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ORIGINAL RESEARCH

Laparoscopic Ventral Hernia Repair in Patients with Child C Cirrhosis: Our Experience

Bharati V Hiremath, Nitin Rao, Bharathi Raja

ABSTRACT

Cirrhosis with refractory ascites was considered a contraindication to laparoscopic surgery,[1] until recently. However, current literature has shown the efficacy and safety of various laparoscopic procedures in the diagnosis and management of surgical conditions in cirrhotic patients. The incidence of ventral hernias in cirrhotic patients with tense ascites is high. It is well known that open hernia repair in patients with ascites is associated with high morbidity and mortality due to ascitic leak from wound site, wound infection and high recurrence rate.[2,3] In view of high complication rate for surgical repair in these patients most surgeons defer elective repair of hernias in these patients. But, left alone ventral hernias in such patients may undergo complications, such as rupture, obstruction, strangulation, which are life-threatening. Hence, elective surgical repair of ventral hernias in these patients should be considered. Laparoscopic ventral hernia repair in these patients helps to overcome the complications and allows earlier recovery. There have been very few studies to evaluate the efficacy of laparoscopic ventral hernia repair in patients with child A cirrhosis. However, there is no literature on efficacy of this procedure in child C cirrhotic patients. This is a retrospective study to evaluate the efficacy of laparoscopic repair using a dual mesh in child C cirrhotic patients with tense ascites and complicated ventral hernias.

Keywords: Laparoscopic ventral hernia, Cirrhosis, Mesh repair.

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INTRODUCTION

Cirrhosis is a chronic progressive condition which is characterized by fibrosis and the replacement of normal hepatic architecture by abnormal nodules.[4] The physiologic and metabolic changes in these cirrhotic patients lead to coagulation defects, fluid retention, poor resistance to infections, hypoproteinemia, poor wound healing which in turn lead to increased perioperative morbidity and mortality. Though several indices have been proposed for estimating the risk in cirrhotic patients the child classification modified by Pugh et al is the most widely accepted and commonly used in practice.[5]

The incidence of ventral hernia is high in patients with cirrhosis due to weak abdominal musculature and raised intra-abdominal pressure due to ascites. Umbilical hernias are more common due to transmission of additional pressure to the umbilicus via portosystemic venous communication.[6] The incidence of ventral hernias in cirrhotic patients with tense ascites is around 20%.[7]

Studies have shown that open repair of ventral hernias in these patients is associated with a high rate of recurrence in the era of only suture repair. However, in the present era of prosthetic mesh though the recurrence rate has decreased the rate of wound complications still remains high.[6]

Hence, the routine repair of these hernias is usually avoided due to the dreaded complications such as postoperative ascitic fluid leak, wound infection and subsequently high recurrence rate. But when these patients present with complications, such as obstruction or imminent rupture surgery become inevitable and the rate of postoperative complications in such situations remains very high.

In order to overcome these complications, we subjected these patients to intraperitoneal laparoscopic hernia repair with the use of a dual mesh.

The advantages of this procedure are as follows:

- Not extending the existing defect in the fascia as is required in the open repair.
- The use of intraperitoneal dual mesh prevents leakage of ascitic fluid.
- The large collateral veins over the anterior abdominal wall in these patients are not interrupted.
- Prevention of exposure of viscera prevents losses of electrolytes and proteins.
- There is minimal intraoperative blood loss.

PATIENTS AND METHODS

Retrospective analysis was done in three patients, two with ascites due to cirrhotic liver disease (child C) and in one patient with Budd-Chiari syndrome. Patients who were included were those with tense ascitis and symptomatic hernias which required surgical intervention (Fig. 1).

These patients had symptoms in the form of pain, obstruction, large hernia with skin excoriation with imminent rupture (Fig. 2).

Technique

Preoperatively the patients were optimized with:

1. Mannitol infusion
2. Correction of prothrombin time with vitamin K and fresh frozen plasma.

Fig. 1: Ventral hernia

Fig. 3: Laparoscopic ports

Single incision laparoscopic surgery (SILS) technique was used in one patient. Only two ports were used in two of the cases.

First, a 10 mm port was inserted in the left hypochondrium (palmas point)–by open technique and ascitic fluid was completely drained (Fig. 3). This was compensated with intraoperative albumin infusion. After draining the ascitic fluid pneumoperitoneum was created. A second 5 mm port was inserted in the left iliac fossa. Intraoperatively, the hernia was identified, contents were reduced and the sac was left *in situ*. The defect was measured intraoperatively and a dual mesh was placed. In our study, the defect size ranged from 2 to 8 cm. The mesh was sized to be 4 cm beyond the defect on all sides.

Dual mesh was used in all the cases. The mesh was secured using polygalactol sutures at the center and polypropylene sutures at the four corners by transfascial stitches using a Gucci needle and rest of the mesh was fixed using tackers. Meticulous closure of the 10 mm port site was done under vision, using Gucci needle. Prophylactic and postoperative antibiotics were used to prevent infection. Strict aseptic precautions were followed which included use of antimicrobial incise drape in all cases and change of gloves prior to mesh insertion. None of the cases required conversion to open repair.

Fig. 2: Marking of the margin

DISCUSSION

The incidence of ventral hernias in patients with cirrhosis is high accounting to around 20%.[7] This is due to increased intra-abdominal pressure exerted against an attenuated umbilical ring and fascia.[8] In patients with chronic liver disease the immune response is poor and the presence of foreign body may cause increased rate of postoperative wound infections. The extension of the defect, high infection rate due to decreased immune response and increased intra-abdominal pressure in the immediate postoperative period due to refilling of ascites all leads to high leak rates, nonhealing of wounds and high chances of recurrence.

The elective repair of umbilical hernia in cirrhotic patients with tense ascites has long been a subject of debate.[9]

In a study conducted by Telem et al to determine optimal management and outcome after umbilical herniorrhaphy in patients with advanced cirrhosis and refractory ascites, a total of 21 patients were included. Mortality rate was 5%, and morbidity was 71%, and follow-up at 36 months showed a 20% mortality rate.

Another study conducted by Youssef YF et al evaluated the outcome of elective mesh repair of umbilical hernia in cirrhotic ascitic patients. There was a postoperative ascitic

leak rate of 15%, wound infection of 25% and recurrence rate of 10%.

These studies quoted above show that the morbidity and mortality of open hernia repair in cirrhotic ascetic patients is high.

When ventral hernias in patients with ascites have been left untreated there have been reports of rupture and evisceration of omentum due to massive ascites. A sudden increase in intra-abdominal pressure due to vomiting, coughing or even straining at stools can cause the rupture of an umbilical hernia.[10] Signs of discoloration, ulceration or sudden rapid increase in size of the umbilical hernia are features of impending rupture. Hence, to avoid this dreaded life-threatening[7] complication elective hernia repair should be planned in all cirrhotic ascitic patients with umbilical hernia.

Safety of laparoscopic surgery is still a debate in cirrhotic patients and was previously considered a contraindication due to associated coagulation defects, portal hypertension immunosupression and technical difficulties due to massive ascites.

However, a few recent studies have shown that laparoscopic ventral hernia repair is safe in cirrhotic ascitic patients with lesser morbidity and mortality as compared to open method.

The minimally invasive and tension-free technique decreases the postoperative pain, shortens recovery and reduces postoperative morbidity and recurrence.[11]

Laparoscopy has the added advantages of avoiding large incision, and postoperative ascitic leak, preservation of abdominal wall avoids interruption of large collateral veins, use of dual mesh prevents ascitic leak and decreases the recurrence rate. It also avoids exposure of viscera reducing the electrolyte and protein losses in cirrhotic patients and perioperative blood loss is minimal.[11]

In a study done by Belli G et al, 14 patients with child A cirrhosis with umbilical/incisional hernia underwent laparoscopic mesh hernia repair. There was no conversion to open method with a minor complicatons rate of 78% (seroma, postoperative ileus, skin breakdown etc). There were no recurrences in the follow-up period of 8 months.

Another study was conducted by Jitea N et al to evaluate the efficacy using prolene mesh in laparoscopic umbilical hernia repair. A total of 21 patients were included of which five patients had cirrhotic ascites. There were no recurrences and morbidity was around 38%. This study has showed that laparoscopic repair using prolene intraperitoneal mesh is a safe and efficient method and helps to avoid infections and complications in cirrhotic patients.[11]

In our study, a total of three patients with child C cirrhosis were included, and all had massive refractory ascites with symptomatic umbilical hernia (Table 1).[12]

In one patient, SILS technique was used and laparoscopic mesh hernia repair was done using parietex mesh (lightweight monofilament polyester mesh). In the other two patients, two-port technique was used 10 mm port in the left hypochondrium and 5 mm port in the left iliac fossa. Omega (the omega-3 fatty acid coated polypropylene mesh exhibited significantly less inflammatory cell recruitment) and proceed (large-pore, monofilament mesh) mesh were used in these patients respectively.

Table 1: Ventral hernia in cirrhotic patients

Age/sex	*55 years/M*	*40 years/M*	*18 years/M*
Diagnosis	CLD, HBV cirrhosis, refractory ascites, umbilical hernia, portal hypertension	CLD, cirrhosis, ascites, umbilical hernia	Chronic Budd-Chiari syndrome, refractory ascites, cirrhosis, IVC stent block, portal HTN, post TIPPS, impending rupture umbilical hernia
LFT	Total bilirubin: 3.5, direct bilirubin: 0.3	Total bilirubin: 2.8, Direct bilirubin: 1.7	Total bilirubin: 3.3 Direct bilirubin: 1.8
INR	Inr: 1.69	Inr: 1.8	Inr: 1.8
Albumin	Total protein: 4.0, *S. albumin:* 2.06	Total protein: 3.2 *S. albumin:* 0.8	Total protein: 4.5 *S. albumin:* 2.0
Child score	Child C category	Child C category	Child C category
Procedure	Laparoscopic umbilical hernia mesh repair	Laparoscopic umbilical hernia mesh repair	Laparoscopic umbilical hernia mesh repair
Ports	SILS port	Two-port technique, one in left hypochondrium (palmas point) One in left iliac fossa	Two-port technique, one in left hypochondrium (palmas point) One in left iliac fossa
Mesh	Parietex	Omega	Proceed
Hospital stay	5 days	6 days	25 days
Complications	None	Seroma	Subcutaneous wound hematoma

All patients were optimized preoperatively with mannitol and correction of coagulation defects.

Ascitic leak was overcome by the use of a dual mesh. It is a soft polypropylene mesh encapsulated with polydiaxone (PDS) and oxidized regenerated cellulose (ORC) which is a plant material and helps to minimize tissue attachment. The absorbable PDS creates a flexible and secure bond between the mesh and the ORC layers. This helps to effectively separate the mesh from the underlying viscera. It also has the added advantage of not harboring bacteria and reduces the chances of mesh infection to minimal. Parietex mesh is a composite dual-sided mesh, provides optimal tissue in-growth and fewer visceral attachments. The skirt on parietal side provides accessible, secure fixation points. Increased rigidity during implantation allows superior handling. The polyester material softens and conforms to the anatomy once implanted. It also protects the viscera from fixation points. Omega mesh is made up of polypropylene with a tissue separating film layer of all-natural, pharmaceutical grade omega-3 fatty acid.

Infection was prevented by strict asepsis during the procedure by use of antimicrobial incise drapes in all patients, change of gloves before insertion of mesh and the use of prophylactic antibiotics intraoperatively and postoperatively.

RESULTS

In all patients the ascitic fluid recollected back within 48 hours, to the preoperative volume. However, none of them had ascetic leak through the operative site. None of the patients had wound infection. There were no recurrences during 6 months follow-up period.

COMPLICATIONS

One patient with Budd-Chiari syndrome had postoperative bleeding from the wound edges resulting in hematoma formation. This patient was on oral anticoagulants which was stopped and converted to intravenous heparin in the preoperative, intraoperative and 24 hours postoperative period. The hematoma was evacuated and the wound was dressed with a Botroclot (aqueous solution of hemocoagulase isolated from *Bothrops atrox*) soaked dressing. There was no further recurrence of hematoma. One patient had a seroma in the region of the umbilicus which was managed conservatively.

CONCLUSION

Our study has shown that laparoscopic repair of ventral hernia in cirrhotic patients with tense ascites is technically feasible and safe. Our study is comparable with the two previous studies for similar situation. However, unlike these studies which were in patients with child A cirrhosis our patients were those with child C cirrhosis. To the best of our knowledge, this is the first study reported for patients with child's cirrhosis.

Though we selected only patients with complicated hernias, our results encourage us to advocate this procedure for prophylactic repair of ventral hernias in all cirrhotic patients with tense ascites.

REFERENCES

1. Adisa AO, Mishra RK. Changing role of laparoscopy in the management of patients with cirrhosis. J Min Access Surg 2008;4:63-70.
2. Lindenmuth WW, Eisenberg MM. The surgical risk in cirrhosis of the liver. Arch Surg 1963:86:77-84.
3. Doberneck RC, Sterling WA, Alison DC. Morbidity and mortality after operation in nonbleeding cirrhotic patients. Am J Surg 1983;146:306-09.
4. Anthony PP, Ishak KG, Nayak NC. The morphology of cirrhosis. J Clin Pathol 1978;31:395-414.
5. Child CG, Turcotte JF. The liver and portal hypertension. Philadelphia; WB Saunders 1964.
6. McAlister V. Management of umbilical hernia in patients with advanced liver disease. Liver transpl 2003;9;623-25.
7. Triantos CK, Kehagias I, Nikolopoulou V, Burroughs AK. Surgical repair of umbilical hernias in cirrhosis with ascites. Am J Med Sci 2011 Mar;341(3):222-26.
8. Fitzgibbons RJ, Greenburg AG. Nyhus and Condon's Hernia.
9. Youssef YF, EI Ghannam M. Mesh repair of noncomplicated umbilical hernia in ascitic patients with liver cirrhosis. J Egypt Soc Parasitol 2007;37(3 Suppl):1189-97.
10. Good DW, Royds JE, Smith MS, et al. Umblical hernia rupture with evisceration of omentum from massive ascites. J Med Case Rep 2011;5:170.
11. Belli G, D'Agostic O-A, Fantinic, Cioffi L, Belli A, Russolillo N, et al. Laparoscopic incisional and umbilical hernia repair in cirrhotic patients. Surg Laparosc Endosc Percutan Tech 2006;16(6):330-33.
12. Jitea N, et al. Umblical hernia in adults: Laparoscopic approach with prolene mesh—is it a safe procedure? Chirurgia (Bucht) 2008;103(2):175-79.

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ORIGINAL RESEARCH

Drainage in Cholecystectomy: Required or Not? A Comparative Randomized Study in Northern Indian Subjects

Aman Nagpal, Subhash Goyal, Latika Abbey, Abhishek Singh

ABSTRACT

Background: Routine abdominal drainage after laparoscopic cholecystectomy is an issue of considerable debate in surgical fraternity. So a comparative study was planned as an effort to solve the controversy regarding the need of drainage in cholecystectomy.

Aim: The aim of the study was to evaluate merits and demerits of drainage *vs* nondrainage in patients undergone cholecystectomy.

Materials and methods: Study was carried out in the Department of General Surgery, MM Institute of Medical Sciences and Research between June 2009 and October 2011 on 40 cases of symptomatic gall stone disease. Cases were divided randomly into two equal groups. Group A containing 20 cases with drain placed and group B containing 20 cases without drainage. Subjects were observed for postoperative morbidity in the form of pain–incidence and severity, duration of postoperative hospital stay, analgesia requirement, postoperative nausea, vomiting and antiemetics required.

Results: Mean operative time in groups A and B was 93 and 86 minutes respectively. Gallbladder rupture was most common complication encountered in both the groups. At 12th postoperative hour, 90% of patients of group A and 95% of patients of group B had pain in abdomen.

Conclusion: We found no significant advantage of using drainage after laparoscopic cholecystectomy, as there was higher incidence of postoperative pain and longer duration of hospital stay with its use. Therefore, its routine use cannot be recommended as a means to reducing postoperative morbidity.

Keywords: Cholecystectomy, Drainage, Postoperative care.

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INTRODUCTION

Cholelithiasis is among the most common gastrointestinal illness requiring hospitalization and frequently occurs in young.[1] Cholelithiasis and associated complications are the leading causes of surgical entry into the peritoneal cavity in Northern India. Cholecystectomy remains the treatment of choice of symptomatic gall stones despite the challenges of dissolution therapy and lithotripsy. The introduction of laparoscopic cholecystectomy has revolutionized this procedure.[2] The need to put a drain has always been a controversial subject in surgery. There are those who believe that all intraperitoneal operations should be drained and there are others who feel drains are useless. Number of drains available bears witness to the fact that no one is ideal or suitable for universal use.

Therapeutic drains are a necessity, prophylactic drains are in questions and perhaps this can be answered by age old saying that drains cannot substitute a meticulous technique. Higher wound infection has been reported in drain group.[3] Hospital stay is also prolonged as none of patient can be discharged on same day. Some studies have demonstrated that infection rate and reoperation rate were not significantly different irrespective of whether drains were put or not. Also, some studies showed that post laparoscopic cholecystectomy, pain was not statistically different between drain and no drain group.

So, in review of this unresolved controversy regarding necessity of using drains in cholecystectomy present study was planned with the aim to evaluate merits and demerits of drainage *vs* nondrainage in the patients undergoing cholecystectomy. Objectives of the study were to find out incidence of postoperative morbidity in terms of complications among patients undergoing cholecystectomy with and without drain and to detect difference in operative time and hospital stay in the above groups.

MATERIALS AND METHODS

The present study was carried out in the Department of General Surgery, Maharishi Markandeshwar Institute of Medical Sciences and Research (MMIMSR), Mullana (Ambala) between June 2009 and October 2011 in which 40 cases of symptomatic gallstone disease were admitted for cholecystectomy included in the study. These 40 cases were randomized into two groups equally, group A contains 20 cases with drain placed in subhepatic space and brought out through right anterior axillary port and group B contains 20 cases without drain.

The inclusion criteria's for study group were symptoms consistent with biliary colic, fit for general anesthesia and

no clinical biochemical or ultrasonographic evidence of common bile duct (CBD) stones. Exclusion criteria for the study group were acute pancreatitis, previous abdominal surgery, carcinoma gallbladder, history of peritonitis, bleeding disorders, cirrhosis and pregnancy. The drain in group A was removed when the discharge was insignificant. All the subjects were observed postoperatively till discharge from hospital for postoperative mortality in the form of pain–incidence and site of pain, discharge in the drain tube-hemorrhagic fluid or bile, duration of postoperative hospital stay, postoperative pain based on visual analog score (VAS score),[4] analgesia requirement, postoperative nausea and vomiting and antiemetic required.

Data was analyzed using statistical software SPSS version 11.1. Mean and standard deviation was calculated for continuous variables like postoperative pain incidence and VAS score. Chi-square and t-test was used as test of clinical significance.

RESULTS AND DISCUSSION

Data of 40 patients was included and analyzed in the study. Average age of the patients in present study was 36.25 years in drain group and 37.90 years in no drain group. Male: female ratio in both the groups in our study was 1:3.5 and 1:4 and overall ratio of the study was 1:3 which is comparative with literature having male:female ratio of 1:3.[5,6]

Intraoperative Comparison of Two Groups

Intraoperative Time in the Study Groups

Mean operative time in groups A and B was 93 and 86 minutes respectively. Others[7] reported that average operative time in group A was 33 minutes whereas average operative time in group B was 30 minutes. The difference in the operating time depends on the experience of the surgeon. Although the mean operative time is more but difference in time taken between both groups is comparable which is supported by previous studies.

Intraoperative Complications in the Study Groups

Gallbladder rupture was most common complication encountered in both the groups (Table 1).

Postoperative Comparison of Two Groups

Postoperative Incidence and VAS Score of Pain Abdomen in Patients of Two Groups

At 12th postoperative hour, 90% of patients of group A and 95% of patients of group B had pain when compared with each other. Incidence of abdominal pain is slightly lower in drain group A than in group B except at 6 hours when the incidence is equal in both groups. In both group patients experienced maximum pain at 6 hours postoperatively (3.20 *vs* 3.85; Table 2). Shoulder tip pain was lower in group A in first 24 hours postoperatively. However, at 48 hours, group A had higher shoulder tip pain than group B.

Postoperative Incidence of Drain Site Pain

Drain site pain in terms of VAS score was significantly higher in group A at all times. Others[8] also showed concurrence with the present study with drain group having less incidence of abdominal pain (38%) as compared to no drain group. So the present study is in resonance with above authors. Reason for higher drain site pain is due to irritant effect of drain, as the drain can induce a foreign body sensation,[9] whereas group B had no significant pain at this site. Regarding intensity of pain, contrary to our findings are shown by others[7] where author showed higher abdominal pain at 23 hours in no drain group (2.24 *vs* 2.46) and beyond 23 hours (1.70 *vs* 1.86; Table 3).

Mean Pain Score at Different Sites in Study Groups

Overall mean pain score was higher in group A than in group B (Graph 1).

Comparison of Postoperative Analgesic Requirement and Patients Required Antiemetics

Comparison of postoperative analgesic requirement showed higher usage in group B than in group A but it was not statistically significant. Postoperative incidence of nausea/vomiting in group B was significantly higher than in group A up to 24 hours. Antiemetic requirement was significantly higher in group B than in group A at all times (Table 4). In our study although incidence of abdominal and shoulder tip pain was less in drain group, but this difference was not statistically significant. Moreover, drain site pain was statistically more in drain group. So there was no clear cut benefit in reducing postoperative pain in laparoscopic cholecystectomy.

Table 1: Intraoperative complications in the study groups

Intraoperative complications	*Group A(%)*	*Group B(%)*
Gallbladder rupture	7 (35)	5 (25)
Cystic artery hemorrhage	2 (10)	0 (0)
CBD injury	1 (5)	0 (0)
Gastric perforation	1 (5)	0 (0)
Total	11	5

Table 2: Postoperative incidence and VAS score of pain abdomen in patients of two groups

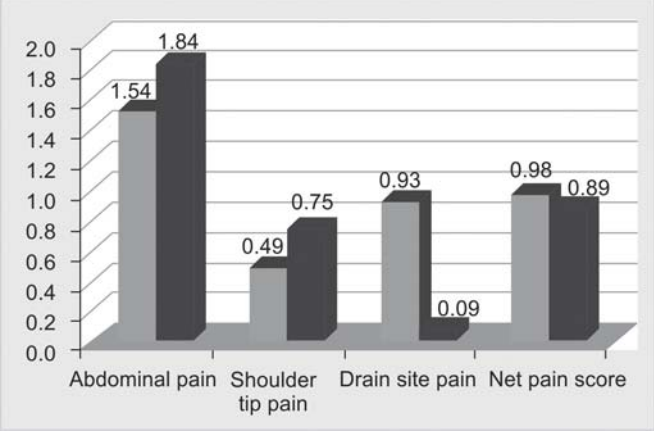
Incidence of pain abdomen				*VAS score of pain abdomen*				
Time (hrs)	*Group A (%)*	*Group B (%)*	*p-value*	*Group A*		*Group B*		*p-value*
				Mean	*Standard deviation*	*Mean*	*Standard deviation*	
0	5 (25)	7 (35)	0.490	0.55	0.99	1.6	2.30	0.069
6	10 (50)	10 (50)	1.00	3.2	3.39	3.85	3.97	0.582
12	18 (90)	19 (95)	0.548	2.35	1.08	2.70	1.12	0.325
24	13 (65)	14 (70)	0.735	1.3	1.17	0.85	0.74	0.156
48	3 (15)	4 (20)	0.677	0.30	0.73	0.20	0.41	0.597

Table 3: Postoperative incidence of drain site pain (right anterior axillary port site)

Incidence of drain site pain				*VAS score of drain site pain*				
Time (hrs)	*Group A (%)*	*Group B (%)*	*p-value*	*Group A*		*Group B*		*p-value*
				Mean	*Standard deviation*	*Mean*	*Standard deviation*	
0	11 (55)	14 (70)	0.002	0.80	0.95	0.15	0.48	0.01
6	14 (70)	3 (15)	0.000	1.55	1.60	0.20	0.52	0.001
12	12 (60)	2 (10)	0.000	1.40	1.50	0.10	0.30	0.001
24	9 (45)	0 (0)	0.000	0.60	0.75	0.00	0.00	0.001
48	4 (20)	0 (0)	0.035	0.30	0.65	0.00	0.00	0.048

Table 4: Number of patients given analgesics at different point of time and patients required antiemetics

	Patients given analgesics			*Patients required antiemetics*		
Time (hrs)	*Group A (%)*	*Group B (%)*	*p-value*	*Group A (%)*	*Group B (%)*	*p-value*
0	16 (80)	18 (90)	0.381	10 (50)	17 (85)	0.019
6	13 (65)	16 (80)	0.294	7 (35)	14 (70)	0.028
12	10 (50)	12 (60)	0.53	5 (25)	12 (60)	0.027
24	4 (20)	5 (25)	0.708	1 (5)	8 (40)	0.008
48	2 (10)	3 (15)	0.636	0 (0)	4 (20)	0.037



Graph 1: Mean pain score at different sites in study groups, group A (gray bar) and group B (black bar)

Comparison of Postoperative Stay in Hospital in Both the Groups

Mean hospital stay was 5.75 and 3.65 days in groups A and B respectively, i.e. higher in group A than in group B. Probably this was due to the reason that none of the patient could be discharged before removal of drain thus increasing the overall stay. Others[5,6] showed equal stay in both groups. This difference is due to the fact that none of the patient in the drain group could be discharged before removal of the drain, thus increasing overall hospital stay and moreover expenditure.

CONCLUSION

To conclude use of drains in laparoscopic cholecystectomy has not much to offer; in the contrary it can be associated with increased pain. We find no significant advantage of using drain after laparoscopic cholecystectomy, therefore, its routine use cannot be recommended as a means to reduce nausea/vomiting as there is higher incidence of postoperative pain and longer duration of hospital stay with its use. However, in a select group of patients it can be justifiable to leave a drain where there is a fear of unsolved or potential bile leak, i.e. imperfect closure of cystic duct or bile staining in the lavage fluid or gallbladder bed suggesting the possibility that an accessory duct has been missed. Simultaneously while putting the drain one need to bear in

mind that drain placement should not be a source of only false sense of security as it can neither prevent postoperative billiary peritonitis, biloma or bleed nor reduced postoperative pain significantly unless great care is taken during surgery.

REFERENCES

1. Townsend CM. Sabiston textbook of surgery. Noida. Elsevier (18 ed), 2009;2:1556.
2. Lazarus EE, Baum V, Breidenbach L. Modern concepts of intraperitoneal drainage. Surg Gynecol Obstet 1954;98(4): 506-08.
3. Thiebe U, Eggert A. Drainage after laparoscopic cholecystectomy. Minimal Invasive Chirurgie 1994;3:90-92.
4. Available from: http://cme.dannemiller.com/sections/professional/cme_article/print page.cfm?id=318 (accessed on 8th November 2011).
5. Uchiyama K, Tani M, Kawai M, Terasawa H, Hama T, Yamaue H. Clinical significance of drainage tube insertion in laparoscopic cholecystectomy: A prospective randomized controlled trial. J Hepatobiliary Pancreat Surg 2007;14(6): 551-56.
6. Tzovaras G, Liakou P, Fafoulakis F, Baloyiannis I, Zacharoulis D, Hatzitheofilou C. Is there a role for drain use in elective laparoscopic cholecystectomy? A controlled randomized trial. Am J Surg 2009;197(6):759-63.
7. Hawasli A, Brown E. The effect of drains in laparoscopic cholecystectomy. J Laparoendosc Surg 1994;4(6):393-98.
8. Morozowicz A, Rucinski P, Polkowski W. Routine drainage of the subhepatic area after laparoscopic cholecystectomy. Prospective, controlled study with random patient selection. Polski Przeglad Chirurgiczny 2006;78(5):597-609.
9. Gurusamy KS, Samraj K, Mullerat P, Davidson BR. Routine abdominal drainage for uncomplicated laparoscopic cholecystectomy. Cochrane Database of Syst Rev 2007;4(3):6004.

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ORIGINAL RESEARCH

Making Robotic Surgery Easier and Safer: A Clinical Review

Meenakshi Jain

ABSTRACT

The author proposes an alternative method of robotic docking for gynecologic total robotic hysterectomy surgery. In this side-docking method, the robot is docked on the side of the patient. The remainder of the patient and trocar setup is similar to traditional docking. The author has had an excellent experience with this method as there does not seem to be an increased risk of robotic arm collision as long as the surgeon respects the basic principle of maintaining at least an 8 to 10 cm distance between each of the instrument ports.

Keywords: Robotic hysterectomy, DaVinci hysterectomy, Robotic surgery.

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INTRODUCTION

I did not want to learn robotics. I was quite content doing most of my hysterectomies and other gynecological procedures laparoscopically.

I was considered a skilled surgeon by my peers, and I felt good about myself. I felt as though I was part of an elite and talented group of surgeons, who were able to do advanced laparoscopic surgeries and could give their patient multiple minimally invasive alternatives to traditional surgery like LASH, TLH, LAVH, laparoscopic myomectomies, etc. The percentage of my patients requiring an abdominal hysterectomy was about 10% or less, all the more telling when compared with the 70% average in the rest of the USA.

When my hospital administrator Mr Conroy approached me with the possibility of purchasing a DaVinci robot for the hospital and asked for my support, I clearly informed him of my total lack of interest in this new technology. I went on and further reiterated my firm belief that this methodology had no benefits over laparoscopy and was merely a gimmick.

Despite my feelings and reservations, I could not deny the rapid incorporation of this new technique in the USA and the growing claims of potential benefits in using this technology, especially in benign gynecology and gynecological oncology.

To clear my conscience, I decided to go through the motions of learning robotics. Four years ago, my clear and simple intent was to learn it, do some cases and then walk away from it guilt-free. Then I would have the first-hand knowledge, perspective and practical experience I needed to easily convince myself, my peers and my patients that my initial gut feelings about robotic surgery were correct, that it was indeed a gimmick and provided neither perceived nor actual benefit over traditional laparoscopic surgery.

I had reservations about using this new technology to treat patients who I was convinced I could treat laparoscopically. To overcome my reservations, I only used this technique on very complex cases. The first 10 robotic cases I performed were only on patients who were very obese, very complex and had very large uteri, factors which I knew would lead me to not even attempt laparoscopy to begin with.

Surprisingly, I was able to do seven of those ten complex cases robotically. I was thrilled and realized I had saved seven of my patients from all the potential consequences of a long hospitalization and the longer recovery times typically associated with an open surgery. So I continued to do robotics but only in very select cases.

CONCERNS ABOUT ROBOTICS

But I still was not completely convinced of the benefits of robotics to use as a replacement to laparoscopy. I had the following concerns, which stopped me from incorporating robotics completely in my practice.

1. Lack of control. I was away from my patient and I felt that in the case of an emergency I would not be able to convert to a laparotomy rapidly and easily.
2. There were too many people in the operating room, there were extra staff, Da Vinci reps, an extra anesthesiologist. All this caused too much commotion and confusion.
3. The size, presence and operation of the robot appeared very intimidating and cumbersome.
4. Docking between the legs was especially difficult, it took a long time and appeared very problematic.
5. My assistant was not able to manipulate the uterus the way I wanted, which made the case very frustrating and as I was away from my patient, even I could not manipulate the uterus myself.
6. I was not used to routinely doing port placement above the umbilicus in the right and left upper quadrants, so I felt somewhat out of my comfort zone.

7. The deep trendelenburg worried me and my anesthesiologists.
8. It seemed as though too much time was being wasted in the turnover time and preparation for a robotic case.
9. The DaVinci technique of port placement made me have both graspers in my left hand and scissors in the right hand. I felt as though I was not utilizing my fourth arm adequately. A couple of times I felt as though my scissors had drifted from my field of vision.
10. My case volume was decreasing because both the duration of the case and the turnover time between cases was increasing.

MY AHA! MOMENT... IT EXISTS!!!

By the 25th case, my staff and I were finally starting to get comfortable. Then 1 day I made a few changes to my docking technique, changed the port placement and the instrument selection, and that day was my AHA moment. That day the Jain technique started and there has been no looking back.

The benefits of the Jain technique are as follows:

1. Cases are not only easier but also much faster, even compared to laparoscopy.
2. The docking takes my staff on an average 2 minutes, including the placement of instruments.
3. There is easy vaginal access.
4. Port placement is the same in more than 95% cases and can be moved up or down depending on the size of the uterus.
5. Since, we follow the same preparation in almost all the cases, the turnover is now as little as an average 20 minutes.

THE PILLARS OF THE JAIN TECHNIQUE

Parallel Docking

I believe parallel docking is much better and easier than midline or side docking in benign gynecological surgeries. I do not like center midline docking between the legs for the following reasons:

a. Takes too long.
b. It is cumbersome and difficult to master.
c. I do not have access vaginally.
d. My assistant is unable to push and manipulate the uterus adequately, because either she is sitting between the robot and the patient or she is leaning over the leg of the patient and pushing the uterus with one hand. This is especially concerning given our collective knowledge and experience that inadequate pushing of the uterus increases the incidence of injuries to the bladder and ureters.
e. While it is true in my opinion that side docking is more advantageous over between-the-leg docking, it should still be noted that side docking involves a process of positioning the robot at a very particular angle falling on the judgment of two different perspectives. The perspective of the person moving the robot and the perspective of the person directing the robot. That may sometimes lengthens the time it takes to dock the robot. Even after a dock position is set, it may require more than a few attempts before final docking occurs.

Benefits of Parallel Docking

In the last about 300 cases I have done parallel docking. Prior to that we were using side docking.

1. It takes on an average half a minute to bring the robot to the correct spot and perhaps another minute to dock. Add a couple minutes to get the camera and instruments ready and from the time I have put in the ports to the time I start the case it takes me less than 3 to 4 minutes.
2. We need only one person moving the robot. It is no different than parking your car. As long as the robot is parallel to the base of the operating room table with the right base of the robot overlapping about six inches to the side of the operating room table (Figs 1 and 2).
3. I always dock from the patient's right side.
4. I recommend bringing the third arm around the back of the robot to the left side of the robot. In essence, I like to have my first and the third arm on the right side of the patient and my second arm to the left of the patient (Figs 3 and 4).
5. I recommend that assistant stands on the left of the patient.

I believe that it makes the docking faster and more efficient. Many physicians have started to accept this as the primary means of docking.

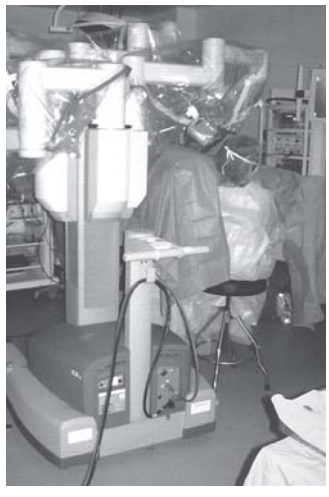

Fig. 1: View of the robot from the foot of the bed

Fig. 2: Relation between the base of the robot and the foot of the bed

PORT PLACEMENT AND INSTRUMENT SELECTION

Where are my Scissors?

The DaVinci technique of port and instrument placement for benign gynecology is to put the scissors on the right side of the abdomen and to put one or two graspers on the left side of the abdomen. It could be a W or a M placement. Therefore, if you are right handed you have two graspers that you are toggling in the left hand while dissecting and cutting with the scissors in the right hand. I feel that my ability to use the two graspers to their full capacity was compromised in the Da Vinci technique, and thus the invention of the Jain technique.

The Jain technique of port and instrument placement is opposite to the DaVinci technique and practically eliminates this limitation. I recommend the following.

Port Placement and Docking Technique (Figs 5 and 6)

1. Dock the first and the third arms of the robot on the right side of the patient's abdomen. As I mentioned earlier, bring the third arm around the back of the robot to the left of the robot.
2. Always dock the third arm first and then the first arm, it makes the docking easier.
3. Dock the second arm of the robot to the left of the patient's abdomen.

Fig. 3: Robot is docked on the right side of the bed

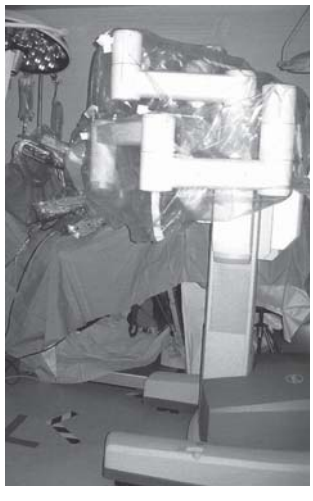

Fig. 4: Third arm is brought to the right side of the robot

Instrument Selection Procedures (Figs 7 to 9)

1. Put the unipolar scissors in the first arm, which is usually in the right upper quadrant.
2. The fenestrated bipolar or a grasper goes in the third arm in the right lower quadrant. I have a separate foot pedal next to my right foot for the Bipolar graspers.

   I switch between my scissors and the fenestrated grasper in my right hand. So you see that I either use my scissors or I use the fenestrated bipolar. In essence, when I use my fenestrated bipolar in the third arm, then my scissors in the first arm are fixed and thus cannot move or get lost reducing the risk of inadvertent injury to vital structures. On a side note, when I am not using the scissors, I leave them near the anterior abdominal wall, away from the bowel and vascular structures.
3. I put the Gyrus grasper in the second arm on the left lower or mid quadrant of the patient's abdomen.
4. My assistant port could be in suprapubic or in the left upper quadrant. The site is dependent on the size of the patient and the pathology.

Note: If I have a clear vision of the pelvis with no redundant bowel, I use a suprapubic port. That port is used essentially for suction irrigation, passage of the suture and removal of the specimens. However, if I see a need for exposure and bowel retraction, I use the assistant port in the left upper quadrant. It is easier for the assistant to then use a retracting device like a paddle or a fan retractor.

In cases of endometriosis resection, I use my bipolar graspers to pull the peritoneum with endometriosis away from vital structures like the ureters, bladder, bowel and the blood vessels. I then use the scissors and the Gyrus to superficially remove the pathology.

Another benefit with the Jain technique is that the two graspers are coming from two opposite sides, which make the retraction and dissection much easier, closely duplicating an open laparotomy.

Also use of the two graspers are very convenient for traction and pulling organs away from vital structures. I believe doing this makes the anatomy clearer and the areas of dissection much more distinct, specifically in robotic cases with the 3D vision.

Fig. 5: Positioning of the arms prior to docking

Fig. 8: Right side view of docked 1st and 3rd arm

Fig. 6: Positioning of the arms after docking

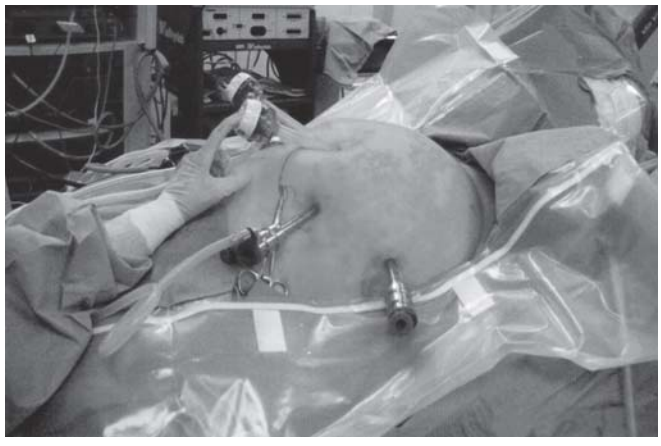

Fig. 9: Usual port placement in Jain technique

Fig. 7: View of the docked robot from the head of the patient

UTERINE MANIPULATION BY RUMI POSITIONING SYSTEM

Every surgeon has his or her preferences for using particular instruments. I have used a Rumi intrauterine manipulator in all my cases and feel that it is an integral part of my surgical technique (Fig. 10). I feel it delineates the anatomy better for me than any other uterine manipulator.

It offers full anteversion, retroversion and lateral positioning. Articulates at the cervix to provide extreme uterine mobility and traction in any direction. The Koh's rings make it much easier to do colpotomy anteriorly and posteriorly. L-shaped locking handle permits repositioning from the surgical field for complete access.

A starter pack which includes the handle and enough tips to perform 10 procedures is offered.

It is very beneficial when used for myomectomies, specially with the Rumi positioning system which is attached to the bed and maintains the position of the uterus. This reduces assistant exhaustion, which often prevents the assistant from pushing the uterus superiorly.

The Rumi retractor (Fig. 11) has an elbow which I believe delineates the fornices very clearly and makes the incision for colpotomy much easier to make compared to other manipulators. I do not suture the Rumi to the cervix.

In addition to using the Rumi I also believe it is important to make sure the assistant who manipulates the uterus is pushing the uterus very firmly. Pushing the uterus superiorly will reduce the chances of injury to ureters and the bladder.

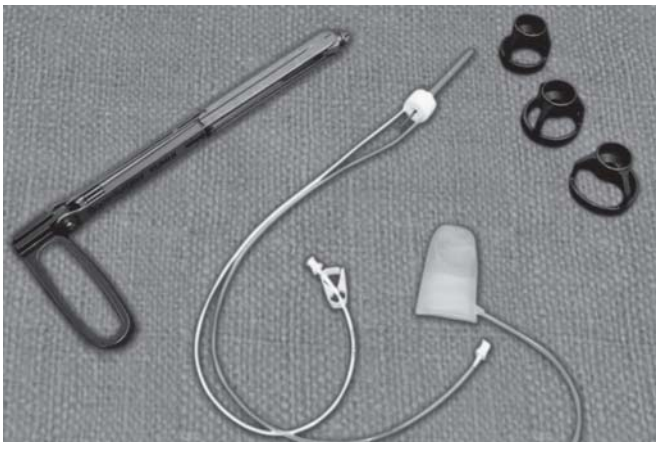

Fig. 10: Unassembled Rumi with three Koh's rings and a vaginal occluder

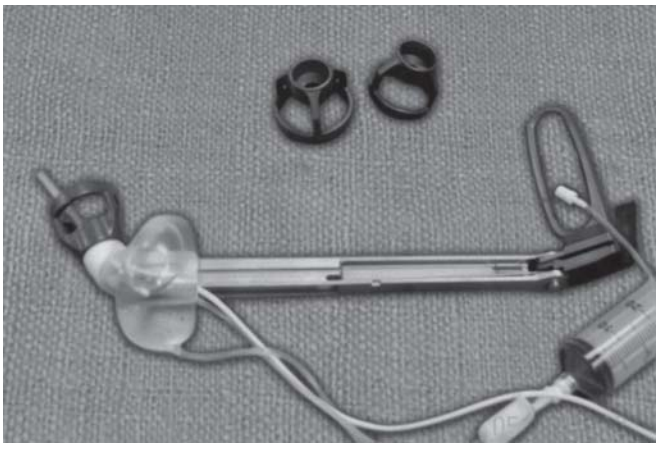

Fig. 11: Assembled Rumi retractor

CONCLUSION

In closing, I would like to mention that I have done approximately 430+ cases using the Jain technique. A significant percentage of the cases have been very complex surgeries with large uteri, 350 lb patients, large fibroids for myomectomy, very dense adhesions from multiple prior surgeries or chronic PID (pelvic inflammatory disease), yet despite this myriad of compounding conditions, all the cases were quick, smooth and without complications.

In each and every case I have used the same docking technique, port placement and instrument selection and have always been more than pleased with the ease of the procedure, my patient's progress and their recovery. In cases of large uteri and complex pathology, the only change I make is to move my ports superiorly.

Last, now that endometriosis resection over ablation is being recognized as the standard of care, learning robotics has become even more necessary. With the Jain technique, excising endometriosis from hard to reach areas, like pelvic side walls, ureters, uterine vessels, bowel, etc. would become easier.

As I mentioned earlier, 4-year-ago, my clear and simple intent was to learn robotic surgery, do a few cases, prove to myself that it had no benefits over laparoscopy and then walk away from it guilt-free. To my surprise, for the last 2 years I have not felt the need to do a laparoscopy. I am convinced that as a robotic surgeon I can do my cases faster and better than I could do with any other modality.

My laparotomy rate has dropped markedly to almost less that 2% since I have incorporated robotic in my practice. Out of the three cases I had to open in last 1 year, except for one case with multiple fibroids, which I was unable to complete robotically the other two were found to be bowel tumors, a GIST and a sarcoma of the small bowel, and a colorectal consul to be requested intraoperatively.

I am very honored to have been able to present my technique. I hope it reduces the learning curve and increases the incorporation of robotics in a physician's practices. I believe robotic surgery is a win-win for both the patient and the surgeon compared to traditional laparoscopy, which is definitely a win for the patient but may be a lose for the surgeon, especially in difficult surgeries.

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ORIGINAL RESEARCH

Combined TAPP and TEP: A New Modified Technique for Laparoscopic Inguinal Hernia Repair

Galal MM Abou El-Nagah

ABSTRACT

Background: No other laparoscopic procedure has been the source of controversy as much as the laparoscopic approach to inguinal hernias. The two common laparoscopic techniques include the transabdominal preperitoneal repair (TAPP) and the total extraperitoneal repair (TEP). We present our experience with a novel technique by combining the two ideas of TAPP and TEP to get benefit of both techniques. We compared the operative time and the need for mesh fixation of the new technique with that of the standard TAPP technique.

Methods: From May 2009 to July 2011, a total of 335 patients complaining of indirect inguinal hernia were included in this study. We have operated on 137 patients with new technique of combined TAPP and TEP (first group). The other 198 patients were operated with the standard TAPP technique (second group). All patients who had the new modified technique were operated by a single surgeon in a university-affiliated hospital.

Results: All procedures have been finished laparoscopically with no conversion. The average operative time was 39.8 minutes for the first group and 44.3 minutes for the second group. Mesh was fixed in 30 patients (21.9%) of the first group and 81 patients (40.9%) of the second group. Postoperative port site infection in the first group occurred in 3 patients (2.19%). No perioperative morbidity or mortality occurred.

Conclusion: Combined TAPP and TEP is safe and feasible. It simplifies the procedure; makes operative time significantly less with lower rate of recurrence as well as decreases the need for mesh fixation.

Keywords: TAPP, TEP, Laparoscopic hernia repair.

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INTRODUCTION

A variety of laparoscopic techniques for hernia repair were described. The two common laparoscopic techniques include the transabdominal preperitoneal repair (TAPP) and the total extraperitoneal repair (TEP) which mimics the open preperitoneal repair of Stoppa. Both the TAPP and TEP use the basic principle of placing a piece of mesh in the preperitoneal space as described by Stoppa.[1] The TAPP repair is performed from within the abdomen with an incision that is made in the peritoneum to access the preperitoneal space. It is the most common laparoscopic technique used because it allows the surgeon to have the entire abdominal cavity as visual referral points. In the TEP repair, dissection is initiated totally in the extraperitoneal space. However, there is a crucial difference between the two techniques because TEP does not include the use of pneumoperitoneum as opposed to TAPP approach. The TEP technique of laparoscopic inguinal hernia repair avoids entry into the abdominal cavity, and thereby eliminates the risks and complications inherent to the TAPP repair. Major blood vessel, bowel and bladder injury are extremely rare and mostly associated with TAPP technique. Recently, the TEP technique has become more popular laparoscopic approach to groin hernias.

In our practice, we developed a novel technique by combining the two ideas of TAPP and TEP so as to get benefit of both techniques. We noticed that creating a 'pneumoperitoneum-like' state in TEP technique facilitates the dissection of the peritoneum and fascia transversalis off anterior abdominal wall. We do this in TAPP by insufflation of CO_2 under vision in extraperitoneal space using Veress needle then withdraw the needle and continue the operation as usual classical TAPP.

METHODS

From May 2009 to July 2011, a total of 235 patients were scheduled for elective laparoscopic inguinal hernia repair and included in this study. All patients have signed an informed consent to be enrolled in this study and protocol of the research has been approved by Alexandria Faculty Medical Ethics Committee. All patients were operated under general anesthesia in a university-affiliated hospital. The patients were randomly divided into two groups: The first group included 137 patients who underwent the new technique of combined TAPP and TEP while the second group included 198 patients who underwent the standard TAPP technique. All the patients had routine preoperative evaluation. The patients were put in supine position which had been changed to Trendelenburg position after introduction of first umbilical trochar.

In the first group, who underwent combined TAPP and TEP, a Veress needle was inserted through a small supra-umbilical incision and a pneumoperitoneum at a pressure of 15 mm Hg was performed. Removal of Veress needle and then a 10 mm camera trochar was inserted instead and the groins were assessed. The preperitoneal space was then entered through a small 2 mm infraumbilical incision,

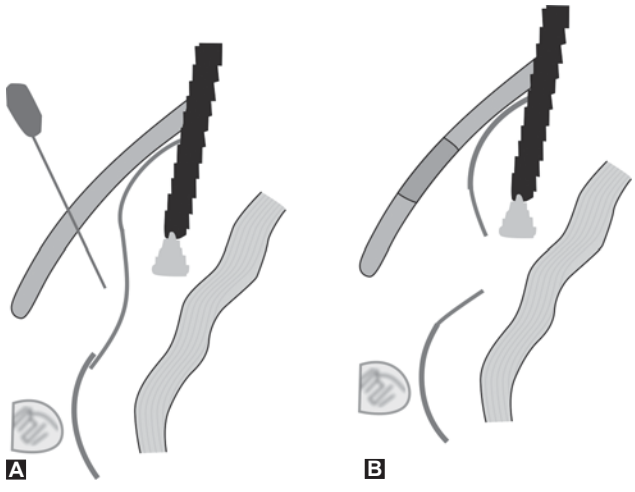
through which another Veress needle or 5 mm trochar was introduced to the preperitoneal space under transperitoneal scope direct vision. The preperitoneal space was insufflated by CO_2 to a pressure of 10 mm Hg so that the peritoneum and fascia transversalis were dissected off anterior abdominal wall under visual control by the intraperitoneal scope (Fig. 1A).

After that, the second Veress needle was withdrawn, insertion of two 5 mm midclavicular routine working trochar to intraperitoneal space and complete the operation as classical TAPP by transverse incision of the peritoneum, dissection of the preperitoneal space and put 15 × 10 cm mesh to cover all three groin hernia orifices (Fig. 1B). Our protocol was routinely not to fix the mesh regarding that the laying space is roomy enough for it to be spread satisfactorily. In some cases where the surgeon was not satisfied, the mesh was sutured to the pubic bone, Cooper's ligament and the muscle layers anteriorly but not into the ileopubic tract or posterior to this. None of our cases had bilateral hernia. Closure of transverse peritoneal incision was done in all cases using continuous 3-0 Vycril intracorporeal sutures. At the end of procedure, routine inspection of the abdomen, deflation of the pneumoperitoneum and closure of the skin incision by subcuticular absorbable fine sutures were done.

All our patients were followed up for 6 to 18 months with an average of 10 months by 3 months OPC visits. All intraoperative and postoperative complications, operative time, hernia recurrence, the need for mesh fixation and patients' satisfaction were recorded and statistically analyzed.

RESULTS

Two hundred and thirty-five male patients were included in this study. Of them, 184 patients (78.3%) suffered from right indirect inguinal hernia, 51 patients (21.7%) suffered from left indirect inguinal hernia. One hundred and sixty-one cases (68.5%) were bubonocele and 74 cases (31.5%) were funicular type of inguinoscrotal hernia, complete scrotal cases were not included. Patients' average age was 34 years (Table 1).



Figs 1A and B: (A) Inflation of preperitoneal space by Veress needle under vision of transperitoneal scope, (B) complete operation as classical TAPP

All procedures were completed laparoscopically. The operative time, defined as the time from skin incision to skin closure, ranged from 30.2 minutes up to 44.6 minutes with average operative time of 39.8 minutes in the first group while in the second group; it ranged from 40.6 minutes up to 49.2 minutes with average of 44.3 minutes. In the first group, we used Veress needle in preperitoneal inflation in 88 cases and 5 mm trochar in 49 cases, we found it easier by trochar but there was no significant difference in operative time recorded which was 39.4 in needle group versus 36.2 minutes in trochar one ($p = 0.79$). In the first group, mesh was fixed in 30 patients (21.9%) while in the second group, it was fixed in 81 patients (40.9%; Table 2).

There were no intraoperative or postoperative complications except for postoperative port site infection which occurred in three patients (2.19%). No perioperative deaths occurred. All patients were discharged within two days of surgery. Their activity was not restricted postoperatively in all patients. No recurrence was observed in regular follow-up visits for 6 to 18 months with average 10 months, and patient satisfaction was subjectively excellent, as determined by office interview.

DISCUSSION

Hernia repair is currently the most commonly performed general surgical operation; it occurs with a greater frequency in men than women (12:1 ratio) and accounts for nearly 800,000 cases per year in the United States.[2] The goals of successful hernia repair must include achievement of an effective repair with the lowest possible recurrence, minimal operative and postoperative discomfort with a rapid return to normal activity, and also cost-effective. Success of groin hernia repair depends largely on the surgeon's understanding of the functional anatomy and pathophysiology of the abdominal wall and groin, as well as knowledge of how to use the currently available techniques and materials most effectively.

Table 1: Patients' demographic data

Patients	
• Age (yrs)	27-51 (average, 34)
• Hernia	
– Right	184 (78.3%)
– Left	51 (21.7%)

Table 2: Relation between method of preperitoneal insufflations and operative time in the first group

Instrument used		*Mean operative time*	*p*
Veress needle	88 (65%)	39.4	0.79
Trochar 5 mm	49 (35%)	36.2	
Total	137 (100%)	30.2	

The repair of inguinal hernias no longer involves just the sewing together of a defect in the musculature. Several approaches, which hernia surgeons must be familiar with, have been used for repair of groin hernias and have included tissue repairs (later termed 'tension' repairs), as well as mesh or tension-free repairs and laparoscopy. Although each of these repairs boasts its successes, there are advantages and disadvantages to each approach.

Tension-free repairs are considered as a milestone in the evolution of the hernia repair surgeries. The use of mesh in hernia repairs, however, was not widely accepted for use until Lichtenstein[3] coined the term 'tension-free' repair. This repair uses nonabsorbable sutures and a prosthetic flat mesh screen to reinforce the canal floor. Since its introduction, this repair has been the most widely performed groin hernia repair and is used as the standard to which newer techniques are compared. In an attempt to improve on the Lichtenstein repair, Gilbert[4] used the internal ring as direct access to the preperitoneal space through an open anterior approach. This innovation of accessing the preperitoneal space from an anterior approach led to the development of the Prolene Hernia System mesh. Finally, advancements in laparoscopy led to the development of laparoscopic inguinal hernia repair. Currently, there are multiple tension-free techniques, which include the open anterior approach (on-lay Lichtenstein patch, plug and patch), open posterior approach (Stoppa-Rives, Kugel), and the closed posterior approach (laparoscopic) either TAPP or TEP.[5]

The laparoscopic approach for inguinal hernia repair was introduced in the 1990s and has since been modified and refined. The early descriptions of laparoscopic inguinal herniorrhaphy were by Ger,[6] Shultz et al,[7] Corbitt,[8] and Filipi et al.[9] Laparoscopic techniques are being used increasingly in the repair of ventral hernias and offer the potential benefits of a shorter hospital stay, decreased wound complications and possibly a lower recurrence rate. However, no other laparoscopic procedure has been the source of as much controversy as the laparoscopic approach to inguinal hernias. The basis for this debate is the already excellent results of conventional open hernia repair. The uptake into practice of this procedure by general surgeons has been less than expected. The main disadvantages are the long learning curve required, relatively high cost, long operative duration, controversial benefits and the need for general anesthesia due to the perceived risk of adverse effects of pneumoperitoneum, which is thought not to be well-tolerated by a patient who is awake during the procedure. While the traditional open mesh repair requires average surgical skills and the delivery of local or regional anesthetics in most of the cases.

It is now accepted widely that bilateral inguinal hernia repair and recurrences are indications for TAPP repair, with clear benefits for the patient in terms of less postoperative pain and shorter work absence.[10]

Laparoscopic techniques for the repair of inguinal hernias have become an increasingly popular alternative to open techniques.[11] There is good evidence that laparoscopic repair of a groin hernia is associated with excellent results when performed by expert surgeons. No clear consensus has emerged as to the best laparoscopic technique.[11]

When faced with an unforeseen anomaly during TEP in which improved abdominal visualization is necessary, a surgeon may convert from a TEP to a TAPP approach.[11] With better equipment and techniques for creation of pneumoperitoneum serious complications are now infrequent.[12]

In our novel techniques, the formation of 'pneumo-peritoneum–like' state facilitates the dissection of the peritoneum and fascia transversalis off anterior abdominal wall under vision so as to reduce complications from unpredictable anomalies and in the same time reducing the operative time. Intraoperative and postoperative complications are minimal as well as recurrence rate. Patients' satisfaction is good. The ability of repair recurrent hernia and bilateral hernias in less time is another advantage. The new technique requires more prospective studies to assess the postoperative complications, training curve of the surgeons and its statistical significance.

CONCLUSION

Our novel use of a laparoscopic combined TEP approach and TAPP approach to repair inguinal hernia is feasible, save and seems to be easier and time saving than original methods separately.

REFERENCES

1. Stoppa RE. The treatment of complicated groin and incisional hernias. World J Surg 1989;13:545-54.
2. Rutkow IM. Demographic and socioeconomic aspects of hernia repair in the United States in 2003. Surg Clin North Am 2003;83: 1045-51.
3. Lichtenstein IL, Shulman AG, Amid PK, Montllor MM. The tension-free hernioplasty. Am J Surg 1989;157:188-93.
4. Gilbert Al. An anatomic and functional classification for the diagnosis and treatment of inguinal hernia. Am J Surg 1989;157: 331-33.

5. Gilbert AI, Graham MF, Voigt WJ. A bilayer device for inguinal hernia repair. Hernia 1999;3:161-66.
6. Ger R. The laparoscopic management of groin hernias. Contemp Surg 1991;39:15-19.
7. Shultz L, Graber J, Pietrafitta J, et al. Laser laparoscopic herniorrhaphy: A clinical trial; preliminary results. J Laparoendosc Surg 1990;1:41-45.
8. Corbitt J. Laparoscopic herniorrhaphy. Surg Laparosc Endosc 1991;1:23-25.
9. Filipi C, Fitzgibbons RJ, Salerno GM, et al. Laparoscopic herniorrhaphy. Surg Clin North Am 1992;72:1109-24.
10. Eklund A, Rudberg C, Leijonmarck CE, et al. Recurrent inguinal hernia: Randomized multicenter trial comparing laparoscopic and lichtenstein repair. Surg Endosc 2007;21:634-40.
11. Freundlich RE, Hawes LT, Weldon SA, Brunicardi FC. Laparoscopic repair of an incarcerated right indirect sliding inguinal hernia involving a retroperitoneal ileum. Hernia 2011 Apr;15(2):225-27.
12. Singh-Ranger D, Taneja T, Sroden P, Peters J. A rare complication following laparoscopic TEP repair: Case report and discussion of the literature. Hernia 2007 Oct;11(5): 453-56.

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REVIEW ARTICLE

Laparoscopic Repair for Choledochal Cyst in Children: Current Status

Ruiz C Hierro

ABSTRACT

Objectives: To determine feasibility and outcome of laparoscopic repair of choledochal cyst in pediatric age.

Materials and methods: A literature search was performed on choledochal cyst and laparoscopic repair in children using PubMed database to extract data related to age, gender, technical details, operative time, conversion rate, intraoperative complications, hospital stay, early and mid-term complications and outcome.

Results: There were 710 patients with a median follow-up of 29.1 months; the median age was 4.3 years and 73.4% were women. The choledochal cysts were classified as type I of Todani´s classification in 74% of cases and in all of them a laparoscopic excision and hepaticoenterostomy was carried out. The mean operative time was 265 minutes and the conversion rate to open surgery was 2.4%. The mean postoperative hospital stay was 6.5 days and the early and late complications were 6.9 and 4% respectively.

Conclusion: The laparoscopic repair of choledochal cyst is safe and feasible in children with early- and mid-term complication rates similar to open surgery.

Keywords: Choledochal cyst, Laparoscopic repair of choledochal cyst.

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INTRODUCTION

Choledochal cyst is a congenital cystic dilatation of the biliary tree that typically affects the pediatric population with a higher prevalence in Asia and girls. If left untreated, they can cause recurrent cholangitis, pancreatitis, sepsis, liver abscesses and cholangiocarcinoma. Therefore, recognition and proper management of choledochal cyst disease are important.[1,2] Complete cyst excision and hepaticoenterostomy have become a standard procedure in open surgery for choledochal cyst, but in the last decade, there has been tremendous development in laparoscopic surgery in children, with a great majority of operations accomplished using the minimally invasive technique. Although most reported series described a small number of patients and an intermediate-term follow-up, the laparoscopic approach seems to be safe and feasible for choledochal cyst repair.[3,4]

MATERIALS AND METHODS

A literature search was performed on choledochal cyst and laparoscopic repair in children using PubMed database to extract data related to age, gender, technical details, operative time, conversion rate, intraoperative complications, hospital stay, early- and mid-term complications and outcome.

RESULTS

We have selected 17 articles and use data only of pediatric age patients. There were 710 patients with a median age of 4.3 years and 73.4% of girls. According to Todani´s classification, 74% of the cases were type I cyst and in all of them a laparoscopic excision plus hepaticoenterostomy was carried out. Both, hepaticojejunostomy (HJ) and hepaticoduodenostomy (HD) were constructed (54.2 and 45.8%). The mean operative time was 265 minutes and the mean conversion rate to open surgery was 7.6%. The mean postoperative hospital stay was 6.5 days and the early and late complications were 11.3 and 6.1% respectively with a median follow-up of 29.1 months.

DISCUSSION

Choledochal cyst is a congenital anomaly usually found in pediatric population. It is estimated to occur in 1 of 5,000 live births, with a higher frequency in Asians. The classic triad of symptoms is jaundice, abdominal pain and vomiting but it is not always present.[1]

Todani et al[5] classified choledochal cysts based on the location of the cyst. Type I or cystic dilatation of the common duct constitutes over 85% of the cases in all reported series. Type II choledochal cyst is very rare and commonly described as a diverticular malformation of the common duct. Type III choledochal cyst or choledochocele usually is intraduodenal and is slightly more common than type II. Type IV choledochal cysts occur in approximately 10% of cases and are multicystic structures with both intra- and extrahepatic components. Finally, type V forms are single or multiple intrahepatic cysts. When these intrahepatic cysts are associated with hepatic fibrosis, they are referred to as Caroli's disease.[6]

The standard investigations include abdominal ultrasound and magnetic resonant cholangiogram, and they

try to clarify the type of bile duct dilatation and to rule out pancreatobiliary malunion.[7] As the antenatal ultrasonography is getting more popular and easily available, more diagnoses are made antenatally. This enables a better communication with parents and an earlier surgery with less disease-related complications and an easier dissection during the surgical procedure as a result of decreased periductal inflammation.[1]

The treatments of these cysts consist on medical management of complications, surgery and long-term follow-up. Choledochal cysts were initially treated by providing external or internal drainage. Although these procedures were easy to perform, they did not decrease the incidence of malignancy because there was continuous reflux of pancreatic juice into the bile duct. If left *in situ*, the risk of cancer in the retained cyst is as high as 50%.[2] At present, total excision of choledochal cysts (types I, II and IV) with hepaticoenterostomy has been widely accepted as the procedure of choice.[8] The principle of laparoscopic surgery for choledochal cyst is similar to that of open surgery, although it is much more technically demanding especially in small children in whom the peritoneal space is very limited.[4]

Proper case selection is mandatory to avoid complications, especially in the first cases at the beginning of the learning curve of the laparoscopic repair. Difficulty may arise in older patients where the size of the cyst may be very large and pericyst inflammation very important due to prior episodes of cholangitis or pancreatitis. Also, we should be cautious in childrens with liver cirrhosis and portal hypertension.[9]

TECHNICAL CONSIDERATIONS

Patient position: The patient is placed in a 30º head-up supine position and the surgeon stands at the lower end of the operating table in small children and at the left side of the table in older ones.

Port position: One 10 mm trocar is inserted through the umbilicus for the telescope and three 5 mm trocars (3 mm trocar for small infants) for instruments: Right flank, left flank and left hypochondrium. And extra port is sometimes used for hepatic retraction.[3,4,8,10]

Cyst dissection: To obtain a good exposure, the liver is either secured to the abdominal wall by a stay-suture placed at the round ligament or separated with a liver retractor. The gallbladder is retracted cranially and the transverse colon and duodenum caudally.[3,4]

The first step in patients without a good preoperative imaging study is to perfom an intraoperative cholangiogram (IOC) through the gallbladder. It is essential to delineate the exact pancreatobiliary anatomy to guide the level of the cyst excision in order to minimize the chance of damaging the pancreatic duct.[4,9]

The cystic artery and duct are identified, clipped and divided; but the gallbladder is left in place to facilitate displacement of the liver upward during dissection and suturing. The mid-portion of the cyst is dissected circumferentially, divided and irrigated to wash out biliary debris. Then, it is opened longitudinally both on the anterior and posterior walls to inspect the orifice of the common biliopancreatic duct distally and the common hepatic duct (CHD) proximally. The cyst is then divided and totally excised. The monopolar electrocautery device was used to ensure the hemostasis of the epicholedochal venous plexus. At the end, a cholecystectomy is carried out.[3,4,9,10]

When extensive pericystic adhesions are present due to recurrent cholangitis, to avoid injury to the portal vein there are two methods:

1. The front wall of the cyst is first opened so separation of the back wall of the cyst from the portal vein is carried out while viewing the cyst internally and externally.
2. The anterolateral part of the cyst is resected first followed by resection or fulguration of the mucosal lining, leaving a narrow rim of the posterior cyst wall on the portal vein and hepatic artery. Injection of saline between the mucosa and the posterior cyst wall helps in the excision by raising a plane of dissection.[3,4]

   Hepaticoenterostomy is then constructed either with duodenum or jejunum. In the HD, the duodenum is mobilized and an anastomosis is constructed 2.0 cm away from the pylorous. In the HJ, a 5/0 silk stay-suture is placed 20 to 40 cm distal to the ligament of Treitz and a second one is placed below the first suture to mark the jejunal limb, which will be anastomosed to the hepatic duct.
3. It is still debated if HD or HJ is the best type of biliodigestive reconstruction after cyst excision. HD is preferred by some surgeons because it is a more simple procedure that can be completely carried out laparoscopically, with less chance of postoperative adhesions, better cosmetic results and shorter operative time. On the other hand, cholangitis and gastritis owing to bilious reflux are major concerns after HD and they are absent in the HJ group.[2,3]

When an HJ is selected as the anastomosis of choice, the Roux-en-Y loop can also be made extracorporeally or totally intracorporeally. In the first one, the jejunal segment with two sutures is exteriorized through the enlarged umbilical wound and the jejunojejunostomy is carried out extracorporeally and then reintroduced to the abdominal cavity. The Roux limb is brought retrocolic to the porta

hepatis and an HJ is performed.[3,4,9,11-13] For the totally intracorporeal approach, the Roux-en-Y loop is carried out by a side-to-side jejunojejunostomy with endostaplers. To reduce the duration of performing this procedure, before making the enterostomy for applying an endoscopic stapler, the two limbs can be approximated side by side, to place two stay sutures on the antimesenteric border of the limbs. Upward traction facilitates Endo-GIA firing and intracorporeal suturing for closure of the enterotomy. The authors that support the extracorporeal jejunojejunostomy argue that this enables meticulous bowel anastomosis just like the open surgery and also avoids intra-abdominal contamination. Even the surgeons familiar with laparoscopic surgery for choledochal cyst prefer the intracorporeal approach due to less technical difficulties, less operative time and less cost (no endostaplers). Nevertheless, in the early part of their learning curve, surgeons can adopt the extracorporeally method before embarking on a totally laparoscopic approach.[7,8,10,14]

Regarding the type of suturing at the time of the hepaticoenterostomy, it can be done by running[4,12] or interrupted sutures.[7,9-11] The latest are used when the diameter of the CHD is less than 1 or 1.5 cm while others do so in all cases to avoid late anastomosis strictures. Endostich device may help to simplify this complex intracorporeal procedure.[15]

The mean operative time in this review is 265 minutes. The relatively longer operative time in the minimally invasive approach *vs* open surgery is due to different factors: Type of cyst, previous recurrent and/or severe inflammation, previous endoscopic retrograde cholangiopancreatogram (ERCP), extraprecautions taken during surgery and time required for instruction of the trainees.[4] As surgeons gain experience with the laparoscopic procedure, the times are decreasing significantly.[13]

The conversion rate to open surgery is variable among different series, in this review, the mean rate is 7.6% (0-50%). The different causes are: Continuation of the cyst either to the liver or to the pancreas, big sized cyst, difficult dissection due to adhesions, oozing, CHD tearing or high section, suspicion of malignancy or prolonged surgery.[1,3,4,8,11,12]

The laparoscopic repair of choledochal cyst can be performed safely with a low intraoperative complication rate. The major complications described are right hepatic duct injury and right hepatic artery injury. Dissection as close as possible to the cyst wall is mandatory to prevent both complication and they could be avoided with increased experience.[3,4,12,16]

The overall short-term complication rate is 11.3%: Bleeding at the HJ junction, anastomotic leakage, intra-abdominal collection, wound infection, prolonged ileus, small bowel obstruction and respiratory tract infection. Anastomotic leakage is the most frequent early complications and in the majority of cases they are treated conservatively with good outcome.[1,3,4,7,9,12-14,16]

The mid-term complications rate is 6.1% with a median follow-up of 29.1 months: Recurrent anastomotic strictures, residual cyst, cholangitis, bilious reflux (only in cases of HD), pancreatitis, small bowel obstruction and ventral hernia.[1,3,4,11-14] Intrahepatic stones and biliary carcinoma are potential complications that were not seen in the series reviewed. Anastomotic stricture is a main concern an there are some methods to avoid it: Ductoplasty in cases of ductal strictures at the moment of surgery, to leave a small cuff of the cyst to facilitate the anastomosis and to make a wide HJ.[3,7,8,12]

Liem et al[16] have compared laparoscopic *vs* open choledochal cyst repair, in the laparoscopic procedure the operative time was significantly longer; the need of blood transfusion was lower (3.2 *vs* 11.1%, p = 0.001); the postoperative evolution was more favorable with less complications (3.9 *vs* 5.5%) and the reintervention rate was also lower (0.3 *vs* 3.6%). The intraoperative complications were similar in both groups (0.6 *vs* 0.3%). The mean postoperative stay was significantly lower is laparoscopic group (7 *vs* 9 days, p = 0.001). Liuming et al,[13] comparing laparoscopic *vs* open surgery, found the same results except for a slightly more early complications (15 *vs* 10%) due to respiratory tract infections although the overall complication rates were similar. In their opinion, this complication is more frequent in the laparoscopic group due to the more operative time and therefore more anesthetic time.

The overall advantages of the laparoscopic approach over the classic open surgery in choledochal cyst is superior visualization of the structures around the cyst and hepatic hilum and in turn meticulous mobilization of the cyst, less blood loss, improved immediate postoperative recovery, less hospital stay and excellent cosmetics.[2,4,7,8,10,13,17]

CONCLUSION

Laparoscopic surgery is feasible for choledochal cyst in experienced hands but is technically demanding with a considerably long-learning curve. The procedure can be performed according to the currently accepted standards of the conventional approach with minimum conversion and acceptable morbidity. The principal advantage is that it allows a very clear visualization and meticulous mobilization of the cyst. Further studies with long-term follow-up are necessary to identify those cases that are at risk of having complications and to determine, if it could became an accepted alternative to conventional laparotomy for choledochal cyst in pediatric population.

REFERENCES

1. She WH, Chung HY, Lan LC, Wong KK, Saing H, Tam PK. Management of choledochal cyst: 30 years of experience and results in a single center. J Pediatr Surg 2009;44(12):2307-11.
2. Singham J, Yoshida EM, Scudamore CH. Choledochal cysts. Part 3 of 3: Management. Can J Surg 2010;53(1):51.
3. Nguyen Thanh L, Hien PD, Dung le A, Son TN. Laparoscopic repair for choledochal cyst: Lessons learned from 190 cases. J Pediatr Surg 2010;45(3):540-44.
4. Lee KH, Tam YH, Yeung CK, Chan KW, Sihoe JDY, Cheung ST, Mou JWC. Laparoscopic excision of choledochal cysts in children: An intermediate-term report. Pediatr Surg Int 2009;25:355-60.
5. Todani T, Watanabe Y, Narusue M, et al. Congenital bile duct cysts. Classification, operative procedures and review of thirty-seven cases including cancer arising from choledochal cyst. Am J Surg 1977;134:263-69.
6. Liu DC, Rodriguez JA, Meric F, Geiger JL. Laparoscopic excision of a rare type II choledochal cyst: Case report and review of the literature. J Pediatr Surg 2000;35(7):1117-19.
7. Urushihara N, Fukuzawa H, Fukumoto K, Sugiyama A, Nagae H, Watanabe K, et al. Totally laparoscopic management of choledochal cyst: Roux-en-Y jejunojejunostomy and wide hepaticojejunostomy with hilar ductoplasty. J Laparoendosc Adv Surg Tech A 2011;21(4):361-66.
8. Palanivelu C, Rangarajan M, Parthasarathi R, Amar V, Senthilnathan P. Laparoscopic management of choledochal cysts: Technique and outcomes—a retrospective study of 35 patients from a tertiary center. J Am Coll Surg 2008;207(6): 839-46.
9. Srimurthy KR, Ramesh S. Laparoscopic management of pediatric choledochal cyst in developing countries: Review of ten cases. Pediatr Surg Int 2006;22:144-49.
10. Ahn SM, Jun JY, Lee WJ, Oh JT, Han SJ, Choi SH, Hwang EH. Laparoscopic total intracorporeal correction of choledochal cyst in pediatric population. J Laparoendosc Adv Surg Tech A 2009; 19(5):683-86.
11. Le DM, Woo RK, Sylvester K, Krummel TM, Albanese CT. Laparoscopic resection of type 1 choledochal cysts in pediatric patients. Surg Endosc 2006;20:249-51.
12. Hong L, Wu Y, Yan Z, Xu M, Chu J, Chen QM. Laparoscopic surgery for choledochal cyst in children: A case review of 31 patients. Eur J Pediatr Surg 2008;18(2):67-71.
13. Liuming H, Hongwu Z, Gang L, Jun J, Wenying H, Wong KK, Miao X, Qizhi Y, Jun Z, Shuli L, Li L. The effect of laparoscopic excision vs open excision in children with choledochal cyst: A midterm follow-up study. J Pediatr Surg 2011;46:662-65.
14. Tang ST, Yang Y, Wang Y, Mao YZ, Li SW, Tong QS, Cao GQ, Zhao ZX. Laparoscopic choledochal cyst excision, hepatico-jejunostomy, and extracorporeal Roux-en-Y anastomosis: A technical skill and intermediate-term report in 62 cases. Surg Endosc 2011;25:416-22.
15. Shimura H, Tanaka M, Shimizu S, Mizumoto K. Laparoscopic treatment of congenital choledochal cyst. Surg Endosc 1998; 12:1268-71.
16. Liem NT, Pham HD, Vu HM. Is the laparoscopic operation as safe as open operation for choledochal cyst in children? J Laparoendosc Adv Surg Tech A 2011;21:367-70.
17. Farello GA, Cerofolini A, Rebonato M, et al. Congenital choledochal cyst: Video-guided laparoscopic treatment. Surg Laparosc Endosc 1995;5:354-58.

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REVIEW ARTICLE

Role of Robotic Surgery in the Treatment of Mirizzi Syndrome

George Chilaka Obonna, RK Mishra

ABSTRACT

Mirizzi syndrome (MS) is a rare complication of cholelithiasis. It presents as a spectrum of disease that varies from extrinsic compression of the common hepatic duct to the presence of a cholecystobiliary fistula. This dangerous alteration to anatomy if not recognized preoperatively has the potential to lead to significant morbidity and billiary injury particularly in the laparoscopic era.

Aim: To study the role of robotic surgery in the treatment of MS having in mind the various types of the syndrome.

Methods: Literature review from HighWire press, PubMed, Medline, goggle, SpringerLink, Wikipedia relevant documents, templates, forms, E-books and Cochrane database was conducted. Analysis of other publications and journals from robotic surgical institute was done, including live robotic surgery and robotic clinical videos.

Results: When a preoperative diagnosis is made through endoscopic stent insertion via endoscopic retrograde cholangiopancreatography (ERCP) with computed tomographic (CT) scan or intraoperative exploration and assessment with ultrasonography establishes Mirizzi types 1 or 2, the current robotic surgical system offers an effective treatment of the syndrome. With the ultra high magnification of the surgical field and the endowristed 7 degrees of refined movement together with an enhanced clinical capability and integration of electrosurgical device, detailed and careful cholecystectomy and even primary closure of common hepatic duct fistula can be perfected.

Conclusion: Combined endoscopic and robotic surgery is effective and safe in the treatment of MS types 1 and 2. Definitely robotics has a role to play in the treatment of MS. During cholecystectomy, partial resection is possible in order to extract the stones,visualize the bile duct and define the type and location of the fistula. T-tube could be placed distal to the fistula in the absence of a preoperative stent. However, complete removal of the gallbladder is now advocated because of the increased risk of malignancy in stone disease.

Keywords: Mirizzi syndrome, Robotic cholecystectomy, da Vinci, Endoscopic retrograde cholangiopancreatography.

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INTRODUCTION

It was in 1948, Argentinean surgeon Pablo Luis Mirizzi, Professor of surgery in Cordoba first described a syndrome of common hepatic duct obstruction in the setting of longstanding cholelithiasis and cholecystitis,[1] erroneously postulating that the extrinsic pressure and inflammation induced spasm of the common bile duct. The classic description of the disease includes four components: (1) A close parallel course of the cystic duct and the common hepatic duct, (2) an impacted stone in the cystic duct or the neck of the gallbladder (GB), (3) common hepatic duct obstruction secondary to external compression by cystic duct stone (and the surrounding inflammation), (4) jaundice with or without cholangitis.

Mirizzi syndrome (MS) is a rare complication of cholelithiasis with an estimated incidence of 0.05 to 2.7% and approximately 0.35% of cholecystectomies.[2-4] The main classifications of MS are by Csendes, Nagakawa and Sherry.

In the Csendes[5] classification:

Type 1: Those with external compression of the common hepatic duct by stone impacted in the cystic duct.

Type 2: Cholecystocholedochal fistula is present with erosion of less than one-third of the circumference of the common hepatic duct.

Type 3: Fistula involves up to two-thirds of the duct circumference.

Type 4: there is complete destruction of the common hepatic duct.

Types 3 and 4 by Nagokawa defined type 3 as hepatic duct stenosis due to a stone at the confluence of the hepatic cystic ducts and type 4 as hepatic duct stenosis as a complication of cholecystitis in the absence of calculi impacted in the cystic duct or GB neck.[6]

McSherry only talked about extrinsic compression of the common hepatic duct (type 1) and presence of cholecystobiliary fistula (type 2).[7]

Precise diagnosis may be difficult initially because the condition may be confused with choledocholithiasis and cholangitis. The classical ultrasound findings are of a contracted GB, dilated intrahepatic ducts and a normal common bile duct.

Although a rare condition, a combination of endoscopic retrograde cholangiopancreatography (ERCP) and robotic surgery will ensure proper treatment of the patient. The role of the current da Vinci surgical system is hereby highlighted from its operational intuition.

METHODOLOGY

This author was present in a live da Vinci Si robotic cholecystectomy performed by Professor RK Mishra at the

Third world association of laparoscopic surgeons conference in World Laparoscopy Hospital, DLF Cyber City, Gurgaon, Haryana, India (Figs 1 and 2). We also have previously studied the mechanism and operational ergonomics of the da Vinci surgical robot. References were also made from available clinical videos.

RESULTS

ERCP and or magnetic resonance cholangiopancreatography (MRCP) are usually used to define billiary images anatomically. Results of axial T2-weighted magnetic resonance imaging (MRI) in a patient having MS and fistula formation usually show pneumobilia and a suspicion of fistula. However, the result of the corona T1-weighted image with intravenous gadolinium in same patient usually confirms the presence of such fistulous tract. On the size of the defect with respect to the common hepatic duct diameter, results show that in the group of MS where a fistula is present; in type 2 the defect is smaller than 33% of the common hepatic duct diameter, type 3—the defect is 33 to 66% of the diameter of the common hepatic duct and type 4 the defect is 66% of the common hepatic duct diameter.

Results also show that nondiagnosis or diagnostic delay is usually common, especially in cases where there are no clinical suspicion and where there are no advanced imaging facilities. It is generally accepted that there is an increased risk of GB carcinoma in patients with stone disease. From the foregoing, particular attention must be focused on the histology of the cholecystectomy specimen retrieved during robotic cholecystectomy. Apart from open cholecystectomy and laparoscopic-assisted cholecystectomy, purely laparoscopic cholecystectomy had been done with limited value in complicated cases of stone disease. Robot-assisted cholecystectomy has now given way to robotic cholecystectomy. In most complicated GB diseases where multiple peritoneal adhersions and distorted anatomy are the rule, robotic retrograde cholecystectomy is an option. Preoperative ERCP and stenting of the bile duct is usually advised. The steps in the surgical procedure in a case of certain diagnosis includes; docking, inserting robotic bipolar forceps and hook, dissection of peritoneal adhersions, aiming at the right subcostal space, visualization of the fundus of the GB and GB exposure with careful dissection of the tissues around the GB, dissection and ligation of the cystic artery, retrograde cholecystectomy leading the way to the cystic duct, ligature of the cystic duct with stone retrieval and closure of fistula.

Port Positions of Robotic Cholecystectomy

Four ports are used like in conventional laparoscopic cholecystectomy with the telescope centered in the umbilical port (12 mm), one port in the epigastrum (8 mm), two other 8 mm ports, one midclavicula line below right costal margin and the second a little inferiolateral to it. For the robotic cholecystectomy because of the size of the robot the working angle is up to 90º and the distance to the target is up to 10 cm (Fig. 3) .

DISCUSSION

Treatment of MS depends on the type. In type 1 cholecystectomy with choledochostomy to remove the impacted stone is effective. While in type 2 closure of the fistula with absorbable material or choledochoplasty with the remnant of the GB can be performed. In type 3, choledochoplasty is recommended while type 4 will need a bilioenteric anastomosis. Robotic surgery is of value in the treatment of stage 1 and 2 in combination with preoperative ERCP and intraoperative robotic ultrasound useful in locating the impacted stone and to partially replicate the touch of the surgeons hand which will soon be embedded as sensors in the newer generation of robots.

Fig.1: Surgeon in robotic console

Fig. 2: Docking of robotic system

First, let us look at the capability of the current robot da Vinci. It has a dual console capability which enables two surgeons to work simultaneously in the surgical field. 3D HD vision with up to 10× magnification offering high level of visual acuity and good perception of depth of the hepatobilliary complex and carlot's triangle with no obscurity by the liver. The digital zoom and high definition of the operation field can detect pinpoint fistula better than the human eye. This offers an immense view of the Calot's triangle superior to laparoscopic and open surgery. It thus provides unsurpassed visual clarity for precise visualization of target anatomy or anomaly. Its endowrist instrumentation-a multiuse facility with natural dexterity available in 8 and 5 mm diameter ensures refined movement. The intuitive motion it provides is best for operation at the Calot's triangle where avoidance of billiary injury is paramount. It maintains a corresponding eye hand instrument tip alignment allowing for intuitive instrument control. Surgeons hand movements are scaled, filtered and seamlessly translated to the robotic arms and instrument (Fig. 4). In this type of complex surgery, with robotics there is perfect alignment between visual and motor axis thus preventing injury to the billiary system.

The ergonomic settings are well-customized with a surgeons touch pad offering comprehensive control of video, audio and system settings, unique user profile providing automatic recall for future cases (Fig. 5). A wide touch screen with telestration capability facilitates team communication with improved visualization of anatomy and instruments entering from the periphery. The integration with electrosurgical devices enables a bloodless surgery. The cross-quadrant access means that there are extended reach instruments offering improved arm range of movements. The implication is that in the same sitting the surgeon can conveniently cover all quadrants of the abdomen unlike in conventional laparoscopic setting. Thus, the current Si model updated da Vinci with all its enhancement like fluorescence imaging, lightweight intelligent camera head, boom compatible vision system, skills stimulator, multifunction energy control, remains unbeatable in task performance especially for complex surgery of MS type 1 and 2.

Operative cholangiography is advocated to improve the safety of cholecystectomy, but an accurate transcystic cholangiogram will not be possible in MS. A standard technique in open surgery for the difficult laparoscopic cholecystectomy was the fundus first approach. This can be replicated in laparoscopic surgery by the use of a liver retractor and means that exposure does not rely on traction on the fundus of the GB.[8] In MS, the GB is often fibrosed and contracted so that fundic traction gives relatively poor exposure of the hepatobiliary triangle. Also once the GB is freed from the liver, the obliterated Calot's triangle can be more easily evaluated. The highly magnified view combined with its modern technology makes robotic surgery superior in most cases.

Fig. 4: da Vinci surgical robot

Fig. 3: Portposition in robotic cholecystectomy

Fig. 5: Robotic console

Conversion or an open operation allows the use of proprioception or the touch of the surgeon's hand and is generally accepted as a way to improve the safety of any operation, especially one in which severe inflammation is present. To replicate this, hand-assisted laparoscopic surgery for MS has been advocated.[9] However, MS open surgery is associated with significant short- and long-term morbidity, and a difficult operation is not necessarily easier or safer when performed open.[10,11] With the recent advanced preoperative imaging, ERCP, current intraoperative robotic fluorescence imaging-compatible and sensors; robotics are now very relevant and useful in stone disease.

ERCP is used to make the diagnosis and insert a stent to alleviate the jaundice and allow planning of an elective operation. Stenting usually overcomes the resistance of the choledochal sphincter and this simplify and improves the safety of the operation. If ERCP is to be used as definitive treatment, sophisticated techniques may be needed for these cases, including the use of a 'mother and baby scope' and electrohydraulic or laser lithotripsy.[12] Any of these sophisticated ERCP techniques would require an endoscopic sphincterotomy. Since, the GB is to be removed anyway, it is preferable to leave the choledochal sphincter intact to avoid long-term risk of choledocholithiasis from a colonized biliary tract and papillary stenosis.[13] When it is not possible to stent the obstruction from below, a percutaneous transhepatic approach could be used. This would be relatively straightforward as the hepatic ducts may be dilated and would be a good strategy in patients unfit for surgery.[14]

There is an estimated five-fold risk of GB malignancy in MS compared with that in uncomplicated gallstone disease.[15] Prasad et al[15] found 5.3% of patients with MS had GB cancer compared with 1% in non-MS cases, and most were diagnosed on histology after cholecystectomy. If the patient is fit for surgery, the optimal management of MS must be complete removal of the GB with a wedge resection of the liver.[16] This is most possible in robotic surgery with ultrasound dissector because it possesses enhanced 3D HD vision with scaled filtered and refined pinpoint dissection strategy.

CONCLUSION

The da Vinci surgical robot has simplified what could have been a complex surgery because of its model technology. In combination with endoscopic stenting, robotics are useful in the operation of patients with MS types 1 and 2. Stenting overcomes the resistance of the choledochal sphincter and even if accurate closure of the opening in a friable and inflamed duct is not possible it should avoid the development of a significant biliary fistula. When there is danger of injury to biliary structures the more than human eye magnification of the operation field and the highly skilled, refined and controlled movement of the surgical robot is actually what is required to make the difference. The drawback of robotic cholecystectomy is the extra time taken to prepare the patient and docking, however, surgery once started does not take much time.

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REFERENCES

1. Mirrizi PL. Syndrome del conducto. J Int de Chir 1948;8: 731-33.
2. Waisberg J, Corona A, Luppinacci RA. Benign obstruction of the common hepatic duct: Diagnosis and operative management. Arq Gastroenterol 2005;42:13-18.
3. Yeh, et al. Laparoscopic treatment for Mirrizi syndrome. Surg Endosc 2003;17:1573-78.
4. Chan CY, Liau KH, Ho CK. Mirrizi syndrom: A diagnostic and operative challenge. Surgeon 2003;1:273-78.
5. Csendes A, Diaz JC, Burdiles P, Maluenda F, Nava O. Mirrizi syndrom and cholecystobilliary fistula: A unifying classification. Br J Surg 2005;76(11):1139-43.
6. Nagokowa T, Ohta. A new classification of Mirrizi syndrome from a diagnostic and therapeutic viewpoint. Hepatogastro-enterology 1997;44:63-67.

7. Mcsherry CK, Ferstenberg H, Virshup M. The Mirrizi syndrome. Suggested classification and therapy. Surg Gastroent 1982;1: 219-25.
8. Martin IG, Dexter SPL, Marton J, Asker J, Firulio A, McMahon J. Fundus first laparoscopic cholecystectomy. Surg Endosc 1995;203-06.
9. Wei Q, Shen LG, Zheng HM. Hand-assisted laparoscopic surgery for complex gallstone disease. World J Gastroenterol 2005;11:3311-14.
10. Hugh TB. New strategies to prevent laparoscopic bile duct injury-surgeons can learn from pilots. Surgery 2002;132:826-35.
11. Martin IG, Dexter SPL, Marton J, Gibson J, Asker J, Firulo A, McMahon MJ. Fundus–first laparoscopic cholecystectomy. Surg Endosc 1995;9:202-06.
12. Seitz U, Bapaye A, Bohnacker S, Navarrete C, Maydeo A, Soehendra N. Advances in therapeutic endoscopic treatment of common bile duct stones. World J Surg 1998;22:1133-44.
13. Jacobs R, Hartman D, Kudis V, et al. Risk factors for symptomatic stone recurrence after transpapillary laser lithotripsy for difficult bile stone using a laser with a stone recognition system. Eur J Gastroenterol Hepatol 2006;18:469-73.
14. Kelly MD. Acute Mirrizi syndrome. J Soc Laparoend Surg 2009;13(1):104-09.
15. Prasad TL, Kuma A, Sikora SS, Sexena R, Kapoor VK. Mirrizi syndrome and gallbladder cancer. J Hepatobiliary Pancreat Surg 2006;13:323-26.
16. Obonna GC, Njoku T, Okoro E, Osime U. Gallbladder carcinoma unassociated with cholelithiasis. Niger J Surg Sci 2007;7(2):113-15.

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REVIEW ARTICLE

Strategic Rest Break in Laparoscopic Surgery: A Need

Bijan Kumar Mukhopadhyay

ABSTRACT

Laparoscopic surgery is a less painful surgery to patients but is more for the doctor. Surgeons feels fatigue and discomfort due to its technical complexity and ergonomics. Prolong duration of surgery and pneumoperitoneum creates the patient exhausted and causes some remarkable hemodynamic changes. During operation the strategic rest break after 90 minutes, for 5 minutes, increase the better outcome not only to patients but also to the doctor.

Keywords: Strategic rest break, Laparoscopic surgery.

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INTRODUCTION

In the era of modern technology, laparoscopy is a gift from bioengineering to the surgeons. Kelling made a landmark in the history of surgery in 1901, by introducing visualizing scope to see the peritoneum of a dog[1] in 1987, Mouret, first successfully performed laparoscopic cholecystectomy.[2]

Patients comfort and safety is the first priority in this century. Laparoscopic surgery is technology advancement surgery and a better choice of mode of surgery nowadays. So, it is essential that we should obtain a clear understanding about the ergonomics as well as its potential problems, instrumental engineering, hemodynamic changes in patient and better postoperative outcome. Complexcity of laparoscopy has some ill effect to the surgon and patients.

ERGONOMICS

Ergonomic is a Greek word ergon means work and nomos means natural laws or the arrangements. Ergonomics is the scientific study of people at work in terms of equipment design, workplace layout, working environment, safety, productivity and training. It is combined systemic approach of anatomy, physiology, psychology and engineering. Studies have shown that correct ergonomics reduce the suturing time.[3] Pressure-related chronic pain in surgeons has been shown relieved by the use of ergonomically design instruments[4] so, it is important to understand the ergonomics for the surgeons for them and the best recovery of patients.

ERGONOMIC CHALLANGES DURING SURGERY

Laparoscopic surgery is the surgery of image. Its a two-dimentional surgery with no depth perception. There are only 4º of freedom. Static posture of surgeon also make surgeon inefficient. View of the operative field is also not under control of surgeon. Prolong duration of surgery makes the surgeon fatigue, decrease visual efficiency and irritable.

HEMODYNAMIC CHANGES OF PATIENTS DURING SURGERY

Investigators have demonstrated significant alterations of cardiac performance after peritoneal insufflations with CO_2 during laparoscopic procedures.[5,6] Induction of anesthesia decreased significantly mean arterial pressure and cardiac index (CI). Tilting the patient to the head-up position reduced cardiac preload and caused further reduction of CI. Peritoneal insufflation resulted in a significant increase (±35%) of mean arterial pressure, a significant reduction (±20%) of CI and a significant increase of systemic (±65%) and pulmonary (±90%) vascular resistances. The combined effect of anesthesia, head-up tilt and peritoneal insufflation produced a 50% decrease in CI. Administration of increasing concentrations of isoflurane, via its vasodilatory activity, may have partially blunted these hemodynamic changes. These results demonstrate that laparoscopy for cholecystectomy in head-up position results in significant hemodynamic changes in healthy patients, particularly at the induction of pneumoperitoneum.

Elevated intra-abdominal pressure (IAP) causes the decrease in venous return and increases the systemic vascular resistance and decreases the myocardial performance leading to decrease in cardiac output.[7] Increase in systemic vascular resistance may increase myocardial oxygen demand. But cardiac output dose not appear to decrease significantly when is <12 mm Hg.[10] Minimizing the IAP should decrease the risk of potentially significant physiologic changes,[8] numerous regional circulatory changes also occurs during laparoscopy including increased cerebral blood flow and increase ICP, decrease hepatic blood flow, bowel blood flow, renal blood flow and urine output, decrease femoral blood flow which may increase the risk of deep venous thrombosis (DVT).[7] Increase in IAP causes upward displacement of the diaphragms, resulting in reduction of the lung compliance, FRC, increase airway resistance, ventilation perfusion mismatch with hypercarbia

and hypoxemia.[8] Pneumoperitoneum increases risk of regurgitation and pulmonary aspiration.

COMPLICATIONS TO SURGEON

In adopting laparoscopic approach with its current limitations and poor ergonomics, surgeons have been known to sustain surgery-related injuries encompassed by a spectrum best described as MAS-related surgeon morbidity syndromes, some of which are currently overlooked and poorly researched. Equivalent morbidities including the overuse syndrome (from overuse of certain muscle groups during long operations) have been documented in open surgery but are nowadays rare occurrences. As more advanced MAS operations are performed with long execution times, new patterns of neuromusculoskeletal injuries are being recognized. The surgical fatigue syndrome has also been described, though its complex nature is not fully understood. Virtually little is known on other long-term adverse effects on the surgeon following many years of operating from images displayed on a television monitor or LCD screen, and these include deterioration of visual acuity and function of the ocular muscles responsible for fixation-refixation of the eyeballs. The limited reported literature on the MAS-related surgeon morbidity syndromes identifies certain risk factors for these injuries pertaining to central and peripheral domains. Laparoscopic surgeon especially women using glove sizes 6.5 or smaller, experience musculoskeletal problems while using common laparoscopic instruments.[9]

COMPERATIVE STUDY

It is a well-known factor that laproscopic surgery is far better than open surgery. Sometimes operative times goes longer than expected, in that case, surgeon as well as patient also suffer. Complex ergonomic makes the surgeon tired and due to prolong CO_2 based pneumoperitoneum and hemodynamic changes makes the patient tired. In a study, it is seen the common complaint from surgeon are as follows:

- Summary of avalidated questionnaire concerning the ergonomics of laparoscopic surgery
- Age, year, mean [range: 39 (33-56)]
- Laproscopic surgery experience, year, mean [range: 5 (1-20)]
- Laparoscopy workload, hour/week, mean [range: 10 (3-24)].

No. of complaints (0-5)*	Conventional laparoscopy
Musculoskeletal system pain	2.4 (1-4)
Neck pain	2.3 (1-4)
Shoulder stiffness	2.2 (1-4)
Arm pain	2.1 (1-4)
Forearm pain	1.8 (1-3)
Elbow stiffness	1.9 (1-3)
Hand pain	2.7 (1-4)
Wrist stiffness	2.4 (2-4)
Finger numbness	2.2 (1-3)
Back pain	3.3 (2-5)
Leg pain	3.3 (2-5)
Eye strain	1.8
Total score	31.6 (20-40)

0: No complaints; 1: Little pain; 5: Severe pain

In patients with carbon dioxide pneumoperitoneum causes respiratory acidosis, presumably from absorption of the gas. Patel et al[10] found that patients undergoing laparoscopic cholecystectomy were at high risk for developing DVT, with 40% having calf DVT and 15% having axial vein DVT on follow-up screening. Cardiac output decreases by up to 30% during laparoscopic surgery, due to a decrease in stroke volume. Pneumoperitoneum also causes an increase in systemic vascular resistance. As a result, mean arterial pressure remains unchanged or increases up to 16%. Patients with marginal cardiac performance may warrant invasive cardiac monitoring to assure they tolerate pneumoperitoneum. Joris et al[11] demonstrated that these hemodynamic changes were at least in part due to intravascular volume status and could be ameliorated by preloading patients with isotonic fluid and achieving pneumoperitoneum in the supine position rather than the reverse—Trendelenberg position.

DISCUSSION

You probably know you are 'supposed to take breaks'. But you ask, 'Why bother'? Many of us seem to prefer to plow through our work without interruption (and pass out at the end of the day). Barreling through 'on a roll' makes us feel productive and taking breaks seems like a waste of time. We continue this habit in the evening and lose track of time as we surf the internet, answer e-mails or concentrate on hobbies. After hours have passed, we 'wake-up' to realize that our eyes are tired, muscles are tight and our rear ends are flat. Put away that pain killer and take a break.

Research has shown that frequent breaks from 30 seconds to 10 minutes are beneficial.[12] The benefits include increased performance and reduced fatigue to the eyes, lower back, neck and wrists, especially when breaks were taken at 20 minutes intervals rather than at 40 minutes intervals.[13-17] Productivity is either unaffected or actually

improved when additional breaks are taken.[13,18,19] In fact, in one study conducted by Alan Hedge at Cornell's Human Factors and Ergonomics Laboratory, use of computer-initiated microbreaks showed a 13% average improvement in accuracy, with faster computer workers showing the greatest improvement.

WHAT TYPE OF BREAK IS BEST?

There are two types of breaks: Microbreaks last between 30 seconds and 5 minutes, while longer breaks are 10 to 15 minutes. Several studies have proven the effectiveness of breaks in reducing the risk of over use injuries. However, there is no consensus regarding the best length or frequency.

1. Forearm, wrist and hand discomfort occurring over the course of the work week with two 15 minutes breaks during an 8-hour work day were eliminated when data entry operators added 5 minutes breaks every hour. In addition, there was no reduction in productivity when the mircrobreaks were included in the day.
2. 'Micropauses' of 15 seconds taken every 10 minutes reduced fatigue at the end of a shift of data entry work by 50%.[12]
3. Frequent pauses are effective, if they are taken before the onset of appreciable fatigue.
4. Frequent pauses of 1.5 minutes resulted in a productivity increase of 6.45%. Pauses 2 minutes long produced a productivity increase of 11.15%.[21]
5. The optimal rest break length for infrequent rest pauses taken every 80 minutes is approximately 6 minutes.[20,22]
6. Either 5 minutes breaks every 30 or 10 minutes breaks every hour resulted in similar reports of worker comfort and measures of accuracy. The 10-minute breaks each hour were less disruptive to work.[7]

To summarize, what matters most is that you break from a particular task to improve circulation and refresh your mind and body. If you break less frequently, such as once per hour, you will need to break longer, from 6 to 10 minutes, than if you break more frequently it has long been assumed that hard-working and competitive 'Type A' people would avoid taking breaks.

National Institute for Occupational Safety and Health (NIOSH) reports in a new study. The findings are published in the May 2000 issue of the Scientific Journal Ergonomics. Regular daily schedule that included two 15 minutes rest breaks, one in each half of the work shift. In the other schedule, the conventional breaks were supplemented with four 5-minute breaks spaced throughout the workday. The workers consistently reported less eye soreness, visual blurring and upper-body discomfort under the supplementary schedule.

During operation if the surgeon takes a break for 5 minutes after each 90 minutes, during this period patients positions should be changed into supine position, all the CO_2 gas should be out take out all the instrument, patient will be under anesthesia, doing this we can prevent to form DVT, microatelectasis, slow growing cerebral edema and respiratory acidosis. Even we can change the hemodynamic status of the patient. Chances of the pulmonary embolism also decrease. Blood flow to the important organs backs to normal.

The strategic rest break for the surgeon is to remember breath and feel relax. Posture and ergonomic status are changed which causes less lactic acidosis and build-up toxins production. Muscle feel relaxed and neck pain, eye strain also reduce.

Prof Dr RK Mishra, director, World Laparoscopy Hospital, advocated for rest break after 45 minutes, for 5 minutes, in laparoscopic surgery. He has seen that after the operation patient face look fresh and postoperative recovery is very good and quicker.

Dr Joice P Hanna and Dr Cuschieiri also advocated for this kind of rest break.

CONCLUSION

Knowledge of pathophysiological changes, adequate monitoring and good planning in surgery with strategic rest break improbe the outcome of the patients and surgeon can perform the surgery for long-term. Though it takes little more longer time than usual to complete of surgery but for the benefit of surgeon and patient, its shows no merit to probe this data, much more clinical study is needed to establish this strategic rest break for the benefit of patients and surgeon.

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REFERENCES

1. Kelling G. Uber oesophagoscopy, gastroscopy, coelioscopy. Munich Med L1901;49:21.
2. Mouret P. From the laparoscopic cholecystectomy to the frontier of laparoscopic surgery. The prospective future. Dig Surg 1991; 8:124.
3. Joice P, Hanna GB, Cuschieri A. Ergonomic evaluation of laparoscopic bowel suturing. Am J Surg 1998;176:373-78.
4. Van veelan MA, Meiier DW. Ergonomics and design of laparoscopic instruments: Results of a survey among laproscopic surgeons. J Laparoendosc Adv Surg Tech A 1999;9:481-89.
5. Motew M, Vankovich AD, Bienarz J, et al. Cardiovascular effects and acid–base and blood gase changes during laparoscopy. Annal Obstet Gynecol 1973;115(7):1002-12.

6. Department of anaesthesiology and abdominal surgery. CHU of Liege. Domaine Du Sart. Tilman, B-4000 Liege, Belgium.
7. Maller C, Cunningham AJ. Physiologic changes during laparoscopy—anesthesiol. Clin North America 2001;19:21-41.
8. Dexter SP, Vilcepic-MGibson J, Mcmbon MJ. Hemodynamic consequences of high pressure and low pressure capno-peritoneum during laparoscopic cholecystectomy. Surg Endosc 1999;9:376-81.
9. Goel A. Laparoscopic hand instruments accessories and ergonomics—World Laparoscopy Hospital.
10. Patel MI, Hardman DTA, Nicholls D, Fisher CM, Appleberg M, et al. The incidence of deep vein thrombosis after laparoscopic cholecystectomy. Med J Austral 1996;164:652-56.
11. Joris JL, Chiche JD, Canivet JL-M, Jacquet NJ, Legros JJY, Hary ML. Hemodynamic changes induced by laparoscopic and their endocrine. J Am Coll Cardiol 1998;32(5):1389-96.
12. Broadhurst J. Polished Prose. More breaks, more often are good for business. Available from: www.polishedprose.com/microbreaks.html
13. McLean L, Tingley M, Scott RN, Richards J. Computer terminal work and the benefit of microbreaks. Appl Ergon, 2001 June; 32(3):225-37.
14. Take a Break: It's Good for You! Sitag, Holland Landing, Ontario. Available from: http://www.sitag.com/images/ergonomics/sitag_news letter_14.pdf
15. Shieh KK, Chen MT. Effects of screen color combination, work-break schedule, and workplace on VDT viewing distance. Int J Ind Ergon 1997 July;20(1):11-18.
16. Strategic rest breaks reduce VDT discomforts without impairing productivity, NOISH study finds. Blosser F, NIOSH Update, May 22, 2000. Available from: http://www.cdc.gov/niosh/restbrks.html
17. Henning RA, Jacques P, Kissel GV, et al. Frequent short rest breaks from computer work: Effects on productivity and well-being at two field sites. Ergonomics 1997;40(1): 78-91.
18. Kopardekar P, Mital A. The effect of different work-rest schedules on fatigue and performance of a simulated directory assistance operator's task. Ergonomics 1994 Oct;37(10): 1697-707.
19. Lang SS. When workers heed computer's reminder to take a break Their productivity jumps. Cornell study finds. Cornell News 1999.
20. Pheasante S. Ergonomics, Work and Health 1991;245.
21. Hanhart, 1954, in Cakir, Hart and Stewart. Visual display terminals 1980;247-53.
22. Graf, 1922, in Cakir, Hart and Stewart. Visual display terminals. 1980;247-53.

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REVIEW ARTICLE

Laparoscopic Sleeve Gastrectomy: An Ideal Procedure for Control of Morbid Obesity

Habeeb Mohamed

ABSTRACT

Background: Sleeve gastrectomy is becoming increasingly popular within bariatric surgery. Initially introduced as a component of complex interventions and later as part of a two-stage operation in high-risk patients, the procedure is now more common as one-stage operation and subject of avid scientific discussion. However, the concept of longitudinal gastric resection is not new. The procedure was already established in ulcer surgery but soon faded into insignificance. This article aims to trace the historical development of resection of the greater curvature and review the current value of sleeve gastrectomy within the spectrum of bariatric surgical procedures.

Materials and methods: Extensive review of literature of articles published in english language was conducted using the following search engines: Google, Yahoo, Medline, PubMed, Medscape, HighWire press and the SpringerLink library available at the World Laparoscopy Hospital, Gurgaon, India. Articles that matched the criteria were selected for review.

Results: Six reviews and 90 articles were selected and reviewed and analyzed to reach the conclusions.

Conclusion: Laparoscopic sleeve gastrectomy is a safe and effective weight loss procedure. Resolution of comorbidity, health-related quality of life and food tolerance were comparable with that of Roux-en-Y gastric bypass with lower incidence of complications comparable to gastric banding. However, there is need for standardization of the procedure and long-term results are yet to be analyzed.

Keywords: Sleeve gastrectomy, Tube gastrectomy, Longitudinal gastric resection, Bariatric surgery.

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INTRODUCTION

Obesity is gradually turning into an epidemic condition throughout the world and has become a social, psychological and economic burden of growing proportions.[1,2] It is associated with a large number of concomitant diseases (including type-2 diabetes, cardiovascular and respiratory diseases, dyslipidemia and elevated risk of cancer) and also markedly shortens the obese person's life expectancy.[3,4]

Due to the limited options and especially the poor long-term results of conservative treatment, the surgical approach of bariatric surgery has been established in the last few decades.[3] A bariatric procedure is considered to be indicated in adult patients with morbid obesity body mass index (BMI) ≥ 40 kg/m^2 or a BMI ≥ 35 kg/m^2 with additional comorbidities.[5,6] Long-term results of the surgical approach have been convincing in terms of reduced morbidity and mortality as well as enhanced quality of life.[7,8] Due to growing experience and the introduction of the endoscopic technique, the procedures have become increasingly safe and can be performed more easily by the use of modern stapling devices. Therefore, bariatric surgery is even considered in adolescents with a high-risk profile or in patients with BMI < 35 kg/m^2.[9,10] Several surgical procedures have been developed over time and nearly all of them are currently performed by the laparoscopic approach. A distinction has been made between restrictive, malabsorptive, combined restrictive and malabsorptive and electrical procedures for gastric stimulation. This diversity and the ongoing modifications of the procedures highlight the fact that there is no ideal procedure for widespread application. The quality of the respective procedures is no longer established by the previously used primary parameter of 'excess weight loss', but by the procedure's potential to maintain sufficient weight reduction on a long-term basis while ensuring minimal mortality and morbidity.

Laparoscopic sleeve gastrectomy (LSG; Fig. 1) was introduced by Gagner et al as a first-step procedure to minimize surgical risk for super-super-obese or high-risk patients, followed by either laparoscopic biliopancreatic diversion with duodenal switch (BPD-DS; Figs 2 and 3) or laparoscopic Roux-en-Y gastric bypass (LRYGBP).[11,12] Recent studies suggest that a second-stage surgical procedure is not always warranted, if adequate weight loss and comorbidity resolution are achieved, and the procedure could be a safe and effective stand-alone procedure for the treatment of morbid obesity.[13-15] The benefits of LSG include a low rate of complications, maintenance of gastrointestinal continuity and absence of malabsorption. As with other bariatric procedures, the results of LSG have mostly been evaluated on the basis of weight loss, and studies have shown that LSG can achieve a satisfactory weight loss on a short- and mid-term follow-up basis, but data still are lacking regarding long-term outcomes.[14,16,17]

MATERIALS AND METHODS

A broad search of literature of articles published in english language was performed in September 2011 using physical

means and electronically using the following search engines: Google, Yahoo, Medline, PubMed, Medscape, HighWire press and the SpringerLink library available at the World Laparoscopy Hospital, Gurgaon, India. The keywords used for the search were 'sleeve gastrectomy', 'tube gastrectomy', 'longitudinal gastric resection' and 'bariatric surgery'. Articles that matched the criteria were selected for review.

The articles were grouped by level of evidence (Table 1) and reviews were made based on evidence-based arguments for and against.

HISTORY

Operations to alter the gastrointestinal tract and produce weight loss have been applied for half a century. Weight loss operations may cause malabsorption, restriction of food intake or a combination of the two. The original operation for morbid obesity, the jejunoileal bypass, was first performed in 1954. However, this purely malabsorptive operation led to unacceptable morbidity and mortality related to bacterial overgrowth and liver damage.[18] The focus shifted away from purely malabsorptive procedures until the 1970s, when BPD was first described,[19] with eventual description of DS in 1993.[20] This operation has been applied laparoscopically with effective weight loss.[21]

Gastric bypass was introduced by Mason in 1966 as a combined restrictive-malabsorptive procedure.[22] Several variations and modifications of the original procedure have evolved over time, such as complete gastric transection, reduction in gastric pouch size and application of a Roux-en-Y.[23] As of 2003, Roux-en-Y gastric bypass (RYGB) accounted for more than 80% of all bariatric procedures performed in the United States. Laparoscopic RYGB was popularized and validated in the early 1990s by Wittgrove and Clark,[24] and several corroborating series have followed.[25-28] Differences exist in the technique for laparoscopic gastrojejunostomy as part of the procedure, including transoral circular stapling,[24] transgastric circular stapling,[26] linear stapling[27] and hand sewing[28] approaches, but all are supported in the literature as producing similar safety and weight loss results.

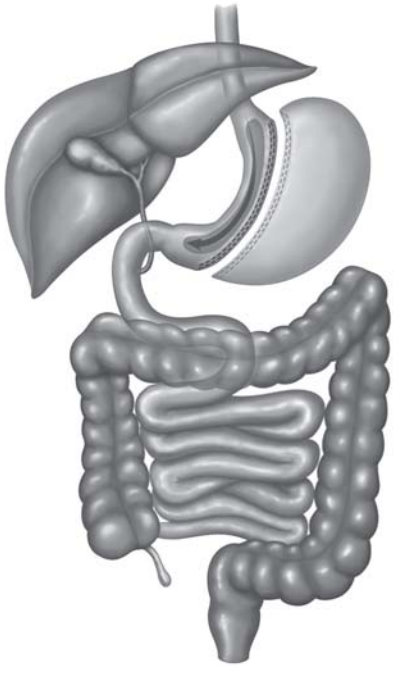


Fig. 1: Sleeve gastrectomy

Fig. 2: Biliopancreatic diversion and duodenal switch

Fig. 3: Roux-en-Y gastric bypass

Table 1: Levels of evidence

Level of evidence	*Criteria*
Ia	Evidence from meta-analysis of randomized controlled trials
Ib	Evidence from atleast one randomized controlled trial
IIa	Evidence from atleast one controlled study without randomization
IIb	Evidence from atleast one other type of experimental study
III	Evidence from descriptive studies, such as comparative studies, correlation studies and case-control studies
IV	Evidence from expert committee reports, opinions or clinical experience of respected authorities or both

In the early 1970s, Printen and Mason[29] developed a purely restrictive operation, the gastroplasty. This operation later developed into vertical-banded gastroplasty (VBG)[30] and ultimately laparoscopic VBG by the 1990s (Fig. 4).[31] Despite efforts to simplify the procedure,[32] gastroplasty operations decreased and accounted for only 7% of US bariatric procedures in 2002. Stomach banding for weight loss, originally introduced in the 1980s with nonadjustable devices, became popular in the early 1990s.[33] In 1993, Belachew and Legrand placed the first laparoscopic adjustable gastric band (AGB; Fig. 5) using the LAP-BAND® system (Allergan Inc, Irvine, CA, USA).[34] Although multiple versions of AGB are available for laparoscopic use, most published results are derived from the LAP-BAND® system.

Laparoscopic adjustable bands quickly became popular worldwide due to their relative ease of placement and safety. The LAP-BAND® system was not approved for use in the United States until 2001, and its use has increased steadily. A recent worldwide survey showed that the laparoscopic AGB accounted for 24% of obesity operations, whereas 26% of the operations were laparoscopic RGB and 23% were open gastric bypass.[35]

Another contemporary restrictive procedure that derives from the concept of vertical gastroplasty is the LSG. The LSG technique developed as a first-stage procedure before DS or gastric bypass for high-risk patients.[36,37] Studies have shown that LSG used in this manner reduces weight, comorbidities and operative risk [American Society of Anesthesiology (ASA) score; Fig. 6] at the time of a second bariatric procedure.[38-40] There is increasing application of LSG as a primary weight loss operation.[36,37,41,42] Evolving data demonstrate that LSG provides substantial weight loss and resolution of comorbidities over 3 to 5 years follow-up periods.[36,38,43-45] Early comparative data demonstrate that the percentage of excess body weight loss (EBWL) with LSG at 1 year is superior to that with AGB and approaches that with RGB and BPD.[46]

Other minimally invasive weight loss procedures are in developmental stages. Gastric pacing, under development in Europe for more than 10 years, has shown acceptable safety and early efficacy (<15 months), although its use is appropriately limited to clinical trials until more mature data become available.[47]

RESULTS

Most surgeons and medical insurance providers today adhere to the guidelines for surgical management of obesity established at the 1991 National Institutes of Health Consensus Conference on Gastrointestinal Surgery for Severe Obesity.[48] According to the guidelines, patients are eligible for surgery if they have failed attempts at nonsurgical weight loss and have a BMI > 35 (Fig. 7) with comorbidity or a BMI > 40 with or without comorbidity.

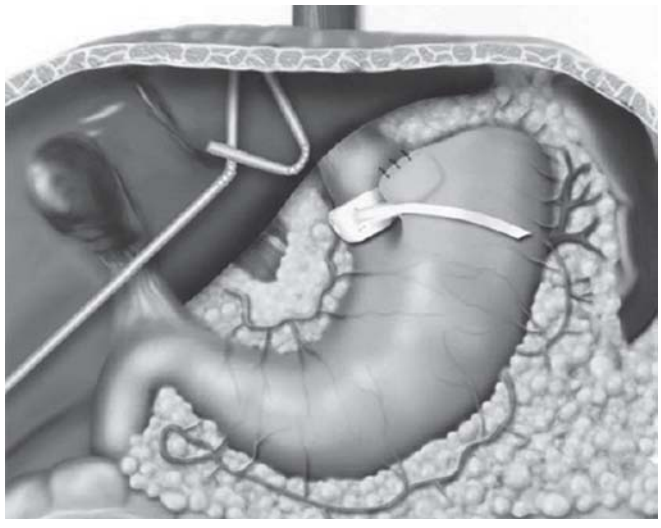


Fig. 4: Vertical-banded gastroplasty

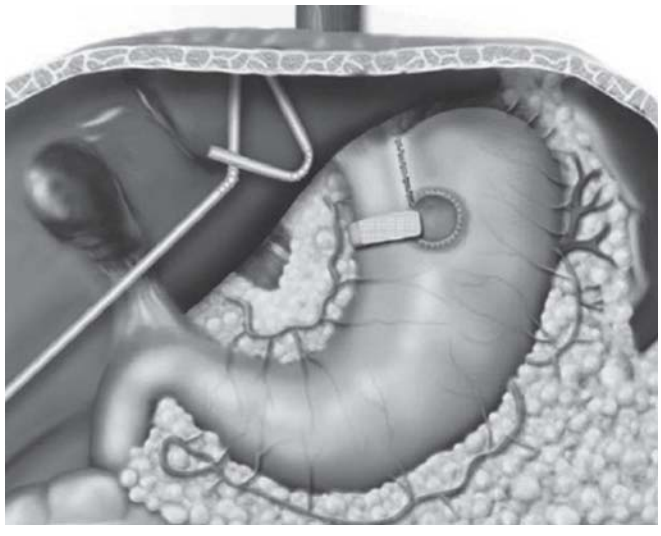


Fig. 5: Adjustable gastric banding

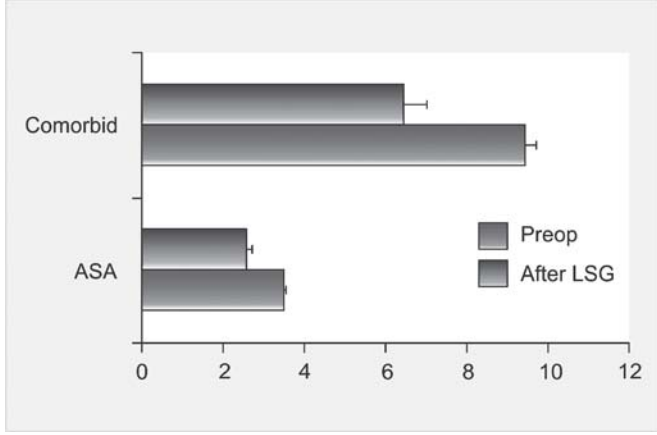


Fig. 6: Effect of LSG on ASA

The only operations endorsed by the panel were gastric bypass and VBG which at the time were the primary procedures with well documented long-term data.

In order to assess new laparoscopic bariatric operations, it is appropriate to establish benchmark outcome goals for comparison. The RYGB is most suitable for comparison because there is significant evidence to document both short-term and long-term outcomes, and it is considered by most surgeons in North America to have the most favorable risk/benefit profile. Table 2 demonstrates selected series of open RYGB published primarily over the past decade with key outcome parameters.[49-59]

The SAGES appropriateness conference statement on optimal management of the morbidly obese patient in 2004 after review of more than 1,500 articles reached consensus regarding indications for surgery, resolution of comorbid illnesses with significant weight loss and the importance of committed bariatric programs (Figs 8 and 9). The indications were similar to that agreed upon by National Institutes of Health Consensus Conference on Gastrointestinal Surgery for Severe Obesity held in 1991 and RYGB was accepted as the 'gold standard' of weight loss surgeries as it was the only procedure which was supported by level 1 evidence of 10 prospective randomized controlled studies in the subject.[60-69]

In 2007, the review 'surgery for obesity: A review of the current state of the art and future directions' by Stephen S McNatt, James J Longhi, Charles D Goldman and David W McFadden compared gastric bypass, biliopancreatic diversion, gastric banding and gastric pacing by reviewing 112 articles and put forward the following observations.

These results clearly indicate that bariatric surgery (Table 3) is an effective and safe method of weight loss with the scientific evidence. The indications for bariatric surgery have been standardized with RYGB as the 'gold standard' of weight loss procedures (Tables 4 and 5).

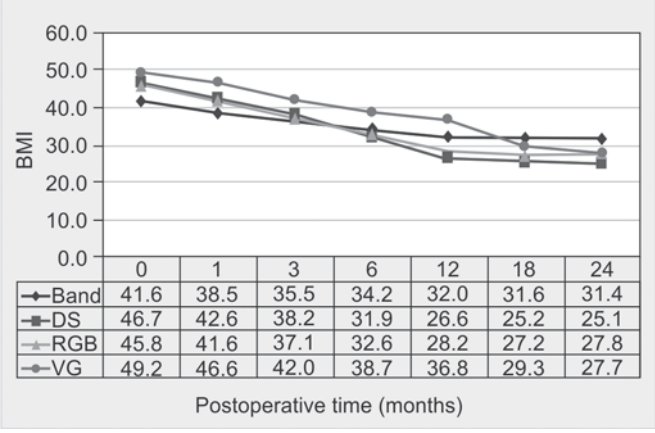


Fig. 7: Postoperative BMI in patients who underwent various laparoscopic bariatric surgeries

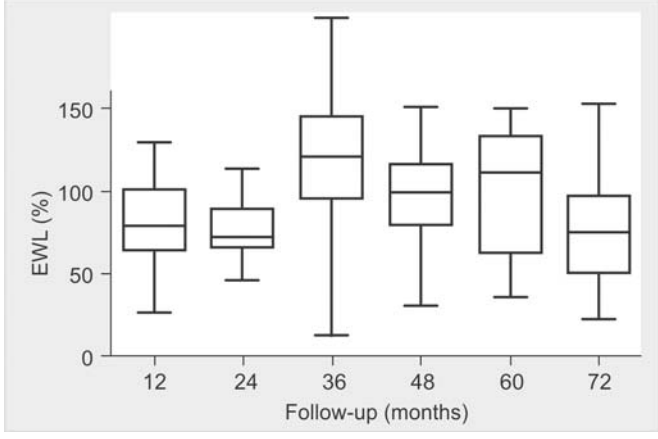


Fig. 8: Percentage of estimated weight loss at different points of time after LSG

Table 2: RCT in favor of RYGB[25]

	N	*Patient size (BMI, kg or % IBW)*	*time (min)*	*Hospital stay (day)*	*Early complication rate (%)*	*Mortality (%)*	*PE rate (%)*	*Leak rate (%)*	*Hernia (%)*	*Follow-up (months)*	*Weight loss*
Mason 1969	26	42	—	—	19	7.7	3.4	0	11.5	12	43 kg
Griffin 1981	402	134 kg	—	—	4.2	0.75	0.25	5.47	3.5	6	35 kg
Linner 1982	174	126 kg	—	—	10.4 (all)	0.57	0	0.57	0	24	64% EWL
Sugerman 1989	182	213%	—	6-7*	—	1	0	1.6	18*	12	67% EWL
Hall 1990	99	198%	120	8	20	0	3	0	2	36	67% lost >50% EBW
Brolin 1992	90	62	—	—	5	0	1.1	0	6.6	43	64% EWL
MacLean 1993	106	50	—	—	—	0	—	5.6	—	33	58% lost >50% EBW
Poires 1995	608	50	—	5-6*	25.5	1.5	—	—	23.9	168	49% EWL
Capella 1996	560	52	—	—	1	0	0	0	—	60	62% EWL
Fobi 1998	944	46	—	4*	2.7	0.4	0.6	3.1	4.7	24	80% EWL
MacLean 1999	243	49	—	—	—	0.41	—	—	16	66	BMI 44→ 29

BMI: Body mass index; EBW: Excess body weight; EWL: Excess weight loss; IBW: Ideal body weight; PE: Pulmonary embolism; — :not reported.

*As reported by the investigator, without mean and standard deviation of the mean; one subphrenic abscess; change in BMI for patients with initial BMI 40-50.

In 2005, in the article 'Laparoscopic sleeve gastrectomy as an initial weight-loss procedure for high-risk patients with morbid obesity' by D Cottam and FG Qureshi of Department of Surgery, University of Pittsburgh Medical Center, Pittsburgh, PA, and Department of Surgery, Veterans Hospital, Pittsburgh, PA, USA, SG Mattar, S Sharma, S Holover, G Bonanomi and R Ramanathan of Department of Surgery, University of Pittsburgh Medical Center, Pittsburgh, PA, USA and P Schauer of Cleveland Clinic, Cleveland, OH, USA published the results of their study on the effect of LSG as an initial procedure prior to laparoscopic RYGB in a staged intervention in superobese patients. In this study, 126 patients (53% female) with mean age 49.5 ± 0.9 years and mean BMI 65.3 ± 0.8, underwent LSG (Tables 6 and 7) as a first stage during the period January 2002 to February 2004 (Fig. 10). After achieving significant weight loss and reduction in comorbidities, these patients then proceeded with the second stage, LRYGBP (Tables 8 and 9).

The study clearly indicated that LSG gave good control of comorbidities with significant weight loss.

In 2008, in the review 'Clinical application of laparoscopic bariatric surgery: An evidence-based review' by Timothy M Farrell, Stephen P Haggerty, D Wayne Overby, Geoffrey P Kohn, William S Richardson and Robert D Fanelli, 254 articles were analyzed with respect to the impact of laparoscopic bariatric surgery on mortality, weight loss and comorbidities and the following guidelines were

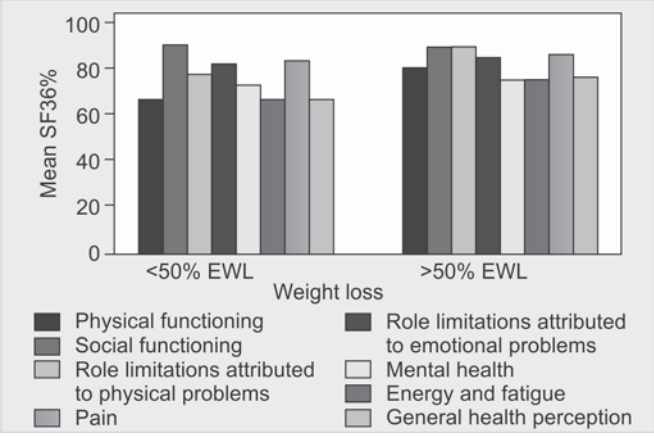


Fig. 9: Comparison of medical outcome score of patients with percentage of estimated weight loss more than 50% with those less than 50%

Table 3: Effects of bariatric surgery on gastrointestinal hormones

Surgery	*Hormone*	*Change*
Gastric bypass	Ghrelin	↓
(Roux-en-Y)	Ghrelin	↑
	Ghrelin	↓
	Ghrelin	No change
	Ghrelin	↓
	Ghrelin	↓
	Ghrelin	↑
	Enteroglucagon	↑
	Enteroglucagon	↑
	GLP-1	↑ (NS)
	CCK	No change
Gastric banding	Ghrelin	↓
	Ghrelin	↓
VBG	PYY	↑
BPD-DS	Enteroglucagon	↑
	Enteroglucagon	↑
	Enteroglucagon	↑
	Ghrelin	↑ (initial only)
Jejunoileal bypass	CCK	↑ (cell no.)
	CCK	↑
	PYY	↑
	Enteroglucagon	↑
	GLP-1	↑

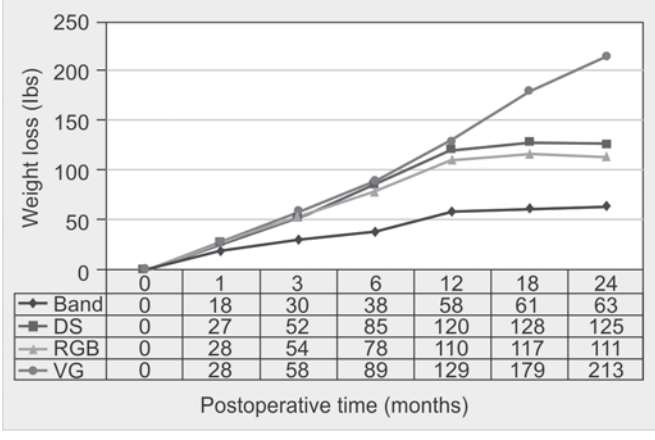


Fig. 10: Postoperative weight loss in patients who underwent various laparoscopic bariatric surgeries

Table 4: Summary of clinical trials showing mean excess weight loss from LAP-BAND and gastric bypass

Author	*n*	*Mean excess weight loss (%)*					*Country*
		*1 yrs**	*2 yrs*	*3 yrs*	*4 yrs*	*5 yrs*	
Watkins et al	138	48.2	—	—	—	—	USA
Spivak et al	500	39	45	47	—	—	USA
Ren et al	99	44	—	—	—	—	USA
Ren et al	115	41.6	—	—	—	—	USA
Rubenstein	63	39	46.5	53.6	54	54	USA
O'Brien and Dixon	709	47	52	53	52	—	Australia
Dargent	500	56	65	64	—	—	France
Holloway	502	50	61	65	—	—	USA

*Follow-up time

Table 5: Summary of clinical trials showing postoperative complications resulting from various bariatric surgeries

Authors	*n*	*Postoperative complications (%)*		
		Erosions	*Prolapse*	*Mortality*
Hollyway et al	502	1(2)*	5(28)	0.2(1)
O'Brien and Dixon	1120	3 (34)	25 (first 500)	0
			47 (second 600)	—
Fielding and Allen	335	0	3.6	—
Weiner et al	184	1.1	2.2	0
Vertruyen	543	4.6	1	—
Belachew et al	763	0.9	8	—
Favretti et al	830	0.5	10	—
Cadiere et al	652	0.3	3.8	—
Spivak et al	500	0.2	2.8 (14)	0
Ren et al	445	0.2(1)	3.1 (14)	—
Ren et al	500	<1(1)	2(2)	0

*Number in parentheses represents number of complications in each group

put forward which were reviewed and coendorsed by the American Society for Metabolic and Bariatric Surgery (Tables 10 to 13).

The results clearly indicate that laparoscopic bariatric surgery is a safe and effective weight loss procedure with efficacy and safety established through scientific research. The review also concluded that along with laparoscopic RGB, AGB, BPD +DS, primary LSG has also been proven to be effective.

In 2007, a study on 'Vertical gastrectomy for morbid obesity in 216 patients: Report of two-year results' by Crystine M Lee, Paul T Cirangle and Gregg H Jossart of the Department of Surgery, California Pacific Medical Center, San Francisco, CA, USA was published which concluded that vertical gastrectomy achieves significant weight loss as par with that of RYGB and DS operations while with fewer complications comparable with AGB. The study was conducted in a nonrandomized form on a total number of 846 patients who underwent laparoscopic bariatric surgery of which 216 (173 female) underwent VG (Tables 14 to 16).

By this time LSG has started to become a popular surgery amongst bariatric surgeons due to its efficacy in weight loss and control of comorbidities and reduced rate of

Table 6: Preoperative comorbid conditions in patients who underwent LSG

Condition	*Percentage of population*
Fatty liver disease	100
Sleep apnea	82
Peripheral edema	59
Hypertension	68
Degenerative joint disease	69
Type II diabetes	59
Low back pain	42
Gastroesophageal reflux disease	36
Elevated triglycerides	52
Depression	36
Asthma	25
Coronary artery disease	18

Table 7: Effect of LSG on comorbid conditions

Condition	*Resolved(%)*	*Improved(%)*
Sleep apnea	80	7
Peripheral edema	91	3
Hypertension	78	7
Degenerative joint disease	85	6
Type II diabetes	81	11
Low back pain	44	10
Gastroesophageal reflux disease	70	8
Elevated triglycerides	73	5
Depression	67	9

Table 8: Comorbid conditions in patients who underwent completion RYGB

Condition	*Percentage unresolved*
Sleep apnea	27
Peripheral edema	8
Hypertension	14
Degenerative joint disease	12
Type II diabetes	14
Low back pain	40
Gastroesophageal reflux disease	20
Elevated triglycerides	38
Depression	27

Table 9: Summary of weight, comorbidities and ASA after each stage

	Preoperative	*12 months after stage I*	*6 months after stage II*	*p-value*
Mean weight (kg)	177	131	109	<0.05
BMI	65 ± 9	49 ± 8	39 ± 8	<0.05
Comorbidities	9 ± 3	6 ± 3	2 ± 1	<0.05
ASA ≥ 3	94%	44%	NA	<0.05

Table 10: Percentage excess body weight lost after bariatric surgical procedures

Operation		*Mean follow-up period (years)*							
		1	*2*	*3*	*4*	*5*	*7*	*8*	*10*
BPD ± DS	(%) EBWL	71.8	75.1	76.3	75.5	73.3	69	75.8	77.0
	Aggregate n	896	1,623	410	1,278	174	89	405	122
	No of studies	4	3	4	3	3	1	2	1
RGB (proximal)	(%) EBWL	67.3	67.5	62.5	58.0	58.2	55.0		52.5
	Aggregate n	1627	385	285	509	176	2		194
	No. of studies	7	5	4	4	3	1		2
AGB	(%) EBWL	42	57.2	54.8	54.5	55.2	51.0	59.3[a]	
	Aggregate n	4456	3383	3104	1435	640	29	100	
	No. of studies	11	11	12	9	5	2	1	

BPD ± DS: Biliopancreatic diversion with or without duodenal switch; RGB: Roux-en-Y gastric bypass; AGB: Adjustable gastric banding; [a]42 patients with 8-year follow-up and band not removed

Table 11: Improvement of comorbidities after bariatric surgery

Operation	*Diabetes resolved (%)*	*Hypercholesterolemia improved (%)*	*Hypertension resolved (%)*	*Sleep apnea resolved (%)*
Banding	47.8	71.1	38.4	94.6
RGB	83.8	93.6	75.4	86.6
BPD ± DS	97.9	99.5	81.3	95.2

RGB: Roux-en-Y gastric bypass; BPD ± DS: Biliopancreatic diversion with or without duodenal switch

Table 12: Mortality and morbidity after laparoscopic bariatric surgery

Operation	*30-day mortality (%)*	*Overall complications (%)*	*Major complications (%)*
Lap AGB	0.05-0.4	9	0.2
Lap RGB	0.5-1.1	23	2
Lap BPD	2.5-7.6	25	5

Table 13: Relative risk and benefits of laparoscopic bariatric surgical procedures

	AGB	*RGB*	*BPD*
Objective			
• Least perioperative risk	+++	++	+
• Most effective durable weight loss	+	++	+++
• Best comorbidity resolution	+	++	+++
• Most reversible	+++	+	+
• Best procedure for avoiding reoperation due to			
– Technical complications—early	+++	++	+
– Technical complications—late	+	++	+++
– Metabolic complications—late	+++	++	+
• Least chance of inadequate weight loss	+	++	+++
Subjective			
• Fewest outpatient visits needed	+	+++	++
• Fewest unintended metabolic consequences of poor follow-up	+++	++	+
• Durable weight loss despite poor patient compliance	+	++	+++

Relative scale: +++ > ++ > +

Table 14: Preoperative variables for patients undergoing various laparoscopic bariatric surgeries

	VG (n = 216)	*Band (n = 271)*	*RGG (n = 303)*	*DS (n = 56)*	*p-value*
Age (y)	43 ± 11	42 ± 12	43 ± 19	42 ± 8	NS
Male (%)	43 (20%)[†]	34 (13%)	46 (14%)	7 (9%)	<0.05 *vs* band, DS[†]
Preop weight (lbs)	302 ± 77[†]	257 ± 42*	281 ± 47	288 ± 49	<0.01 *vs* band, RGB[†]; <0.01 *vs* RGB, DS*
Preop BMI (kg/m^2)	49 ± 11[†]	42 ± 5*	46 ± 6	47 ± 6	<0.01 *vs* band, RGB[†]; <0.01 *vs* RGB, DS*
OR time (min)	90 ± 30[†]	89 ± 25*	140 ± 37	226 ± 45	<0.01 *vs* RGB, DS[†]; <0.01 *vs* RGB, DS*
EBL (ml)	35 ± 19[†]	29 ± 18[†]	53 ± 44[†]	89 ± 47[†]	<0.01 *vs* all other groups[†]
Length of stay (d)	1.9 ± 1.2[†]	1.2 ± 0.7*	2.8 ± 1.4	3.2 ± 2.0	<0.01 *vs* all[†]; <0.01 *vs* RGB, DS*

Table 15: Postoperative parameters in patients who underwent various laparoscopic bariatric surgeries

	VG (n = 216)	*Band (n = 271)*	*RGG (n = 303)*	*DS (n = 56)*	*p-value*
Preop weight (lbs)	302 ± 77†	257 ± 42*	281 ± 47	288 ± 49	<0.01 *vs* band, RGB†; <0.01 *vs* RGB, DS*
1 year weight (lbs)	242 ± 64†	194 ± 33*	174 ± 36	165 ± 29	<0.0 *vs* all†; <0.01 *vs* RGB, DS*
Preop BMI (kg/m^2)	49 ± 11†	42 ± 5*	46 ± 6	47 ± 6	<0.01 *vs* Band, RGB†; <0.01 *vs* RGB, DS*
1 (year) BMI (kg/m^2)	37 ± 9†	32 ± 5*	28 ± 5	27 ± 4	<0.01 *vs* all†; <0.01 *vs* RGB, DS*
1 (year) EWL (%)	59 ± 17†	47 ± 20*	75 ± 16	79 ± 12	<0.05 *vs* all†; <0.01 *vs* RGB, DS*
1 (year) weight lost (lbs)	129 ± 51†	58 ± 27*	110 ± 37	120 ± 24	<0.01 *vs* band, RGB†; <0.01 *vs* RGB, DS*

Table 16: Postoperative complications in patients who underwent various laparoscopic bariatric surgeries

	VG (n = 216)	*Band (n = 271)*	*RGG (n = 303)*	*DS (n = 56)*	*p-value*
Nonoperative readmissions (%)	5 (2.3%)	4 (1.5%)†	12 (7.1%)	4 (7.1%)	<0.05 *vs* DS†
Reoperations (%)	6 (2.8%)†	13 (4.8%)‡	26 (8.6%)	18 (32.1%)	<0.03 *vs* RGB, DS†; <0.01 *vs* all*
Deaths (%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NS
Major complications (%)	10 (4.6%)†	13 (4.8%)‡	32 (10.6%)	22 (39.3%)*	<0.03 *vs* RGB, DS†; <0.03 *vs* RGB, DS†; <0.01 *vs* all*
Total complication (%)	16 (7.4%)	18 (6.6%)†	69 (22.8%)	27 (48.2%)	<0.03 *vs* RGB, DS†; <0.03 *vs* RGB, DS†; <0.01 *vs* all*

complications. But there was lack of standardization of the procedure especially with regard to technique, volume of gastric tube and oversewing of gastric serosa over the staple line to prevent bleeding and leak.

In 2008, in an article 'Laparoscopic sleeve gastrectomy: Standardized technique of a potential standalone bariatric procedure in morbidly obese patients' by Markus A Kueper, Klaus M Kramer, Andreas Kirschniak, Alfred Königsrainer, Rudolph Pointner and Frank A Granderath of the Department of General, Visceral and Transplant Surgery, University Hospital Tuebingen, Tuebingen, Germany, an attempt was made in proposing a standardized form of LSG so that it could be compared with other procedures like malabsorptive procedures and AGB which already have standardized format.

The surgical technique proposed by the article is given below:

The patient is positioned in a modified antitrendelenburg position with the right arm away from the body. The abdomen is prepared and draped in the customary fashion. Five 12 mm trocars (Ethicon endosurgery, Norderstedt, Germany) are placed as shown in Figure 11. After exploration of the abdomen and the anterior wall of the stomach, the liver is retracted via trocar No. 5. We then start the dissection of the short gastric vessels to the point of the angle of His using the UltraCision harmonic scalpel (Ethicon endosurgery). The greater omentum is then separated from the greater curvature under protection of the gastroepiploic arcade. The endpoint of the preparation is about 7 to 8 cm prepyloric. A 34-Fr tube is then positioned along the minor gastric curvature as the leading structure for the stapling line to follow. The greater curvature is then stapled strictly along the stomach tube using a 60 mm Endo-GIA (Ethicon endosurgery). The starting point is 7 to 8 cm prepyloric to the point of the angle of His. Typically, four to five staple lines are needed. The dissected part of the stomach is withdrawn from the abdomen at trocar No 3 and the staple line will be overstitched by simple sutures. This is done not to prevent insufficiency in the staple line but rather to prevent staple line bleeding. It is possible to overstitch only areas of bleeding between the staples, not the whole staple line.

The analysis of operative data and early outcome showed that the results of LSG were comparable to that of LAGB (Figs 12A to C) which has the least complication rate (Table 17).

In 2011, Mathieu D'Hondt, Sofie Vanneste, Hans Pottel, Dirk Devriendt, Frank Van Rooy and Franky Vansteenkiste of the Department of Digestive Surgery, Groeninge

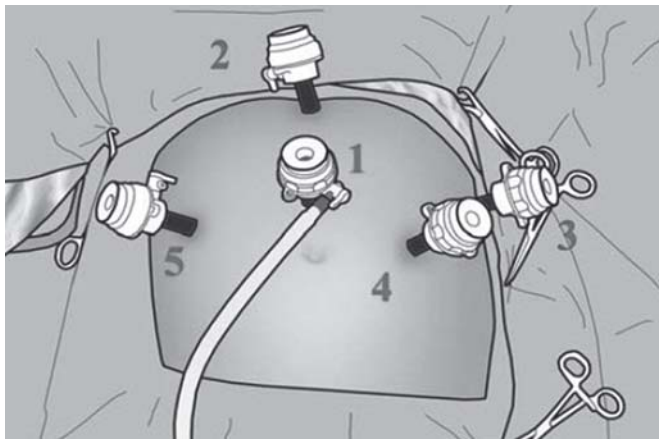
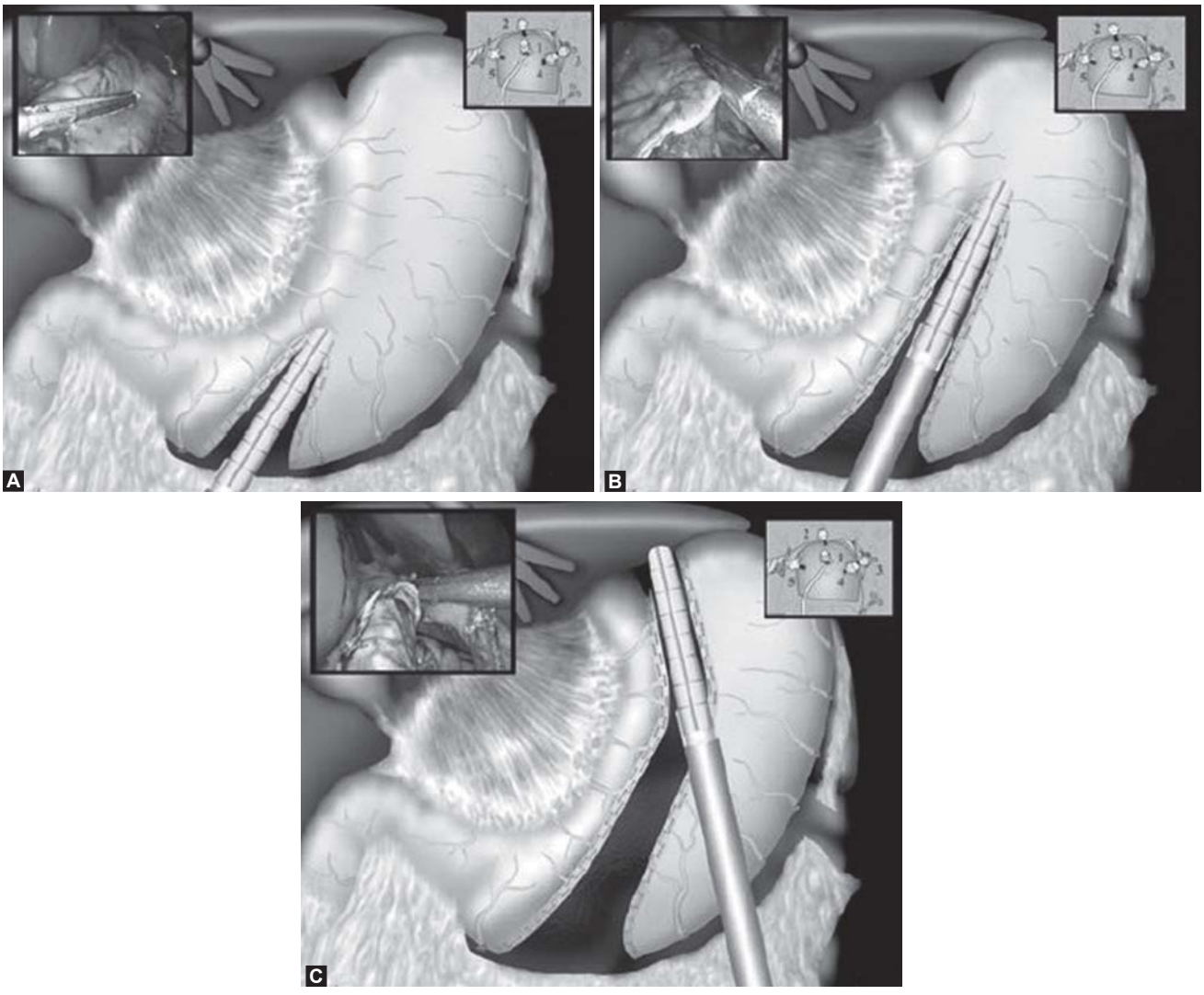


Fig. 11: Trocar position for LSG



Figs 12A to C: Technique of LSG

Hospital, President Kennedylaan 4, 8500 Kortrijk, Belgium published a study 'Laparoscopic sleeve gastrectomy as a single-stage procedure for the treatment of morbid obesity and the resulting quality of life, resolution of comorbidities, food tolerance, and 6-year weight loss' (Tables 18 to 20), which evaluated long-term weight loss, resolution of comorbidities, quality of life (QoL) and food tolerance after LSG (Fig. 13). A retrospective review of a prospectively collected database was performed on 102 patients who underwent LSG as a sole bariatric procedure during the period January 2003 to July 2008.

The study concluded that LSG is a safe and effective bariatric procedure, although a tendency for weight regain is noted after 5 years of follow-up evaluation. Resolution of comorbidity is comparable with that reported in the literature. The LSG procedure results in good to excellent health-related QoL. Food tolerance is lower for patients after LSG than for nonobese patients who had no surgery (Figs 14 and 15), but 95.2% described food tolerance as acceptable to excellent.

DISCUSSION

Bariatric surgery is the cornerstone of the treatment of morbid obesity. Various procedures have been developed which can be classified mainly into restrictive, malabsorptive, combined restrictive and malabsorptive and electrical procedures for gastric stimulation. The restrictive procedures have fewer complications with lesser excess weight loss whereas malabsorptive procedures have greater excess weight loss at the risk of increased complications. Thus, we can see that the complexity of the surgical techniques and the potential surgical and metabolic complications of the various procedures are inversely related to the anticipated course of weight loss. Due to these reasons, a procedure like sleeve gastrectomy which apparently can be performed easily and has a favorable risk-benefit ratio would appear to have arrived at the right moment. The renaissance and the enormously rapid and widespread application of this method as a single-step procedure, is quite understandable.[70]

Table 17: Comparison of operative data and early outcome between LSG and LAGB

	LAGB	*LSG*	*p-value*
Sex (M/F)	7/9	7/9	
Age (years), mean and range	43.9 (27-62)	42.8 (24-68)	0.79
BMI (kg/m^2), median and range	44.9 (41-65)	49.1 (43-68)	0.22
Operating time (min), mean and range	106 (60-210)	115 (55-180)	0.43
EWL (kg), mean and range	24.4 (8-47)	24.1 (9-34)	0.93
EWL (%), mean and range	39.1 (13-81)	33.0 (11-49)	0.30
Hospital stay (d), median and range	5.5 (3-19)	9.0 (7-52)	0.08

Table 18: Weight loss at different follow-up points after LSG

Follow-up period (months)	*Patients (n)*	*Mean EWL (%)*	*SD*	*Patients with EWL >50% (%)*
12	83	81.51	24.27	92.9
24	62	75.00	17.82	89.5
36	44	83.75	32.89	87.0
48	33	72.88	22.60	85.7
60	27	71.30	29.59	64.3
72	23	55.91	25.55	54.5

Table 19: Improvement of medical comorbidities after LSG

Aggravated	*Unchanged*	*Improved*	*1 major comorbidity resolved, others improved*	*All major comorbidities resolved, others improved*
4	19	8	31	21

Table 20: Resolution or improvement of comorbidities after LSG

Comorbidity	*Improved (no of patients)*	*Period (months[a])*	*Resolved (patients: n)*	*Period (months[a])*	*Improved/resolved [patients: n(%)]*
T2DM	1/10	3	4/10	4 (2-6)	5/10 (50)
HT	2/22	4(3-5)	18/22	5 (2-12)	20/22 (90.9)
OSA	–	–	7/7	12 (2-12)	7/7 (100)
DL	3/36	9(7-16)	25/36	8 (2-11)	28/36 (77.7)

T2DM: Type 2 diabetes mellitus; HT: Arterial hypertension; OSA: Obstructive sleep apnea; DL: Dyslipidemia; [a]Expressed as median (range)

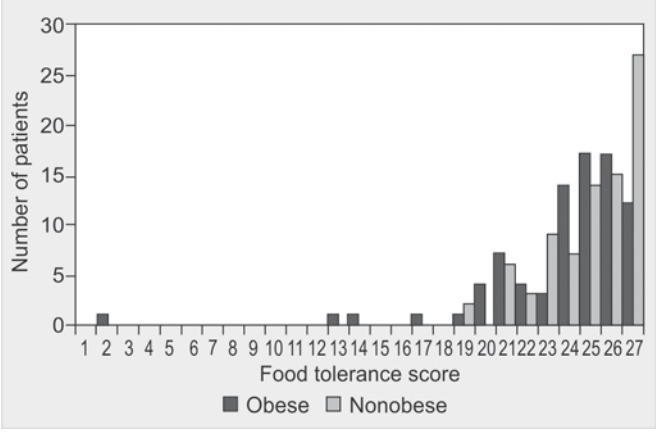


Fig. 13: Comparison of food tolerance of 83 patients after LSG with 83 nonobese nonsurgical patients

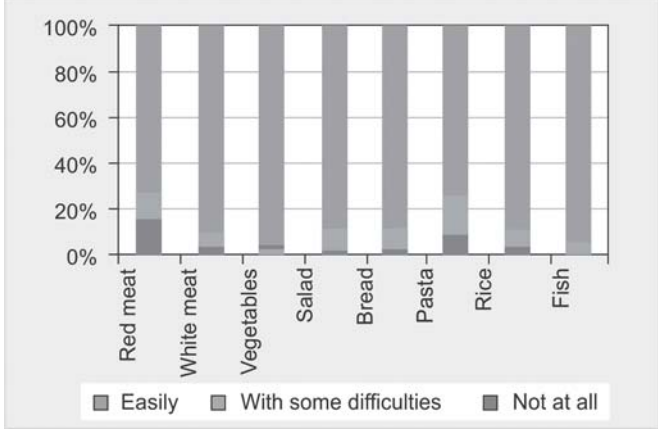


Fig. 14: Tolerance for different types of food

Introduced as a stepwise mode of treatment, the procedure reduced the previously high mortality rates in high-risk patients (>6% with a BMI >60 kg/m^2). As single-step procedure, it was convincing because of its low complication (about 9%) and mortality rates (<1%) as well as its low rate of gastrointestinal long-term side effects.[71-73] In trials, sleeve gastrectomy was found to achieve a mean excess weight loss of 33 to 83%, 1 year after surgery.[74] Despite this wide range, it may be assumed that even in the midterm, the procedure is associated with a similar marked

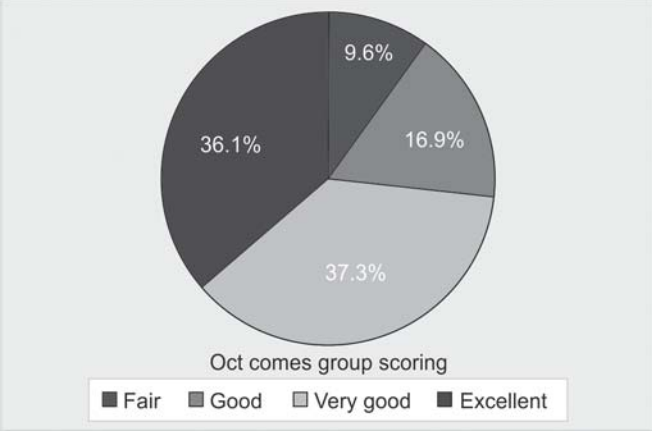


Fig. 15: BAROS score at median follow-up point of 49 months

reduction of weight as the usual procedures while reducing obesity-associated concomitant diseases.[75,76] If additional weight reduction is required subsequently, the procedure can be performed in a two-step manner with a malabsorptive component (gastric bypass or biliopancreatic diversion), either in a combined manner or a repeat sleeve gastrectomy can be conducted.[77,78]

However, sleeve gastrectomy is also not the ideal solution. We should consider the fact that longitudinal gastric resection on the side of the greater curvature is an irreversible step and is associated with placement of a long row of stapler sutures along a gastric wall of varied structure.[74,79] The most frequent surgical complications of the procedure are leaks (about 0.9%), strictures (about 0.7%) and postoperative bleeding (about 0.4%). Revision rates are reported to be around 4%.[71,72] In addition to intraoperative inspection of the sutures, for instance by endoscopy or the use of methylene blue, several authors recommend oversewing the row of clip sutures or the use of clip reinforcement.[83,84,80] However, procedures of suture reinforcement or oversewing are controversially discussed. Some authors express apprehensions about suture weakening, do not necessarily attribute the reduction of insufficiency rates to suture reinforcement or warn against strictures due to oversewing.[79,81] Other authors recommend laparoscopic greater curvature plication in order to avoid gastric resection and associated complications.[82]

Although, a growing number of studies have been focused on the use of sleeve gastrectomy as a single-step procedure and report convincing results, adequate evaluable long-term results (>5 years) are not yet available.[83,73,85] Moreover, sleeve gastrectomy is not performed in a standardized manner. Various tube diameters and calibration probes (32-60 French) are used.[70,86] Besides, the extent of resection, especially of the antrum varies.[84,87] Intraoperative measurement of the volume of the resected stomach is of great importance. A removed volume <500 cm^3 is apparently associated with an early weight regain.[84] Thus, the results of various workgroups must be compared with caution. The experience of the surgeon also is a substantial factor influencing the outcome of the procedure at present.

Bariatric surgery is a domain of complex interventions in high-risk patients. An ideal procedure does not exist and the key to successful treatment lies in a careful assessment of the individual risk jointly by the surgeon and the patient, as well as in providing intensive care and information before the operation and particularly in the long-term after a bariatric operation.[88] Eating habits, baseline weight, the anticipated weight loss, comorbidities, gender, age and compliance are some of the numerous factors that must be taken into account.[89] A team experienced in handling a wide spectrum of bariatric operations with confidence is indispensable to perform successful obesity surgery with sustained enhancement of QoL and life expectancy.[90]

LSG should not be viewed as a universal procedure. It is definitely a good treatment option as the excess weight loss is comparable to that of malabsorption procedures and has the advantage of lower rate of complications similar to that of restrictive procedures. However, it should be performed in a more standardized manner and with due regard to future long-term results.

CONCLUSION

LSG is a safe and effective weight loss procedure. Resolution of comorbidity, health-related QoL and food tolerance were comparable with that of RGB with lower incidence of complications comparable to gastric banding. However, there is need for standardization of the procedure and long-term results are yet to be analyzed.

REFERENCES

1. World Health Organization. Obesity: Preventing and managing the global epidemic. Report of a WHO consultation. WHO Tech Rep Ser 2000;894:1-253.
2. Buchwald H, Buchwald JN. Evolution of operative procedures for the management of morbid obesity 1950-2000. Obes Surg 2002;12:705-17.
3. Colquitt JL, Picot J, Loveman E, et al. Surgery for obesity. Cochrane Database Syst Rev 2009;15:CD003641.
4. Adams KF, Schatzkin A, Harris TB, et al. Overweight, obesity, and mortality in a large prospective cohort of persons 50 to 71 years old. N Engl J Med 2006;355:763-78.
5. Fried M, Hainer V, Basdevant A, et al. Inter-disciplinary European guidelines on surgery of severe obesity. Int J Obes 2007;31:569-77.
6. American society for bariatric surgery, society of american gastrointestinal endoscopic surgeons. Guidelines for laparoscopic and open surgical treatment of morbid obesity. Obes Surg 2000;10:378-79.
7. Buchwald H, Estok R, Fahrbach K, et al. Weight and type 2 diabetes after bariatric surgery: A systemic review and meta-analysis. Am J Med 2009;122:248-56.

8. Christou NV, Sampalis JS, Liberman M, et al. Surgery decreases long-term mortality, morbidity, and health care use in morbidly obese patients. Ann Surg 2004;240:416-23.
9. O'Brien PE, Dixon JB, Laurie C, et al. Treatment of mild to moderate obesity with laparoscopic adjustable gastric banding or an intensive medical program: A randomized trial. Ann Intern Med 2006;144:625-33.
10. Crocker MK, Yanovski JA. Pediatric obesity: Etiology and treatment. Endocrinol Metab Clin North Am 2009;38:525-48.
11. Ren CJ, Patterson E, Gagner M. Early results of laparoscopic biliopancreatic diversion with duodenal switch: A case series of 40 consecutive patients. Obes Surg 2000;10:514-23.
12. Regan JP, Inabnet WB, Gagner M, Pomp A. Early experience with two-stage laparoscopic Roux-en-Y gastric bypass as an alternative in the super-super-obese patient. Obes Surg 2003;13: 861-64.
13. Himpens J, Dapri D, Cadière GB. A prospective randomized study between laparoscopic gastric banding and laparoscopic isolated sleeve gastrectomy: Results after 1 and 3 years. Obes Surg 2006;16:1450-56.
14. Moon Han S, Kim WW, Oh JH. Results of laparoscopic sleeve gastrectomy (LSG) at 1 year in morbidly obese Korean patients. Obes Surg 2005;15:1469-75.
15. Till H, Blücher W, Kiess W. Efficacy of laparoscopic sleeve gastrectomy (LSG) as a stand-alone technique for children with morbid obesity. Obes Surg 2008;18:1047-49.
16. Roa P, Kaidar-Person O, Pinto D, Cho M, Szomstein S, Rosenthal RJ. Laparoscopic sleeve gastrectomy as treatment for morbid obesity: Technique and short-term outcome. Obes Surg 2006;16:1323-26.
17. Arias E, Martinez PR, Ka Ming Li V, Szomstein S, Rosenthal R. Mid-term follow-up after sleeve gastrectomy as a final approach for morbid obesity. Obes Surg 2009;19:544-48.
18. Buchwald H, Rucker RD. The rise and fall of jejunoileal bypass. In: Nelson RL, Nyhus LM (eds). Surgery of the small intestine. Appleton Century Crofts, Norwalk, CT, 1987;529-41.
19. Scopinaro N, Gianetta E, Civalleri D, et al. Biliopancreatic bypass for obesity: II initial experience in man. Br J Surg 1979;66:618-20.
20. Marceau P, Biron S, Bourque R-A, et al. Biliopancreatic diversion with a new type of gastrectomy. Obes Surg 1993;3:29-35.
21. Gagner M, Patterson E. Laparoscopic biliopancreatic diversion with duodenal switch. Dig Surg 2000;17:547-66.
22. Mason EE, Ito C. Gastric bypass in obesity. Surg Clin North Am 1967;47:1845-52.
23. Buchwald H, et al. Consensus conference statement bariatric surgery for morbid obesity: Health implications for patients, health professionals, and third-party payers. J Am Coll Surg 2005;200:593-604.
24. Wittgrove AC, Clark GW. Laparoscopic gastric bypass, Roux-en-Y-500 patients: Technique and results, with 3 to 60 months follow-up. Obes Surg 2000;10:233-39.
25. Schauer PR, Ikramuddin S, Gourash W, et al. Outcomes after laparoscopic Roux-en-Y gastric bypass for morbid obesity. Ann Surg 2000;232:515-29.
26. de la Torre RA, Scott JS. Laparoscopic Roux-en-Y gastric bypass: A totally intra-abdominal approach: Technique and preliminary report. Obes Surg 1999;9:492-98.
27. DeMaria EJ, Sugerman HJ, Kellum JM, Meador JG, Wolfe LG. Results of 281 consecutive total laparoscopic Roux-en-Y gastric bypasses to treat morbid obesity. Ann Surg 2002;235:640-45 discussion 645-47.
28. Higa KD, Boone KB, Ho T, et al. Laparoscopic Roux-en-Y gastric bypass for morbid obesity: Technique and preliminary results of our first 400 patients. Arch Surg 2000;9:1029-33.
29. Printen KJ, Mason EE. Gastric surgery for relief of morbid obesity. Arch Surg 1973;106:428-31.
30. Mason EE. Vertical banded gastroplasty. Arch Surg 1986;152: 413-16.
31. Chua TY, Mendiola RM. Laparoscopic vertical banded gastroplasty: The milwaukee experience. Obes Surg 1995;5: 77-80.
32. Champion JK, Hunt T, DeLisle N. Role of routine intraoperative endoscopy in laparoscopic bariatric surgery. Surg Endosc 2002;6:1663-65.
33. Kuzmak LI. A review of seven years' experience with silicone gastric banding. Obes Surg 1991;1:403-08.
34. Belachew M, Legrand MJ, Defechereux TH, et al. Laparoscopic adjustable silicone gastric banding in the treatment of morbid obesity: A preliminary report. Surg Endosc 1994;8:1354-56.
35. Buchwald H, Williams SE. Bariatric surgery worldwide 2003. Obes Surg 2004;14:1157-64.
36. Hamoui N, Anthone GJ, Kaufman HS, Crookes PF. Sleeve gastrectomy in the high-risk patient. Obes Surg 2006;16: 1445-49.
37. Moon Han S, Kim WW, Oh JH. Results of laparoscopic sleeve gastrectomy (LSG) at 1 year in morbidly obese korean patients. Obes Surg 2005;15:1469-75.
38. Himpens J, Dapri G, Cadiere GB. A prospective randomized study between laparoscopic gastric banding and laparoscopic isolated sleeve gastrectomy: Results after 1 and 3 years. Obes Surg 2006;16:1450-56.
39. Cottam D, Qureshi FG, Mattar SG, et al. Laparoscopic sleeve gastrectomy as an initial weight-loss procedure for highrisk patients with morbid obesity. Surg Endosc 2006;20:859-63.
40. Milone L, Strong V, Gagner M. Laparoscopic sleeve gastrectomy is superior to endoscopic intragastric balloon as a first-stage procedure for superobese patients (BMI C50). Obes Surg 2005; 15:612-17.
41. Braghetto I, Korn O, Valladares H, et al. Laparoscopic sleeve gastrectomy: Surgical technique, indications and clinical results. Obes Surg 2007;17:1442-50.
42. Roa PE, Kaidar-Person O, Pinto D, et al. Laparoscopic sleeve gastrectomy as treatment for morbid obesity: Technique and short-term outcome. Obes Surg 2006;16:1323-26.
43. Silecchia G, Boru C, Pecchia A, et al. Effectiveness of laparoscopic sleeve gastrectomy (first stage of biliopancreatic diversion with duodenal switch) on comorbidities in superobese high-risk patients. Obes Surg 2006;16:1138-44.
44. Vidal J, Ibarzabal A, Nicolau J, et al. Short-term effects of sleeve gastrectomy on type 2 diabetes mellitus in severely obese subjects. Obes Surg 2007;17:1069-74.
45. Weiner RA, Weiner S, Pomhoff I, et al. Laparoscopic sleeve gastrectomy: Influence of sleeve size and resected gastric volume. Obes Surg 2007;17:1297-1305.
46. Lee CM, Cirangle PT, Jossart GH. Vertical gastrectomy for morbid obesity in 216 patients: Report of two-year results. Surg Endosc 2007;21:1810-16.
47. De Luca M, Segato G, Bussetto L, et al. Progress in implantable gastric stimulation: Summary of results of the European multicenter study. Obes Surg 2004;14(Suppl 1):S33-S39.
48. Gastrointestinal surgery for severe obesity: Consensus development conference statement. Ann Intern Med 1991;115: 956-61.
49. Mason EE, Ito C. Gastric bypass. Ann Surg 1969;170:329-39.

50. Griffen WO, Bivins BA, Bell RM, Jackson KA. Gastric bypass for morbid obesity. World J Surg 1981;5:817-22.
51. Linner JH. Comparative effectiveness of gastric bypass and gastroplasty. Arch Surg 1982;117:695-700.
52. Sugerman HJ, Londrey GL, Kellum JM, et al. Weight loss with vertical banded gastroplasty and Roux-en-Y gastric bypass for morbid obesity with selective vs random assignment. Am J Surg 1989;157:93-102.
53. Hall JC, Watts JM, O'Brien PE, et al. Gastric surgery for morbid obesity: The Adelaide Study. Ann Surg 1990;211:419-27.
54. Brolin RE, Kenler HA, Gorman JH, Cody R. Long-limb gastric bypass in the superobese: A prospective randomized trial. Ann Surg 1991;215:387-95.
55. MacLean LD, Rhode BM, Sampalis J, Forse RA. Results of the surgical treatment of obesity. Am J Surg 1993;165:155-62.
56. Pories WJ, Swanson MS, MacDonald KG, et al. Who would have thought it? An operation proves to be the most effective therapy for adult-onset of diabetes mellitus. Ann Surg 1995;222: 339-52.
57. Capella JF, Capella RF. The weight reduction operation of choice: Vertical banded gastroplasty or gastric bypass. Am J Surg 1996;171:74-79.
58. Fobi MAL, Lee H, Holness R, Cabinda D. Gastric bypass operation for obesity. World J Surg 1998;22:925-35.
59. MacLean LD, Rhode B, Nohr CW. Late outcome of isolated gastric bypass. Ann Surg 2000;231:524-28.
60. Brolin RE, et al. Long-limb gastric bypass in the superobese. A prospective randomized study. Ann Surg 1992;215:387-95.
61. Choban PS, Flancbaum L. The effect of roux limb lengths on outcome after Roux-en-Y gastric bypass: A prospective randomized clinical trial. Obes Surg 2002;12:540-45.
62. Griffen WO Jr, Young L, Stevenson CC. A prospective comparison of gastric and jejunoileal bypass procedures for morbid obesity. Ann Surg 1977;186:500-09.
63. Hall JC, et al. Gastric surgery for morbid obesity. The Adelaide study. Ann Surg 1990;211:419-27.
64. Laws HL, Piantadosi S. Superior gastric reduction procedure for morbid obesity. A prospective, randomized trial. Ann Surg 1981;193:334-40.
65. Mclean LD, et al. Surgery for obesity—an update of a randomized trial. Obes Surg 1995;5:145-50.
66. Nguyen NT, et al. Laparoscopic vs open gastric bypass: A randomized study of outcomes, quality of life, and costs. Ann Surg 2001;234:279-89.
67. Pories WJ, et al. The effectiveness of gastric bypass over gastric partion in morbid obesity. Consequence of distal gastric and duodenal exclusion. Ann Surg 1982;194:389-99.
68. Sugarman HJ, et al. Weight loss with vertical banded gastroplasty and Roux-Y bypass for morbid obesity with selective vs random assignment. Am J Surg 1989;157:93-102.
69. Westling A, Gustavsson S. Laparoscopic *vs* open Rouxen-Y gastric bypass: A prospective, randomized trial. Obes Surg 2001;11:284-92.
70. Gagner M, Deitel M, Kalberer TL, et al. The second international consensus summit for sleeve gastrectomy, March 19-21, 2009. Surg Obes Relat Dis 2009;5:476-85.
71. Gumbs AA, Gagner M, Dakin G, et al. Sleeve gastrectomy for morbid obesity. Obes Surg 2007;17:962-69.
72. Frezza EE, Reddy S, Gee LL, et al. Complications after sleeve gastrectomy for morbid obesity. Obes Surg 2009;19:684-87.
73. Menenakos E, Stamou KM, Albanopoulos K, et al. Laparoscopic sleeve gastrectomy performed with intent to treat morbid obesity: A prospective single-center study of 261 patients with a median follow-up of 1 year. Obes Surg 2010;20:276-82.
74. Akkary E, Duffy A, Bell R. Deciphering the sleeve: Technique, indications, efficacy, and safety of sleeve gastrectomy. Obes Surg 2008;18:1323-29.
75. Todkar JS, Shah SS, Shah PS, et al. Long-term effects of laparoscopic sleeve gastrectomy in morbidly obese subjects with type 2 diabetes mellitus. Surg Obes Relat Dis 2010;6:142-45.
76. Vidal J, Ibarzabal A, Romero F, et al. Type 2 diabetes mellitus and the metabolic syndrome following sleeve gastrectomy in severely obese subjects. Obes Surg 2008;18:1077-82.
77. Langer FB, Bohdjalian A, Felberbauer FX, et al. Does gastric dilatation limit the success of sleeve gastrectomy as a sole operation for morbid obesity? Obes Surg 2006;16:166-71.
78. Baltasar A, Serra C, Pérez N, et al. Re-sleeve gastrectomy. Obes Surg 2006;16:1535-38.
79. Baker RS, Foote J, Kemmeter P, et al. The science of stapling and leaks. Obes Surg 2004;14:1290-1308.
80. Consten EC, Gagner M, Pomp A, et al. Decreased bleeding after laparoscopic sleeve gastrectomy with or without duodenal switch for morbid obesity using a stapled buttressed absorbable polymer membrane. Obes Surg 2004;14:1360-66.
81. Chen B, Kiriakopoulos A, Tsakayannis D, et al. Reinforcement does not necessarily reduce the rate of staple line leaks after sleeve gastrectomy. A review of the literature and clinical experiences. Obes Surg 2009;19:166-72.
82. Ramos A, Galvao Neto M, Galvao M, et al. Laparoscopic greater curvature plication: Initial results of an alternative restrictive bariatric procedure. Obes Surg 2010;20:913-18.
83. Tucker ON, Szomstein S, Rosenthal RJ. Indications for sleeve gastrectomy as a primary procedure for weight loss in the morbidly obese. J Gastrointest Surg 2008;12:662-67.
84. Weiner RA, Weiner S, Pomhoff I, et al. Laparoscopic sleeve gastrectomy-influence of sleeve size and resected gastric volume. Obes Surg 2007;17:1297-1305.
85. Fuks D, Verhaeghe P, Brehant O, et al. Result of laparoscopic sleeve gastrectomy: A prospective study in 135 patients with morbid obesity. Surgery 2009;145:106-13.
86. Dapri G, Vaz C, Cadière GB, et al. A prospective study comparing two different techniques for laparoscopic sleeve gastrectomy. Obes Surg 2007;11:1435-41.
87. Baltasar A, Serra C, Pérez N, et al. Laparoscopic sleeve gastrectomy: A multi-purpose bariatric operation. Obes Surg 2005;15:1124-28.
88. Shen R, Dugay G, Rajaram K, et al. Impact of patient follow-up on weight loss after bariatric surgery. Obes Surg 2004;14:514-19.
89. Buchwald H. A bariatric surgery algorithm. Obes Surg 2002;12: 733-46.
90. Hollenbeak CS, Rogers AM, Barrus B, et al. Surgical volume impacts bariatric surgery mortality: A case for centers of excellence. Surgery 2008;144:736-43.

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CASE REPORT

Chronic Mesenteroaxial Gastric Volvulus and Congenital Diaphragmatic Hernia: Successful Laparoscopic Repair

Nitinkumar Bhajandas Borkar, Nitin Pant, Satish Kumar Aggarwal

ABSTRACT

Gastric volvulus is a rare cause of recurrent abdominal pain in children. Usually it is associated with diaphragmatic pathology. A 9-year-old boy presented with recurrent abdominal pain and vomiting. Investigations confirmed a volved stomach in the left chest and a left congenital diaphragmatic hernia (CDH). Laparoscopic reduction and repair of CDH was performed successfully. The stomach was devolved and reduced into the abdomen. No gastropexy was performed. The patient is asymptomatic 2 years after surgery.

Traditional treatment of gastric volvulus has been derotation and gastropexy with the anterior abdominal wall. Our case shows that gastropexy may not be needed in all cases. Also, this is perhaps the first case to undergo laparoscopic repair of CDH and gastric volvulus in pediatric population.

Keywords: Gastric volvulus, Congenital diaphragmatic hernia, Laparoscopy.

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INTRODUCTION

Congenital diaphragmatic hernia (CDH) results from failure of pleuroperitoneal canal to close around 6th and 8th weeks of gestation. Although neonatal presentation with respiratory distress is common presentation, delayed presentation and incidental detection is also well known. Association of CDH with mesenteroaxial volvulus of the stomach is also well known. In children, mesenteroaxial is the most common type of gastric volvulus and association with anatomic defects is a rule.[1] Although laparoscopic repair of CDH was reported as early as 1995, there is no report of concomitant correction of symptomatic gastric volvulus.[2] Also the traditional treatment of gastric volvulus has been reduction and gastropexy. Here, we report a case of CDH with mesenteroaxial gastric volvulus, which was managed laparoscopically. No gastropexy was done.

CASE REPORT

A 9-year-old boy presented with history of episodic non-bilious vomiting and recurrent colicky abdominal pain for a year. There was no history of constipation, fever or a prior surgery. On examination there was fullness in upper abdomen but no tenderness. Bowel sounds were normal. There was decreased air entry in the left lower lobe. Rest of the examination was normal. Plain X-ray showed elevated left dome of diaphragm and a large air fluid level just beneath it. Rest of the bowel gas pattern was normal. Visualized lung fields were normal. A nasogastric tube could be easily passed. About 500 ml gastric nonbilious fluid was aspirated with relief from distension. Eventration of diaphragm with volvulus was suspected. A contrast enhanced computed tomographic (CT) scan showed a volved stomach with air fluid level in the left chest and diaphragmatic hernia (Fig. 1).

In view of associated gastric volvulus, laparoscopic approach was used rather than thoracoscopy. Under general anesthesia in supine position, a 10 mm primary port was inserted by open technique. Pneumoperitoneum was created using 10 mm Hg pressure. Two working ports of 5 mm each were inserted in the right and left upper abdomen respectively. An epigastric port was inserted for retracting the liver. The left side was elevated to facilitate the operation. Additionally, the falciform ligament was hooked up with a stitch. The left triangular ligament was taken down to retract the left lobe of liver. A large posterolateral defect in the diaphragm was found, through which the stomach, spleen and part of small bowel and large bowel was herniating (Fig. 2). Intestines were reduced with gentle pull. The spleen was reduced with the help of the shaft of the 5 mm Babcock forceps. The margins of the defect were

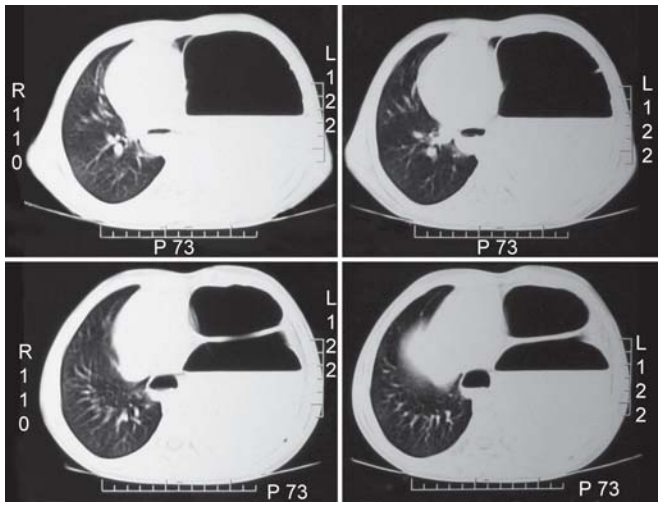

Fig. 1: CT chest showing left diaphragmatic hernia and gastric volvulus

freshened with diathermy. The defect was closed by interrupted polyglactin 2/0 sutures using intracorporeal knotting (Fig. 3). Chest tube was inserted under guidance before taking the last two bites. The viscera were placed in the normal anatomical position. Hemostasis was checked and port sites closed. Postoperative chest X-ray showed satisfactory profile of the left diaphragm and expanded lung (Fig. 4). The nasogastric tube was removed on the 3rd day and feeds started. The child was discharged on the 5th postoperative day. He has remained asymptomatic during a 2 years follow-up.

DISCUSSION

Gastric volvulus can occur in both adults and children. In 1866, Berti reported a mortality secondary to an isolated acute gastric volvulus.[3] In 1904, Borchardt described the clinical features of acute gastric volvulus which later denominated as 'Borchardt's triad': Acute localized epigastric distension, inability to pass the nasogastric tube and unproductive retching.[4] This triad may not always present in children, as in our case where we were able to pass the nasogastric tube. Delayed presentation of CDH has been reported at all ages and account for 5 to 10% of all CDH.[5] Patients can present with either digestive or respiratory symptoms. Pulmonary hypoplasia, usually a major prognostic factor in neonate, is often minor or nonexistent in this setting. Cameron and Howard found congenital diaphragmatic hernia in 65% of children with gastric volvulus and 84% of those less than 1 month.[6] The high frequency of this association may be explained by the increased space around the stomach under the left diaphragmatic defect and by the laxity of gastrophrenic and gastrosplenic ligament. Surgical treatment is the primary mode of therapy. Traditionally, it includes reduction of the contents, repair of the defect and fixation of the stomach. Contrary to the popular belief, we have not done any gastric fixation in our case. Once the defect was repaired all the viscera occupied the normal anatomical position. Therefore, the extra space around the stomach was obliterated. No extra manoeuvre was required to keep the stomach in its normal position below the left lobe of liver and to the right of the spleen. No gastropexy was, therefore, felt necessary. We feel that gastropexy should be an essential step in idiopathic type of gastric volvulus. A review of 77 cases of gastric volvulus in children described three recurrences, two of which were seen in patients who had undergone reduction only without anterior gastropexy. The third recurrence, however, was seen after reduction and anterior gastropexy.[1] There was no recurrence in the group where reduction and repair of associated defect had been performed. We have not performed gastropexy in our case and the patient has not had a recurrence during 2 years follow-up. Although the tradition favors fixing the stomach, we feel that the main reason for repeated volvulus in our case was availability of free space within the hernia. Once this space was obliterated

Fig. 2: Laparoscopic view of the defect. Chest wall is seen through the defect

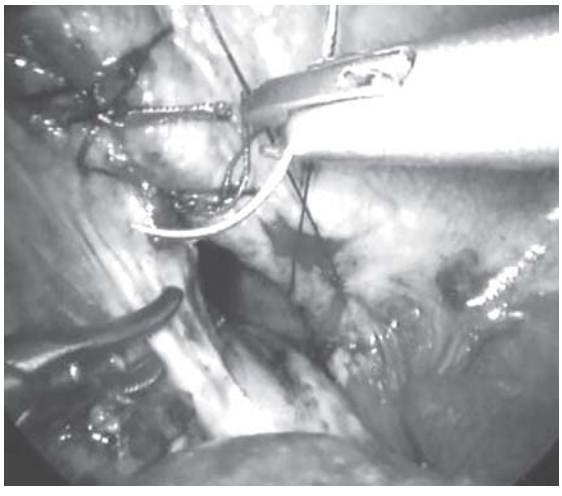

Fig. 3: Laparoscopic view showing suturing of the defect

Fig. 4: Postoperative chest X-ray showing normal position of diaphragm

by reducing the contents and repairing the defect, the causative factor was gone and the stomach was restored to its normal anatomic confines. However, we are unable to recommend omitting gastropexy based on a single case. Perhaps more anatomical studies could throw light on this aspect of the treatment.

Usual minimal invasive approach to diaphragmatic hernia is thoracoscopic. We chose to do laparoscopy because we are more familiar with this approach. We do open repair also by abdominal route. Also, it is more useful to detect and treat abnormalities of gut position. The mobilization of the left lobe of liver (especially if it forms a part of the contents) is also easier through the laparoscopic approach. The posterior lip of the defect is better defined after incising the overlying posterior peritoneum. This incision, we believe, is easier and well controlled, if performed laparoscopically. We feel that the choice of the approach should depend upon the surgeon's preference, anatomical defect and associated problems.

REFERENCES

1. Miller DL, Pasquale MD, Seneca RP, Hodin E. Gastric volvulus in the pediatric population. Arch Surg 1991 Sep;126(9): 1146-49.
2. Van der Zee DC, Bax NM. Laparoscopic repair of congenital diaphragmatic hernia in a 6-month-old child. Surg Endosc 1995 Sep;9(9):1001-03.
3. Berti A. Singolare attortigliamento dell esofago colduodeno seguito da rapido morte. Gazz Med 1866. Ital 9:136.
4. Borchardt M. Zur Pathologic und therapie des magen volvulus. Arch Klin Chir 1904;74:243-60.
5. Berman L, Stringer DA, Ein S, Shandling B. Childhood diaphragmatic hernias presenting after the neonatal period. Clin Radiol 1988 May;39(3):237-44.
6. Cameron AE, Howard ER. Gastric volvulus in childhood. J Pediatr Surg 1987 Oct;22(10):944-47.

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CASE REPORT

Tack Sinus: A New Complication of Laparoscopic Ventral Hernia Repair

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ABSTRACT

In this era of laparoscopic surgery, laparoscopic repair of ventral hernia is gaining popularity due to faster recovery, shorter hospital stay and lower recurrence rates. In obese patients it is a technically easier procedure than open repair. However, this new method requires advanced technologies. Transfacial sutures and tacks are the usual methods to fix the mesh to the anterior abdominal wall. These methods, however, have their own complications. This article is to report an unusual complication of tacks migrating and trying to extrude out of anterior abdominal wall, forming chronic sinuses.

Keywords: Laparoscopy, Tack, Sinus.

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INTRODUCTION

Laparoscopic ventral hernia repair (LVHR) has gained popularity over the recent years ever since introduced by Karl Leblanc in 1992. It has a number of advantages over traditional open hernia repair.[1] It continues to gain popularity because of its low rates of complications and hernia recurrence and short hospital stay and short recovery times.[2] There are various methods of mesh fixation. Currently, two methods of mesh fixation are commonly employed. One involves placement of both transabdominal sutures (TAS), either absorbable or nonabsorbable, and tacks; the other entails insertion of two circles of tacks without TAS [the double-crown (DC) technique].[3] Numerous studies have proven that transfacial sutures are a must for fixing the mesh in terms of strength while the tacks provide extra reinforcement. However, fixing with transfacial sutures takes a longer time[4] and is a more tedious process. Tacks are used in laparoscopic ventral hernia repair to decrease the operative time and the number of subcutaneous prolene knots of the transfacial sutures are used. Moreover, the ease of their application makes their use even more appealing.

However, usage of tacks has its own disadvantages and complications. Besides being expensive, various complications have been reported like tack site pain,[5] tack hernia,[6] recurrence of hernia[7] and seroma formation. This is a case report of a new complication that has not been reported so far in literature, i.e. migration of tacks through the anterior abdominal wall forming multiple sinuses which henceforth may be referred to as 'tack sinus'.

CASE REPORT

A 50-year-old diabetic lady, underwent elective laparoscopic paraumbilical mesh hernia repair on 25.06.10 under general anesthesia. Two ports were used. One 10 mm port at Palmar's point and a 5 mm port placed laterally in the left flank. All adhesions were released. Dual mesh was introduced through the 10 mm port. This mesh was sized to lie 3 cm beyond the size of the defect. It was fixed with prolene transfacial sutures at all the four corners and in the center at the site of the defect. The fixation was further enforced by using tacks (nonabsorbabale helical titanium) at the periphery and around the defect (DC method). Total number of 15 tacks were used. Postoperative recovery of the patient was uneventful and patient was discharged on 2nd day postoperative. Port site sutures were removed on 8th day.

She presented 8 weeks later with two discharing sinuses on the anterior abdominal wall in the infraumbilical region. The serous discharge and scrapings from these sinuses was thoroughly investigated by culture sensitivity of the discharge for routine and tuberculous culture and sensitivity. acid-fast bacillus (AFB) staining of the discharge showed no tuberculous bacilli. There was no growth seen in either of the cultures. Patient was treated with regular curettage and dressings. Patient was, however, lost to follow-up.

This patient presented to us again in the month of October 2011. At this visit she had four discharging sinuses in the infraumbilical region. This time too the discharge was serous in nature. Induration was felt at the site of the discharging sinuses. A soft tissue scan of the anterior abdominal wall showed these sinus tracts extending up to the fascia only. The lower two of these sinuses were multi-truncated. An exploration and excision of these sinuses was planned.

Intraoperatively, it was seen that these sinuses were formed of very thick fibrous tissue. To our surprise two of these sinus tracks had the spiral tacks in them above the level of fascia. These tacks had dragged the mesh along with them. A few millimeter length of the mesh was protruding in each of these two sinuses. However, the mesh

did not look infected. These sinus tracks along with the bit of mesh were excised (Fig. 1). The other two sinus tracts contained the prolene sutures used for transfacial fixation of the mesh (Fig. 2). All these sinues extended from the skin upto external oblique aponeurosis only.

After excising the tracts, defects in the external oblique aponeurosis were closed with 1-0 prolene (Fig. 3). Since, the mesh did not look infected and all cultures were negative, a decision was made not to remove the mesh. A primary closure of skin and subcutaneous tissue was done. Patient did well postoperatively. All wounds healed well and now patient is 5 months postoperative and doing well.

DISCUSSION

Laparoscopic repair of ventral hernia was introduced in the early 1990s. Since, then newer and newer methods of mesh fixation are being introduced. Majority of the published reports advocate the mandatory use of transfacial sutures[8] and further fixation may be achieved by various fixation devices available. Park et al first popularized the use of sutures in 1996.[9] In recent times different types of fixation devices are available for reinforcing the fixation of the mesh. A few types of such tacks available are compared in the table below:

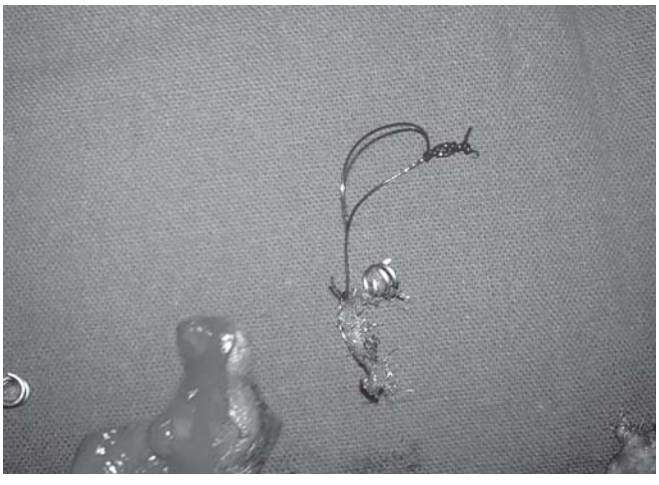

Fig. 1: Contents of sinus tracts

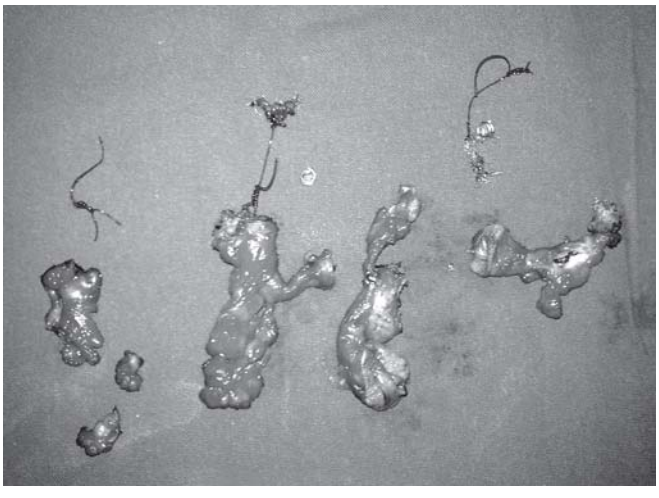

Fig. 2: Sinuses with sutures and tacks

Fig. 3: After sinus excision

LVHR involves using a mesh and fixing it to the anterior abdominal wall using sutures and fixation devices. Transabdominal prolene nonabsorbable sutures are used to fix the mesh. However, the chief disadvantage is that the knots of these sutures can be felt in the subcutaneous plane and can cause significant discomfort to the patient. Moreover, application of these sutures is a tedious process. With different types of fixation devices e.g. tacks being available over the recent years and the ease of their application has made their use more appealing. The list of these fixation devices is as shown in the Table 1. Of these the most commonly used ones are tacks. Nonabsorbable titanium helical tacks are deployed through the mesh to fix it to the anterior abdominal wall (peritoneum to preperitoneum). They are compatible with magnetic resonance imaging and inert in tissue. However, the use of

Table 1: Few of the types of tacks available

Type	*Composition*	*Degradation*
Absorbable ethicon SecureStrap™ 5 mm strap device	Blend of polydioxanone dyed with D and C violet #2 and an L lactide/ glycolide copolymer	Hydrolysis by 12 to 18 months
Absorbable 5 mm spiral tapered construct AbsorbaTack™	Synthetic polyester copolymer derived from lactic and glycolic acid	Hydrolysis by 1 year
Absorbable 5 mm spiral construct Sorbafix™	Poly (D, L)–Lactide (PLA)	Degrades by 1 year post-implantation
Nonabsorbable titanium helical fastners protack	Titanium	

tacks has its own disadvantages. Acute problems that occur with nonabsorbable tacks may be related to patient characteristics such as morbid obesity, to difficulty getting the tack to penetrate and secure the mesh adequately and various device malfunctions.[10]

Tacks are known to cause pain like transfacial sutures. Even though a permanent metal tack is not reactive in the sense of causing allergy there is still inflammation around it and inflammation near a nerve running through a muscle causes pain that can be quite disabling[8] similar pain can be noted with absorbable tacks but its absorption will decrease the pain to a considerable limit. The only issue of concern, however, with absorbable tacks was the over all strength of attachment to abdominal wall. Recurrence of hernia with only the use of tacks is higher when compared to reinforcement of the mesh with transabdominal sutures. Hence, suture fixation was stronger than tacks alone.[8]

Two incidences of tack site hernia have been reported. The hernial defect was seen between the sutures rather than the site of suture evidently showing that tacks were responsible for the same.[6] Seroma formation is a common complication after LVHR.[8]

Migration of tacks can occur if not appropriately placed and they can drop into the peritoneal cavity and serve as lead points causing small bowel obstruction at any point in the near or distant future.[10] The length of these helical tacks is 4 mm and width is approximately 3 mm. This penetrates approximately 3 to 4 mm into these tissues.

We, however, encountered a case of migration of tacks, not a case of drop into the peritoneal cavity, but migration to the anterior abdominal wall forming multiple sinus tracts. This discovery of tacks migrating anteriorly toward the abdominal wall is a completely new finding. Our patient had an obese abdomen and a thin anterior abdominal wall was not encountered to give these tacks an easy way out. Two of these sinuses had spiral tracks along with which a part of the mesh was also protruding. The fact that these tacks were placed in between prolene sutures makes it unlikely that the latter was responsible for migration of these tacks. Is it possible that the spiral design helps propel the tack every time there is a sudden rise in inraperitoneal pressure? And due to their nonabsorbable nature is it possible that migration of these tacks may occur years later?

CONCLUSION

Tacks are a convenient and quick way of fixing a mesh in LVHR. However, their use has it's own complications like pain, mesh migration, hernia, etc. As more and more LVHRs are done these complications are being reported, and one needs to be aware of these in order to tackle them rightly or better still avoid them. Newer technologies may help manufacture better configured and bioabsorbable tacks.

REFERENCES

1. McGreevy JM, Goodney PP, Birkmeyer CM, Finlayson SRG, Laycock WS, Birkmeyer JD. A prospective study comparing the complication rates between laparoscopic and open ventral hernia repairs. Surg Endosc 2003;17:1778-80.
2. Sajid MS, Bokhari SA, Mallick AS, Cheek E, Baig MK. Laparoscopic versus open repair of incisional/ventral hernia: A meta-analysis. Am J Surg 2008;197:64-72.
3. Morales-Conde S, Cadet H, Cano H, Bustos M, Martin J, Morales-Mendez S. Laparoscopic ventral hernia repair without sutures—double crown technique: Our experience after 140 cases with a mean follow-up of 40 months. Int Surg 2005; 90(3 Suppl):S56-62.
4. Wassenaar EB, Raymakers JTFJ, Rakic S. Impact of the mesh fixation technique on operation time in laparoscopic repair of ventral hernias. Hernia 2008;12:23-25.
5. Wassenaar E, Schoenmaeckers E, Raymakers J, van der Palen J, Rakic S. Mesh-fixation method and pain and quality of life after laparoscopic ventral or incisional hernia repair: A randomized trial of three fixation techniques. Surg Endosc 2010;24:1296-1302.
6. LeBlanc KA. Tack hernia: A new entity. JSLS 2003;7: 383-87.
7. Koehler RH, Voeller G. Recurrences in laparoscopic incisional hernia repairs: A personal series and review of the Literature. JSLS 1999;3:293-304.
8. LeBlanc KA. Incisional and ventral hernia repair. Controversies in laparoscopic surgery 30:385-96.
9. Park A, Gagner M, Pomp A. Laparoscopic repair of large incisinal hernias. Surg Laparosc Endosc 1996;6:123-28.
10. Gillian GK, Bell R, Kroh M. Advances in absorbable fixation devices for laparoscopic ventral hernia repair. General Surgery News 2009 June;36:05.

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CASE REPORT

Laparoscopic Diagnosis and Management of Splenogonadal Fusion: Case Report and Review of Literature

Medhat M Ibrahim

ABSTRACT

Splenogonadal fusion is a rare congenital anomaly in which there is fusion of the spleen and the gonad or mesonephric derivatives. Approximately, 150 cases have been reported since the condition was first described by Bostroem in 1883.

The diagnosis of this uncommon anomaly is rare even to be suspected preoperatively; I describe a case in which laparoscopic diagnosis and management has been done and review of the literature.

Keywords: Splenogonadal fusion, Laparoscopic management of splenogonadal fusion.

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INTRODUCTION

Splenogonadal fusion is a rare entity with approximately 150 cases reported since the first description of this entity in 1883 by Bostroem. Close proximity of the spleen and gonad during early embryological development allows fusion, whether continuous or discontinuous, of these seemingly unrelated organs. The continuous type of splenogonadal fusion describes the gonad attached to the anatomic spleen. The discontinuous type consists of gonadal fusion with an accessory spleen or ectopic splenic tissue. The diagnosis of this uncommon anomaly is rare even to be suspected preoperatively. Laparoscope is more diagnostic than the ultrasound, computed tomographic (CT) scan, magnetic resonance imaging MRI and helpful in the management. I present a case of continuous splenogonadal fusion presenting as an impalpable left testicle. This case is unique in that the laparoscopic management in such condition after negative open groin exploration.

CASE PRESENTATION

An 11-year-old boy had impalpable left testis since birth. He had ultrasound, CT scan examinations and open groin exploration which reviled no left tests. Physical examination, apart from the left groin scar and the impalpable left tests, was unremarkable. Routine preoperative laboratory investigations were within normal range.

On laparoscopic exploration, a reddish brown, smooth cord of tissue measuring about 20 mm in diameter was observed to be coming from above to down in a peritoneal fold ending by fusion to the superior pole of the testis intra-abdominal higher to the internal ring of the inguinal canal (Fig. 1).

Grossly, the tubular cord had the appearance of splenic tissue having a serosal capsule and fibrous trabeculae and a vascular pedicle running on its medial aspect (Fig. 2). The splenic cord-like tissue fuse with upper pole of the testis, there was a line of demarcation between the different tissues. Laparoscopic-assisted left orchidopexy with preservation of the spleen was then performed. He has uneventful postoperative follow-up for 1 year.

Histopathological examination confirmed that specimen was splenogonadal fusion. There was no evidence of malignance.

DISCUSSION

This is case presents an unusual presentation of splenogonagal fusion. The case is unique in that it was diagnosed and managed with laparoscope. The meta-analysis of published reports of 111 boys with splenogonadal fusion found that 31% had cryptorchidism. Of these, 59% were bilateral, 26% had right intra-abdominal testes and 65% had left intra-abdominal testes. Of those with continuous splenogonadal fusion, 44% had cryptorchidism. Solely cryptorchid cases with splenogonadal fusion reportedly had bilateral absence of legs, imperforate anus, spina bifida, diaphragmatic hernia and hypospadias.[1]

About 120 to 150 cases of splenogonadal have been reported in the literature. Splenogonadal fusion is most commonly an incidental discover during a routine groin exploration for an undescended testis or hernia. While in our case, the surgeon how had done the open groin exploration could not find the testes because the testes and the cord were totally high intra-abdominal. Nearly, 17% of the splenogonadal fusions were diagnosed at autopsy.[2] Testicular or inguinoscrotal swelling was the most common presentation.[3] In this case, no scrotal or inguinal swelling farther more; there was a scare of negative open groin exploration. Karaman and Gonzales, 37% of 137 cases underwent an unnecessary orchiectomy because of suspicion

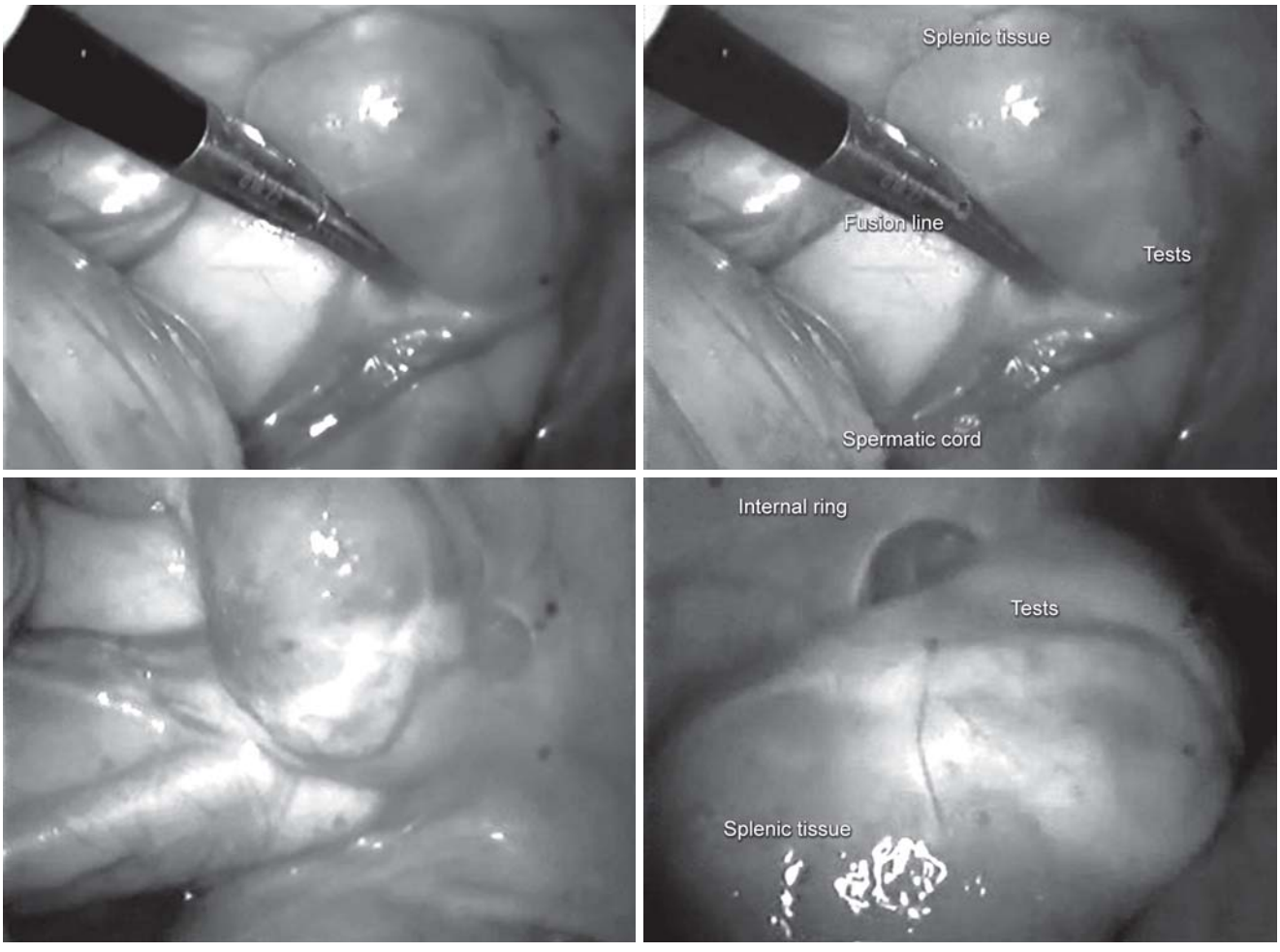

Fig. 1: These are multiple pictures of splenogonadal fusion

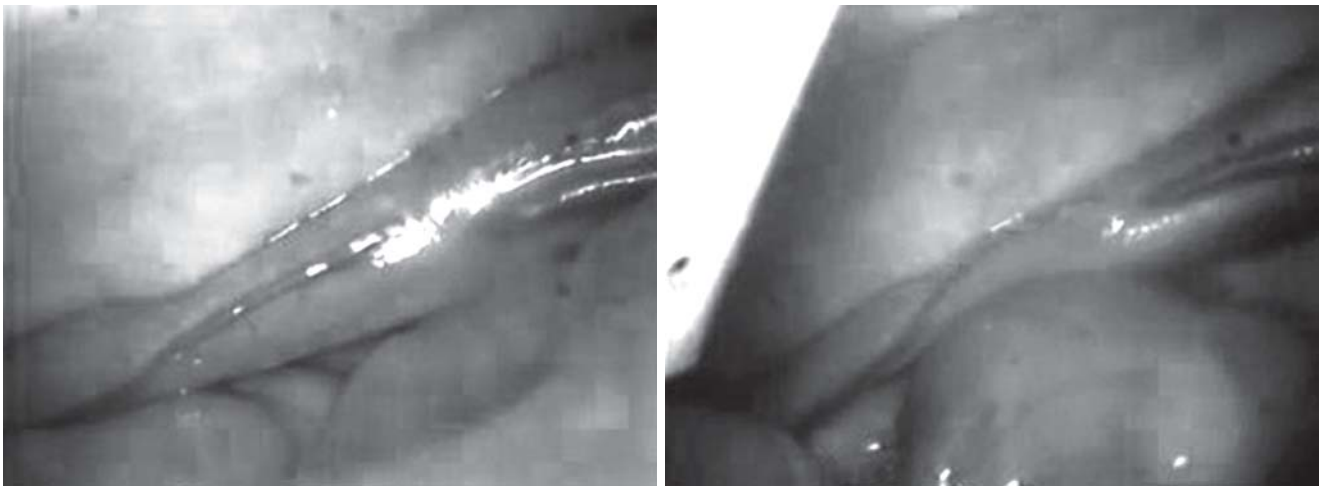

Fig. 2: This is splenic tissue with vascular pedicle on its surface

of a primary testicular neoplasm.[2] Only four were reported with a malignant testicular neoplasm and a coexistent splenogonadal fusion. Other presentations include that of an acute painful scrotal swelling secondary to affection of the ectopic splenic tissue by various processes. Talmann[4] and Settle[5] reported cases presented with acute scrotal pain and swelling secondary to malaria involvement of the ectopic splenic tissue. These patients' symptoms subsided as the malaria resolved. Acute torsion of the splenic tissue,[2] mumps, leukemia and mononucleosis[6] and traumatic rupture of the ectopic spleen[7] also presented as painful scrotal swellings. Mechanical bowel obstruction by the intraperitoneal cord of the continuous splenogonadal fusion was described by Hines and Eggum.[8] Sripathi[9] one case of

macroorchidism was reported. Few cases were diagnosed preoperatively. One of those was reported by Kadlic[10] in 1943. Three cases were diagnosed by 99mtc-sulfur colloid liver-spleen scan, one of them during workup of a patient with an undescended left testicle and associated limb malformations,[11] and two cases during evaluation of intra-abdominal mass.[12,13] Patel[14] diagnosed one case by ultrasonography when he followed a tubular process arising from the upper pole of the spleen down to the upper pole of a left undescended testis. Our case has the same anomalies of Patel case but it cannot suspect or diagnosed by ultrasound or CT scan prior to the previous surgery had done. He also noted movement of the upper splenic pole when applying traction to the testis. The left side is far commonly involved than the right side. Only three cases (2%) had a discontinuous right-sided splenogonadal fusion and were all male.[15,16] Half of the cases presented below 10 years[3] and 82% below 30 years.[2] It is predominant in male. Male-to-female ratio is about 1:16.[3]

Two forms of splenogonadal fusion have been described, continuous and discontinuous. The continuous form occurs when the anatomic spleen is connected by a discrete cord to the gonad. The discontinuous form consists of a fused splenogonadal structure that has lost continuity with the main spleen. This is a variant of an accessory spleen. The continuous type seems to be predominant.[17] Our case is continues type of splenogonadal fusion. A column of splenic tissue come out from the upper pole of the spleen and passing downward anterior to the anterior splenic boarder, swing to the left over the splenic flexure of the colon, then passé though left paracolic gatture to fuse with the left test in the abdominal cavity.

Two theories have been proposed to describe splenogonadal fusion. Von Hochstetter attempted to explain this entity by a retroperitoneal pathway for the splenic angle to come into contact with the developing gonad. In this theory, the splenic cells could potentially be found along the pathway of gonadal descent.[18,19] Sneath[20] proposed that inflammation over two opposing peritoneal surfaces, namely, the gonadal ridge and spleen, could cause fusion. During gonadal migration, the peritonealized adhesion would lengthen and develop as a cord continuous with the spleen or rupture during development, making it discontinuous with the spleen.[18] Because of the rarity of this condition it is infrequent to be diagnosed preoperatively.[21] Techniques of diagnostic imaging is available if there is a clinical suspicion of splenogonadal fusion. The most reliable preoperative imaging, according to published results, is technetium isotope scanning, which detects accessory splenic tissue.[21] Laparoscopic diagnosis of impalpable testes is superior to all investigation including ultrasound, CT scan, or even MRI.[22] Laparoscope was valuable and highly effective not only in the diagnosis but also in the management of this case. It should be pointed out that orchiectomy has been performed needlessly,[21] the unique in this case is the use of laparoscope in the diagnosis and management. The search of the database shows there is laparoscopic use in splenogonadal fusion.

CONCLUSION

Splenogonadal fusion is a rare condition, seldom to be malignant. Diagnostic imaging has a limited role in the evaluation of boys with undescended testes and it is related condition. I recommend that efforts be developed to increase routine use of laparoscope in the evaluation of a boy with cryptorchidism. Laparoscope is essential for diagnosis and management of simple, complex and rare anomalies associated with undescended testes such as splenogonadal fusion.

REFERENCES

1. Cartes D, Thorup JM, Visveld J. The pathogenesis of cryptorchidism and splenogonadal fusion: A new hypothesis. Br J Urol 1995 Jan;77:285-90.
2. Karaman MI, Gonzales ET Jr. Splenogonadal fusion: Report of 2 cases and review of the literature. J Urol 1996;155:309-11.
3. Carragher AM. One hundred years of splenogonadal fusion. Urology 1990;35:471-75.
4. Talmann IM. Nebenmilzen in nebenhoden und somenstrang. Virchows Arch Pathol Anat 1926;259:37.
5. Settle ER. The surgical importance of accessory spleens with a report of 2 cases. Amer J Surg 1940;50:22.
6. Andrews RW, Copeland DD, Fried FA. Splenogonadal fusion. J Urol 1985;133:1052-53.
7. Halvorsen JF, Stray O. Splenogonadal fusion. Acta Paed Scand 1978;67:379.
8. Hines JR, Eggum PR. Splenic-gonadal fusion causing bowel obstruction. Arch Surg 1961;83:887-89.
9. Sripathi V. Macro-orchidism may be an indicator of continuous splenogonadal fusion. BJU Int (England) 1999 Oct;84(6): 733- 34.
10. Kadlic T. Nebenmilz in einer angeborenen Skrotalhernie. Zentralbl All Pathol 1943;81:49.
11. Guarin U, Dumitrieva Z, Ashley SJ. Splenogonadal fusion—rare congenital anomaly demonstrated by 99mtc-sulphur colloid imaging: Case report. J Nucl Med 1975;16:922.
12. Falkowski WS, Carter MF. Splenogonadal fusion associated with an anaplastic seminoma. J Urol 1980;124:562-64.
13. Steinmetz AP, Rappaport A, Nikolov G, et al. Splenogonadal fusion diagnosed by spleen scintigraphy. J Nucl Med (United States) 1997;38(7):1153-55.
14. Patel RV. Splenogonadal fusion. J Pediatr Surg 1995;30: 873-74.
15. Gordeef M, Cuenant J. Rate surnumeraire a localisation scrotale. Maroc Med 1951;30:744-45.
16. Tiberio G, Colombo F, Panizzari GP. A Proposito di un caso di ectopia splenica nell'emiscroto destro (fusione gonadosplenica). Chirurgia 1965;20:193.

17. Putschar WGJ, Manion WC. Splenic-gonadal fusion. Am J Pathol 1956;32:15-28.
18. May JE, Bourne CW. Ectopic spleen in the scrotum: Report of two cases. J Urol 1974;111:120-23.
19. Von Hochstetter A. Milzgewebe im linken ovarium des linken individualteiles eines menschlichen thoracopagus. Virchows Arch 1953;324:36.
20. Sneath WA. An apparent third testicle consisting of a scrotal spleen. J Anat Physiol 1912-13;47:340.
21. William L, Duncan Jra, Mark A. Barraza. Splenogonadal fusion: A case report and review of literature. J Pedia Surg 2005;40:E5–7.
22. Gregory E Tasiana, Hillary L Coppb, Laurence S Baskin. Diagnostic imaging in cryptorchidism: Utility, indications and effectiveness. J Pedia Surg 2011;46:2406-13.

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