility of DRS is more so in urology and gynecology as robotics is best for single quadrant surgery and for fixed structures. Other surgical fields are also making promising progress with the total number of robotic surgeries on the rise worldwide.

Robotic Surgery in Gynecology

In gynecology, hysterectomy remains the hallmark surgery. Though noteworthy advances are being made in general gynecology, reproductive gynecology, and reconstructive gynecology, much of the focus still remains on gynecologic oncology and the role of DRS in gynecology is still expanding.

It was noted that in hysterectomies done for benign conditions, with robotics there were significantly lesser operative times, blood loss and conversion rates. Since robotics gives better results with intracorporeal suturing, it is especially useful in tubal anasthamosis that requires precision and extensive suturing. But further studies are needed to validate its use and consequent pregnancy outcomes. In myomectomy, robotic surgery offers many advantages compared with traditional laparoscopy in the form of better enucleation due to better dexterity, better intracorporeal suturing, less blood loss, and hospital stay. DRS is expected to play a significant role in the most recent upcoming subdivision of Obstetrics and Gynecology—Pelvic Reconstructive Surgery. Particularly procedures such as sacrocolpopexy and vesicovaginal fistula repair are well suited for robotics given the necessity of intracorporeal suturing.

Role of Robotic Surgery in Gynecologic Oncology

The role of DRS becomes highly significant in oncology, as the tumor clearance gets translated into survival benefits. Total hysterectomy and staging for endometrial cancer and radical hysterectomy or trachelectomy and pelvic lymphadenectomy for cervical cancer are surgeries where robotic surgery is advised.

Endometrial Cancer and Robotic Surgery

The standard treatment in most centers is hysterectomy and bilateral salphingo-oopherectomy with pelvic and aortic lymphadenectomy. Tumor grade, depth of invasion, tumor size and lymphovascular space invasion are the main factors deciding the risk of metastasis. The most common limiting factor for comfortable and optimum lymphadenectomy is obesity. The procedure remains a difficult task when approached through laparoscopy. A few reasons cited by the surgeons are: prolonged operating times, fatigue and difficult learning curve. Owing to the better ergonomics and easier learning curve, DRS is fast replacing laparoscopy and open techniques in the treatment of endometrial cancer. Most of the recent studies report a favorable report except for the longer operating time.

Some of the limiting factors noted in laparoscopic surgeries are obesity, narrow pelvis and bulky tumors. Endometrial cancer is commonly associated with obesity and this offers a challenge due to difficult exposure during aortic lymph node dissection and difficulty with ventilating in the steep Trendelenberg position. In such cases, robotics has given better results and is now more preferred over the laparoscopic approach.

Cervical Cancer and Robotic Surgery

For stage 1A-2 and 1B cervical cancer, radical hysterectomy with pelvic lymphadenectomy is the standard operative treatment. The complication rate, amount of blood loss and mean hospital stay was comparatively lesser. Except for initial studies, other studies show lesser operative time, which may be due to the initial learning curve. For women with undiagnosed cervical cancer who underwent a simple hysterectomy, radical parametrectomy and lymphadenectomy have been suggested as suitable alternatives to pelvic radiation. This procedure has also been tried through robotics at a centerin Houston. Another area of interest is fertility-sparing trachelectomy with pelvic lymphadenectomy. There is not much information available yet on this topic.

In a study by Puntambekar et al.[5] in Pune, 80 cases were performed robotically. They state that their operative time and estimated blood loss were considerably lower when compared with those of other standard international studies. There was no conversion to open surgery; furthermore no major intraoperative or postoperative complications were noted.

Many other studies,[6] also suggest that robotic radical hysterectomy (RRH) is preferable over laparoscopic radical hysterectomy (LRH) due to the decrease in blood loss, hospital stay, recovery time, and complications. However, it also depends significantly on the skill of the surgeon.

Larger series—notably among them Boggess et al.[7] and Lowe et al.[8]—concluded that there were no transfusions, length of stay in the hospital not more than a day and on the whole the complication rates were significantly lower when compared with open or laparoscopic approaches.

In their experience with 164 oncological surgeries by Puntambekar et al.[9] 35 patients come under the purview of gynecology. They state in their series that the mean operative time was lesser possibly because of extensive open and laparoscopic experience, hybrid techniques, and team effort. They also report that the blood loss was comparatively lesser and they were able to achieve a comparable parametrial, distal vaginal margin and adequate nodal clearance.[10]

In most of the studies, DRS was seen to be associated with lesser blood loss and subsequent blood transfusions with mean hospital stay being significantly lesser. The operative time was comparable between the two groups. More studies need to be done to shed more light on this matter.

Cost Factor

The main limiting factor hindering the utilization of this technology to its full extent is the cost. The total cost of the surgery can be divided into the following categories:

- Equipment: the DRS (which is being marketed by the Intuitive Surgical Systems, Inc.) is right now the only robotic system available. Owing to the patent that has not yet expired, the market is under monopoly. The capital amount and yearly maintenance costs are hence fixed and exuberant.
- Instrument costs: since most of the working instruments are disposable, they add significantly to the final cost.
- Operation theatre cost: as the working staff, the sterilization techniques and other minor costs remain the same in both, this does not add significantly to the final cost. A question may be raised regarding the possible longer operating hours in robotics

but that is expected to decrease with the increased experience of the surgeon.
- Length of stay in the hospital: it was seen in most studies to be lesser than the laparoscopic surgeries.
- Other costs: Other expenditure ssuch as consultations with other departments, ICU care, blood transfusions, and so on needs to be accounted for individually.

As seen above it is clear that the major cost is due to the robot itself, the disposable working instruments and its maintenance. Now, on broader inspection we can safely assume that once other Robotic systems come into the market the scenario will change drastically. Though one may argue that the other costs may also contribute significantly, it is seen that robotic surgery is associated with lesser blood loss, lesser complications, and lesser need for intensive care.

Once newer robot systems become available and easily affordable, there may be an overuse of the same even in cases where it is not indicated and offers no advantage over the traditional laparoscopy. The possibility of patients demanding for a robotic surgery should not be neglected. It becomes the responsibility of the robotic surgeons to maintain the rational use of this technology.

Future of Robotic Surgery in India

Though our country is on the right track with regard to utilization of this technology, much research is needed to make it more productive and cost-effective. This has to be based on critical analysis of evidence-based literature available regarding the same in our institutions. As with any new technology, our outcomes will improve with more experience.

Mass media has a role of paramount importance in creating awareness among the surgeons and patients alike regarding the advantages and accessibility of this technology as there is no dearth of critics.[11] The government also has to come up with suitable strategies to make this technology accessible to all. Another factor is lack of awareness about the same in many parts of the country due to lack of access to the technology, deficit of learning opportunities and also the innate inability of a few to accept the new technology.

Since the introduction of DRS this revolution has gained momentum and it may just be a matter of years when open and laparoscopic surgeries will be considered outmoded. With the introduction of telesurgery, the prospects are innumerable and not at all beyond imagination.

Conclusion

India is notably at the brink of a revolution. The need of the hour is to make this new surgically innovative technology accessible to all—to the surgeons as well as the patients. Robotic surgical training is essential for surgeons to help keep up with this revolution so that the man and machine are in sync and move ahead together. It is up to the undoubted talented surgeons of India to embrace this technology to render better quality of medical care to the society.

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REVIEW ARTICLE

Ectopic Pregnancy: Laparoscopic Conservative Treatment and Laparoscopic Salpingotomy

Bassim Alsadi

Abstract

Objective: Whether a laparoscopic salpingostomy should be done or a salpingectomy for surgical treatment of ectopic pregnancy.

Materials and methods: Literature examining and review the impact of recent advances in the diagnosis and laparoscopic conservative treatment of ectopic tubal pregnancy. Articles published in English language using the following search engines: Medline, Pubmed, Medscape, and Cochrane Database of Systematic Reviews.

Results: The choice of salpingostomy or salpingectomy relies upon many factors and includes shared decision-making between the surgeon and patient. Laparoscopic surgery remains the "gold standard" in majority of women.

Conclusion: There is some evidence to suggest that future fertility outcomes are slightly improved after tubal conservation at surgery in comparison with salpingectomy. As the incidence of ectopic pregnancy continues to rise in a population that will likely desire future fertility, early diagnosis is key in facilitating safe utilization of more conservative management in the hope of preserving tubal function and reproductive potential.

Keywords: Ectopic pregnancy, Laparoscopy, Salpingectomy, Salpingotomy, Ultrasound.

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Introduction

An ectopic pregnancy is an extrauterine pregnancy in which a fertilized ovum implants outside the uterine cavity. Ectopic implantation occurs in 2% of all pregnancies and often affects young women who desire future fertility.[1,2]

Theoretically, factors that impede migration of the conceptus to the uterine cavity may predispose a woman to develop an ectopic gestation. These may be intrinsic anatomic defects in the tubal epithelium, hormonal factors that interfere with normal transport of the conceptus, or pathologic conditions that affect normal tubal functioning.

Ectopic pregnancy occurs when the developing blastocyst becomes implanted at a site other than the endometrium of the uterine cavity. The most common extrauterine location is the fallopian tube, which accounts for 98% of all ectopic gestations.[3]

In addition to the immediate risks of life threatening hemorrhage and those related to its treatment, women with ectopic pregnancies have a subsequent increased risk of infertility and recurrent ectopic pregnancy.

Ectopic pregnancy remains the leading cause of maternal morbidity and occasionally mortality in the first trimester of pregnancy especially in the developing countries, for example, 1–3% all ectopic in Cameroon.[4]

Avoidance of tubal damage is the best strategy to prevent ectopic pregnancies and maintain reproductive potential.

The prevalence of ectopic pregnancy among women with symptoms such as first trimester bleeding, pain, or both ranges from 6 to 16%,[5] and the physical findings depend on whether tubal rupture has occurred.

Women with intraperitoneal hemorrhage present with significant abdominal pain and tenderness, along with various degrees of hemodynamic instability. However, women without rupture may also present with pelvic pain or vaginal bleeding, or both.[6–8] Ectopic pregnancy may also be asymptomatic.

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In a retrospective study of 2,026 pregnant women who presented to the emergency department with first trimester vaginal bleeding and abdominal pain, 376 (18%) were diagnosed with ectopic pregnancy. Of these 376 women, 76% had vaginal bleeding and 7% had abdominal pain.[9] In a population-based registry of ectopic pregnancy from France, the incidence of rupture was 18%.[10]

There has been a rise in the incidence because of a dramatic increase in sexually transmitted disease, use of intrauterine device for contraception, and iatrogenic-induced complications which result from an increase in the administration of *in vitro* fertilization (IVF).

Risk factors for ectopic pregnancy should be elicited, including prior ectopic pregnancy, current use of an intrauterine device, prior tubal ligation, and IVF (Table 1). However, over 50% of women are asymptomatic before tubal rupture and do not have an identifiable risk factor for ectopic pregnancy.[11]

A population-based French study identified four factors that increased the risk of rupture when an ectopic pregnancy was suspected: (1) never having used contraception, (2) history of tubal damage and infertility, (3) induction of ovulation, and (4) high level of human chorionic gonadotropin (hCG, at least

Table 1: Risk factors for ectopic pregnancy

Risk factor	*Odds ratio*
High risk	
Previous ectopic pregnancy	9.3–47
Previous tubal surgery	6.0–11.5
Tubal ligation	3.0–139
Tubal pathology	3.5–25
In utero DES exposure	2.4–13
Current IUD use	1.1–45
Moderate risk	
Infertility	1.1–28
Previous cervicitis (gonorrhea, chlamydia)	2.8–3.7
History of pelvic inflammatory disease	2.1–3.0
Multiple sexual partners	1.4–4.8
Smoking	2.3–3.9
Low risk	
Previous pelvic/abdominal surgery	0.93–3.8
Vaginal douching	1.1–3.1
Early age of intercourse (<18 years)	1.1–2.5

DES, diethylstilbestrol; IUD, intrauterine device
Adapted *from*: Ankum WM, Mol BWJ, et al. Fertil Steril 1996;65:1093; Murray H, Baakdah H, et al. CMAJ 2005;173:905 and Bouyer J, Coste J, et al. Am J Epidemiol 2003;157:185

Table 2: Incidence of different types of ectopic pregnancy

Type	*Incidence (%)*
Ampullary	70
Isthmic	12
Fimbrial	1.1
Interstitial	2.4
Ovarian	3.2
Intra-abdominal	1.3
Cervical	<1

Adapted *from*: Bouyer J, Coste J, Fernandez H, et al. Sites of ectopic pregnancy: a 10 year population-based study of 1,800 cases. Hum Reprod 2002;17:3224

10,000 IU/L).[10] The overall rate of tubal rupture in this series was 18%.

Prompt diagnosis and proper treatment may also play a role in the preservation of fertility after an ectopic pregnancy. The increased knowledge of risk factors among clinicians and proper patient education have enabled an early and accurate diagnosis of ectopic pregnancy.

Awareness of the incidence of different types of ectopic pregnancy is most critical for early detection (Table 2).

In one series of 1,800 surgically treated cases, the distribution of sites was ampullary (70%), isthmic (12%), fimbrial (11.1%), ovarian (3.2%), interstitial (2.4%), and abdominal (1.3%) (Fig. 1).[3]

Anatomy of the Fallopian Tube

The oviduct or tube is approximately 10–12 cm long. The intramural or interstitial portion of the tube is approximately 1 cm long, traverses through the myometrium, and opens in the endometrial cavity. This is the opening through which the sperm travel to the oviduct and the embryo enters the cavity. It is also a highly vascular area and makes conservative surgical management more difficult.

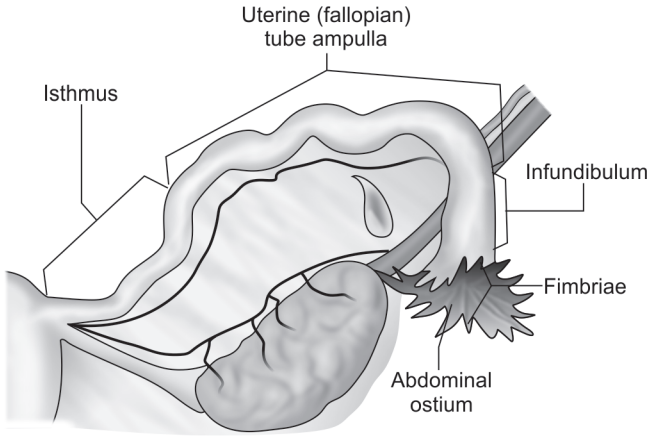

Fig. 1: Anatomy of the fallopian tube (modified from Netter FH. Netter Atlas of Human Anatomy. 3rd ed. New Jersey: Icon Learning Systems; 2003)

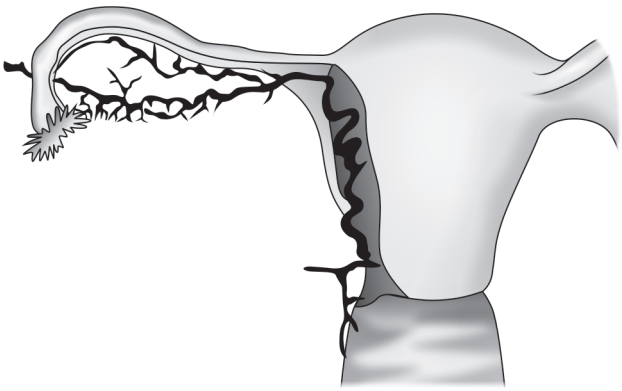

Fig. 2: Blood supply to the fallopian tube. A cascade of vessels originating from an arcuate formed by a branch of the ovarian artery and tubal branch of the uterine artery (modified from Netter FH. Netter Atlas of Human Anatomy. 3rd ed. New Jersey: Icon Learning Systems; 2003)

The isthmus of the tube is approximately 4–6 cm in length and its lumen is approximately 1–2 mm until it gets to the ampulla where it enlarges.

The ampulla is the longest segment of the tube and makes up approximately two-thirds of the total length. Beneath the mucosa of the ampullary portion of the tube, there is a series of large blood vessels mostly veins originating from the uterine/ovarian supply to the tube. These become engorged at the time of ovulation to bring the fimbriae closer to the ovary. They can also be problematic during surgical treatment for an ectopic pregnancy. These vessels travel in a thick longitudinal muscle layer. The lumen of the tube is wider here and the mucosa has more rugae, which are covered with ciliated and secretory cells. These cells may be damaged with infection, previous ectopic or surgery predisposing patients to a greater risk of tubal pregnancy (Fig. 1).

The final portion of the tube is the infundibulum; it is funnel shaped and its most distal end is called the fimbriae. There are greater concentrations of ciliary cells here that facilitate transport of the ovum into the ampulla (Fig. 2).

Studies that combined the level of serum β-human chorionic gonadotropin (β-hCG) and pelvic ultrasonography led to the concept of the discriminatory zone (level of serum β-hCG above which a normal intrauterine pregnancy should be seen).

The sonographic absence of an intrauterine gestational sac with a serum β-hCG level above the discriminatory zone is highly suggestive of an ectopic pregnancy.[12,13]

The diagnosis is less evident when the β-hCG level is below the discriminatory level and when the adnexal ultrasonographic findings are inconclusive.[14]

Promising tools to achieve an early diagnosis of ectopic pregnancy are ultrasonographic endometrial patterns and the endometrial thickness. Several endometrial patterns have been correlated with the presence of an ectopic pregnancy, which include the endometrial trilaminar pattern.[15] Regardless of the location, the endometrium often responds to ovarian and placental production of pregnancy-related hormones. The most common types of endometrium associated with ectopic pregnancy are decidual reaction (42%), secretory endometrium (22%), and proliferative endometrium (12%).[16] The trilaminar pattern is specific for the diagnosis of ectopic pregnancy, but it is associated with low sensitivity.[17]

The endometrial thickness tends to be lesser in patients with an ectopic pregnancy.[17] However, there was no endometrial thickness value that was adequately specific and sensitive for the diagnosis of ectopic pregnancy.[17]

Over the last decades, transvaginal ultrasound (TVUS) has become the first step in the diagnosis of ectopic pregnancy and the most useful imaging test for determining the location of a pregnancy. TVUS should be performed as part of the initial evaluation and may need to be repeated, depending upon the hCG level or a suspicion of rupture. Sensitivity of TVUS as a single test in the diagnosis of ectopic pregnancy is 74% (95% CI: 65.1–81.6) with a specificity of 99.9% (95% CI: 99.8–100).[18] Between 87% and 99% of tubal pregnancies can now be diagnosed reliably using TVUS.[19]

Approximately 60% of ectopic pregnancies are seen as an inhomogeneous mass ("blob sign") adjacent to the ovary, 20% appear as a hyperechoic ring (bagel sign), and 13% have an obvious gestational sac with a fetal pole, with or without fetal cardiac activity.[19]

The diagnosis of ectopic pregnancy (EP) relies on the interpretation of serial hCG levels in conjunction with TVUS and clinical history. Transvaginal sonography is sensitive and specific for distinguishing an intrauterine pregnancy (IUP) from an EP when the presenting hCG is above the discriminatory zone.[13,20]

Measurement of hCG is performed initially to diagnose pregnancy and then followed to assess for ectopic pregnancy. For follow-up, hCG is measured serially (every 48–72 hours). A single hCG measurement alone cannot confirm the diagnosis of ectopic or normal pregnancy.

Clinical interpretation of TVUS in patients with hCG levels close to, or below, the discriminatory zone is challenging, and initial TVUS alone cannot detect 26% of ectopic pregnancies.[18] Additional factors may impact the diagnostic utility of TVUS.[21,22] Medical and/or surgical management is often appropriate once the diagnosis has been confirmed.

Although surgical intervention has long been the gold standard of ectopic treatment, medical management of unruptured ectopic pregnancy has emerged as a safe and effective alternative.

Regardless of the treatment strategy used, the primary goal is the avoidance of catastrophic outcomes including tubal rupture. Fertility preservation should also be a variable in the decision-making process for unruptured ectopic pregnancies.

Unfortunately, there is no consensus in the literature regarding the optimal treatment of tubal pregnancy for the maintenance of fertility.

The greatest risk factor for an ectopic pregnancy and loss of fertility is a history of previous ectopic pregnancy. The recurrent ectopic rate is 10–15% after the first ectopic pregnancy, and 30% after the second.[23] This risk is related to both the underlying tubal disorder that led to the initial ectopic pregnancy and to the choice of treatment procedure.

Sexually transmitted infections or tubal surgery are responsible for the majority of the tubal damage seen in ectopic pregnancies. Postabortal or puerperal infection, appendicitis, and endometriosis are additional etiologies for tubal pathology. One episode of salpingitis results in subsequent ectopic pregnancy in up to 9% of women. Smoking is also a risk factor but may be a surrogate marker as it coincides with other high-risk behaviors.[1] As an example, a study of surgical and medical therapy of ectopic pregnancy reported the rates of recurrent ectopic pregnancy after single dose methotrexate, salpingectomy, and linear salpingostomy were 8, 9.8, and 15.4 percent, respectively, among patients who attempted to conceive.[24]

Despite remarkable advances made in both diagnosis and treatment, ectopic pregnancies continue to account for up to 9% of all maternal deaths in developed countries.[25] The ability to make diagnoses early and accurately has led to the significant expansion of treatment options and the development of innovative surgical and nonsurgical treatment approaches. Today, ectopic pregnancies continue to make up approximately 2% of all recognized pregnancies.[26] Less than 5% of ectopic pregnancies are found outside the tube in locations including the ovary or other intraabdominal structures, the cervix, or defects in the myometrium (e.g., cesarean scar pregnancy). The diagnostic and treatment approaches to these unusual ectopic pregnancies vary greatly depending on their location.

The diagnosis of an ectopic pregnancy is made on the basis of history including physical examination, the assessment of risk factors, vaginal ultrasonography, and serum hCG levels.

The concept of a "discriminatory zone" which is the hCG level above which we expect to see an intrauterine gestational sac has been an important addition to the early diagnosis of an ectopic pregnancy.[27–30] In most institutions, the discriminatory zone is a serum hCG level of 1,500 or 2,000 IU/L with TVUS. The reported sensitivity and specificity of hCG of >1,500 IU/L are 15.2 and 93.4%, and for an hCG level of >2,000 IU/L, they are 10.9 and 95.2%, respectively.[31]

The level is higher for transabdominal ultrasound (approximately 6,500 IU/L), but TVUS is the standard modality used to evaluate ectopic pregnancy.

However, the correct level to use for the discriminatory zone is controversial. A number of factors (e.g., prostaglandins, integrin, growth factors, cytokines, lectin, matrix-degrading cumulus, and modulator proteins) may cause premature implantation in the tube.[32] Pelvic infection may alter tubal function, in addition to causing tubal obstruction and pelvic adhesive disease. Some data suggest that a history of chlamydial infection results in the production of a protein (PROKR2) that makes a pregnancy more likely to implant in the tubes.[33]

Of interest is the fact that unusual forms of ectopic pregnancies, such as interstitial and heterotopic pregnancies, are encountered more often. This is partly because of the more frequent use of assisted reproductive techniques.[4,34,35] Very rarely it is found retroperitoneally or after a hysterectomy.[36–40]

Bassil et al.[41] reported advanced heterotopic pregnancy after IVF and embryo transfer, with survival of both the baby and the mother.

Ectopic Pregnancy: Management of Treatment Options based on Location

The management of ectopic pregnancy can be expectant, medical, or surgical. The choice depends on the clinical circumstances, site of ectopic pregnancy, and serum hCG levels.

The laparoscopic approach is emerging as the gold standard for the management of ectopic pregnancy by salpingostomy (incising the tube to remove the tubal gestation but leaving the remainder of the tube intact) or salpingectomy (removal of the fallopian tube), depending upon the clinical scenario.

In 1973, Shapiro and Adler described treatment of ectopic pregnancy and reported laparoscopic salpingectomy using electrocoagulation.[42]

Salpingotomy by laparoscopy was first reported using multiple punctures in 1980.[43] Linear salpingotomy with a cutting current was described by DeCherney et al.[44]

Laparoscopy is the surgical procedure of choice to both confirm and facilitate removal of an ectopic pregnancy. However, not all ectopic pregnancies are suitable for laparoscopic treatment, these include contraindication for laparoscopy, insufficient laparoscopic experience of the surgeon, or severe pelvic adhesion.

Laparotomy may be indicated if the patient is hemodynamically unstable or the size of the ectopic indicates an open surgery. Patients should always be counseled on the risk of conversion to laparotomy when laparoscopy is performed (Fig. 3).

Conservative Laparoscopic Treatment vs Radical Treatment for Ectopic Pregnancy

The laparoscopic conservative treatment of ectopic pregnancy was reported by Manhes et al.[43] Pouly investigated the fertility of cases that preserved tubes after surgical treatment for ectopic pregnancy. The ratios of intrauterine pregnancy and ectopic pregnancy after salpingostomy were 67% and 12%, respectively.[46]

Laparoscopic procedures were associated with shorter operation times, less intraoperative blood loss, shorter hospital stays, and lower analgesic requirements.[47–51]

The use of conservative surgical techniques exposes women to the risk of persistent trophoblast which may lead to recurrence

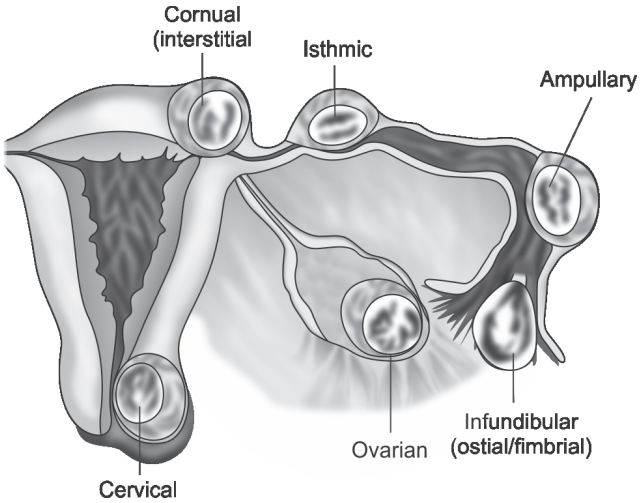

Fig. 3: Sites of implantation of ectopic pregnancies (Nezhat C, Siegler A, et al. Operative Gynecologic Laparoscopy: Principles and Techniques. 2nd ed. McGraw-Hill; 2000)[45]

of clinical symptoms,[52] potential need for further treatment, and postoperative serum hCG monitoring.[53,54] Laparoscopic salpingotomy should be considered as the primary treatment when managing tubal pregnancy in the presence of contralateral tubal disease and the desire for future fertility. The possibility of further ectopic pregnancies in the conserved tube should be discussed if salpingotomy is being considered by the surgeon or requested by the patient.

The European Surgery in Ectopic Pregnancy (ESEP) study group suggests that salpingectomy should generally be preferred to salpingotomy in women with tubal pregnancy and a healthy contralateral tube as salpingotomy does not significantly improve fertility prospects compared with salpingectomy.[55]

Results from another recent randomised controlled trial (DEMETER) found that salpingostomy and salpingectomy resulted in similar rates of spontaneous conception of an intrauterine pregnancy at two years (70% vs 64%).[56]

In a large prospective cohort study in France, the cumulative intrauterine pregnancy rate within 24 months was higher after salpingotomy than after salpingectomy (76% vs 67%).[57] This difference became significant, after multivariate analysis, in women older than 35 years and in those with a history of infertility or tubal disease, in line with other data.[57–59]

The persistent trophoblast was more common in the salpingotomy group than in the salpingectomy group, with the reported frequency similar to the 6% reported elsewhere.[57]

In reviews of controlled and uncontrolled studies, rates of persistent trophoblast have been 8.1–8.3% after laparoscopic salpingotomy and 3.9–4.1% after open salpingotomy.[24,53,60] Factors that have been suggested as increasing the risk of developing persistent trophoblast include higher preoperative serum hCG levels (>3,000 IU/L),[61] a rapid preoperative rise in serum hCG[62] and the presence of active tubal bleeding.[61]

Two randomized trials found that the rates of recurrent ectopic pregnancy after salpingostomy or salpingectomy are similar.[55,56]

Results of a cohort study reported in 2012 suggest that the 2-year cumulative rate of recurrence of ectopic was 19% whatever the treatment received. There was 18.5% recurrence after salpingostomy or salpingectomy and 25.5% after medical treatment.[57] After adjustment to confounders, the rate of recurrence was significantly higher among women who had a history of voluntary termination of pregnancy.

Conversely, fewer recurrences occurred among women having a history of infertility or previous live birth.[57]

Ectopic implantation usually occurs because clinical or subclinical salpingitis causes anatomic and functional changes in the fallopian tubes. These changes are typically bilateral and permanent; thus, it is not surprising that ectopic pregnancy is often followed by recurrent ectopic pregnancy and infertility.

Technical Aspects of Laparoscopic Conservative Treatment

In the late 1970s, Bruhat et al. described principles and techniques for laparoscopic salpingostomy,[43,63,64] and some improvements to the initial technique were made in the 1980s.[65] Since then, the technique has not been substantially modified.

There is some evidence that favors the conservative approach in terms of fertility prognosis.[66–68]

In the absence of clinically relevant predictive factors of failure for a conservative surgical technique by laparoscopy, a standardized surgical technique and the use of appropriate instrumentation

are recommended to achieve lower failure rates and reduce the probability of persistent ectopic pregnancy.[69] Faulty equipment and use of inappropriate instrumentation have been cited as reasons for conversion[70] or change in surgical techniques.[71]

The linear salpingotomy must be as nontraumatic as possible. The most common technique is monopolar electrosection, because it is the easiest and cheapest method.[74]

As previously described,[43,63,64] linear salpingotomy must be performed along the antimesenteric border to preserve tubal vascularization. The salpingotomy must be carried out at the internal part of the hematosalpinx. The trophoblast is located there, and the distal part contains generally only clots. The incision should be done over the ectopic pregnancy, reaching the proximal (medial) portion of the hematosalpinx.[69]

This is very important because one study[72] noted the trophoblastic tissue to be implanted medial to the salpingotomy site in tubes that had been excised after the diagnosis of persistent ectopic pregnancy. These findings suggest that surgeons may not remove adequately the tissue medial to the site of the "bulge" within the tube.[69]

Salpingostomy must be large enough (10–15 mm) to allow the introduction of a 10 mm cannula and extraction of trophoblast without difficulty through it. With a narrower device, the risk of partial removal of the trophoblast increases. The high rate of failure in some series is largely explained by the use of inefficient suction devices.

The products of conception are released from the tube using a combination of hydrodissection with irrigating solution under high pressure and gentle blunt dissection with a suction irrigator. The specimen can then be placed into a laparoscopic pouch and removed from the abdominal cavity; it is also useful for removal of large fragments of placental tissue. Using fluid to remove the gestation is preferable to removing it bluntly. Extracting the products of conception in pieces with forceps may lead to retained trophoblastic tissue, particularly in the area of the tube proximal to the ectopic gestation. The tubal expression ("tubal milking") without associated salpingotomy procedure is associated with a higher rate of persistent ectopic pregnancy and should be avoided.[43,64,73]

The use of a fine monopolar needle, as a result of its minimal surface, allows clean and the most precise cutting of the three tubal layers, avoiding further tissue damage.[69]

The use of monopolar scissors or other devices with greater surfaces leads to a less precise cutting limit and unnecessary thermal damage to the surrounding tissue.[69]

The crucial point is to avoid large coagulation of the tubal wall, which can lead to a tuboperitoneal fistula.[74] Therefore, it must be achieved with a fine electrode and a cutting current. The electrode must not be pressed on the tube but rather should just touch it slightly to increase the power density. The speed of movement along the incision must be sufficiently fast to maximize the cutting effect and limit the collateral coagulation. Bipolar coagulation is forbidden for this step.[74]

The tube is carefully irrigated, inspected for complete removal of the trophoblast, and explored to ensure hemostasis.

Complete hemostasis of the tube is unnecessary or even deleterious. If no vasoconstrictive drugs are used, the bleeding generally comes from the trophoblast implantation area (Fig. 4). Bipolar electrocoagulation, used to achieve hemostasis, leads to large destruction of the tube and is not efficient. Generally, the bleeding stops by itself after 5–10 minutes (Fig. 5).[74] In the case of severe bleeding, removal of the tube must be considered but only after mechanical compression of the mesosalpinx for at least 5 minutes (Fig. 6).[74] A preventive injection of vasoconstrictive drugs (Pitressin) is an efficient alternative when permitted (Fig. 7).[65] The salpingotomy incision is left open to heal by secondary intention[75] to decrease the risk of obstruction and allow better healing of mucosal folds (Fig. 8).[67] It was proved that suturing the tube increases the risk of obstruction and decreases postoperative fertility.[75] In addition, laparoscopic suturing is time-consuming and it does not have additional benefits.[76] Fertility performance after surgery appears to be related to reproductive performance before the ectopic pregnancy (Fig. 9).

Laparoscopic Radical Treatment (Salpingectomy) for Tubal Ectopic Pregnancy

Salpingectomy is the standard procedure if the condition of the tube is compromised (ruptured or otherwise disrupted), bleeding is uncontrolled, or the gestation appears too large to remove with salpingostomy. Salpingectomy is required in women who have contraindications to methotrexate therapy.

Fig. 4: Exposure of an unruptured ampullar ectopic pregnancy (Donnez J, et al. Atlas of Operative Laparoscopy and Hysteroscopy. Informa; 2007)

Fig. 5: A forceps, a monopolar electrode, and a suction device are introduced into the abdomen (Donnez J, et al. Atlas of Operative Laparoscopy and Hysteroscopy. Informa; 2007)

Fig. 6: The salpingostomy is performed at the proximal part of the hematosalpinx (Donnez J, et al. Atlas of Operative Laparoscopy and Hysteroscopy. Informa; 2007)

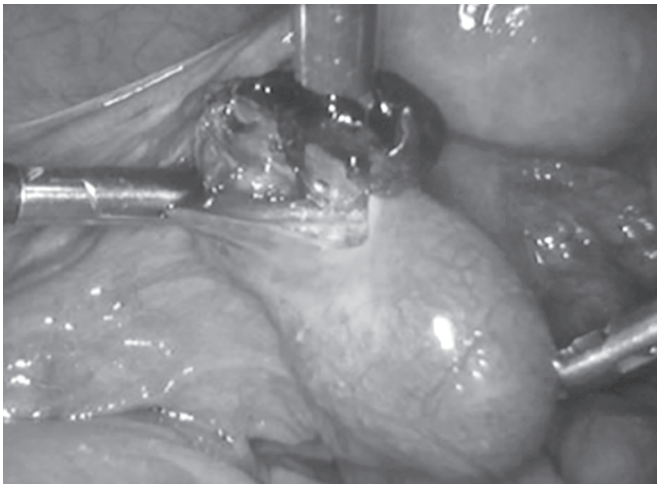

Fig. 7: The robust, large suction device permits removal of the trophoblast through gentle and progressive traction (Donnez J, et al. Atlas of Operative Laparoscopy and Hysteroscopy. Informa; 2007)

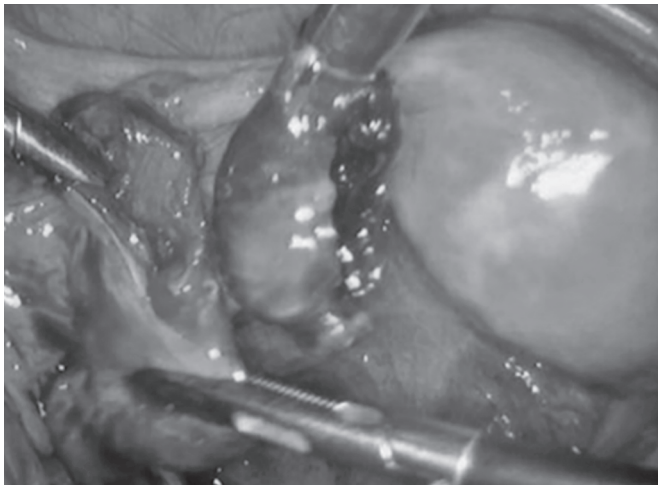

Fig. 8: A repeat suction is performed (Donnez J, et al. Atlas of Operative Laparoscopy and Hysteroscopy. Informa; 2007)

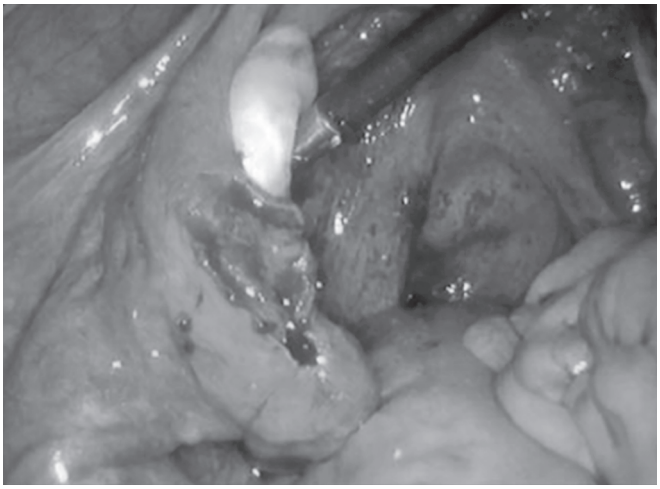

Fig. 9: This minimal bleeding does not require further hemostasis and coagulation. The abdominal cavity must simply be washed (Donnez J, et al. Atlas of Operative Laparoscopy and Hysteroscopy. Informa; 2007)

For women who have completed childbearing, bilateral salpingectomy may be performed as permanent sterilization. The availability and high intrauterine pregnancy rate of IVF have also decreased the need to preserve diseased fallopian tubes, including tubes with an ectopic pregnancy. However, many women do not have access to IVF for financial, geographic, or ethical reasons. An additional potential benefit of salpingectomy rather than another sterilization method is a decrease in the risk of tubal neoplasia with spread to the ovary.

Salpingectomy appears to be associated with a reduced risk of ovarian cancer, and some data suggest that the tube is the site of origin for some high-grade serous carcinomas that were presumed to be ovarian.[77–80] However, further study is needed, and unilateral salpingectomy has not been investigated.

Electrosurgery was applied for salpingectomy by bipolar or even monopolar coagulation. No data support a difference in the use of any of these technologies, even though bipolar cautery is generally considered to be less dangerous. The mesosalpinx and the blood vessels coursing through can be desiccated with bipolar electrosurgery. It is rarely necessary to desiccate either the tubo-ovarian or utero-ovarian vessels, thus sparing the accessory blood supply to the ovary.

There is no difference in the direction of the salpingectomy: it can be carried out from the isthmus to the infundibulopelvic ligament or *vice versa*. Extraction of the tubes from the abdominal cavity must be done in an endobag or through a culdotomy, rather than pulling the tube through a trocar incision.[74]

Conclusion

Ectopic pregnancy remains the leading cause of death in the first trimester of pregnancy. Today, TVUS examination facilitates early detection of most ectopic pregnancies. Whether a laparoscopic salpingostomy should be done or a salpingectomy is still a matter of debate. The choice of salpingostomy or salpingectomy relies upon many factors and includes shared decision-making between the surgeon and patient.

The effect of different management strategies on subsequent fertility after tubal ectopic pregnancy is still controversial.

Awareness of the possibility of an ectopic pregnancy is most critical for early detection. Prompt diagnosis and proper treatment may also play a role in the preservation of fertility after an ectopic pregnancy. The increased knowledge of risk factors among clinicians and proper patient education have enabled an early and accurate diagnosis of ectopic pregnancy.

Although surgical intervention has long been the gold standard of ectopic treatment, medical management of unruptured ectopic pregnancy has emerged as a safe and effective alternative. Laparoscopic surgery remains the "gold standard" in majority of women.

There is some evidence to suggest that future fertility outcomes are slightly improved after tubal conservation at surgery in comparison with salpingectomy. Long-term follow-up shows that the IUP rate in laparoscopy, medical management, and expectant management are all comparable, and the most important factor in surgical cases is the health of the contralateral tube. As the incidence of ectopic pregnancy continues to rise in a population that will likely desire future fertility, early diagnosis is key in facilitating safe utilization of more conservative management in the hope of preserving tubal function and reproductive potential.

In the absence of clinically relevant predictive factors of failure for a conservative surgical technique by laparoscopy, a standardized surgical technique and the use of appropriate instrumentation are recommended to achieve lower failure rates and reduce the probability of persistent ectopic pregnacy.[69] The strict respect of the operative procedure is the best guarantee to prevent persistent trophoblast after salpingostomy. Unfortunately, there is no consensus in the literature regarding the optimal treatment of tubal pregnancy for the maintenance of fertility.

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REVIEW ARTICLE

Natural Orifice Specimen Extraction: An Incisionless Approach for Colorectal Cancer (Technical Report)

Islam H Metwally

Abstract

Background: Natural orifice surgery represents a greatstep to the future. Difficulties arose on our current practice. Reviewing the literature does not solve all the debates.

Report: The author suggests a simple algorithm for transanal natural orifice specimen extraction (NOSE).

Conclusion: Transanal extraction of colectomy and/or proctectomy specimen is a readdily feasible technique.

Keywords: Colon, Natural orifice, Rectum, Specimen extraction, Transanal.

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Background

Natural orifice specimen extraction (NOSE) for colon and rectal cancer is still taking its first steps in oncology practice. Several safety questions, as well as, technical difficulties arose with practizing this technique.[1] As a part of Oncology Center Mansoura University (OCMU) center current clinical trial on natural orifice transluminal endoscopic surgery (NOTES) for colorectal cancer with ClinicalTrials.gov Identifier: NCT02549456, transanal NOSE is practiced. Different technical steps in our practice, as well as, in published series are displayed in an algorithm with videos when possible.

Technique

Excluding cases of intersphincteric resection and some cases of ultralow anterior resection where specimen extraction is straight forward and anastomosis is done on the anal verge, the classic transanal NOSE technique is depicted in Flowchart 1 and below:

Step I: Laparoscopic sigmoidectomy, anterior, low, or ultralow resection is done.

Step II: Cut the distal end by advanced bipolar for the mesentry or mesorectum, then use scissors to cut the lumen (to avoid sealing of the wall that may hinder specimen extraction).

Step III: Either.

- A: Use a long instrument to grip the colon and retrieve it through the anal canal. Cut the proximal end and insert the anvil extracorporeal (preferred method if feasible). Here you can close the distal end with V-Loc® suture (Covidien, MA, USA) transanally or laparoscopically, so implementing a one-stapling technique (much reducing the cost) (Video 1). Otherwise, you may choose to close the stump by a linear stapler, implementing a double-stapling technique.
- B: Insert the anvil transanally, then choose.

  B1: If you are planning for an end-to-end anastomosis, then cut the proximal end, insert the anvil, then take a manual purse string suture,[1] or do a colotomyto insert the anvil through and use a linear stapler to close just around the anvil's tip (author's technique) (Video 2).

  B2: If you are planning for a side-to-end anastomosis, then do colotomy and insert the anvil with its auxiliary trocar and push against wall to make a new narrow colotomy (with/without purse string reinforcement), or use a guide tube to facilitate the anvil exteriorization.[2]

  B3: If you are planning for a pouch reconstruction, then do the pouch with a linear stapler, then insert the anvil through the resultant opening.[3]

Step IV: Only applies for technique IIIB, extract the specimen either by an Endobag® (Covidien, MA, USA) (Video 3), or a camera sleeve,[4] or aCai tube,[5] or a rigid platform; transanal endoscopic microsurgery (TEM) (Richard Wolf, IL, USA) or transanal endoscopic operation (TEO) (Karl Storz, Tuttilingen, Germany).

Step V: Close the distal stump (as in step IIIA), but here you are mostly implementing either a double- or triple-stapling technique.

Conclusion

Transanal NOSE is a feasible and flexible method that can minimize the complications associated with rectal and sigmoid resection. To our opinion, any surgeon experienced in colorectal laparoscopy can easily apply this technique with a short learning curve.

Supplementary Materials

Video 1: Closing the rectal stump after transanal NOSE after low anterior resection using the direct exteriorization and

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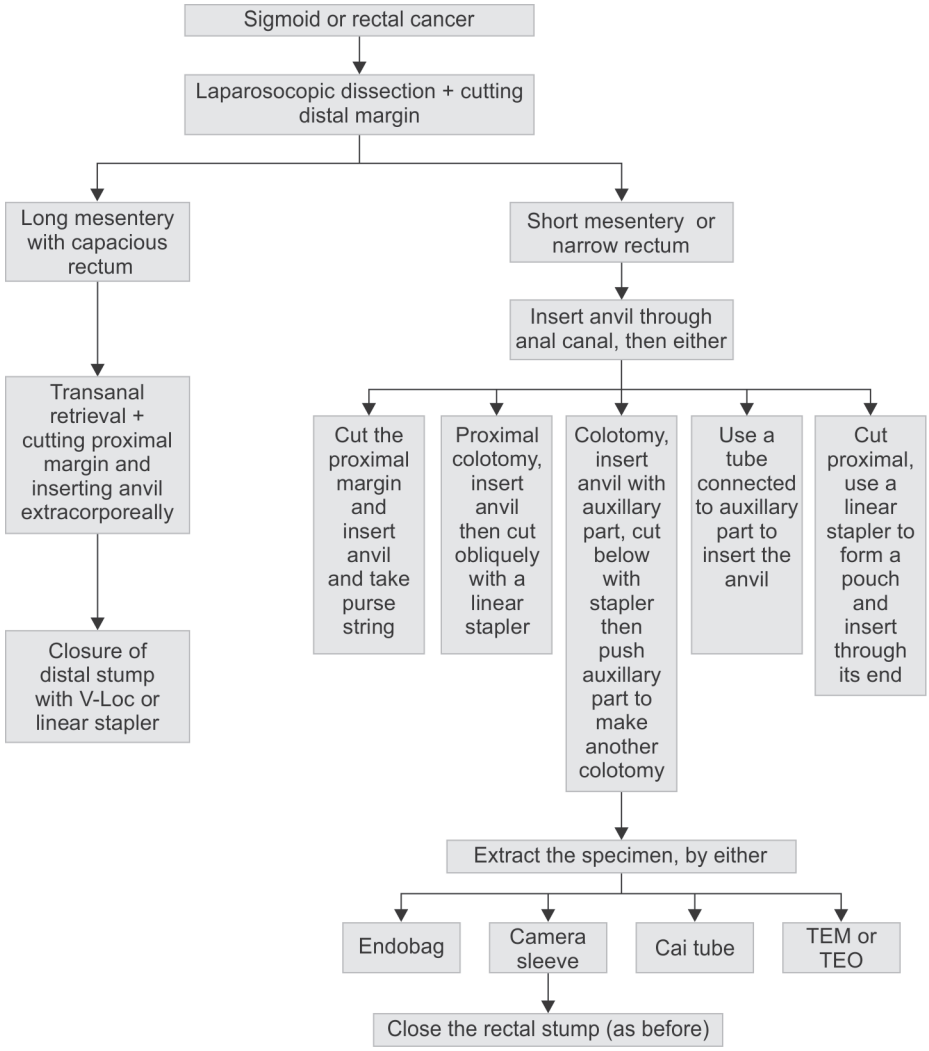
Flowchart 1: An algorithm summarizing steps of transanal NOSE for colorectal cancer



extracorporeal insertion of the anvil. https://www.dropbox.com/s/c2morvt85od2d45/video%201%20M.mp4?dl=0

Video 2: Insertion of a trans-anally pushed anvil of a circular stapler into the proximal colonic stump (OCMU technique). https://www.dropbox.com/s/r95q142vil5i4w7/Video%202%20M.mp4?dl=0

Video 3: A second method for extraction of the specimen transanal using an endobag. https://www.dropbox.com/s/tvvkmbhj3t159x2/Video%203%20M.mp4?dl=0

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REVIEW ARTICLE

Single-port Laparoscopic Surgery: A Mini Review

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Abstract

Introduction: Operative laparoscopy has advanced progressively since 1987 after laparoscopic cholecystectomy by means of four trocars. One of the main advantages of laparoscopic surgery over traditional open surgery is that it often requires a shorter hospital stay than traditional open surgery. Compared to conventional laparoscopic surgery, single incision laparoscopic surgery (SILS) has more benefits. In this article, we review laparoscopic surgery with single incision.

Materials and methods: Literature review was performed on newly minimal invasive approach for laparoscopic surgery.

Results: Single incision laparoscopic surgery has advantages in minimizing the invasiveness of surgical incision, reducing the number of incisions and the associated possible wound morbidities. This includes the reduced risks of wound infection, pain, bleeding, organ injury, and port site hernia. Even though SILS is recognized to be a more complicated procedure and costly, patients are experiencing less pain and almost scarless wound.

Conclusion: Single incision laparoscopic surgery is an exciting new approach in the field of laparoscopic surgery.

Keywords: Laparoscopic surgery, SILS, Single port.

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Introduction

Surgery to treat various diseases has been recorded back to the middle ages. For two centuries, large incisions were necessary to perform abdominal surgical procedures. Although effective, several known morbidities were related to this method, including postoperative pain, wound infection, incisional hernia, and prolonged hospitalization.[1] The present surgical site infection rate is 15–25%, depending on the level of contamination.[2]

Laparoscopic surgery was introduced in 1983 by Lukichev and 1985 by Muhe who performed laparoscopic cholecystectomy. Their cumbersome techniques did not receive the attention they probably deserved. Interest started to grow after Mouret in 1987 reported the first acknowledged laparoscopic cholecystectomy by means of four trocars.[3] Since then, operative laparoscopy has advanced progressively. Several operative procedures have been performed by this new approach. Due to its minimal invasiveness to the abdominal wall, laparoscopic surgery is also called minimally invasive surgery. Laparoscopic procedures can be performed using small incisions of around 0.5–1.5 cm that can be made far away from the surgical site. Small surgical instruments can then be inserted through the incision and passed through to the operational site. The whole procedure is performed using a laparoscope, which is a camera instrument that can relay live video images from inside the body to a TV monitor.[4]

Literature Review

One of the main advantages of laparoscopic surgery over traditional open surgery is that it often requires a shorter hospital stay than traditional open surgery. Procedures such as appendectomy or cholecystectomy require the patient to stay at the hospital for only one night after surgery. This is because patients experience less pain and bleeding after surgery.[5]

Another important advantage of laparoscopic surgery is that as the incision wound is much smaller than open surgery, post-surgical scarring is significantly reduced. Cosmetically, it is more desirable to most patients. Risks of keloid formation is therefore significantly reduced as well.[6]

In conventional laparoscopic surgery, 3–4 small incisions are made. In a more complex procedure such as large bowel resection or bariatric (obesity) surgery, up to six incisions can be made, allowing more instruments to be used to assist organ resection.[4,7–9] Obviously, the more the wounds made, the more pain it will eventually cause to the patients. On the contrary, less wound signifies less pain. This brings about the concept of Single incision laparoscopic surgery (SILS).[10,11]

Single incision laparoscopic surgery has many other names, including laparo-endoscopic single-site surgery, single-port access surgery, trans-umbilical endoscopic surgery, and one-port umbilical surgery. There is no standardized name so far.[12]

With this technique, the surgeon operates exclusively through a single entry point, typically at the patient's umbilicus. Unlike a traditional multiport laparoscopic approach, SILS leaves only a single small scar. During the years following the introduction of SILS in 1997, enthusiasm was limited because of lack of technical support and poor equipment. In 2005, Hirano et al.[13] reintroduced the technique with some advancements compared to previous techniques. Since then, the technology has progressed steadily. Among advancements created were articulating instruments, laparoscope adjustments, several trocars adjacent to each other through a single incision.

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Single incision laparoscopic surgery is gaining popularity due to its advantages in minimizing the invasiveness of surgical incisions. With the reduced number of incisions, the associated possible wound morbidities will also be reduced. This includes the reduced risks of wound infection, pain, bleeding, organ injury, and port site hernia.[12] In addition, one important feature of SILS is that since the wound is at umbilicus, it leaves a single small scar that is well-hidden, it is almost unseen when the wound is healed, thereby it is almost "scarless".

In the beginning of SILS introduction, procedures were limited to simple operations such as cholecystectomy and appendectomy. With the increased experience of surgeons and better equipment features, SILS now can be practiced on more complex procedures such as colon resections and bariatric surgery.

In general, SILS techniques take about the same amount of time as traditional laparoscopic surgeries. However, SILS is recognized as a more complicated procedure because it involves manipulating three articulating instruments through one access port. From a financial point of view, the use of a single-port device and the increased skills needed to perform, SILS is slightly more costly compared to the conventional multiport laparoscopic surgery. However, along with many benefits, SILS often offers overall financial advantages to hospitals, patient's healthcare insurance options, and employers, too. Typically, the patient's hospital stay is shorter as well as less medical assistance is needed compared to traditional laparoscopic surgeries.

Although SILS offers desirable benefits for any wide variety of patients undergoing abdominal surgery, not everyone is an applicant for the procedure. Obesity, severe adhesions, or scarring from previous surgeries are a few of the factors that would prohibit patients from undergoing this surgery. Nonetheless, new technologies are evolving continuously. The invention of new surgical tools will hopefully overcome the current obstacles in SILS in the future.

Conclusion

Single incision laparoscopic surgery is an exciting new approach in the field of laparoscopic surgery. Patients will recover uneventfully, with minimal postoperative pain, and with minimal scar almost unseen. The increased cost of the surgery is traded off by a shorter hospital stay and faster recovery.

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