World Journal of Laparoscopic Surgery

An Official Publication of the World Association of Laparoscopic Surgeons, UK

WJOLS

Also available online at
www.jaypeejournals.com
www.wjols.com

Access Online Resources

For more details, visit
www.wjols.com

Bibliographic Listings:
ProQuest, Scopus, Journals Factor, EBSCO,Genamics JournalSeek, Emcare, HINARI, Embase, J Gate, Google Scholar, Ulrich, CiteFactor, SIS, OAJI, MIAR, SIF, COSMOS, ESJI, SJIF, SJR, IIJIF, ICI

JAYPEE Jaypee Journals

Editorial

Minimal access surgery is a technology-based surgery. The everchanging innovations in the realm of laparoscopy/robotic and endoscopy surgery are taking place at such a rapid pace that the practitioner of this discipline always feels lagging behind the new developments.

The 21st century owes the rapid improvement of human race primarily to the advancement in information technology. The tremendous improvement in computing/digitalizations of applications has led to the emergence of single incision laparoscopic surgery, natural orifice transluminal endoscopic surgery, robotic surgery and other emerging techniques.

The World Journal of Laparoscopic Surgery (WJOLS) is a reputed journal and its editorial board includes a number of national and international surgeons, who pioneered and improved the advanced minimal access surgery techniques. The WJOLS is now one of the most sought-after journal for original and review articles on the newest techniques and applications in operative laparoscopy, endoscopy and other da Vinci robotic surgery.

I am very happy to tell all our readers that WJOLS in its new Avatar provides complete, timely, accurate, practical coverage of laparoscopic techniques and procedures. It also includes current and basic research topics, preoperative and postoperative patient management, complications in laparoscopy and endoscopy surgery, and new development in laparoscopy and da Vinci robotic instrumentation and technology.

RK Mishra
Editor-in-Chief

10.5005/jp-journals-10033-1217

ORIGINAL ARTICLE

Gastric Plication as a New Stand-Alone Procedure for the Treatment of Morbid Obesity

[1]Youssef A Andraos, [2]Dany Ziade, [3]Rana Achkouty, [4]Therese Youssef Andraos

ABSTRACT

Purpose: Gastric plication of the greater curvature is spreading over all the bariatric centers as a new investigational procedure for the treatment of morbid obesity. Conventional bariatric surgeries 'gastric band', 'sleeve gastrectomy', 'vertical banding gastroplasty' and 'gastric bypass' are associated with severe complications and a high rate of failure or weight regain.

Materials and methods: Authors present their experience on 482 laparoscopic greater curvature plication (LGCP) performed over a period of 26 months. A total of 449 patients responded to inclusion criteria: 147 men and 302 women. Their mean age was 35.99 ± 10.85 years. Their mean body mass index (BMI) was equal to 39.93 ± 6.15 kg/m^2.

Results: The average percentage of excess weight loss (%EWL) at 1, 3, 6, 12, 18 and 24 months was 30.19, 47.07, 63.05, 68.15, 68.62 and 69.29% respectively. Moreover, this study was divided into two subgroups and results were studied based on the type of suturing and patient's BMI over a period of 1 year. The first subgroup included 183 patients, where gastric plication was performed with continuous suturing at the first and second row. The second subgroup included 186 patients, where gastric plication was performed with separated stitches at the first row and continuous suturing at the second row. In the second subgroup, a higher degree of %EWL was found. The complication rate was greater in the first subgroup. The overall rate of immediate surgical complications was 1.33%. Mean hospital stay was 36 hours.

Conclusion: Gastric plication is safe and efficient on EWL based on short-term results. Separated suturing is associated with a higher %EWL and a lower rate of complications, with a short hospital stay. Long-term data are needed to consolidate these results.

Keywords: Obesity, Overweight, BMI, %EWL, Gastric plication, Bariatric surgery, LGCP.

How to cite this article: Andraos YA, Ziade D, Achkouty R, Andraos TY. Gastric Plication as a New Stand-Alone Procedure for the Treatment of Morbid Obesity. World J Lap Surg 2014;7(2):49-59.

[1,2]Chief, [3]Anesthesiologist, [4]Medical Student

[1]Department of General Surgery, Abou Jaoude Hospital, Beirut Lebanon

[2,3]Department of Anesthesiology (Bariatric Unit), Abou Jaoude Hospital, Beirut, Lebanon

[4]Department of Medicine, American University of Beirut, Beirut Lebanon

Corresponding Author: Youssef A Andraos, Chief Department of General Surgery, Abou Jaoude Hospital, Beirut Lebanon-60144, Phone: +961-3-250811, e-mail: yaandraos@hotmail.com

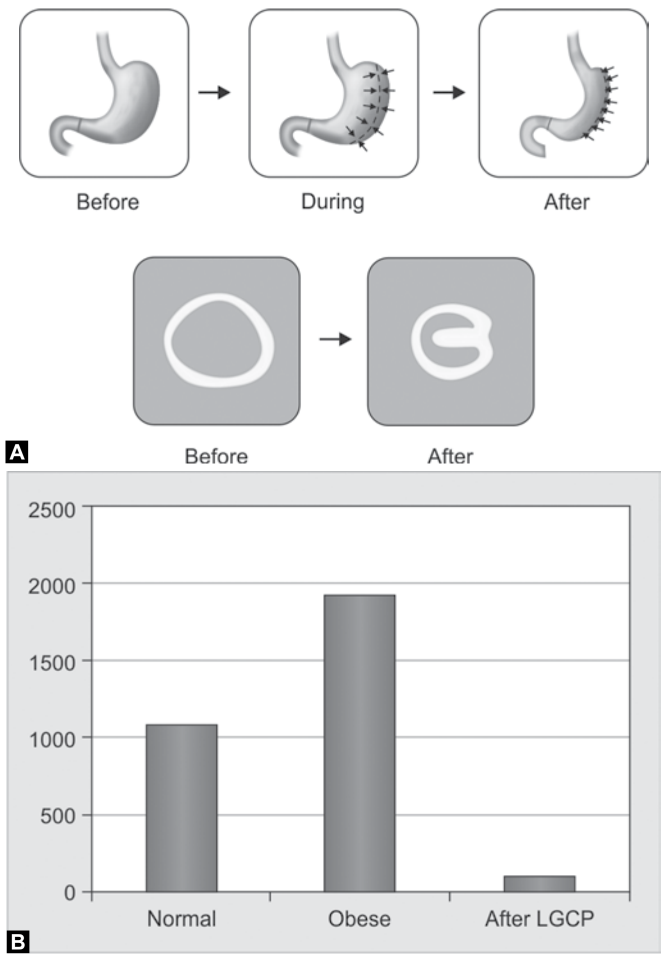
Source of support: Nil

Conflict of interest: None

INTRODUCTION

Gastric plication of the greater curvature achieves weight loss by reducing gastric volume by 80 to 90%[1,2] (Figs 1A and B).

Gastric restriction is performed laparoscopically[3-7] by suturing the infolded greater curvature of the gastric wall (Figs 2A and B). Conventional bariatric surgeries, such as 'gastric band', 'sleeve gastrectomy', 'vertical banding gastroplasty' and 'gastric bypass' are associated with severe complications and a high rate of failure or weight regain.[8-18] Published short-term and midterm data on gastric plication



Figs 1A and B: (A) Gastric capacity reduction by folding the gastric greater curvature inward and (B) gastric capacity evaluation in a normal and obese person[1] before and after LGCP as measured by peroperative gastric filling show that it is effective on excess weight loss (EWL) and is associated with a low rate of complications.[4,5,19-22]

This case series highlights technical steps, results and complication management of this procedure.

MATERIALS AND METHODS

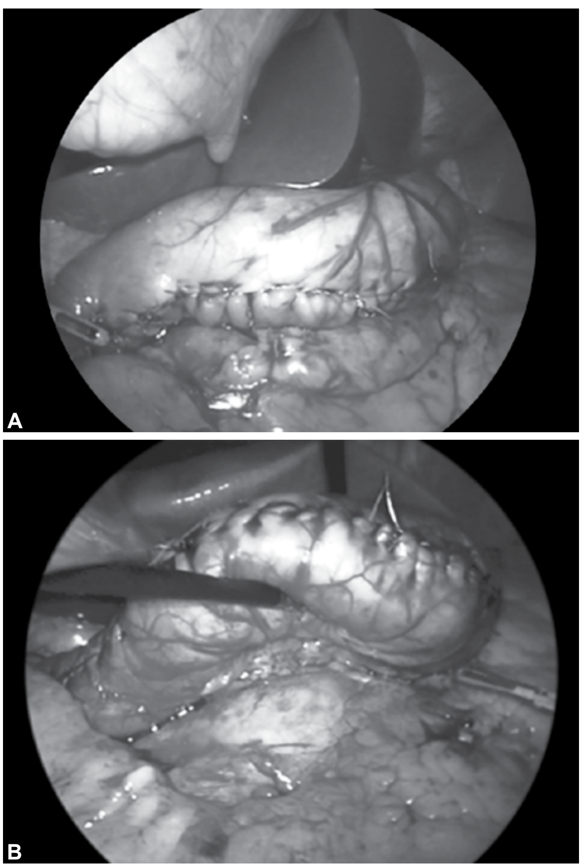
Study patients and endpoints: The present case-series study received the approval of the local ethics committee and was conducted using the National Institute of Health (NIH) inclusion criteria for bariatric surgery,[15,23,24] the United States Food and Drug Administration (FDA) approval of Adjustable Gastric Band (AGB) and the ASMBS position regarding bariatric surgery in class 1 obesity (BMI 30-35 kg/m^2).[24]

A total of 482 patients underwent laparoscopic greater curvature plication (LGCP) from December 13, 2010 to February 4, 2013. Thirty-three cases were excluded for previous bariatric surgery. A total of 449 patients responded to inclusion criteria and are included in the study. Results and complications were recorded till the end of the second year.

Surgical Techniques

Patient Installation

Patients were placed under general anesthesia in an anti-Trendelenburg position at a 30 to 45º French position.



Figs 2A and B: (A) Anterior and (B) posterior laparoscopic views of gastric plication

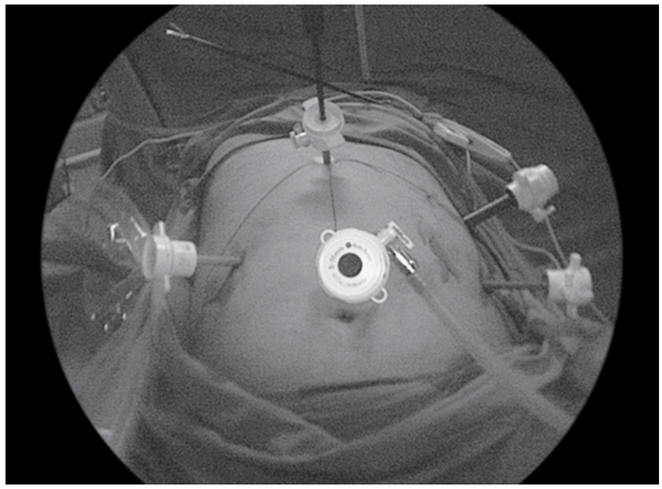


Fig. 3: Trocars placement

Trocar Placement (Fig. 3)

A five-trocar port technique was used for all patients except those with a small left liver for whom a three-trocar technique was adopted.

Dissections (Figs 4A to G)

The greater curvature is completely liberated from gastroepiploic and splenic attachments from the gastroesophageal (GE) junction to 3 cm before the pylorus. The posterior gastric wall was held up and the body of the stomach was freed completely from the gastropancreatic attachment. The posterior fundus was completely liberated from the left crus and the hiatus was inspected to rule out a hiatal hernia. Reparation of the hiatal hernia was performed at the same time when found in order to decrease the restricted gastric volume.

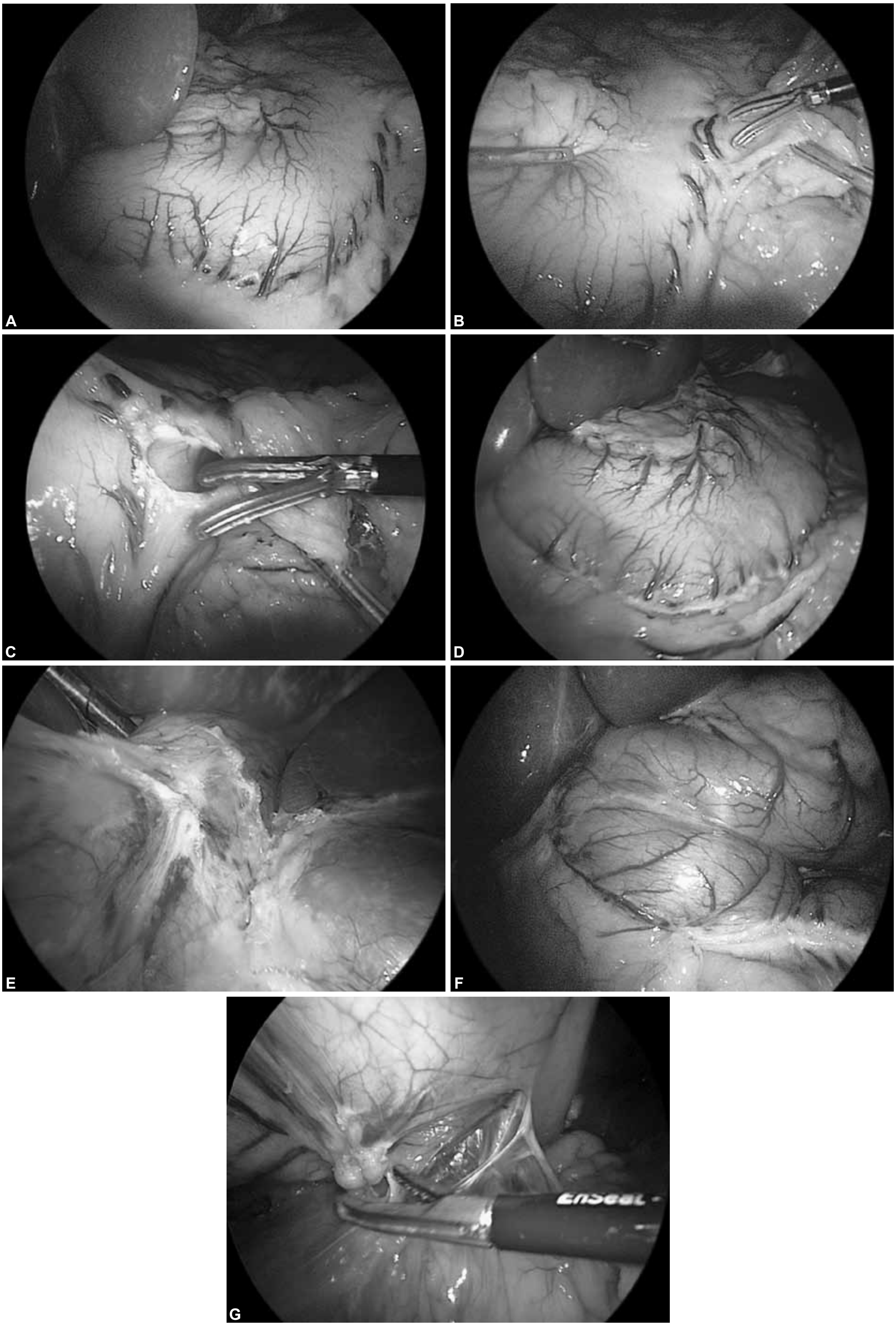
Calibration and Plication (Figs 5A to D)

A complete visualization of the whole stomach, anteriorly and posteriorly, is the key of a good gastric calibration.

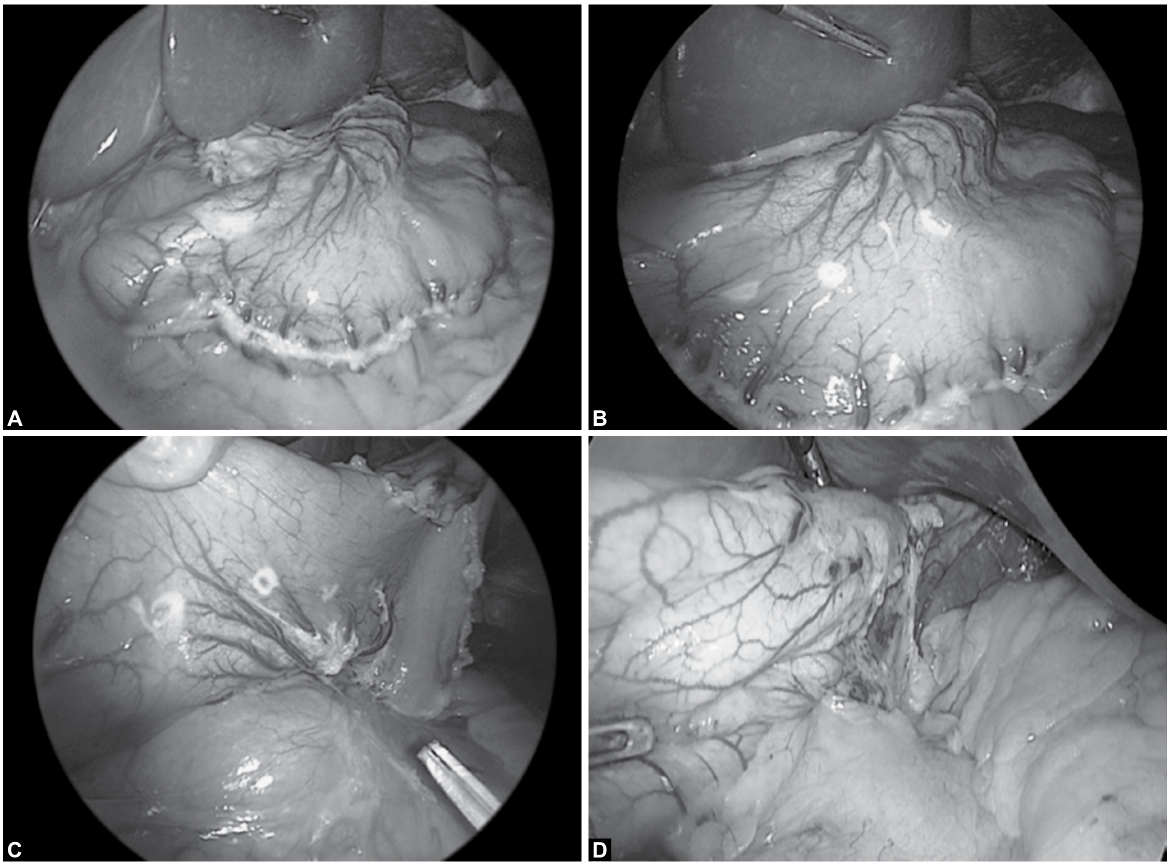
Gastric plication was created by the invagination of the greater curvature over a 36 French calibrating tube. Anterior and posterior marks on the gastric wall were made by methylene blue or bipolar coagulation. These marks help in avoiding the narrowing of the plicated stomach or the widening of the residual gastric space.

Critical Points

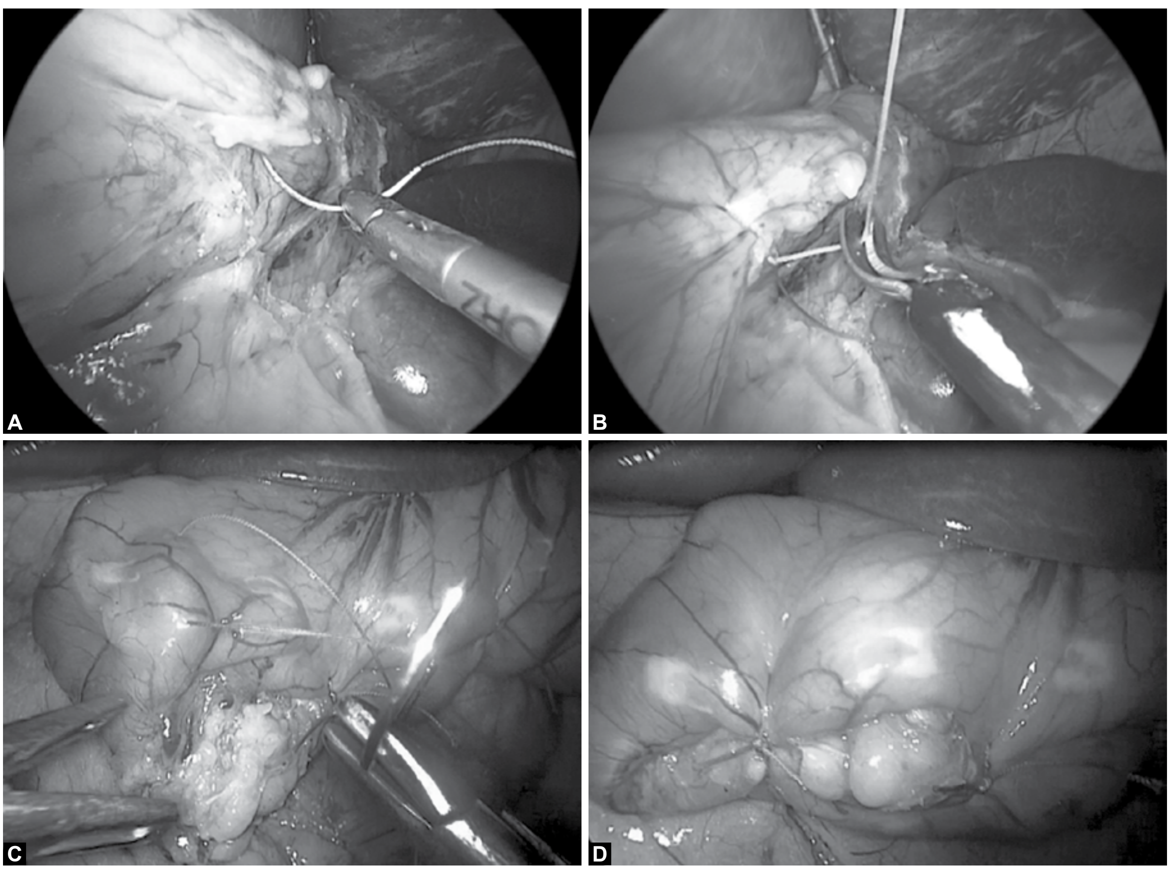
1. The first point of the plication (Figs 6A and B) is started by a cardio plication in case of cardial enlargement with GE reflux. If there is no preexisting GE reflux, the plication is started 1 cm from the GE junction to avoid dysphagia. In case of hiatal hernia with or without GE reflux, the gastric hernia is treated by left and right crus closure after intra-abdominal reintegration. Then, the gastric plication starts 1 cm from the GE junction.



Figs 4A to G: (A) Branches of the crow feet, (B) the beginning of the gastric dissection, (C) entry to the greater sac at the level of the horizontal branch of the crow feet, (D) complete greater curvature dissection (freed from gastroepiploic/gastrosplenic vessels), (E) left crus dissection, (F) dissection stopped 3 cm before the pylorus and (G) posterior gastric attach liberation



Figs 5A to D: (A) French tube calibration, (B) bipolar anterior gastric wall marks, (C) bipolar posterior gastric marks and (D) invagination of the greater curvature

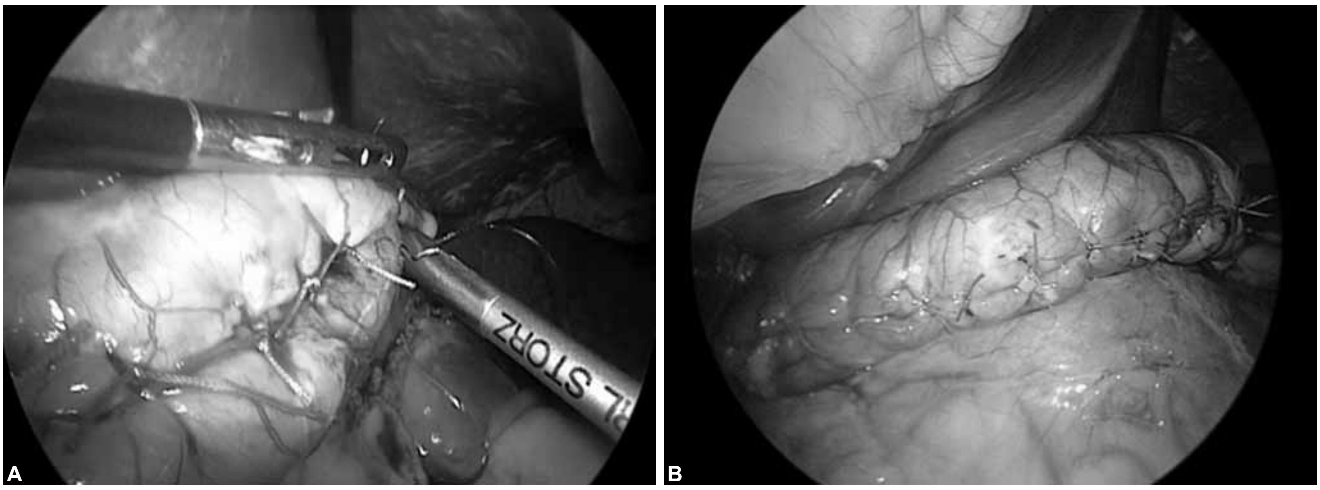


Figs 6A to D: (A) First point: starts 1 cm from the gastroesophageal junction, (B) final view of the first point, (C) the last point: starts 3 cm before the pylorus and (D) final view of the last point

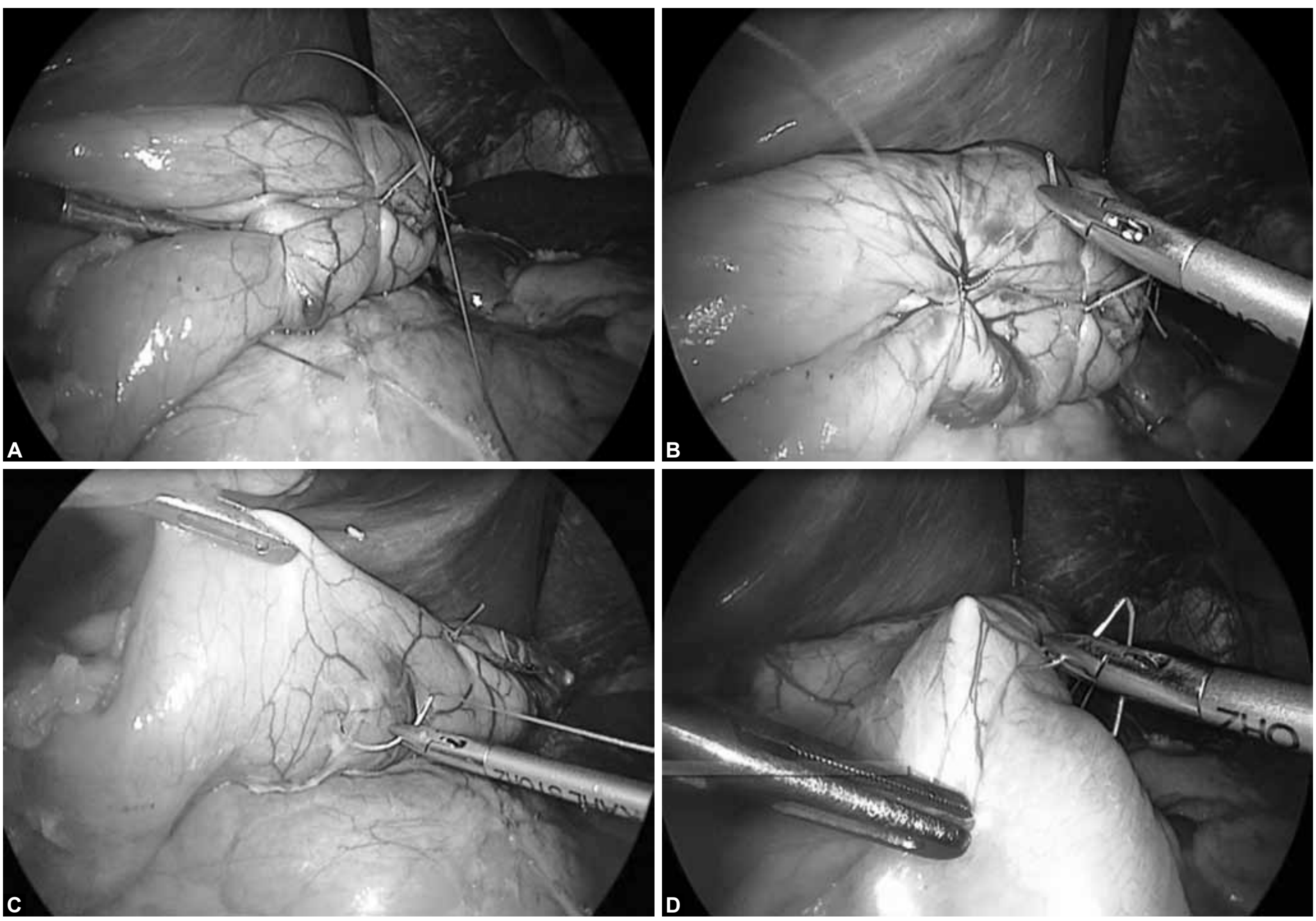
2. The last point of the plication (Figs 6C and D) is stopped 3 cm before the pylorus. This distance prevents gastric obstruction by fold invagination into the pylorus. The angulus points are ath risk of obstruction to because of gastric wall thickness at this level.
3. The first row of stitches (Figs 7A and B) is made with separated nonabsorbable stitches which are 1 cm apart. This way leads to less edema, less venous stasis, and less hematoma compared to continuous suturing; thus, the stomach is better calibrated. The final restricted volume is reached by the end of the first row of separated stitches before edema and venous stasis installation.

Moreover, symmetry of the plicated stomach is better obtained by making separated stitches. Asymmetry will lead to redistribution of intragastric pressure which can lead to partial anterior, posterior, or total gastric expansion.

The way of performing the stitches was also modified (Figs 8A to D). Stitching starts on the posterior gastric



Figs 7A and B: (A) Upper part of the first row, (B) lower part of the first row



Figs 8A to D: (A) The stitching starts at the posterior gastric marks, (B) the stitching ends at the anterior gastric marks, (C) anterior and posterior wall are taken several times symmetrically and (D) final view marks. Then, the mid-distance from the greater curvature on the posterior gastric wall is taken. The greater curvature is also charged. Subsequently, the anterior gastric wall is symmetrically loaded and sutured to the posterior bites. Finally, the knot is made. This method of stitching will not leave a dead gastrogastric space in which fluid and seroma can accumulate leading to complete gastric compression and obstruction (so-called compartment syndrome).

4. The second row of stitches (Figs 9A to C) consists of continuous nonabsorbable stitches 3 to 5 mm apart. It starts from the HIS angle and stops 3 cm from the pylorus.

Leak and patent lumen tests were performed in all cases with 50 to 60 ml of diluted methylene blue. No drain is placed at the end of the operation.

Postoperative Treatment and Follow-up

At postoperative day 1, patients were given gastrografin meal (Fig. 10). If no obstruction or leak was noticed, the patients were discharged from the hospital at day 2. The patient was discharged from hospital with a prescription of proton pump inhibitor (PPI) twice a day for 6 months to decrease gastric acidity, esogastric reflux and to prevent suture rupture by acid erosion which can lead to early gastric expansion.

STATISTICAL ANALYSIS

All statistical analysis was performed with the use of SPSS software, version 17.0. A descriptive approach is used for all variables. The main variable is the percentage of EWL at different periods after surgery (1, 3, 6, 12, 18 and 24 months). Statistical analysis is done by using different statistical tests for categorical and continuous variables (chi-square test, student test…) in the overall group and in different subgroups by BMI, and types of sutures. The p-values were two-sided, with an α value of 0.05 considered as statistically significant.

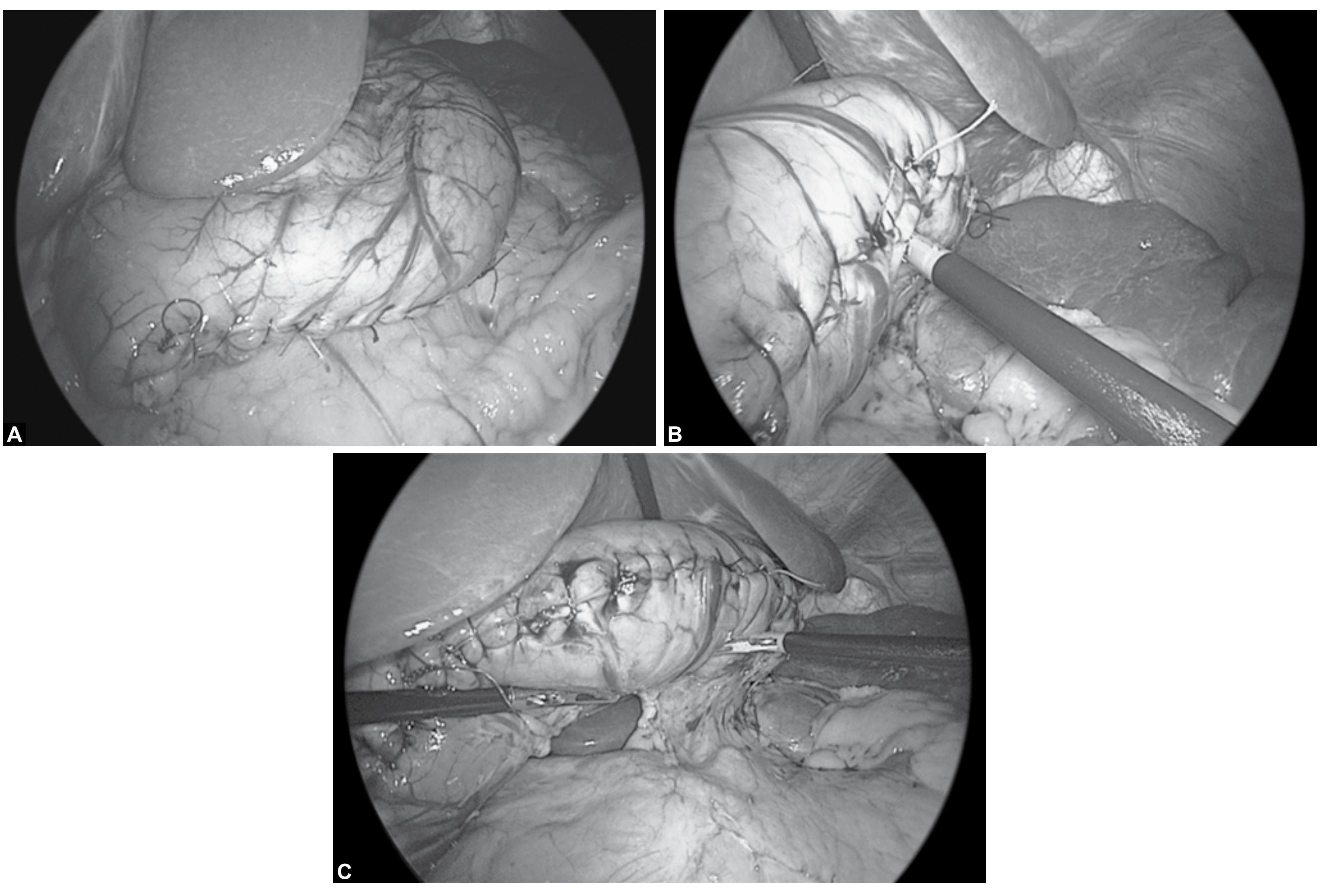
RESULTS

General Characteristics

Surgery Characteristics

Out of the 449 patients undergoing LGCP and over a period of 26 months, 395 (88.0%) were followed over a period of 1 month, 357 (79.5%) over a period of 3 months, 318 (70.8%) over a period of 6 months, 243 (54.1%) over a period of 12 months, 116 (25.8%) over a period of 18 months, and 21 (4.7%) over a period of 24 months.

- Surgery was done in 448 patients by laparoscopy, and in 1 patient by open surgery.
- Mean operative time was 65 minutes.



Figs 9A to C: (A) Anterior lower gastric view, (B) upper gastric view—plicated fundus and (C) posterior gastric view

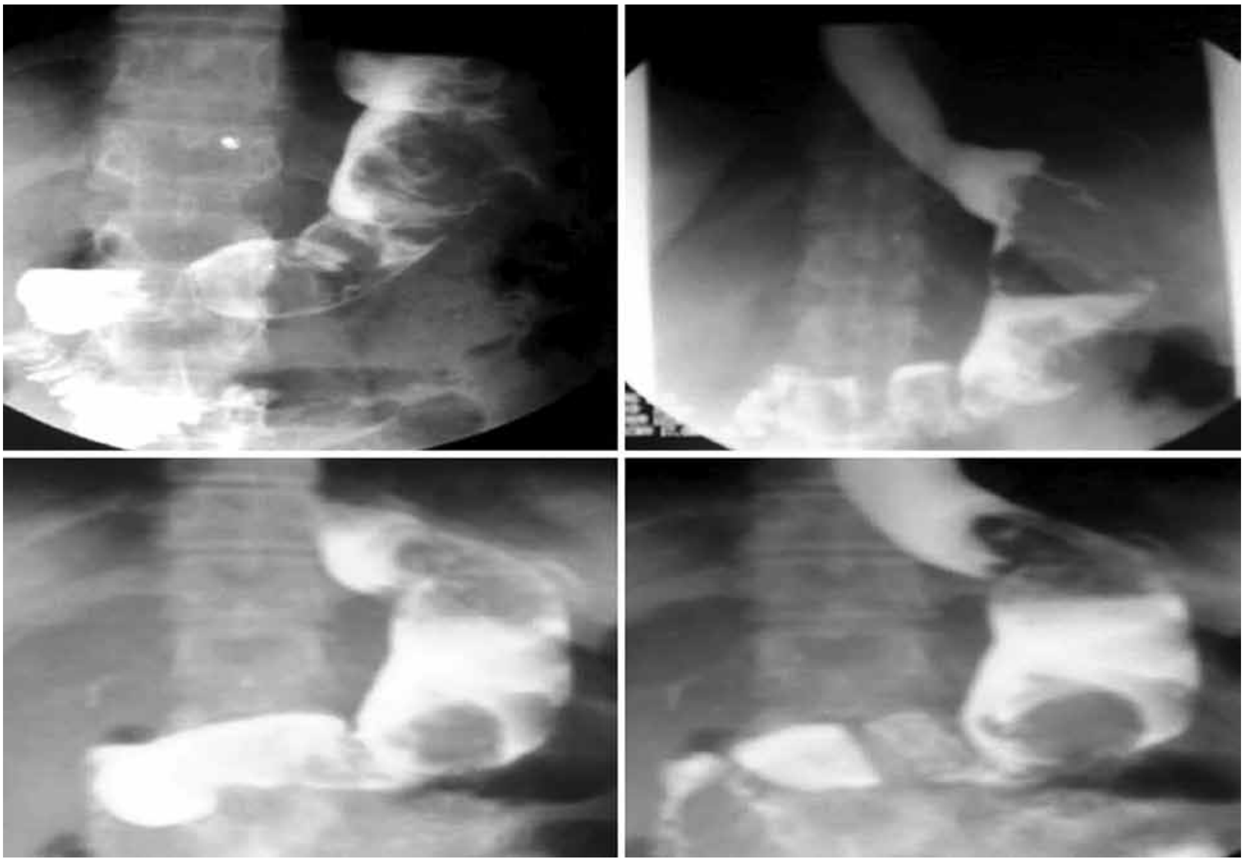


Fig. 10: Postoperative gastrografin meal X-ray (normal gastrografin meal at day 1)

- Mean hospital stay was 36 hours. A total of 428 patients (95.3%) left the hospital after 24 hours stay and 21 patients (4.7%) were kept more than 1 day.

Patients' Characteristics

Over the 449 patients included:

- A total of 147 patients were men (32.7%) and 302 patients were women (67.3%).
- The mean age of all the patients was 35.99 ± 10.85 years.
- The mean BMI was equal to 39.93 ± 6.15 kg/m^2 with a mean body weight of 112.9 ± 23.4 kg.

Excess Weight Loss and BMI

All Patients (n = 449)

A significant EWL is noted until 12 months postsurgery, with a peak of EWL during the first 6 months ($p < 0.001$) (Table 1). However, despite a slight loss of excess weight after the 12 months, this loss seems to be nonsignificant ($p > 0.05$), and a plateau phase seems to be reached at one year postsurgery.

Patients with BMI between 30 and 45 (n = 368)

In a subgroup analysis of patients with a BMI between 30 and 45 (Table 2), similar results are noted as in the overall group. In fact, a significant EWL is also noted until 12 months after the surgery, with a peak of EWL during the first 6 months ($p < 0.001$). However, the slight increase also noted after the 12 months, is nonsignificant ($p > 0.05$), and a plateau phase is reached at 1 year postsurgery, like in the overall group.

Patients with BMI >45 (n = 80)

In another subgroup analysis of patients with a BMI >45 (Table 3), similar results are noted as in the overall group and in the subgroup of BMI between 30 and 45, despite lesser degrees of loss of the excess weight in this subgroup. In fact, a peak of significant EWL is noted until 12 months after the surgery ($p < 0.001$). However, despite a relative gain of weight after the 12 months, this gain seems to be nonsignificant ($p > 0.05$), and the plateau phase seems also to be reached at 1 year postsurgery.

Comparison between Subgroups of BMI

By a comparison between the subgroups of BMI (Graph 1), a significant difference is noted in EWL between the two subgroups (BMI between 30 and 45 and BMI >45) at the different periods. In fact, a more important percentage of EWL is seen in the subgroup of BMI between 30 and 45, and a lower percentage is seen in the subgroup of BMI >45.

Excess Weight Loss and Types of Sutures

To refine the results, the first 80 cases were considered as the learning curve and the study was divided into two

Table 1: Follow-up on % EWL over 1, 3, 6, 12, 18 and 24 months

Time (months)	*Number of patients (N)*	*Minimum %EWL*	*Maximum %EWL*	*Average % EWL ± standard deviation*	*p-value*
1	395	12.05	77.78	30.19 ± 10.6	<0.001*
3	357	19.48	121.43	47.07 ± 15.0	<0.001*
6	318	19.48	140.00	63.05 ± 20.0	0.003*
12	243	20.45	142.86	68.15 ± 19.4	0.84
18	116	20.45	142.86	68.62 ± 22.1	0.90
24	21	39.06	104.65	69.29 ± 20.5	

*Statistically significant

Table 2: Follow-up on % EWL over 1, 3, 6, 12, 18 and 24 months in patients with BMI between 30 and 45

Time (months)	*Number of patients (N)*	*Minimum % EWL*	*Maximum % EWL*	*Average % EWL ± standard deviation*	*p-value*
1	327	14.29	77.78	31.98 ± 10.6	
3	295	22.22	121.43	49.57 ± 14.9	<0.001*
6	261	20.45	140.00	66.17 ± 20.2	<0.001*
12	194	20.45	142.86	70.82 ± 19.9	0.02*
18	93	20.45	142.86	72.12 ± 22.9	0.63
24	17	39.06	104.65	73.90 ± 20.0	0.76

*Statistically significant

Table 3: Follow-up on % EWL over 1, 3, 6, 12, 18 and 24 months in patients with BMI >45

Time (months)	*Number of patients (N)*	*Minimum % EWL*	*Maximum % EWL*	*Average % EWL ± standard deviation*	*p-value*
1	68	12.05	36.29	21.56 ± 5.1	
3	62	19.48	57.14	35.15 ± 8.1	<0.001*
6	57	19.48	75.00	48.79 ± 10.8	<0.001*
12	49	35.82	90.91	57.47 ± 12.7	<0.001*
18	23	38.10	76.32	54.47 ± 10.3	0.33
24	4	44.05	54.05	49.69 ± 4.4	0.37

*Statistically significant

subgroups. The first subgroup includes 183 patients from May 15, 2011 till February 27, 2012, with a follow-up of 18 months. The first and second row of the plication were performed with continuous suturing using nonabsorbable stitches. The second subgroup consists of 186 patients from February 28, 2012 till February 4, 2013, with a follow-up of 12 months. The first row was made with separated suturing stitches over a 36 French calibration tube with anterior and posterior marks. The second row was performed with continuous suturing.

Analysis by Type of Sutures

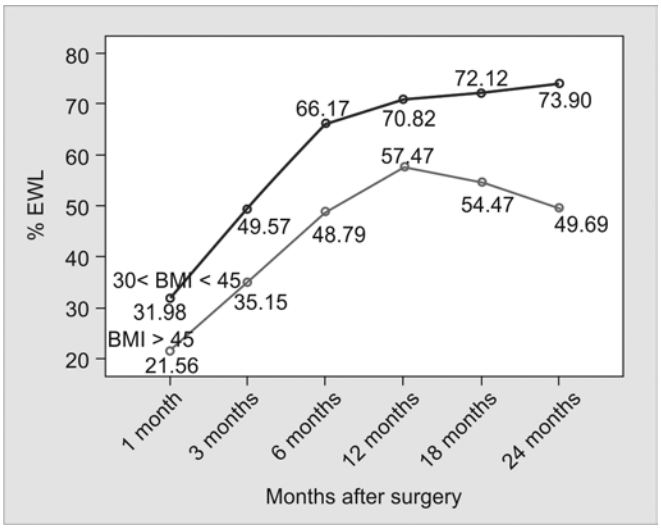
In the continuous suturing subgroup (Table 4), similar results were noted as in the overall group. A significant EWL is noted until 12 months after the surgery, with a peak of EWL during the first 6 months after surgery ($p < 0.001$). However, the nonsignificant changes (66.42%) noted at 18 months ($p = 0.92$) are mostly due to a plateau phase reached by 1 year postsurgery.

Moreover, in the separated suturing subgroup (Table 5), similar results to that in the overall group and the continuous suturing subgroup were noted, with obviously higher degrees of EWL in this subgroup. However, a strong trend to a significant increase to 80.77% is noted at 12 months ($p = 0.07$); a statistical significance is mostly not reached because of the relative small number of patients followed up to this period (only 20 patients).

Comparison between the Two Types of Sutures

By a comparison between the subgroups by the type of sutures, a significant difference is noted in EWL between the two subgroups (continuous and separated suturing) at the different periods, with higher degrees of EWL in the separated suturing subgroup. In fact, a lower percentage of EWL is seen in the subgroup of continuous suturing, and a higher percentage in the subgroup of separated suturing (Graph 2). However, no comparison is done at 18 months because, up to this date, there are no patients in the separated suturing subgroup who reached this period after surgery.

By a comparison between the subgroups of type of sutures, and only including the patients with a BMI >45, a significant difference in EWL is noted between the two subgroups (continuous and separated suturing) at the



Graph 1: Clinical data summary by 30 < BMI < 45 and BMI > 45: EWL% is 31.98% *vs* 21.56% at 1 month (p < 0.001); 49.57% *vs* 35.15% at 3 months (p < 0.001); 66.17% *vs* 48.79% at 6 months (p < 0.001) and 70.82% *vs* 57.47% at 12 months (p < 0.001). However, after 12 months, a significant difference is noted between the subgroups, because of a slight trend to an additional increase in %EWL in the subgroup of BMI between 30 and 45, and a slight decrease in %EWL in the subgroup of BMI > 45 (p < 0.001)

different periods. This result is similar to that seen in the overall group independent of the BMI, with higher degrees of EWL in the separated sutures subgroup. However, no comparison is done at 18 months because, up to this date, no patient in the separated suturing subgroup has reached this period (Graph 3).

Complications

Major Surgical Complications

a. Peroperative massive bleeding due to mesenteric trocar lesion (0.2%):
   - Treated by laparotomy for hemostasis and open LGCP was achieved.

b. Gastric obstruction (0.4%):
   - Due to gastric fold invagination into the lower esophagus (0.2%)
     – Treated by laparoscopic deplication and a looser gastric plication was performed.
   - Due to gastric fold invagination into the pylorus (0.2%)
     – Treated by deplication.

c. Gastrogastric herniation (0.6%):
   - Leading to esogastric leak and peritonitis (0.2%)
     – Treated by laparoscopic deplication, gastric suture and looser plication.
   - Leading to gastric hernia necrosis and peritonitis (0.2%).
     – Treated by gastric resection of necrotic herniation, and deplication.
   - Leading to late gastric obstruction at 4 months (0.2%).
     – Deplication

d. Gastric leak over a stitch (0.2%)
   - Deplication and gastric suture

e. Subphrenic abscess (0.2%)
   - CT-guided percutaneous drain

f. Gastric bleeding by gastric ulcers at 2 months (0.2%).
   - Blood transfusion, endoscopic sclerosis with PPI

g. Portomesenteric thrombosis (0.4%)
   - One case treated by thrombolysis and heparinotherapy
   - One case treated by intestinal resection and heparinotherapy

h. Gastric line suture rupture and re-expansion (1.78%).
   - Seven cases treated by replication (delayed reintervention).
   - One case treated by sleeve gastrectomy (delayed reintervention).

In total:
- Six cases (1.38%): acute early reintervention.

Table 4: Subgroup 1: Gastric plication with continuous suturing at the first/second rows (n = 183)

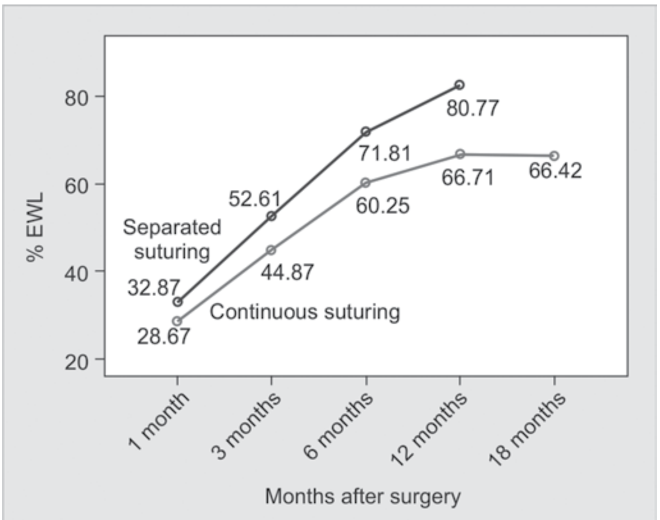
Time (months)	*Number of patients (N)*	*Average % EWL ± standard deviation*	*p-value*
1	173	28.67 ± 9.8	
3	161	44.78 ± 13.5	< 0.001*
6	158	60.25 ± 18.6	< 0.001*
12	146	66.71 ± 17.5	0.002*
18	42	66.42 ± 18.2	0.92

*Statistically significant

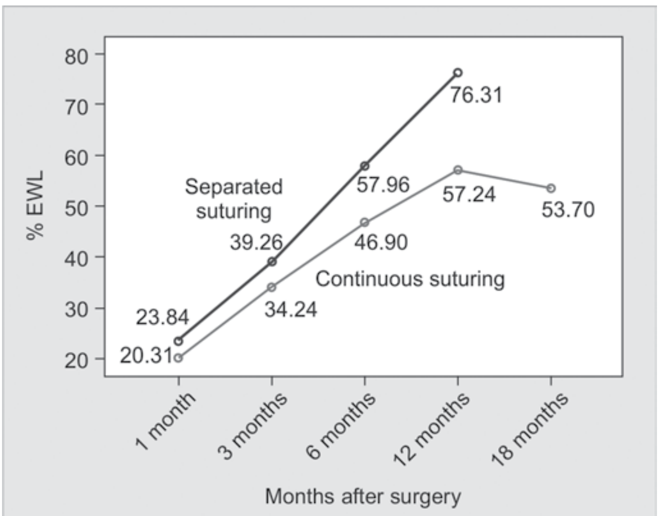
Table 5: Subgroup 2: Gastric plication with separated stitches in the first row with anterior and posterior marks over a 36 Fr tube, and the second row with continuous suturing (n = 186)

Time (months)	*Number of patients (N)*	*Average % EWL ± standard deviation*	*p-value*
1	142	32.87 ± 11.6	
3	121	52.61 ± 14.2	< 0.001*
6	83	71.81 ± 19.7	< 0.001*
12	20	80.77 ± 20.3	0.07

*Statistically significant



Graph 2: Clinical data summary by type of sutures: continuous *vs* separated suturing: %EWL is 28.67% *vs* 32.87% at 1 month (p = 0.001); 44.78% *vs* 52.61% at 3 months (p <0.001); 60.25% *vs* 71.81% at 6 months (p <0.001), and 66.71% *vs* 80.77% at 12 months (p = 0.001)



Graph 3: Excess weight loss by type of sutures (continuous *vs* separated sutures) in patients with BMI >45: %EWL is 20.31% *vs* 23.84% at 1 month (p = 0.03); 34.24% *vs* 39.26% at 3 months (p = 0.04); 46.90% *vs* 57.96% at 6 months (p = 0.002) and 57.24% *vs* 76.31% at 12 months (p = 0.005)

- Two cases (0.46%): percutaneous treatment.
- Ten cases (2.3%): reintervention for gastric re-expansion or late suture line rupture.

Major Medical Complications

- Transitory gastric obstruction by gastric fold edema (3.5%)
  - Treated by IV fluid and PPI.
  - Spontaneous resolution happened in 3 to 5 days
- Right lower lobe pneumonia (0.2%)
  - Antibiotherapy
- Lower limb thrombophlebitis (0.2%)
  - Heparinotherapy

Minor Complications

- Nausea (13.99%)
- Vomiting (12.86%)
- Minor hematemesis (8.53%)
- Hiccup (4.45%)
- Sialorrhea (8.53%)
- Melena (5.25%)
- Diarrhea (3.46%)
- Gastric spasm (3.24%)

DISCUSSION

General overview of the results: In the overall group, a significant increase in the percentage of EWL was noted, and consequently a decrease in body weight, until 12 months after surgery, with a peak of EWL during the first 6 months (p < 0.001). A 'plateau phase' is reached by the first year after the surgery with a loss of around 70% of the excess weight, and a stability in the body weight is noted thereafter in the second year (study follow-up period). These results are similar Talebpour, Brethauer and Ramos's results.[11,13,16]

However, in subgroup-analysis depending on BMI, and type of suturing, the following observations were found:

- The percentage of EWL is more important in patients with BMI between 30 and 45, than those with a BMI >45.
- Higher percentages of EWL are noted with the separated suturing, relative to the continuous suturing, at different periods of follow-up. A 'plateau phase' is reached at around 1 year after surgery with continuous suturing. However, no data are available in the separated suturing subgroup about whether the plateau phase is also reached after 1 year or higher percentages of EWL are observed thereafter, because no patient in this subgroup has reached a period of follow-up more than 1 year. Moreover, and in a subgroup analysis of patients with BMI >45, the separated suturing also seems to be superior to the continuous suturing, with higher percentages of EWL observed with the first technique.

Major surgical and medical complications are relatively rare. Globally, the rate of gastric leak is 0.66%. In the continuous suturing subgroup, the rate of leak is 1.09%, whereas in the separated suturing subgroup, the rate of leak is 0.535%. The rate of acute gastrogastric herniation leading to re-intervention is 1.6%, while this complication is inexistent in the subgroup who underwent separated suturing. This can be explained by a better symmetrical folding and adequate gastric calibration that separated suturing can provide. Tightness is the main cause of gastric obstruction, gastrogastric herniation, and gastric leak. Asymmetry is the main cause of total or partial gastric re-expansion, notably at the level of the gastric fundus. Management of these surgical complications is mainly treated by deplication, and gastric leak suturing. Early reversibility is highly appreciated in case of early complications (leak, obstruction and psychological intolerance) up to 6 months. Late reversibility is rarely needed because gastric re-expansion allows the performance of all kinds of bariatric surgeries. Replication is made in case of suture line rupture, gastrogastric herniation or gastric re-expansion. Minor complications consist mostly of nausea and vomiting related to gastric fold edema and compartment syndrome which can be dramatically decreased by draining the gastrogastric space. This complication disappears spontaneously within 2 to 3 days postoperatively.

CONCLUSION

Laparoscopic greater curvature plication is highly associated with a reduction in body weight, with increasing percentages of EWL during the first year after surgery reaching a plateau phase thereafter. Higher percentages are observed in specific population, particularly patients with BMI between 30 and 45. The new modified technique consisting of separated suturing of the first row is highly superior to the old one with continuous suturing of the first and second row; however, no data exists after 1 year of follow-up with this new technique. Major surgical and medical complications are rare.

REFERENCES

1. Geliebter A. Gastric distension and gastric capacity in relation to food intake in Humans. Physiol Behav 1988;44(4-5):665-668.
2. Scozzari G, Toppino M, Famiglietti F, Bonnet G, Morino M. 10-year follow-up of laparoscopic vertical banded gastroplasty: good results in selected patients. Ann Surg 2010 Nov;252(5):831-839.
3. Toouli J, Kow L, Ramos AC, et al. International multicenter study of safety and effectiveness of Swedish adjustable gastric band in 1, 3 and 5-year follow-up cohorts. Surg Obes Relat Dis 2009 Sep-Oct;5:598-609.
4. Fusco PE, Poggetti RS, Younes RN, et al. Evaluation of gastric greater curvature invagination for weight loss in rats. Obes Surg 2006 Feb;16(2):172-177.
5. Fusco PE, Poggetti RS, Younes RN, et al. Comparison of anterior gastric wall and greater gastric curvature invaginations for weight loss in rats. Obes Surg 2007 Oct;17(10):1340-1345.
6. Talebpour M, Amoli BS. Laparoscopic total gastric vertical plication in morbid obesity. J Laparoendosc Adv Surg Tech A 2007 Dec;17(6):793-798.
7. Sales Puccini CE. Sales gastric surset: a new alternative in bariatric restrictive surgery. Rev Colomb Cir 2008;23(3):131-135.
8. Brethauer SA, Harris JL, Chand B, et al. Initial results of vertical gastric plication for severe obesity. Presented at: Society of American Gastrointestinal and Endoscopic Surgeons. Phoenix, Arizona 2009 April 22-25.
9. Gastrointestinal surgery for severe obesity: National Institutes of Health Consensus Development Conference Statement. Am J Clin Nutr 1992 Feb;55(2 Suppl):615S-619S.
10. Buchwald H, Avidor Y, Braunwald E, et al. Bariatric surgery: a systematic review and meta-analysis. JAMA 2005 Apr;292(14): 1724-1737.
11. Nocca D, Frering V, Gallix B, et al. Migration of adjustable gastric banding from a cohort study of 4236 patients. Surg Endosc 2005 Jul;19(7):947-950.
12. Baltasar A, Bou R, Bengochea M, et al. Use of a Roux limb to correct esophagogastric junction fistulas after sleeve gastrectomy. Obes Surg. 2007 Oct;17(10):1408-1410.
13. Martin LF, Smits GJ, Greenstein RJ. Treating morbid obesity with laparoscopic adjustable gastric banding. Am J Surg 2007 Sep;194(3):333-343.
14. Gumbs AA, Gagner M, Dakin G, Pomp A. Sleeve gastrectomy for morbid obesity. Obes Surg 2007 Jul;17(7):962-969.
15. Galvao M, Ramos AC, Campos JM, et al. Endoscopic removal of eroded adjustable gastric band. Lessons learned after 5 years and 78 cases. Surg Obes Relat Dis 2010 Jul-Aug;6(4):423-427. Epub 2009 Oct 6.
16. Campos GM, Rabl C, Roll GR, et al. Better weight loss, resolution of diabetes, and quality of life for laparoscopic gastric bypass vs banding: results of a 2-cohort pair-matched study. Arch Surg 2011;146(2):149-155.
17. Campos JM, Siqueira LT, Meira MR, et al. Gastrobronchial fistula as a rare complication of gastroplasty for obesity: a report of two cases. J Bras Pneumol 2007 Aug;33(4):475-479.
18. Taylor TV, Knox RA, Pullan BR. Vertical gastric plication: an operation for gastroesophageal reflux. Ann R Coll Surg Engl 1989 Jan;71(1):31-36.
19. Ramos A, Galvão M, Campos JM, Mottin CC. Laparoscopic greater curvature plication: Initial results of an alternative restrictive bariatric procedure. Obes Surg 2010 Jul;20(7):913-918.
20. Talebpour M, Motamedi SM, Talebpour A, Vahidi H. Twelve years experience of laparoscopic gastric plication in morbid obesity: development of the technique and patient outcomes. Ann Surg Innov Res 2012 Aug 22;6(1):7.
21. Sasse KC, Ganser JH, Kozar MD, Watson RW 2nd, Lim DC, McGinley L, Smith CJ, Bovee V, Beh J. Outpatient weight loss surgery: initiating a gastric bypass and gastric banding ambulatory weight loss surgery center. JSLS 2009 Jan-Mar;13(1):50-55.
22. De Maria EJ. Clinical Issues Committee of the American Society for Metabolic and Bariatric Surgery, Updated Position Statement on Sleeve Gastrectomy as a Bariatric Procedure. Surg Obes Relat Dis 2010 Jan-Feb;6(1):1-5.
23. Brethauer SA, Harris JL, Kroh M, Schauer PR. Laparoscopic gastric plication for treatment of severe obesity. Surg Obes Relat Dis 2011 Jan- Feb;7(1):15-22.
24. Brethauer SA. Bariatric surgery in class I obesity (body mass index 30-35 kg/m^2). Surg Obes Relat Dis 2013;9:e1-e10.

10.5005/jp-journals-10033-1218

ORIGINAL ARTICLE

Comparing Task Performance and Comfort during Nonpulmonary Video-assisted Thoracic Surgery Procedures between the Application of the 'Baseball Diamond' and the 'Triangle Target' Principles of Port Placement in Swine Models

[1]Ahmad Jameel Ismail, [2]RK Mishra

ABSTRACT

Objective: The baseball diamond principle (BDP) is the conventional principle used for ports placement in video-assisted thoracic surgery (VATS). The triangle target principle (TTP) was introduced as an alternative principle where BDP is associated with difficulties especially in lung resections. We compared the task performance and surgeon's discomfort during some nonpulmonary VATS procedures between using the BDP and TTP in swine models.

Materials and methods: Thirty-six nonpulmonary VATS procedures were done on swine models at the World Laparoscopy Hospital, Gurgaon, NCR Delhi, India, from 19th February 2013 to 23rd March 2014. The procedures are 12 VATS pericardial window, 12 esophagocardiomyotomy and 12 thoracic sympathectomy (6 using BDP and 6 using TTP of each procedure). The outcome measures were the execution time, the errors rate and the surgeon's discomfort.

Results: Video-assisted thoracic surgery pericardial window using TTP took longer time to be executed with a mean difference of 93 seconds when compared to using BDP but the errors rates and surgeon's discomfort was similar between BDP and TTP. VATS esophagocardiomyotomy using BDP took longer time with a mean difference of 326.67 seconds but using the TTP was associated with more errors and surgeon's discomfort. In VATS thoracic sympathectomy using the BDP took longer time with a mean difference of 194 seconds, but the execution time data using BDP was not reproducible when validated statistically. The errors rates and surgeon's discomfort was similar between BDP and TTP.

Conclusion: Using baseball diamond principle appears to lead to better task performance and less Surgeon's discomfort during some nonpulmonary VATS procedures in swine models but there is need for studies with larger sample size. TTP use may be more favored during nonpulmonary VATS when stapling will be required.

[1]Senior Registrar, [2]Director, Professor and Senior Consultant

[1]Department of Surgery, Cardiothoracic Surgery Unit, Aminu Kano Teaching Hospital, Kano, Nigeria

[2]Department of Laparoscopic Surgery, World Laparoscopy Hospital, Gurgaon, Haryana, India

Corresponding Author: Ahmad Jameel Ismail, Senior Registrar, Department of Surgery, Cardiothoracic Surgery Unit Aminu Kano Teaching Hospital, PMB 3452, Kano, Nigeria e-mail: iajameel@yahoo.com

Keywords: Video-assisted thoracic surgery, Ports placement, Baseball diamond, Triangle target.

How to cite this article: Ismail AJ, Mishra RK. Comparing Task Performance and Comfort during Nonpulmonary Video-assisted Thoracic Surgery Procedures between the Application of the 'Baseball Diamond' and the 'Triangle Target' Principles of Port Placement in Swine Models. World J Lap Surg 2014;7(2):60-65.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Video-assisted thoracic surgery (VATS) or thoracoscopic surgeries refer to totally thoracoscopic approaches, where visualization is dependent on video monitors, and rib spreading is avoided by using a thoracoscope, video monitors and one to four small (1-2 cm) incisions.[1] VATS involve the use of ports through which long instruments including thoracoscope, graspers, scissors, forceps, retractors are passed into the chest cavity via 1 to 2 cm skin incisions. There are ergonomic principles governing the positioning and placement of these ports to facilitate task performance and surgeons comfort. These principles include the following:

- The optical trocar port is placed at the center so that the telescope will come to lie between the working instruments.
- The instruments should act as type 1 lever with equal length inside and outside the peritoneal or thoracic cavity.
- The manipulation angle between the two working instruments should optimally be 60° (elevation angles of 30° and azithmus angle of 15-45°).
- The working instruments should not face or work against the telescope as this leads to production of mirror image and difficult task execution with increased error rate.

To achieve above principles, the baseball diamond principal (BDP) is used in deciding the sites of ports placement. The BDP is the conventional principle used in laparoscopic and VATS.[2-5] In BDP, the position of the baseball infielders (infield players) is used as the position of the ports (Fig. 1). The optical port for the telescope is placed at the position

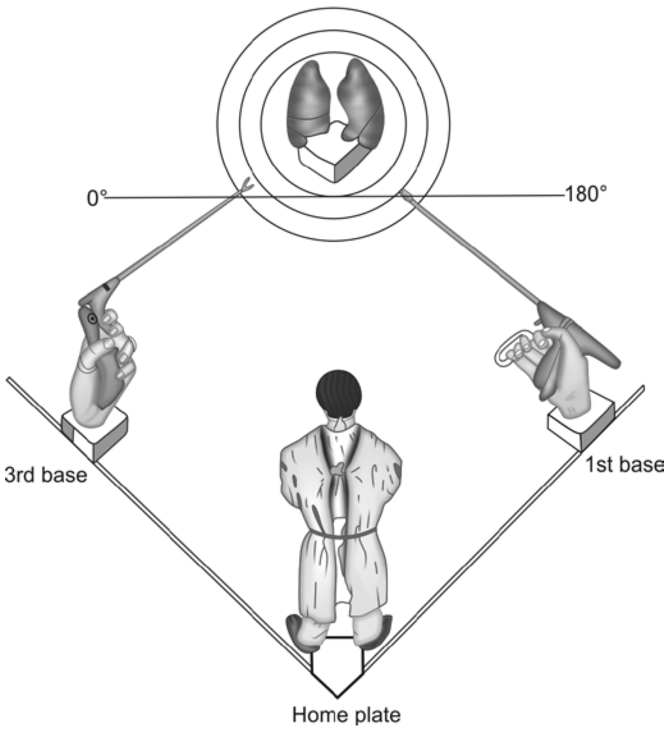


Fig. 1: Baseball diamond concept

of the catcher at the home plate, the 1st working instrument at the 1st baseman location, the target at the 2nd baseman position and the 2nd working instrument corresponds to the position of the 3rd baseman. Thus, the optical port is placed directly opposite the target and the working instruments are lateral to the optical port.

The experience that BDP may pose difficulties in some VATS procedures led to the introduction of an alternative principle to ensure better task performance. Sasaki et al[6] pointed to the difficulty they experienced in treating thoracic lesions especially peripheral lung lesions using the BDP and they developed and introduced the triangle target principle (TTP) to solve the difficulty. They also concluded that the application of TTP for ports placement can be used to access and treat all thoracic lesions. The TPP involves placing three ports to make an equilateral triangle between the optical port, the 1st working instrument and the target. A 3rd port (usually used for introduction of grasping forceps) is placed close to the target and hence called the target port (Figs 2A and B).

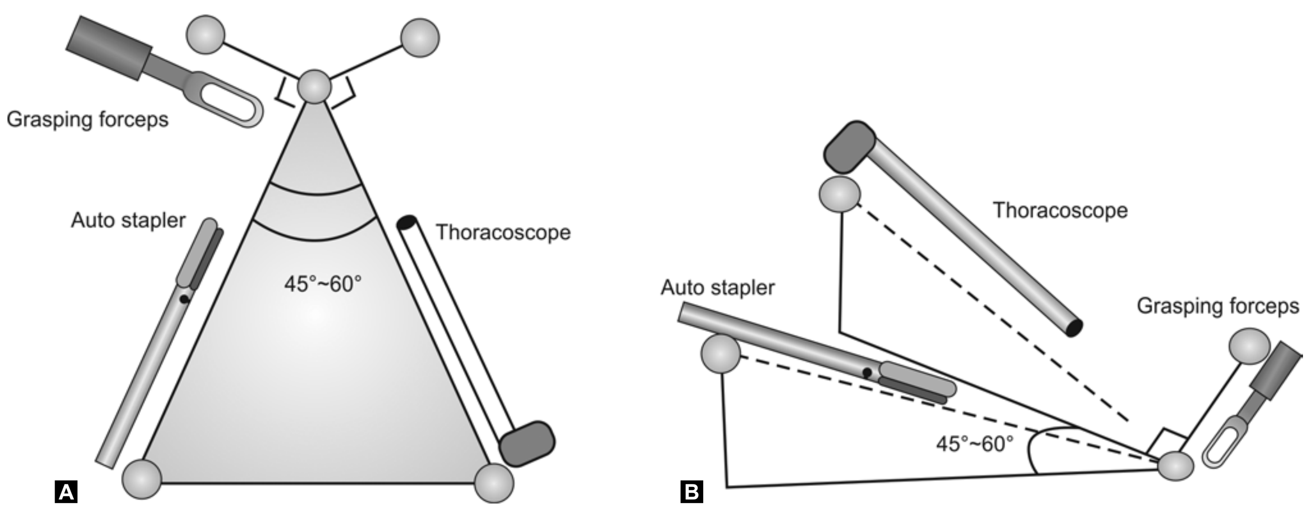
Most of the procedures done using the TTP when it was introduced involved lung resections and there is a need to assess the use of the TTP in nonpulmonary procedures and compare it with the conventional BDP.

MATERIALS AND METHODS

Thirty-six nonpulmonary VATS procedures were conducted on swine models by the candidate at the Institute of Minimal Access Surgery, the Global, Open, University in the World Laparoscopy Hospital, Gurgaon, India, over 6 months between 19/09/2013 and 23/03/2014. Twelve pigs were used and three procedures were done on each animal. The procedures include 12 pericardial window, 12 esophagocardiomyotomy and 12 thoracic sympathectomy. Six of each of the procedures were done using BDP and six using TTP.

The outcome measures are execution time (seconds), errors (pericardial window-myocardial injury; esophagocardiomyotomy-esophageal perforation, aortic injury and thoracic sympathectomy-intercostal vessels bleeding) and surgeons discomfort level as analyzed by visual analog system (VAS) ranging from 1 to 10 in increasing discomfort pattern.

The research was an animal study which is strictly regulated in India under the provisions of section 15 of the Prevention of Cruelty to Animals Act, 1960, and the rules under the Act of 1998 and 2001. This is enforced by the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA).[7] In conducting this research the operational guidelines for observance of good practices by the CPCSEA was strictly adhered to. Permission and approval for procurement of the pigs from CPCSEA



Figs 2A and B: Geometry for (A) baseball diamond and (B) triangle target principles registered animal breeding houses and conduct of the research was obtained. At the end of the experiments euthanasia was induced and the animal carcasses were disposed according to the provisions.

The animals were anesthetized (ketamine, propofol, diazepam, midazolam and tramadol). The ports were created using surgical scalpel and air was insufflated into the chest cavity to collapse the ipsilateral lung. The optical trocar was inserted blindly while the working ports were inserted under vision. Pericardial window was done using a grasper and a scissors. Esophagocardiomyotomy was done with the alternating use of scissors, monopolar hook diathermy and grasper for retracting the lower lobe of the left lung. Monopolar hook diathermy was used to do thoracic sympathectomy. At the end of the procedure euthanasia was conducted by giving high dose of succinylcholine and the carcasses disposed appropriately.

There are some limitations of this research which include: (i) the small sample size because the study is on animal models which are not commonly used now because of stringent legislations and the limited time (ii) swine models have flimsy tissues and are easily injured and the space between the anterior and posterior axillary lines are shorter which limit exposure.

BDP *vs* TTP

Port Placement in VATS Pericardial Window

The ports placement for VATS pericardial window by the BDP requires putting the optical port at 8th intercostal space along the posterior axillary line, the 1st working port at the 6th intercostal space along the posterior axillary line and the 2nd working port at the 7th Intercostal space along the anterior axillary line.

The TTP requires placing the optical port at the 7th intercostal space along the posterior axillary line, the 1st working port at the 4th intercostal space along the posterior axillary line and the target port at the 3rd intercostal space along the midclavicular line (Fig. 3).

Port Placement in VATS Heller's Esophagocardiomyotomy

The ports placement for VATS Heller's esophagocardiomyotomy by the BDP requires putting the optical port at 7th intercostal space along the midaxillary line, the 1st working port at the 8th intercostal space along the posterior axillary line and the 2nd working port at the 6th intercostal space along the posterior axillary line.

The TTP requires placing the optical port at the 7th intercostal space along the midaxillary line, the 1st working port at the 8th intercostal space along the posterior axillary line and the target port at the 5th intercostal space along the midaxillary line (Fig. 4).

Port Placement in VATS Thoracic Sympathectomy

The ports placement for VATS thoracic sympathectomy by the BDP requires putting the optical port at 5th intercostal space along the midaxillary line, the 1st working port at the 4th intercostal space along the posterior axillary line and the 2nd working port at the 3rd intercostal space along the anterior axillary line.

The TTP requires placing the optical port at the 7th intercostal space along the anterior axillary line, the 1st working port at the 8th intercostal space along the posterior axillary line and the target port at the 4th intercostal space along the midaxillary line (Fig. 5).

RESULTS

VATS Pericardial Window

The mean execution time for VATS pericardial window using the BDP for ports placement was 561seconds

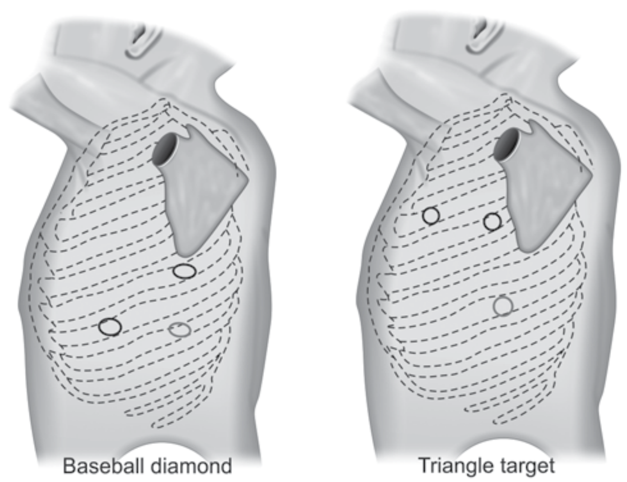


Fig. 3: Ports for VATS pericardial window: BDP *vs* TTP

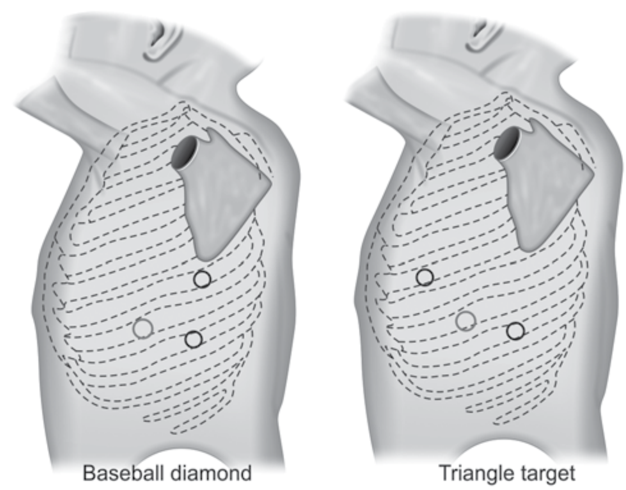


Fig. 4: Ports for VATS esophagocardiomyotomy: BDP *vs* TTP

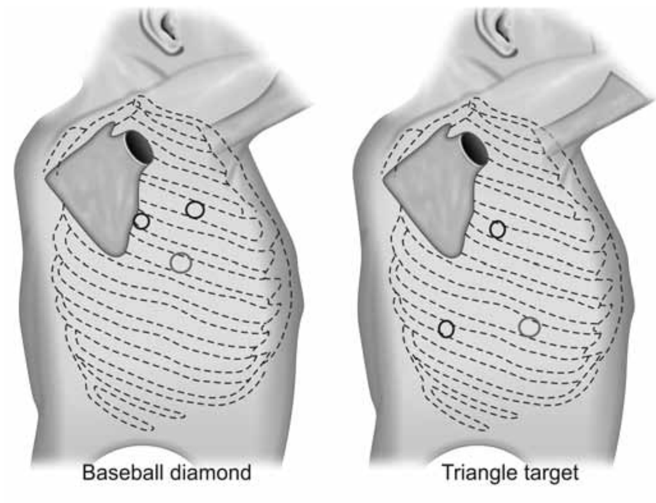


Fig. 5: Ports for VATS thoracic sympathectomy: BDP *vs* TTP

(530-580 seconds). The mean time using the TTP for ports placement was 654 seconds (625-670 seconds). This shows a mean difference of 93 seconds with the TTP of port placement taking a longer time to execute (Table 1).

The data for the Execution time by using both the BDP and TTP were found to be statistically significant and reproducible using Chi-square (χ^2-value of 2.649 and 2.734 respectively at a p-value of 11.07). Hence, the difference between the execution times when BDP and TTP were used was statistically significant and VATS pericardial window done using TTP takes a longer time to be executed.

There were no major errors (myocardial injury) recorded while using both the BDP and TTP for port placement in VATS pericardial window. Thus, VATS pericardial window using BDP and TTP are comparable in terms of the error rates.

The surgeon's discomfort during VATS pericardial window using the BDP for port placement ranged from 3 to 5 (mean of 3.83) and the discomfort when the TTP was used ranged from 3 to 6 (mean of 4.17). VATS pericardial window between the application of BDP and TTP is comparable in terms of the surgeon's discomfort.

There was presence of mirror imaging when TTP was used which made the procedure difficult.

VATS Heller's Esophagocardiomyotomy

The mean execution time for VATS esophagocardiomyotomy using the BDP for ports placement was 1375 seconds (1360-1400 seconds). The mean time using the TTP for ports placement was 1048.33 seconds (1000-1100 seconds). This shows a mean difference of 326.67 seconds with the BDP of port placement taking a longer time to execute (Table 1).

The data for the execution time by using both the BDP and TTP were found to be statistically significant and reproducible using Chi-square, although BDP is more reproducible (χ^2-value of 0.797 and 7.90 respectively, at a p-value of 11.07). Hence, the difference between the execution times when BDP and TTP were used was statistically significant and VATS esophagocardiomyotomy done using BDP takes a longer time to be executed.

There were major errors recorded while using both the BDP and TTP for port placement in VATS esophagocardiomyotomy. One episode of esophageal perforation was recorded using BDP while an episode of esophageal perforation and one aortic injury were recorded.

Thus, VATS esophagocardiomyotomy using BDP and TTP are comparable in terms of the error rates but TTP may be associated with more complications.

The surgeon's discomfort during VATS esophagocardiomyotomy using the BDP for port placement ranged from 4 to 7 (mean of 5.83) and the discomfort when the TTP was used ranged from 6 to 8 (mean of 7). VATS esophagocardiomyotomy using the application of TTP causes more discomfort to the surgeon than using the BDP.

VATS Thoracic Sympathectomy

The mean execution time for VATS thoracic sympathectomy using the BDP for ports placement was 656 seconds (590-700 seconds). The mean time using the TTP for ports placement was 462 seconds (432-505 seconds). This shows a mean difference of 194 seconds with the BDP of port placement taking a longer time to execute (Table 1).

The data for the execution time by using the BDP was not significant and not reproducible (χ^2 of 21.04) but that

Table 1: Execution time (seconds) for VATS pericardial window, esophagocardiomyotomy and thoracic sympathectomy between BDP and TTP

	VATS PW		*VATS OCM*		*VATS TS*	
Sl. no.	*BDP*	*TTP*	*BDP*	*TTP*	*BDP*	*TTP*
1.	580	670	1360	1010	700	505
2.	555	670	1370	1080	650	470
3.	570	644	1365	1100	700	435
4.	570	670	1370	1070	596	460
5.	530	645	1385	1030	590	470
6.	561	625	1400	1000	700	432
Mean	561	654	1375	1048.33	656	462

by using TTP was statistically significant and reproducible using chi-square (χ^2-value of 7.80 at a p-value of 11.07). VATS thoracic sympathectomy done using BDP takes longer time to be executed, although the BDP data is not reproducible.

There was one episode of major errors (intercostal vessels injury) recorded while using both the BDP and TTP for port placement in VATS thoracic sympathectomy. Thus, VATS thoracic sympathectomy using BDP and TTP are comparable in terms of the error rates.

The surgeon's discomfort during VATS thoracic sympathectomy using the BDP for port placement ranged from 4 to 6 (mean of 4.83) and the same discomfort level was obtained when the TTP was used. VATS thoracic sympathectomy between the application of BDP and TTP is comparable in terms of the surgeon's discomfort.

DISCUSSION

The BDP is the conventional principle for deciding sites of port placement during VATS.[1-3,8] It is the background principle to which other principles are compared.

VATS Pericardial Window

The result showed that using the TTP for ports placement led to longer execution time with a mean difference of 93 seconds. The error rates and the surgeons discomfort were however similar.

The prolonged execution time may be attributable to the mirror image produced when TTP is used. The scissors and the grasping forceps were often alternated between the working port and the target port during the procedure to conform to the different orientations for resecting the pericardial segment. The mirror image distorts the visuals and the orientation which prolongs the execution time.

With more experience this problem may be addressed by maintaining the grasping forceps in the target port and cutting the pericardial segment with a scissors or monopolar spatula through the working port.

The TTP may have a role when dealing with pericardial lesions requiring digital palpation and stapling, such as pericardial cysts. The manipulation angle between the grasping forceps and the stapler (through the target and working ports respectively) is then 90° which is the perfect angle for stapling. When BDP is used in this scenario, a different access may be required for the stapler to achieve this angle.

Thus, BDP is preferred for ports placement during VATS pericardial window but TTP may have clear advantages when dealing with pericardial lesions requiring digital palpation and stapling.

VATS Esophagocardiomyotomy

From the results the execution time for VATS esophagocardiomyotomy using BDP for ports placement was more than when TTP was used with a mean difference of 326.67 seconds. This is in contrast to the results of the errors rates and surgeons discomfort which were more when TTP was used.

One episode of esophageal perforation was recorded when using the BDP while two major errors (esophageal perforation and descending aortic injury) were recorded when TTP was used. This is significant as it translates to 33.3% error rate.

The surgeon's discomfort using TTP was worse with an average of 7 compared to 5.83 recorded for BDP.

The increased error rates and surgeon's discomfort can be explained by the mirror image produced when using TTP and the flimsy nature of the pig's tissue giving rise to injury to the esophagus and the surrounding structures even with minimal force.

The prolongation of the execution time when BDP was used which is in contrast to the trends of the error rates and the surgeon's discomfort could have been due to the increased error rates in TTP use. When these major errors are encountered, the procedure do not usually proceed and the execution time when using TTP is recorded as shortened. This calls for more data from larger sample size to revalidate this and offer more explanations.

The BDP appears to be better than the TTP of ports placement for VATS esophagocardiomyotomy in terms of the error rates and the surgeon's discomfort, although it took longer time to be executed.

The TTP may have clear advantages over BDP when treating other esophageal diseases requiring stapling, such as esophageal diverticulum or during esophagectomy due to the 90° manipulation angle between the grasping forceps and the stapler.

VATS Thoracic Sympathectomy

The execution time for VATS thoracic sympathectomy when using the TTP was less than when BDP was used (mean difference of 194 seconds). But the execution time data is not statistically significant and so not reproducible (χ^2 = 21.04 at p-value of 11.07). Thus, there may be need for a larger sample to reassess its reproducibility and then objectively compare it with the TTP. The BDP and the TTP are comparable in terms of the error rates and the surgeons discomfort.

It can also be seen that TTP is comparable or more favorable to BDP when the instrument through the target port is used for retraction only and not for other manipulations. When used for other purposes, the mirror image produced will lead to reduced task performance and increase surgeon's discomfort.

CONCLUSION

The BDP is the conventional principle used to decide sites for port placement during VATS. The TTP was introduced as an alternative principle when difficulty was observed during some procedures using the BDP especially pulmonary procedures. This thesis compares the two principles during VATS pericardial window, VATS esophagocardiomyotomy and VATS thoracic sympathectomy.

The BDP appears to be associated with better task performance in terms of the execution time and error rates and has less surgeons discomfort during some nonpulmonary VATS procedures in swine models compared to the TTP when stapling is not required.

The TTP may offer more advantages when the instrument passed through the target port is used only for retraction and also in VATS procedures where stapling may be required.

The prolonged execution time associated with BDP during VATS esophagocardiomyotomy and VATS thoracic sympathectomy needs further evaluation with a large data.

RECOMMENDATIONS

- The BDP should be preferred during nonpulmonary VATS procedures when stapling may not be required.
- The TTP should be preferred during nonpulmonary VATS procedures when the instrument through the target port is used only for retraction or stapling will be required.
- There is need for a larger sample size to have a more reproducible and validated result.
- There should be caution when translating this data to humans as the swine models have some peculiarities, such as flimsy tissues and shortened space between the anterior and posterior axillary lines.
- Surgical simulation using animal models is a high fidelity method and should be encouraged when ever feasible.
- An alternative to the swine models should be considered for VATS procedures. The sheep models have stronger tissues and are an option.

REFERENCES

1. De Silva MC, Swanson SJ. Video-assisted thoracic surgery in ACS surgery: principles and practice. Chapter 10. 4th ed; 2010. Decker Intellectual Properties.
2. Mishra RK. Textbook of practical laparoscopic surgery. 3rd ed. Jaypee Brothers Medical Publishers (P) Limited, New Delhi, India; 2013.
3. Landreneau RJ, Mack MJ, Hazelrigg SR, Dowling RD, Acuff TE, Magee MJ, Ferson PS. Video-assisted thoracic surgery: basic technical concepts and intercostal approach strategies. Ann Thorac Surg 1992;54(4):800-807.
4. Landreneau RJ, Mack MJ, Keenan RJ, Hazelrigg SR, Dowling RD, Ferson PS. Strategic planning for video-assisted thoracic surgery. Ann Thorac Surg 1993;56(3):615-619.
5. Denny TL. Video-assisted thoracic surgery. Lands bioscience. Georgetown, Texas, USA; 2001.
6. Sasaki M, Harai S, Kawabe M, Uesaka T, Morioka K, Ihaya A, Tanaka K. Triangle target principle for trocar placement during video-assisted thoracic surgery. European J Cardiothoracic Surg 2005;27(2):307-312.
7. Operational guidelines for observance of good practices in CPCSEA. An Indian committee for the purpose of promotion and supervision of experiments on animals (CPCSEA) document. Available at: www.envfor.nic.com
8. Mayhew PD. Thoracoscopy: basic principles, anaesthetic concerns, instrumentation and thoracic access. Compendium: continuing education for veterinarians. 2013 Jan. Available at: www.vetlearn.com.

10.5005/jp-journals-10033-1219

ORIGINAL ARTICLE

Pain and Cosmesis following Four-Port Laparoscopic Cholecystectomy: The Patient View

[1]M Patel, [2]CP Neal, [3]AR Dennison, [4]MS Metcalfe, [5]G Garcea

ABSTRACT

Introduction: The standard four-port laparoscopic cholecystectomy (SLC) is presently the gold standard in gallbladder surgery in the United Kingdom. The introduction of single port laparoscopic cholecystectomy (SILC) is said to offer potential improvements in pain and cosmesis postoperatively. This study surveyed patient satisfaction at each of their port sites following uncomplicated four-port cholecystectomy.

Materials and methods: Retrospective postal questionnaire poll of 100 patients aged between 18 and 82. A ten-point visual analog score was used to assess postoperative pain at each respective port site within the first 72 hours. A similar scale was used to assess cosmetic satisfaction relating to scar color, stiffness, thickness and irregularity. Patients were asked whether or not they would prefer a single incision operation based on their experience of the standard four-port technique.

Results: Sixty-one patients returned their questionnaires (61% response rate). The median pain scores were highest at the umbilical port site the epigastric port site collectively had the worst cosmetic outcome in terms of satisfaction with scar color, stiffness, thickness and irregularity. 79.7% of patients were satisfied with the four-port procedure and only 20.3% would have preferred a single-port operation if given the option.

Conclusion: Patient satisfaction with standard four-port cholecystectomy is high. The umbilical port was consistently the most painful postoperatively, with cosmesis scores being worst for the epigastric port site. However, there is no firm data that would support SILC over SLC based on this evidence.

Keywords: Cosmesis, Pain, Scar, Port site, Cholecystectomy.

How to cite this article: Patel M, Neal CP, Dennison AR, Metcalfe MS, Garcea G. Pain and Cosmesis following Four-Port Laparoscopic Cholecystectomy: The Patient View. World J Lap Surg 2014;7(2):66-68.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Over the last two decades, minimally invasive surgery has revolutionized the way in which symptomatic gallstones are managed. The standard four-port laparoscopic cholecystectomy (SLC) is the current gold-standard of surgical treatment, and remains the primary technique employed for the 60,000 cholecystectomies performed annually within the United Kingdom.[1] In an attempt to reduce operative trauma and improve cosmetic results, there is a trend toward minimising the number of incisions with the use of single-port laparoscopic cholecystectomy (SILC) and natural orifice transluminal endoscopic surgery (NOTES). Our aim was to investigate patient satisfaction with the standard four-port technique by assessing postoperative pain and cosmetic result scores as well overall satisfaction in an attempt to identify whether a single-incision technique would help us to provide a more acceptable patient experience.

[1,2]Specialist Trainee, [3-5]Consultant

[1,2]Department of General Surgery, University Hospitals of Leicester, Leicester, United Kingdom

[3-5]Department of Hepatobiliary and Pancreatic Surgery University Hospitals of Leicester, Leicester, United Kingdom

Corresponding Author: M Patel, Specialist Trainee, Department of General Surgery, University Hospitals of Leicester Leicester, LE5 4PW, United Kingdom, Phone: 0116 258 446 Fax: 0116 268 4708, e-mail: meerapatel@doctors.org.uk

MATERIALS AND METHODS

Study Protocol Open Access

The study consisted of a retrospective postal questionnaire poll of 100 patients aged between 18 and 82. Inclusion criteria included patients who had undergone an elective SLC (all performed by the same surgeon) within the last 6 months (from December 2011 to May 2012). Those who required conversion to open cholecystectomy were excluded from this study. Questionnaires were timed to be received at 2 months following surgery. A ten-point visual analog score (zero = no pain, ten = severe pain) was used to assess postoperative pain scores (within the first 24 hours) at the four respective port sites. A similar scale was used to assess cosmetic satisfaction relating to scar color, stiffness, thickness and irregularity (zero = like normal skin, ten = very different to normal skin). Patients were asked to report port site wound infections and overall satisfaction with their operation. More specifically, they were asked whether or not they would prefer a single incision operation based on their experience of the standard four-port technique.

Operating Technique

A standard four-port technique utilizing 10 mm incisions at the umbilicus and epigastric region, with two lateral 5 mm retraction ports. The gallbladder was retrieved from the epigastric port site using a standard commercially available endoscopic retrieval bag. All port sites were infiltrated with local anesthetic postprocedure (Fig. 1).

Statistical Method

Descriptive statistical analysis was undertaken on the data obtained using Microsoft Excel 2007 (Microsoft Corporation, USA).

RESULTS

Sixty-one patients returned their questionnaires (61% response rate). The median pain score (higher score indicates worse pain) at the umbilical port was 3 (0-10), 1 (0-8) at the anterior axillary line port, 2 (0-9) at the midclavicular line port and 3 (1-10) at the epigastric port site. In response to which site was painful for the longest period of time following surgery: 42.4% of patients stated the umbilical port, 33.9% the epigastric port and 8.5% stated the anterior axillary line port (Fig. 2) (Table 1). The epigastric port site collectively had the worst cosmetic outcome in terms of satisfaction with scar color, stiffness, thickness and irregularity (median scores 4, 2, 2 and 1 respectively). Table 2 summarizes median cosmetic scores at the respective sites. The epigastric port site was the one and only site complicated by wound problems with 10.2% of study participants reporting infection at this site. 79.7% of patients were satisfied with the four-port procedure and only 20.3% would have considered a single-port operation based on their overall pain/cosmetic satisfaction.

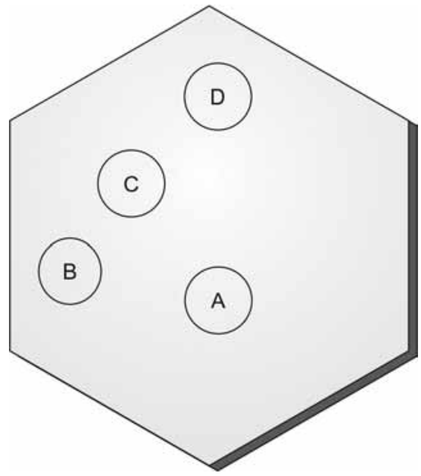


Fig. 1: Port site placement

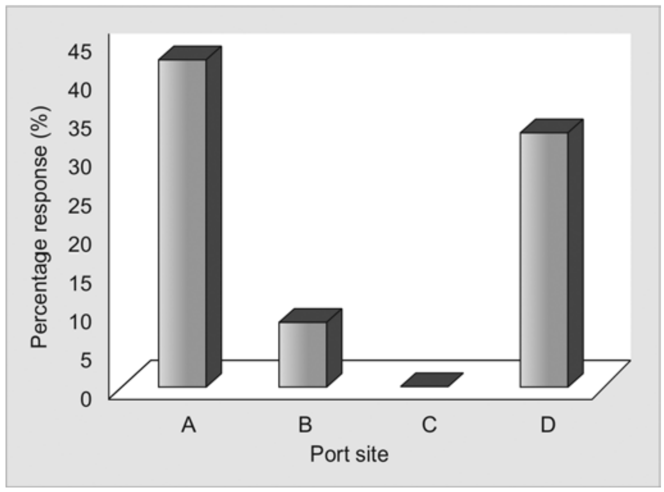


Fig. 2: Responses to the question relating to which port site is painful for the longest postoperative period

DISCUSSION

The SILC was first described by Navarra in 1997[2] and has since gained momentum, generating numerous studies (randomized, nonrandomized) and meta-analyses comparing the relative benefits of the single-incision technique over the SLC. Although not yet scientifically proven, advocates of SILC claim that improved cosmetic outcome is one of the main benefits over SLC as well as less postoperative pain, reduced wound complications and faster recovery.[3,4] In May 2010, the National Institute of Clinical Excellence (NICE) summarized the somewhat limited and largely inconclusive data regarding the safety and benefits of the SILC; stating publication of further evidence on the incidence of complications and comparison of outcomes of this procedure with the SLC is required. Few studies have reported on cost comparison between SILC and SLC. Bearing in mind the technical aspects of SILC are not standardized, there is statistically significant data to suggest the cost of SILC is higher than SLC with equivalent quality-of-life scores, pain analog scores, and pain-medication use.[5] In Hall et al[6] systematic review of studies, they reported similar or worse postoperative pain scores in 10 out of 13 articles comparing the SILC to the SLC.[6] Additional studies have confirmed there is no benefit conferred from the SILC within the 6, 8 or 24 hours postoperative period.[4,7] In this study, the umbilical port had the highest median pain score and was reported as the site painful for the longest period after the operation. A number of studies have highlighted the umbilical port site as the most problematic in terms of postoperative complications. Monkhouse et al[8] performed a retrospective wound review of patient who had undergone the SLC; 48% of patients had experienced a wound related issue (pain, infection) with 65% of these at the umbilicus.[8]

Table 1: Postoperative pain scores and port-site infection results

	A	*B*	*C*	*D*
Median pain score	3 (0-10)	1 (0-8)	2 (0-9)	3 (1-10)
Site painful for the longest period	42.4%	8.5%	0%	33.9%
Port-site infection	0%	0%	0%	10.2%

Table 2: Median cosmetic scores at each port site (0-10 scale)

	Port site			
Cosmetic feature	*A*	*B*	*C*	*D*
Color	3	2	1	4
Stiffness	1	1	1	2
Thickness	1	1	1	2
Irregularity	1	1	1	1

Median cosmetic scores were higher (i.e. worse score) at the epigastric port, closely followed by the umbilical port-with 'color' as the feature scored as most unlike normal skin at both sites. Anecdotal evidence (also mentioned in a number of studies) would suggest the site of gallbladder retrieval is more likely to be complicated by postoperative wound infection and/or pain. The patients, in this study, underwent retrieval of the excised gallbladder via the epigastric port and this may account for the proportion of wound infections reported at this site and consequential poor cosmetic outcome. The main impetus behind the development of the SILC is a perceived benefit of superior cosmetic outcome. There are six studies investigating cosmesis after SILC, with three reporting a significantly improved cosmesis with this technique.[6] Interestingly, Bignell et al[9] assessed cosmetic outcome in women 4 years after SLC and concluded patients perceive cosmetic results after the procedure as excellent, with further anecdotal evidence suggesting the umbilical port as the site of problems for some patients.[9] We have confirmed the site of gallbladder retrieval will continue to cause problems with wound quality; importantly, the results demonstrated the umbilical port site can be problematic resulting in increased pain/suboptimal cosmetic result irrespective of this technicality.

Whilst the aim of this study is not to compare the SLC with the SILC, it is our aim to measure the quality of the services we provide and also to assess for the potential to provide a better surgical experience. The implementation of the Health and Social Care Act 2012 places the patient at the center of a new system. Patient experience, questionnaires/feedback and quality improvement will be central to hospitals securing services. We are aware of the influence patient factors, such as recall accuracy may have on retrospective pain ratings, however, studies have shown retrospective reports of pain intensity are consistent with those made while the pain was experienced.[10] Although we have not directly compared the SLC with the SILC, we have been unable to generate evidence from our experience with the SLC that would support the use of a single umbilical incision to replace the SLC; the problems which do exist have been demonstrated to be acceptable to patients across a number of studies and are those which are unlikely to be resolved by a single incision operation. It is possible, given our data, that SILC may offer a marginal benefit in cosmesis by avoiding an epigastric incision. However, it remains to be determined if the additional expense incurred by SILC would make this cost-effective.

CONCLUSION

Patient questionnaires and feedback are central to assessing and improving the quality of the services we provide. Introducing SILC is unlikely to resolve the few issues which have been highlighted with the standard technique. Overall satisfaction with the conventional technique is high and this has been confirmed in a number of studies. Published data quantifying the cosmetic benefits of SILC over SLC is sparse and there is a lack of data from randomized studies validating any benefit. Robust evidence is required to demonstrate that SILC provides a cost-effective superior cosmetic/overall better outcome than the SLC. Ultimately, we have to raise the question: 'why fix it if it is not broken?'

REFERENCES

1. Available at: http://www.nhs.uk/pages/homepage.aspx. Date last accessed on 13/10/2012.
2. Navarra G, Pozza E, Occhionorelli S, Carcoforo P, Donini I. One-wound laparoscopic cholecystectomy. Br J Surg 1997;84(5):695.
3. Marks J, Tacchino R, Roberts K, et al. Prospective randomized controlled trial of traditional laparoscopic cholecystectomy versus single-incision laparoscopic cholecystectomy: report of preliminary data. Am J Surg 2011;201(3):369-372.
4. Prasad A, Mukherjee KA, Kaul S, Kaur M. Postoperative pain after cholecystectomy: conventional laparoscopy versus single-incision laparoscopic surgery. J Minim Access Surg 2011;7(1):24-27.
5. Leung D, Yetasook AK, Carbray J, Butt Z, Hoeger Y, Denham W, Barrera E, Ujiki MB. Single-incision surgery has higher cost with equivalent pain and quality-of-life scores compared with multiple-incision laparoscopic cholecystectomy: a prospective randomized blinded comparison. J Am Coll Surg 2012 Nov;215(5):702-708.
6. Hall TC, Dennison AR, Bilku DK, Metcalfe MS, Garcea G. Single-incision laparoscopic cholecystectomy: a systematic review. Arch Surg 2012 Jul 1;147(7):657-666.
7. Garg P, Thakur JD, Garg M, Menon GR. Single-incision laparoscopic cholecystectomy vs conventional laparoscopic cholecystectomy: a meta-analysis of randomized controlled trials. J Gastrointest Surg 2012 Aug;16(8):1618-1628.
8. Monkhouse SJ, Court EL, Beard LA, Bunni J, Burgess P. A retrospective wound review of standard four-port laparoscopic cholecystectomy: is there need for single-port laparoscopic surgery? Surg Endosc 2012 Jan;26(1):255-260.
9. Bignell M, Hindmarsh A, Nageswaran H, Mothe B, Jenkinson A, Mahon D, Rhodes M. Assessment of cosmetic outcome after laparoscopic cholecystectomy among women 4 years after laparoscopic cholecystectomy: is there a problem? Surg Endosc 2011 Aug;25(8):2574-2577.
10. Rohini T, Niven CA, Brodie EE. How well do patients recall past experience of pain? Nursing Times 2007 Nov;103(42): 34-35.

10.5005/jp-journals-10033-1220

ORIGINAL ARTICLE

Laparoscopic Cholecystectomy after Endoscopic Retrograde Cholangiopancreatography: The Optimal Timing for Operation

[1]Samir A Ammar, [2]Mohamad Abdel Bar, [3]Mohy El Shafy

ABSTRACT

Background: In patients with choledochocystolithiasis (CCL), early laparoscopic cholecystectomy (LC), within 72 hours, is recommended after endoscopic stone extraction. The objective of this study is to investigate LC for CCL within 24 hours of endoscopic retrograde cholangiopancreatography (ERCP) to determine its feasibility and safety.

Materials and methods: Group I, those patients who had LC within 24 hours after ERCP was compared with group II, those who had LC after 24 hours, but within 72 hours. Primary outcome was the conversion rate from LC to open cholecystectomy. Secondary outcomes were duration of LC, postoperative morbidity and hospital stay.

Results: Of 60 consecutive patients, 31 were in group I and 29 were in group II. There were no differences in groups I *vs* II in demographics, laboratory or ultrasonographic findings. The hospital stay in group I was significantly shorter than that of group II (2.5 ± 1.5 *vs* 4 ± 2 days respectively). There was no statistically significant difference in operative time, conversion to open cholecystectomy or postoperative morbidity between both groups.

Conclusion: LC for CCL within 24 hours after ERCP is feasible and safe with short hospital stay.

Keywords: Laparoscopic cholecystectomy, Gallstones, Common bile duct stones, Timing of operation.

How to cite this article: Ammar SA, Bar MA, El Shafy M. Laparoscopic Cholecystectomy after Endoscopic Retrograde Cholangiopancreatography: The Optimal Timing for Operation. World J Lap Surg 2014;7(2):69-73.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Symptomatic cholecystolithiasis is one of the most common gastrointestinal surgical entities, and a considerable amount of patients present with complications of gallstone disease. There is no consensus on the correct strategy for the care of simultaneous gallbladder and common bile duct (CBD) stones. Many therapeutic options are available, including laparoscopic, endoscopic, percutaneous and open traditional techniques, either through a combination of these treatments or by conducting them in a stepwise sequence. Endoscopic retrograde cholangiopancreatography (ERCP) remains the preferred approach at most centers for managing patients with suspected CBD stones.[1,2] A CBD clearance can be carried out by ERCP with endoscopic sphincterotomy (ES) before laparoscopic cholecystectomy (LC) in many cases, and it is the most common strategy used in the majority of hospitals worldwide.[1]

The safety of early LC after ES for choledochocystolithiasis (CCL) has already been investigated in observational and randomized studies; early LC, within 72 hours, has a better outcome than delayed.[3-8] Early elective LC should be carried out for all surgically fit patients, regardless of age, since it may prevent biliary complaints related to GB stones, further CBD procedures or emergency surgery, which is a more difficult procedure with poorer results.[9] However, no clinical trials address LC within 24 hours after ERCP. The purpose of this study is to evaluate feasibility and safety of LC within 24 hours after ES for CCL.

MATERIALS AND METHODS

This prospective randomized study was carried out in the period from January 2011 to January 2014 at Department of Surgery, Assiut University Hospital, Egypt. All patients of 18 years and older who underwent successful ERCP and ES and stone extraction for choledocholithiasis and who had radiologically proven residual gallbladder stones were eligible for inclusion. Patients were divided into two groups: Group I, those patients who had LC within 24 hours after ES and group II, those who had LC after 24 hours, but within 72 hours of ERCP.

Our exclusion criteria were, contraindication or failure of ERCP, previous abdominal operations, associated comorbidities, pregnancy, or evidence of inflammation: cholangitis [abdominal pain, fever, elevated bilirubin, elevated leukocyte count/C-reactive protein (CRP) and pus drainage after

[1]Assistant Professor, [2]Senior Resident, [3]Professor

[1-3]Department of Surgery, Assiut University Hospital, Assiut Egypt

Corresponding Author: Samir A Ammar, Assistant Professor, Department of Surgery, El Gamaa Street, Assiut University Hospitals, Assiut, Egypt, Phone: 02-0882180562 e-mail: samirahmed70@hotmail.com

ES], pancreatitis (upper abdominal pain, elevated leukocyte count/CRP, elevated amylase at least 3 times normal, and elevated lipase levels), and cholecystitis (pain in the right upper quadrant, fever and leukocytosis, in the absence of hyperbilirubinemia).

All patients were subjected to complete evaluation through a detailed history, complete physical examination, laboratory investigations, and imaging study (US and/or MRCP). Randomization was done using computer-generated random number sequences. ERCP was performed for all patients under general anesthesia. If CBD stones were found on endoscopic cholangiography, ES was performed and the stones were extracted using either Dormia basket or balloon catheter. Mechanical lithotripsy was done in cases of large stones. Occlusion cholangiography was done at the end of every ERCP to ensure that no missed stones.

Laparoscopic cholecystectomy was done in both groups by the same surgical team using the standard four-port technique. In case of difficulty or complication, conversion to open cholecystectomy was done by a subcostal incision. The decision for conversion could only be taken by the most experienced surgeon in the operating team.

Primary outcome was the conversion rate from laparoscopic to open cholecystectomy. Secondary outcomes were duration of LC (measured from first incision to last skin suture), postoperative morbidity and hospital stay. Complications were recorded during the hospital stay and at the outpatient clinic, which every patient visited after 2 to 4 weeks. All patients were followed up for 6 months and were instructed to notify the surgeon if there were any symptoms suggesting biliary complication.

STATISTICAL ANALYSIS

Statistical analyses were performed using the Statistical Package for Social Sciences, version 16.0 (SPSS Inc, Chicago, IL, USA). Data are expressed as mean ± standard deviation (SD) for continuous variables and percentages for categorical variables. Student t-test was used to analyze continuous variables, whereas chi-square test was used to analyze categorical variables. p-value is considered statistically significant when less than 0.05.

RESULTS

During the period of the study, out of 65 patients recruited, 60 patients were included in the final analysis. Five patients were complicated by mild post ERCP pancreatitis, 3 in group I and 2 in group II, and excluded from the final analysis. Patients with acute pancreatitis were treated successfully with conservative treatment. No other post ERCP complications were reported.

Laparoscopic cholecystectomy was performed in 31 patients in group I and in 29 patients in group II. The age ranged from 25 to 65 years (mean 46 ± 12.8). Both groups were matched to each other as regard age, sex, laboratory and US characteristics (Table 1).

No mortality was recorded in either group. The mean duration of surgery was longer in group 2 than in group 1 (48.5 ± 11.6) *vs* (43 ± 10.4) but the result did not reach statistical significance. The conversion rates to an open procedure were 6.4 and 10.3% in groups I and II respectively (Table 2). The main reasons for conversion were dense adhesions in Callot's triangle, unclear anatomy and bleeding from the gallbladder bed. The hospital stay was

Table 1: Patients' characteristics

Variables	*Group I*	*Group II*	*p-value*
Number of cases	31	29	
Age (years) (mean ± SD)	46.2 ± 11.2	47.3 ± 11.1	0.7
Sex (female/male)	21/10	21/8	0.69
Proportion of abnormal LFTs (%)	25/31 (80%)	26/29 (89%)	0.3
US findings			
• Dilated CBD diameter (> 8 mm)	29/31 (93.5%)	24/29 (8.2.7%)	0.19
• CBD stone (s)	28/31 (90%)	23/29 (79.3%)	0.23

LFTs: Liver function tests

Table 2: Patients' outcomes

Variables	*Group I*	*Group II*	*p-value*
Operative time (min) (mean ± SD)	43 ± 10.4	48.5 ± 11.6	0.057
Conversion rate	6.4%	10.3%	0.58
Length of hospital stay (days) (mean ± SD)	2.5 ± 1.5	4 ± 2	0.001
Postoperative complications			
• Bleeding	0	1/29 (3.4%)	
• Bile leak	1/31 (3.2%)	0	
• Wound infection	0	1/29 (3.4%)	

significantly prolonged among patients in the group II (4 ± 2 days) *vs* (2.5 ± 1.5 days) in group I.

One patient had cystic stump leakage after LC, for which postoperative endoscopic intervention and stent placement was done. This patient did recover completely. Another patient had postoperative blood collection in gallbladder bed and percutaneous pigtail catheter drainage was carried out. Otherwise, the complications in all groups were minor, and responded well to conservative management. During the follow-up period, no biliary symptoms appear in both groups.

DISCUSSION

The last 30 years have seen major developments in the management of gallstone-related disease. ERCP has become a widely available and routine procedure, whilst open cholecystectomy has largely been replaced by a laparoscopic approach, which may or may not include laparoscopic exploration of the common bile duct (LCBDE). In addition, new imaging techniques such as magnetic resonance cholangiography (MRC) and endoscopic ultrasound (EUS) offer the opportunity to accurately visualize the biliary system without instrumentation of the ducts.[1,10]

Choledocholithiasis is concomitant with gallstones in approximately 3 to 20% of the patients.[11-16] In the pre-endoscopy and prelaparoscope era, the standard treatment for patients suffering from gallstones accompanied with CBD stones was open cholecystectomy and CBD exploration.[17] Currently, open choledochotomy could still play a role in those cases with an intraoperative unexpected diagnosis of choledocholithiasis, with CBD dilatation or where all other endoscopic, percutaneous and laparoscopic approaches failed.[18] However, open CBD exploration remains the 'gold standard' for selected rare patients, such as those with Mirizzi syndrome, Billroth II anatomy, and those requiring a drainage procedure.[18,19] A Roux-en-Y hepaticojejunostomy, a choledochojejunostomy, or a surgical sphincteroplasty may be indicated for sphincter of Oddi stenosis/dysfunction, primary CBD stones, patients with duodenal diverticula, multiple stones or intrahepatic stones.[10]

With the advent of laparoscopic and endoscopic techniques, several alternative treatments have been developed to treat CCL. An interesting observational study from Sweden reported a so-called 'paradigm shift' from open choledochotomy and cholecystectomy toward bile duct clearance using the endoscopic route and selective LC in patients suffering from CCL.[20] Cholecystectomy is recommended for all patients with CBD stones and symptomatic gallbladder stones, unless there are specific reasons for considering surgery inappropriate.[1]

Endoscopic retrograde cholangiopancreatography remains the preferred approach at most centers for managing patients with suspected CBD stones. However, ERCP is associated with complications such as pancreatitis, hemorrhage, cholangitis, duodenal perforation (5 to 11%) and mortality of up to 1%.[2] Moreover, failure rates of 5 to 10% are reported with ERCP. In the present study, mild post-ERCP pancreatitis occurred in five patients (6.7%); all of them were treated successfully with conservative treatment. In addition, when patients proceed to ERCP, a significant number of them may not have stones.[21,22] ERCP should be performed only in patients who are expected to require an intervention; it is not recommended for use solely as a diagnostic test.[23]

Previous studies have shown that LC after ES is more difficult than LC for uncomplicated cholelithiasis: the conversion rate after a previous ES has been reported to be as high as 8 to 55% *vs* lower than 5% in patients with uncomplicated disease.[4,8,9,24-28] In this study, the conversion rates to an open procedure were 6.6 and 10.6% in groups I and II respectively. It might be beneficial to have these patients operated on by an experienced laparoscopic surgeon to minimize the risk of conversion and subsequent morbidity.[29] The etiology is thought to be because of disruption of the sphincter of Oddi and subsequent bacterial colonization of the biliary tract leading to inflammation and subsequent scarring of the hepatoduodenal ligament hindering dissection of Calot's triangle. This theory of reflux and bacterial colonization is strengthened by the finding that bile in patients who have undergone a sphincterotomy is colonized in approximately 60% of patients.[30,31]

The technique of combined LC with intraoperative ERCP as a single-step procedure implies some organizational problems concerning the availability of an endoscopic setting and experienced endoscopist in the operating theater whenever needed. Performing ERCP after surgery would raise the dilemma of managing CBD stones whenever ERCP fails to retrieve them because a third procedure would then be needed.[1,32,33] Sequential treatment, ES followed by early elective LC, is a safe procedure, and should be considered as a standard, definitive treatment for CCL.[34]

Laparoscopic cholecystectomy should be performed soon after ES; surgery could be easier if performed early before inflammatory process sets in. This study revealed that the first group stayed in the hospital for a shorter time than the second group (2.5 ± 1.5 *vs* 4 ± 2 days). This difference in the length of stay was statistically significant ($p = 0.001$). Such a longer stay will possibly lead to increased cost of health services and could lead to increased incidence of hospital acquired infections. If early LC for acute cholecystitis is recommended within 24 hours,[35] it should be possible to offer the same standard of care to patients with CCL after ES. These findings have implications for surgical practice. However, patient's condition, organizational facilitation, operator's expertise and local resources should be taken into account in making treatment decisions.

CONCLUSION

Laparoscopic cholecystectomy for CCL within 24 hours after ERCP is feasible and safe and has become our standard of practice.

REFERENCES

1. Williams EJ, Green J, Beckingham I, Parks R, Martin D, Lombard M. Guidelines on the management of common bile duct stones (CBDS). Gut 2008;57(7):1004-1021.
2. Coelho-Prabhu N, Shah ND, Van Houten H, Kamath PS, Baron TH. Endoscopic retrograde cholangiopancreatography: utilisation and outcomes in a 10-year population-based cohort. BMJ Open 2013;3(5):e002689.
3. Reinders JS, Goud A, Timmer R, et al. Early laparoscopic cholecystectomy improves outcomes after endoscopic sphincterotomy for choledochocystolithiasis. Gastroenterology 2010;138(7): 2315-2320.
4. Salman B, Yilmaz U, Kerem M, et al. The timing of laparoscopic cholecystectomy after endoscopic retrograde cholangiopancreatography in cholelithiasis coexisting with choledocholithiasis. J Hepatobiliary Pancreat Surg 2009;16(6):832-836.
5. Zang J, Zhang C, Zhou H, Gao J. Early laparoscopic cholecystectomy after endoscopic common bile duct stone extraction: the experience from a developing country. Surg Laparosc Endosc Percutan Tech 2011;21(2):120-122.
6. Akaraviputh T, Rattanapan T, Lohsiriwat V, Methasate A, Aroonpruksakul S, Lohsiriwat D. A same day approach for choledocholithiasis using endoscopic stone removal followed by laparoscopic cholecystectomy: a retrospective study. J Med Assoc Thai 2009;92(1):8-11.
7. Bostanci EB, Ercan M, Ozer I, Teke Z, Parlak E, Akoglu M. Timing of elective laparoscopic cholecystectomy after endoscopic retrograde cholangiopancreaticography with sphincterotomy: a prospective observational study of 308 patients. Langenbecks Arch Surg 2010;395(6):661-666.
8. McAlister V, Davenport E, Renouf E. Cholecystectomy deferral in patients with endoscopic sphincterotomy. Cochrane Database Syst Rev 2007(4):CD006233.
9. Lau JY, Leow CK, Fung TM, et al. Cholecystectomy or gallbladder in situ after endoscopic sphincterotomy and bile duct stone removal in Chinese patients. Gastroenterology 2006;130(1):96-103.
10. Sharma A, Dahiya P, Khullar R, Soni V, Baijal M, Chowbey PK. Management of common bile duct stones in the laparoscopic era. Indian J Surg 2012;74(3):264-269.
11. Collins C, Maguire D, Ireland A, Fitzgerald E, O'Sullivan GC. A prospective study of common bile duct calculi in patients undergoing laparoscopic cholecystectomy: natural history of choledocholithiasis revisited. Ann Surg 2004;239(1):28-33.
12. Hemli JM, Arnot RS, Ashworth JJ, Curtin AM, Simon RA, Townend DM. Feasibility of laparoscopic common bile duct exploration in a rural centre. ANZ J Surg 2004;74:979-982.
13. Petelin JB. Laparoscopic common bile duct exploration. Surg Endosc 2003;17(11):1705-1715.
14. Fiore NF, Ledniczky G, Wiebke EA, et al. An analysis of perioperative cholangiography in one thousand laparoscopic cholecystectomies. Surgery 1997;122(4):817-821.
15. Ko CW, Lee SP. Epidemiology and natural history of common bile duct stones and prediction of disease. Gastrointest Endosc 2002;56(Suppl 6):S165-S169.
16. Tazuma S. Gallstone disease: epidemiology, pathogenesis, and classification of biliary stones (common bile duct and intrahepatic). Best Pract Res Clin Gastroenterol 2006;20(6):1075-1083.
17. Bansal VK, Misra MC, Garg P, Prabhu M. A prospective randomized trial comparing two-stage *vs* single-stage management of patients with gallstone disease and common bile duct stones. Surg Endosc 2010;24(8):1986-1989.
18. Bencini L, Tommasi C, Manetti R, Farsi M. Modern approach to cholecysto-choledocholithiasis. World J Gastrointest Endosc 2014;6(2):32-40.
19. Phillips EH, Toouli J, Pitt HA, Soper NJ. Treatment of common bile duct stones discovered during cholecystectomy. J Gastrointest Surg 2008;12(4):624-628.
20. Sandzén B, Haapamäki MM, Nilsson E, Stenlund HC, Oman M. Treatment of common bile duct stones in Sweden 1989-2006: an observational nationwide study of a paradigm shift. World J Surg 2012;36(9):2146-2153.
21. Rhodes M, Sussman L, Cohen L, Lewis MP. Randomised trial of laparoscopic exploration of common bile duct versus postoperative endoscopic retrograde cholangiography for common bile duct stones. Lancet 1998;351(9057):159-161.
22. Nathanson LK, O'Rourke NA, Martin IJ, et al. Postoperative ERCP *vs* laparoscopic choledochotomy for clearance of selected bile duct calculi: a randomized trial. Annals of Surgery 2005; 242(2):188-192.
23. Blumgart LH. Stones in the common bile duct C clinical features and open surgical approaches and techniques. In: Blumgart LH, editor. Surgery of the liver, bilary tract and pancreas. 4th ed. Philadelphia, Saunders Elsevier 2007;528-547.
24. Boerma D, Rauws EA, Keulemans YC, et al. Wait-and-see policy or laparoscopic cholecystectomy after endoscopic sphincterotomy for bile-duct stones: a randomised trial. Lancet 2002;360(9335):761-765.
25. De Vries A, Donkervoort S, Geloven AA, Pierik EG. Conversion rate of laparoscopic cholecystectomy after endoscopic retrograde cholangiography in the treatment of choledocholithiasis: does the time interval matter? Surg Endosc 2005;19(7):996-1001.
26. Sarli L, Iusco DR, Roncoroni L. Preoperative endoscopic sphincterotomy and laparoscopic cholecystectomy for the management of cholecystocholedocholithiasis: 10-year experience. World J Surg 2003;27(2):180-186.
27. Donkervoort SC, van Ruler O, Dijksman LM, van Geloven AA, Pierik EG. Identification of risk factors for an unfavorable laparoscopic cholecystectomy course after endoscopic retrograde cholangiography in the treatment of choledocholithiasis. Surg Endosc 2010;24(4):798-804.
28. Livingston EH, Rege RV. A nationwide study of conversion from laparoscopic to open cholecystectomy. Am J Surg 2004;188(3): 205-211.
29. Reinders JS, Gouma DJ, Heisterkamp J, Tromp E, van Ramshorst B, Boerma D. Laparoscopic cholecystectomy is more difficult after a previous endoscopic retrograde cholangiography. HPB (Oxford) 2013;15(5):230-234.

30. Csendes A, Burdiles P, Maluenda F, Diaz JC, Csendes P, Mitru N. Simultaneous assessment of bile from gallbladder and common bile ductin control subjects and patients with gallstones and common duct stones. Arch Surg 1996;131(4):389-394.
31. Reinders JS, Kortram K, Vlaminckx B, van Ramshorst B, Gouma DJ, Boerma D. Incidence of bactobilia increases over time after endoscopic sphincterotomy. Dig Surg 2011;28:288-292.
32. Kharbutli B, Velanovich V. Management of preoperatively suspected choledocholithiasis: a decision analysis. J Gastrointest Surg 2008;12(11):1973-1980.
33. Schroeppel TJ, Lambert PJ, Mathiason MA, Kothari SN. An economic analysis of hospital charges for choledocholithiasis by different treatment strategies. Am Surg 2007;73(5):472-477.
34. Costi R, DiMauro D, Mazzeo A, Boselli AS, Contini S, Violi V, Roncoroni L, Sarli L. Routine laparoscopic cholecystectomy after endoscopic sphincterotomy for choledocholithiasis in octogenarians: is it worth the risk? Surg Endosc 2007;21(1):41-47.
35. Stevens KA, Chi A, Lucas LC, Porter JM, Williams MD. Immediate laparoscopic cholecystectomy for acute cholecystitis: no need to wait. Am J Surg 2006;192(6):756-761.

10.5005/jp-journals-10033-1221

ORIGINAL ARTICLE

Is There an Ideal Port Position for Laparoscopic Urological Procedures?

[1]Bashir Yunusa, [2]RK Mishra, [3]JS Chowhan

ABSTRACT

Background: Reports have suggested increased use of laparoscopy in the treatment of urological diseases and equally wrong port positions as the commonest cause of struggling during surgeries and increased in complications and operative time.

Aim: We aimed to find out the ideal positions for laparoscopic ports to be placed during urological procedures.

Methods: We performed different laparoscopic tasks in both the upper and lower urinary tract regions, at different ports position making different manipulation angles and operative time recorded. The procedures were performed on both dry and wet laboratory and on human during laparoscopic donor nephrectomies.

Results: The average operative time of those ports whose position approximate to manipulation angle of 60º was shorter and more comfortable to the surgeons.

Conclusion: There is no ideal positions for port placement in urological procedures based on anatomical landmarks, but rather any position that approximate its manipulation angle to as close to 60º as possible.

Keywords: Port positioning, Manipulation angles, Laparoscopic urological.

How to cite this article: Yunusa B, Mishra RK, Chowhan JS. Is There an Ideal Port Position for Laparoscopic Urological Procedures? World J Lap Surg 2014;7(2):74-87.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Laparoscopic Nephrectomy and Port Positioning

There are various approaches to nephrectomy and the placement of ports depends on the approach and the side, and whether or not a single site laparoendoscopic approach is intended.

Transperitoneal Approach

In this approach, usually a 12 mm port is placed at umbilicus by open Hasson technique, which is often primarily used as a camera port. Another 12 mm laparoscopic port is placed between umbilical port and anterior superior iliac spine (spinoumbilical port) and a 5 mm port is placed in line with the camera port at about 3 cm below the costal margin and 3 cm lateral to the midline. The fourth usually for retraction if needed, is a 5 mm port placed 4 cm below the costal margin in anterior axillary line.[1-6] Both kidneys have similar approach on either side.

Another approach is to place the laparoscopic port on the midclavicular line just at or above the upper border of the umbilicus. A working port usually 10/12 mm is positioned a fingerbreadth below the costal margin on the anterior axillary line. A second working port, is placed on the anterior axillary line just above the superior iliac crest. An additional working port may be placed on the midaxillary line midway between the costal margin and the superior iliac crest to provide access for a retracting instrument and to mobilize the kidney laterally. For the extremely thin patient the port sites are all moved medially with the laparoscope at the umbilicus, the working ports on the midclavicular line and an additional port on the anterior axillary line.[8]

One other approach for the left kidney is to place the camera port at the paraumblical space at the lateral border of the rectus muscle at the level of the umbilicus while the patient is placed in the right lumbotomy position; through the open introduction technique according to Hasson. One additional 10 mm and one 5 mm trocar are then inserted under laparoscopic vision in the epigastric and midclavicular positions.[9]

The left kidney can also be approached with the camera port placed just to the left of the umbilicus. The left hand 12 mm port placed along the lateral border of the rectus abdominis muscle lateral to the umbilicus. The right hand port placed on the lateral border of the rectus near the dome of the bladder. A fourth port to be placed laterally to retract the sigmoid colon medially.[10]

The Retroperitoneal Approach to the Kidneys

In the retroperitoneal laparoscopic approach, incision is made at tip of 12th rib and then blunt dissection or balloon used to create space and the working port is placed between the midaxillary line and the anterior axillary line (5 cm above the iliac crest). A 5 mm port is then inserted at the junction of the 12th rib and paraspinal muscles (renal angle).[11]

[1]Senior Registrar, [2]Professor, [3]Consultant

[1]Department of Surgery, Division of Urology, Aminu Kano Teaching Hospital, Kano, Nigeria

[2]Minimal Access Surgery, World Laparoscopy Hospital, Gurgaon Haryana, India

[3]Department of Laparoscopic Surgery, World Laparoscopy Hospital, Gurgaon, Haryana, India

Corresponding Author: Bashir Yunusa, Senior Registrar Department of Surgery, Division of Urology, Aminu Kano Teaching Hospital, Kano, Nigeria, e-mail: bashrano@gmail.com

Another approach through the retroperitoneal space is obtained through a 15 to 20 mm incision just below the tip of the 12th rib and the secondary ports are then placed along the inferior border of the costal margin using digital palpation through the balloon dilated incision site. After digital placement of all the secondary ports, the primary balloon-tip port is inserted. The posterior secondary 12 mm port is placed at the lateral border of the paraspinal muscle along the inferior border of the 12th rib. An anterior port is placed near the anterior axillary line, just below the inferior tip of the 11th rib. An additional 5 mm port may be placed, on the midaxillary line at or above the level of the superior iliac crest, and used for retraction and suction. Often a 12 mm port is placed at Petit's triangle just above the midportion of the iliac crest and a fingerbreadth superior to the iliac crest.[8]

Hand-assisted Laparoscopic Nephrectomy

The hand-assisted device for right renal surgery could be located at and just below the umbilicus on the midline. Alternatively, on the right side, the hand port may be placed as a Gibson incision in the right lower quadrant. A port is placed on the midclavicular line just above the superior iliac crest; the laparoscope is positioned at this port site. A 12 mm port is placed two fingerbreadths below the costal margin on the midclavicular line, to accommodate the Endo-GIA stapling device. A 5 mm port is placed on the midline in the epigastric region for placement of an instrument to retract the liver superiorly and medially.[8]

Conversely, on the left the incision for the hand-assisted laparoscopic (HAL) device is located on the midline, at and above the umbilicus on the midclavicular line just above the superior iliac crest, a 10 mm port placed for positioning of the 10 mm, 30º laparoscope. The laparoscope may then be used for visualization of the HAL device incision. An additional 12 mm working port is placed on the midclavicular line 2 fingerbreadths below the costal margin. Retraction of the kidney laterally may be facilitated by an instrument placed through a 5 mm port in the midaxillary line, midway between the costal margin and superior iliac crest.[8]

Laparoendoscopic Single Site Nephrectomy

Since the advent of laparoscopy, urologists have tried to minimize scars and improve cosmesis, leading to the progression to laparoendoscopic single site urological procedure. Access is usually gain through the umbilicus, but others include transabdominal or retroperitoneal flank approach, a suprapubic or mini-Pfannenstiel approach or Gibson incisions.[12]

Either a specialized port or cluster conventional port can be used to obtain access. Conventional laparoscopic techniques are generally followed, although modifications in techniques and manoeuvres unique to single site surgeries are employed.[12]

During laparoendoscopic single site (LESS) nephrectomy, a periumbilical incision is made to the rectus fascia. The peritoneum is entered with an extra-long trocar. After pneumoperitoneum, another trocar, is placed 1 to 1.5 cm caudal and at the 4 o'clock position to the extra-long trocar, eventually functioning as the camera port. A 12 mm port is inserted 1.5 cm caudal to the second trocar, resulting in triangular configuration. A fourth 12 mm standard length trocar is placed 1 cm cephalad to the umbilical protuberance, through which liver or splenic retraction and control of the renal upper pole and adrenal gland is achieved.[13]

Natural Orifice Transluminal Endoscopic Nephrectomy

Natural orifice transluminal endoscopic surgery (NOTES), with the objective of incision free abdominal surgery through natural orifices (mouth, vagina and rectum) has been described. Although, there were reports on successful completion of six laparoscopic transvaginal nephrectomies using conventional instruments in a porcine model, there were note of limitations of the laparoscopic instruments making the procedure cumbersome and time consuming. Clayman et al reported their experience with single port NOTES transvaginal nephrectomy and encountered similar difficulty until a purpose built multi lumen operating instruments were made available.[14]

Hybrid NOTES in which two natural orifices are used for approaches has also been described and tried for nephrectomies. Transvaginal NOTES hybrid combined with either transgastric or transvesical nephrectomy, transvesical-transgastric have all been described.[15]

Laparoscopic Pyeloplasty

Standard port placement described as ports placed in the upper and lower quadrant midclavicular lines and the camera port placed near the umbilicus. An assistant port is placed in the suprapubic midline.[16]

Another approach with a primary port at 2.5 cm to the right of umbilicus, a 5 mm port midway between the primary port and right costal margin and, on right midclavicular line, and another 5 mm port midway between the anterosuperior iliac spine and the umbilicus was used while the patient was placed in the 45 left lateral position. Fourth flank port is placed for retraction.[17]

LESS Pyeloplasty

The patient is positioned in a modified flank fashion, and a 2.5 cm incision is made within the umbilical dimple to conceal the scar. After insufflation of the abdomen, three

5 mm trocars are placed through the anterior abdominal fascia in a triangular configuration. A 5 mm 45° laparoscope is used along with articulating laparoscopic instruments. The laparoscope is placed through the most medial trocar and positioned anteriorly in the abdomen so that the camera looks down onto the surgical field. The working instruments are placed through the two lateral trocar.[18]

Laparoscopic Adrenalectomy

Laparoscopic adrenalectomy (LA) has become a gold standard in the management of most of the adrenal disorders, after it was described by Schuessler et al in 1993 and matched it success with open.[19] Apart from advantages like early recovery, reduced hospital stay and cosmesis, the main benefits of LA over open adrenalectomy are decreased incidence of intraoperative and postoperative hemorrhage, decreased morbidity and mortality.

Transperitoneal Laparoscopic Adrenalectomy

This involves putting 12 mm port in the umbilicus or at the lateral border of rectus abdominis muscle just above the level of umbilicus. Two subcostal 5 mm ports at midclavicular line and in the lateral border of the rectus and another 3.5 mm subcostal trocar-anterior axillary line, for the left adrenals. The right is approached through a mirror image and an additional epigastric port to the left of the liver for its retraction.[20]

Right adrenalectomy can also be performed with four ports. The primary camera port 10 mm to be placed at about 3 cm lateral and cephalad to the umbilicus. Two working ports, 5 and 10 mm are placed in the midclavicular position, the upper one (5 mm) below the costal margin, and the lower one (10 mm), 10 to 12 cm below the upper one. Another 5 mm port is to be placed in the sub-xiphisternal position for liver retraction. A fifth 5 mm port, if required, is placed in the right anterior axillary line, to facilitate retraction or suction.[20,21]

And another approach is to put the telescope's trocar at the umbilicus while maintaining the positions of the other trocars.[20] In the case of the left usually, the first three ports are placed in a mirror image of the right. A fourth 5 mm port, if required, is placed in the left midaxillary line to facilitate retraction.[20-22]

Retroperitoneal Lateral Laparoscopic Adrenalectomy

Retroperitoneal lateral approach to the left adrenal gland is through an incision at the inferior edge of the 12th rib in which the camera port is placed, the second port 5 mm at anterior axillary line midway between the iliac crest and costal margin, third port is placed posteriorly between the 12th rib and iliac crest along the lateral border of sacrospinatus muscles and the fourth port for retraction is placed cephalad to the first port at anterior axillary line. The right side is a mirror image of the left but the liver lobe is retracted percutaneously reducing the ports number to three.[23]

Retroperitoneal posterior approach described by Walz et al, and thoracoscopic transdiaphragmatic approach described by Gill et al are not commonly used.[20]

LESS Adrenalectomy

The approach is usually through transumbilical incision and placement of multichannel single Gelport and 3.5 mm ports for flexible laparoscope, SILS dissector and tissue sealing device; and the adrenal gland approached anteriorly in cases of right side with no mobilization of the right lobe of the liver, and the left is approached laterally.[23] Retroperitoneal LESS adrenalectomy has also been described.

Laparoscopic Approaches to the Ureter

A three-port approach with primary port at the umbilicus, one 5 mm port midway between the umbilicus and the medial costal margin and a 5 mm port midway between the anterosuperior iliac spine and the umbilicus, was described.[24]

Umbilical port with, ipsilateral hypochondrium and iliac fossa as working ports have been described for approaches to upper and mid ureter while ipsilateral paraumbilical and suprapubic ports for lower ureter while maintaining the umbilical port.[25]

In cases of retrocaval ureter, a three port approach with a primary port at 2.5 cm to the right of umbilicus, a 5 mm port midway between the primary port and right costal margin, and on right midclavicular line, and another 5 mm port midway between the anterosuperior iliac spine and the umbilicus was used while the patient is placed in the left lateral position. Mobilization of the ureter in the inter-aortocaval region require additional 5 mm port to be inserted at the flank.[17]

LESS approach to lower ureter through suprapubic transvesical port has been described.[26]

Laparoscopic Prostatectomy

Laparoscopic simple or radical prostatectomy has been performed through almost the same approach. The commonly described conventional laparoscopy is through a primary port placed upper side of the umbilicus. Then secondary ports at upper margin of the pubic bone and levels of the anterior superior iliac spines bilaterally and the fifth port at a point midline at about 15 cm from the pubic bone[27,28] while others described both iliac fossae for the last two ports, most especially when it is to be robotic assisted[29] others described the distance of the second and third ports to be 8 to 10 cm from the camera port.[30]

Transumbilical LESS radical prostatectomy was first described in 2008 by Kaouk et al, through the umbilicus using a single three-channel port, and 2 years later Desai et al published the initial series of single-port transvesical simple prostatectomy where a single-port device inserted percutaneously into the bladder through a 2 to 3 cm incision in the suprapubic skin crease was used.[5]

Laparoscopic Cystectomy

Laparoscopic cystectomy has been described by many authors, but remains to be evaluated and is far from being a standard procedure. While some described a similar approach to prostatectomy with periumbilical port, two others 8 to 10 cm away from the primary port and then bilateral iliac fossae[31] others described only four ports approach with 3 to 4 cm supraumbilical camera port and two iliac fossae ports and suprapubic port[32] and the sixth port is only needed during urinary diversion in radical surgeries.[33]

In the hand-assisted approach, a 7 cm periumbilical incision is made as the hand port, camera is placed at the left of the hand port in the midclavicular line at the level of the umbilicus, a second port is placed 5 cm below the level of the umbilicus at right midclavicular line. A 10 mm port is placed in the left anterior axillary line and a 5 mm at midline about 5 cm above the pubic symphisis.[34]

Kaouk et al described the laparoscopic radical cystectomy and pelvic node dissection through a single umbilical port and an extracorporeal urinary diversion by way of extension of the umbilical port site.[5]

Laparoscopic Varicocelectomies

Laparoscopic varicocelectomy is generally performed transperitoneally, but extra or retroperitoneal has also been described. And two trocars or single trocar approaches described, but generally three trocars are required especially in bilateral cases.[35]

Varicocelectomy is performed in a transperitoneal laparoscopic fashion with two ports placed at supraumbilical and caudal and lateral to the umbilicus on the contralateral side of the varicocele.[36]

For the three ports approach, some described the subumbilical camera port with secondary trocars at midline half way between umbilicus and pubic symphysis, and the other at midclavicular line 1 to 2 cm below horizontal line to the umbilicus while maintaining subumbilical camera port[37] while others described umbilical primary port and both lower abdominal quadrants ports.[38,39]

Mitrofanoff

A four-port transperitoneal approach is described, with camera at umbilicus, two 5 mm at left lower quadrant and right midaxillary line at the level of the umbilicus. Fourth port at left midaxillary also at umbilical level.[40]

Other LESS Procedures

Single site laparoscopic surgery has been reported in small numbers for a variety of other urological conditions. A mesh sling has been successfully removed from the bladder via a transvesical approach. Sacrocolpopexies, orchidopexy and orchidectomy have been successfully performed through a single incision without complication.[5]

DISCUSSION

First: Tables 1A to D showed readings of timing obtained while making a surgeon's knot in the region of upper urinary tract in the dummy at different manipulation angles which were validated by χ^2 tests and average obtained. The average timing in seconds for 30, 60 and 90º were 221.20, 130 and 283.95 respectively. Although all the readings were reproducible at p-value (30.144), 5% level of significance:

Table 1A: Timing for surgeon's knotting in upper urinary track with manipulation angle 30º

Sl no.	*Observed (O)*	*Expected (E)*	*O-E*	*(O-E)²*	*(O-E)²/E*
1	249	221.20	27.8	772.88	3.49
2	206		–15.2	231.04	1.04
3	220		–1.2	1.44	0.01
4	212		–9.2	84.64	0.38
5	239		–17.8	316.84	1.43
6	232		–21.2	116.64	0.53
7	200		27.8	449.44	2.03
8	249		–11.2	125.44	3.49
9	210		11.8	209.44	0.57
10	233		–11.8	139.24	0.63
11	204		–17.2	295.84	1.33
12	210		–11.2	209.44	0.57
13	223		1.8	3.24	0.01
14	222		0.8	0.64	0.01
15	199		–22.8	492.84	2.23
16	206		–15.2	231.04	1.04
17	254		32.8	1075.84	4.86
18	201		20.2	408.04	1.84
19	239		17.8	316.84	1.43
20	216		–5.2	27.04	0.12
	Average timing = 221.20				χ^2 = 27.06

p-value (30.144) > χ^2, data are reproducible it has clearly demonstrated that the 60º angle has shorter operative time followed by 30 and then 90º. This is shown in Graph 1 (Figs 1 and 2).

Table 1B: Timing for surgeon's knotting in upper urinary track with manipulation angle 60º

Sl. no.	Observed (O)	Expected (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
1	120	130.00	–10	100	0.77
2	131		1	1	0.01
3	118		–12	144	1.11
4	128		–2	4	0.03
5	160		30	900	6.92
6	138		8	64	0.49
7	127		–3	9	0.07
8	140		10	100	0.77
9	120		–3	9	0.07
10	127		11	121	0.93
11	141		8	64	0.49
12	138		6	36	0.28
13	136		8	64	0.49
14	138		6	36	0.28
15	113		–17	289	2.22
16	119		–11	121	0.93
17	129		–1	1	0.01
18	130		0	0	0.00
19	129		–1	1	0.01
20	131		1	1	0.01
	Average timing = 130.00				χ^2 = 15.88

p-value (30.144) > χ^2, so data are reproducible

Table 1C: Timing for surgeon's knot in upper urinary track with manipulation angle 90º

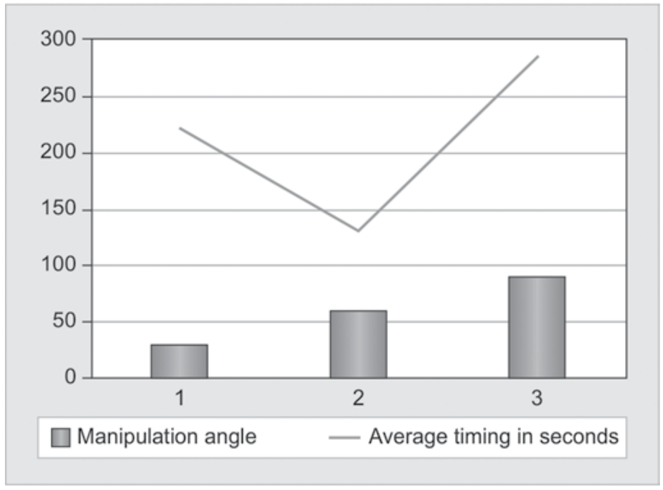
Sl. no.	Observed (O)	Expected (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
1	275	283.95	–8.5	80.10	0.28
2	270		–13.95	194.60	0.69
3	296		12.05	145.20	0.51
4	305		21.05	443.10	1.56
5	268		–15.95	254.40	0.90
6	262		–21.95	481.80	1.70
7	271		–12.95	167.70	0.59
8	265		–18.95	359.10	1.26
9	281		–2.95	8.70	0.03
10	281		–2.95	8.70	0.03
11	320		36.05	1299	4.58
12	270		–13.95	194.60	0.69
13	290		6.05	36.60	0.13
14	298		14.05	197.40	0.70
15	273		–10.95	119.90	0.42
16	268		–15.95	254.40	0.90
17	315		31.05	964.10	3.40
18	309		25.05	964.10	2.21
19	294		10.05	101.00	0.36
20	268		15.95	254.40	0.90
	Average timing = 283.95				χ^2 = 0.90

p-value > χ^2, so data are reproducible

Second: Tables 2A to D showed readings of timing taken to clip a renal vessel in the swine at different manipulation angles which were validated by χ^2 test and average obtained. The average timing in seconds for 30, 60 and 90 degree were 16.00, 11.10 and 30.20 respectively. Although,

Table 1D: Average timing of surgeon's knotting in the region of the upper urinary tract with respective manipulation

Manipulation angle	30	60	90
Average timing in seconds	221.20	130.00	283.95
χ^2	27.06	15.88	21.81



Graph 1: Average timing of surgeon's knotting in upper urinary tract

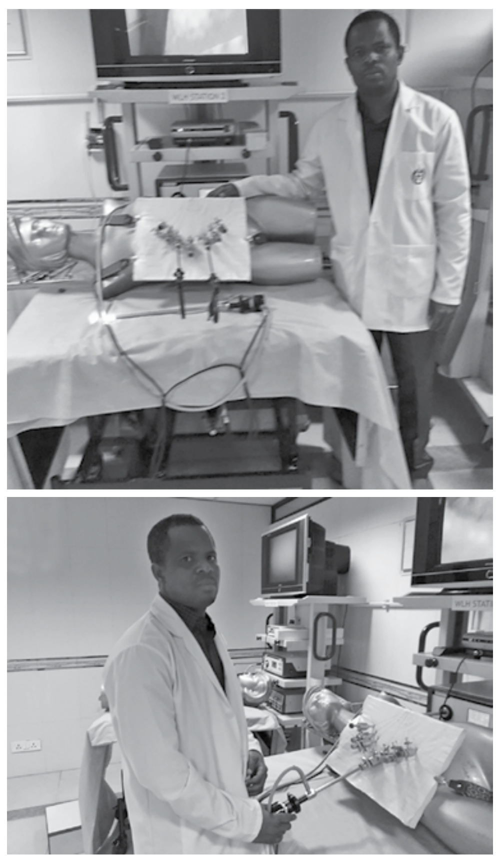


Fig. 1: The ports positioning for the upper tract tasks on the dummies

Table 2A: Timing of clipping of renal vessels at 30º manipulation angle

Observed timing (O) (in sec)	Expected (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
16	16 seconds	0	0	0.00
15		1	1	0.06
22		6	36	2.25
14		−2	4	0.25
16		0	0	0.00
13		−3	9	0.56
17		1	1	0.06
18		2	4	0.25
19		3	9	0.56
15		−1	1	0.06
17		1	1	0.06
16		0	0	0.00
14		−2	4	0.25
15		−1	1	0.06
13		−3	9	0.56
16		0	0	0.00
14		−2	4	0.25
10		−6	36	2.25
21		5	25	1.56
19		3	9	0.56
	Average time in seconds = 16			χ^2 = 9.56

p-value (30.144) > χ^2, so data are reproducible

Table 2B: Timing of renal vessels clipping with manipulation angle of 60º

Observed timing (O) (in seconds)	Expected (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
13	11.1	1.9	3.61	0.33
11		– 0.1	0.01	0.00
19		7.9	62.41	5.62
11		– 0.1	0.01	0.00
10		– 1.1	1.21	0.11
16		4.9	24.01	2.16
9		– 2.1	4.41	0.39
8		– 3.1	9.61	0.87
9		2.1	4.41	0.39
9		– 2.1	4.41	0.39
11		– 0.1	0.01	0.00
12		0.9	0.81	0.07
11		– 0.1	0.01	0.00
12		0.9	0.81	0.07
12		– 0.9	0.81	0.07
11		0.1	0.01	0.00
10		– 1.1	1.21	0.11
10		– 1.1	1.21	0.11
10		– 1.1	1.21	0.11
8		– 3.1	9.61	0.87
	Average time = 11.1			χ^2 = 11.66

p-value > χ^2, so data are reproducible

Table 2C: Timing for renal vessel ligation with manipulation angle 900

Sl. no.	Observed time in seconds (O)	Expected time in seconds (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
1	32	30.2	1.8	3.24	0.08
2	37		6.8	46.24	1.53
3	25		−5.2	27.04	0.90
4	34		3.8	14.44	0.48
5	29		−1.2	1.44	0.05
6	29		−1.2	1.44	0.05
7	27		−3.2	10.24	0.34
8	18		−12.2	148.84	4.93
9	33		2.8	7.84	0.26
10	36		5.8	33.64	1.11
11	29		1.2	1.44	0.05
12	27		−3.2	10.24	0.34
13	35		4.8	23.04	0.76
14	28		−2.2	4.40	0.15
15	32		1.8	3.24	0.08
16	37		6.8	46.24	1.53
17	25		−5.2	27.04	0.90
18	24		−6.2	38.44	1.27
19	38		7.8	60.84	2.01
20	29		−1.2	1.44	0.05
	Average time = 30.2				χ^2 = 16.85

p-value is > χ^2, so data is reproducible

all the readings were reproducible at p-value (30.144), 5% level of significance: it has clearly demonstrated that the 60º angle has shorter operative time followed by 30 and then 90º, and the angle 60º followed by 30º were more reproducible than 90º. This is shown in Graph 2 (Figs 3 and 4).

Third: Tables 3A to D showed readings of timing taken for ureteroureteral anastomosis in the swine at different manipulation angles which were validated by χ^2 test and average obtained (Fig. 5). The average timing in seconds for 30,

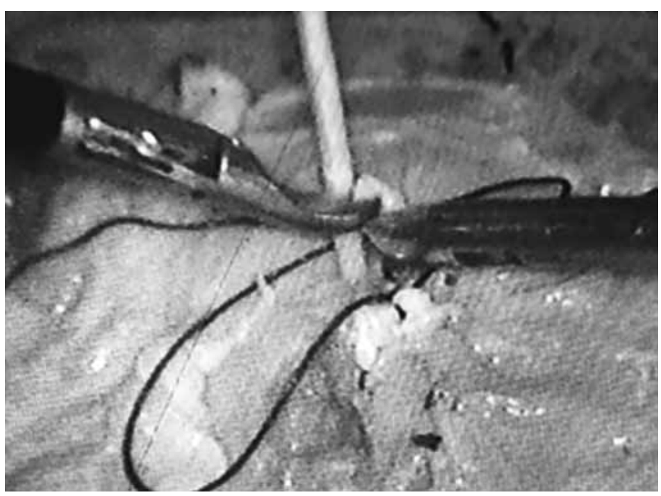


Fig. 2: Tying a knot around a fixed distance to ensure the manipulation angle is maintained

Table 2D: Average timing of renal vessels clipping

Manipulation angles in degrees	30	60	90
Mean timing in seconds	16.00	11.10	30.20
χ^2	9.56	11.65	16.85

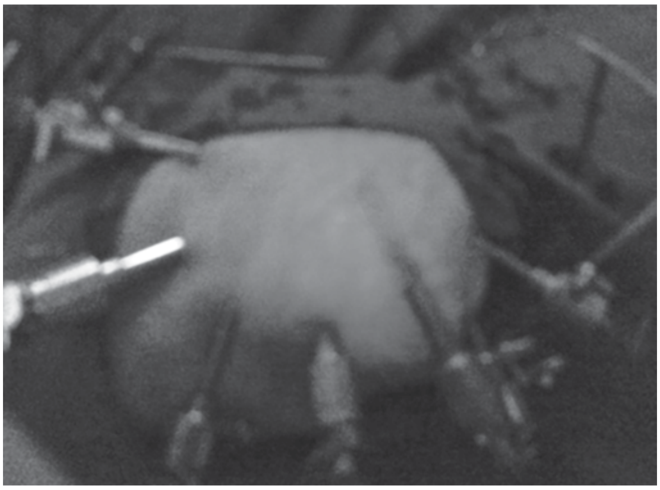


Fig. 3: The ports positioning for the upper tract tasks on the swine with illumination

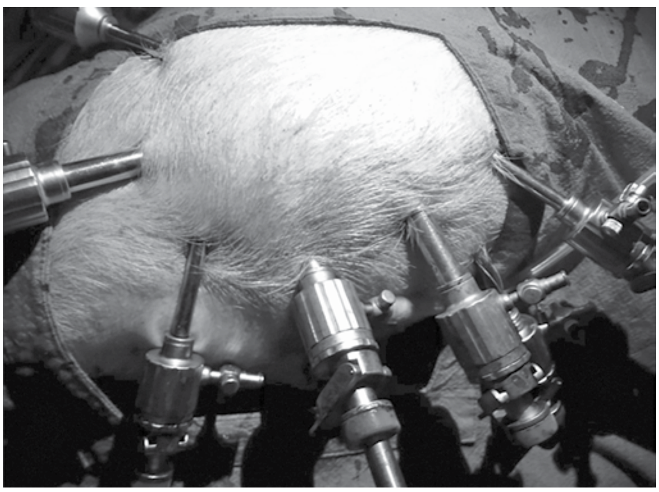
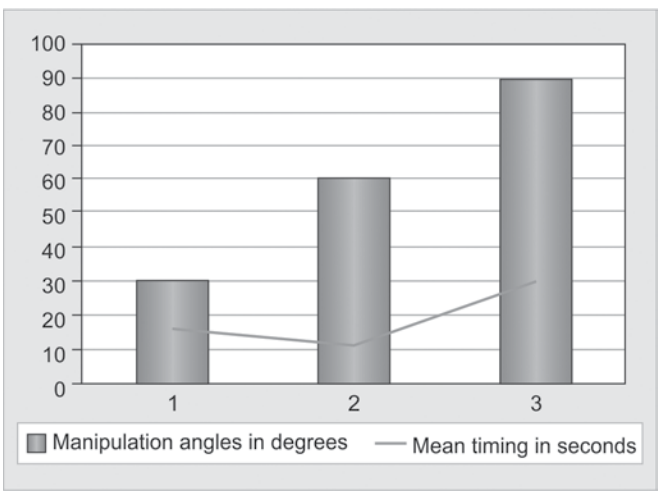


Fig. 4: The ports positioning for the upper tract tasks on the swine



Graph 2: Timing of renal vessels clipping

Table 3A: Timing of ligation of ureteroureteric anastomosis with 30º manipulation angle

Sl. no.	Observed *(O)*	*Expected (E)*	*O-E*	*(O-E)²*	*(O-E)²/E*
1	387	381.65	5.35	28.62	0.075
2	377		–4.65	21.62	0.057
3	397		15.35	235.62	0.62
4	372		–9.65	93.12	0.24
5	310		–28.35	803.72	2.11
6	368		–13.65	186.32	0.49
7	389		7.35	54.02	0.14
8	398		16.35	267.32	0.70
9	387		5.35	28.62	0.07
10	401		19.35	374.42	0.98
11	390		8.35	69.72	0.18
12	403		21.35	455.82	1.19
13	402		20.35	414.12	1.09
14	304		–77.65	6029.52	15.80
15	391		9.35	87.42	0.23
16	398		16.35	267.32	0.70
17	393		5.35	128.82	0.34
18	395		19.35	178.22	0.47
19	381		–0.65	0.42	0.00
20	390		8.35	69.72	0.18
	Average time = 381.65				χ^2 = 25.66

p-value (30.144) is > χ^2, so data are reproducible

Table 3B: Ureteroureteric anastamosis with manipulation angle 60º

Sl. no.	*Observed time in second (O)*	*Expected time (E)*	*(O-E)*	*(O-E)²*	*(O-E)²/E*
1	320	306.6 seconds	13.4	179.56	0.59
2	310		3.4	11.56	0.034
3	315		8.4	70.56	0.23
4	298		–8.6	73.96	0.24
5	296		–10.6	112.36	0.37
6	306		–0.60	0.36	0.00
7	310		3.4	11.56	0.038
8	310		3.4	11.56	0.038
9	306		–0.6	0.36	0.00
10	302		–4.6	21.16	0.070
11	315		8.40	70.56	0.23
12	299		–7.6	57.76	0.19
13	307		0.40	0.16	0.00
14	309		2.4	5.76	0.019
15	309		2.4	5.76	0.019
16	309		2.4	5.76	0.019
17	307		0.40	0.16	0.00
18	305		–1.60	2.56	0.0083
19	299		–7.6	57.76	0.1884
20	300		–6.6	43.56	0.1421
	Average time = 306.60 seconds				χ^2 = 2.43

p-value (30.144) > χ^2, so data are reproducible

60 and 90º were 381.65, 306.60 and 460.45 respectively. Only readings at 30 and 60º were reproducible at p-value (30.144), 5% level of significance; but the χ^2 of readings at 90 was less than p-value, indicating nonreproducibility. These suggest that the 60º angle has shorter operative time then the 30º and also demonstrated that the more difficult, a laparoscopic task, is more likely it become nonreproducible at an angle of 90º and above, probably due to fatique from high elevation angle and shoulder over stretching due to poor ergonomics.[41] This is shown in Graph 3.

Table 3C: Timing for ureteroureteral anastomosis at manipulation angle 90º

Sl. no.	*Observed time in sec. (O)*	*Expected time (E)*	*O-E*	*(O-E)²*	*(O-E)²/E*
1	445	460.45	15.45	238.70	0.52
2	470		9.55	91.20	020
3	468		7.85	57.00	0.13
4	492		31.55	995.41	2.16
5	415		–45.45	2065.70	4.49
6	462		1.55	2.40	0.01
7	447		–13.55	180.90	0.39
8	480		19.55	382.20	0.83
9	479		18.55	344.10	0.75
10	412		48.55	2347.40	5.10
11	482		21.55	464.40	1.01
12	499		38.55	1486.10	3.23
13	433		27.55	753.50	1.64
14	483		22.55	508.50	1.10
15	490		29.55	873.20	1.90
16	495		34.55	1197.70	2.59
17	432		–28.45	809.40	1.76
18	453		–7.45	55.50	0.12
19	469		8.55	73.10	0.16
20	413		–47.45	2251.50	4.89
	Average time = 460.45				χ^2 = 32.95

p-value (30.144) < χ^2, so data are not reproducible

Table 3D: Average timing for ureteroureteral anastomosis

Manipulation angles in degree	30	60	90
Mean timing in seconds	381.65	306.60	460.45
χ^2	25.66	2.43	32.95

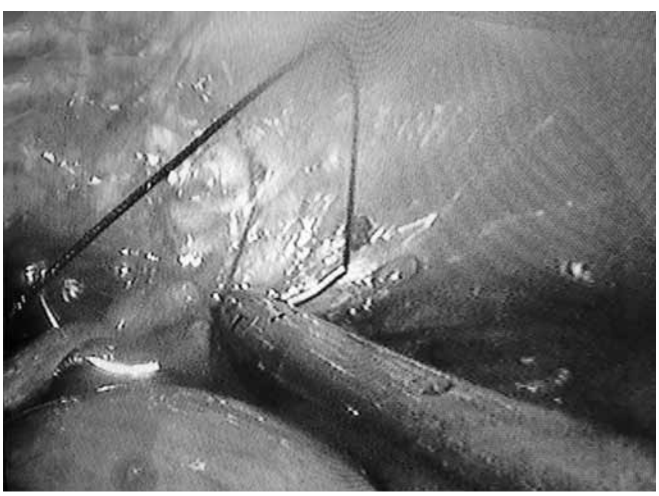
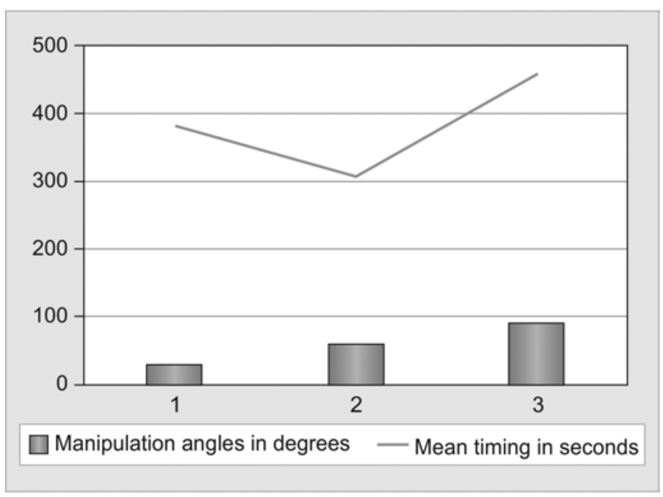


Fig. 5: The approximate manipulation angle while knotting in the upper tract in a swine

Fig. 6: Arrangement of port's positions for tasks in the pelvis

Fig. 7: A picture of ring transfer in the pelvis at 60° manipulation angle



Graph 3: Average timing of ureteroureteral anastomosis

Table 4A: Timing for ring transfer in pelvis with manipulation angle 30°

Sl. no.	Observed time in sec. (O)	Expected time (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
1	27	33.2	6.2	38.44	1.16
2	41		7.8	60.84	1.83
3	35		1.8	3.24	0.10
4	20		–13.2	174.24	5.25
5	38		4.8	23.04	0.69
6	62		28.8	829.44	24.98
7	48		14.8	219.04	6.60
8	34		0.8	0.64	0.02
9	48		14.8	219.04	6.60
10	31		–2.2	4.84	0.15
11	30		–3.2	10.24	0.31
12	27		–6.2	38.44	1.16
13	38		4.8	23.04	0.69
14	31		–2.2	4.84	0.15
15	39		5.8	33.64	1.01
16	32		1.2	1.44	0.04
17	42		8.8	77.44	2.33
18	35		1.8	3.24	0.10
19	25		–8.2	67.24	2.03
20	40		6.8	46.24	1.39
	Average time = 33.2				χ^2 = 56.57

p-value (30.144) < χ^2, so data are not reproducible

Table 4B: Time for ring transfer in pelvis with manipulation angle 60º

Sl. no.	Observed time in sec. (O)	Expected time (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
1	15	20.1	–5.1	26.01	1.29
2	19		–1.1	1.21	0.06
3	24		3.9	15.21	0.76
4	22		1.9	3.61	0.18
5	22		1.9	3.61	0.18
6	25		4.9	24.01	1.20
7	24		3.9	15.21	0.76
8	22		1.9	3.61	0.18
9	19		–1.1	1.21	0.06
10	16		–4.1	16.8	0.84
11	17		–3.1	9.61	0.48
12	19		–1.1	1.21	0.06
13	21		0.9	0.81	0.00
14	17		–3.1	9.6	0.48
15	21		0.9	0.81	0.00
16	25		4.9	24.01	1.19
17	20		–0.1	0.01	0.00
18	20		–0.1	0.01	0.00
19	15		–5.1	26.01	1.29
20	19		1.1	1.21	0.06
	Average time = 20.1				χ^2 = 8.64

p-value (30.144) > χ^2, so data are reproducible

Table 4C: Timing for ring transfer in pelvis with manipulation angle 90º

Sl. no.	Observed time in sec. (O)	Expected time (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
1	90	72.35	17.65	311.52	4.31
2	82		9.65	93.12	1.29
3	85		12.65	160.02	2.21
4	75		2.65	7.02	0.10
5	54		18.35	336.72	4.65
6	60		–12.35	152.52	2.11
7	96		23.65	559.32	7.73
8	59		–13.35	178.22	2.46
9	74		1.65	2.72	0.04
10	49		–23.35	545.22	7.54
11	56		–16.35	267.32	3.70
12	69		–3.35	11.22	1.16
13	86		13.65	186.32	2.58
14	87		14.65	214.62	2.97
15	67		–535	28.62	0.40
16	63		–9.35	87.42	1.20
17	68		–4.35	18.92	0.26
18	79		6.65	44.22	0.61
19	73		0.65	0.42	0.01
20	74		1.65	2.72	0.04
	Average time = 72.35 seconds				χ^2 = 44.33

p-value (30.144), data are not reproducible

Table 4D: Average timing of ring transfer in the pelvis

Manipulation angle in degrees	30	60	90
Mean timing in seconds	33.20	20.10	72.35
χ^2	56.57	8.64	44.33

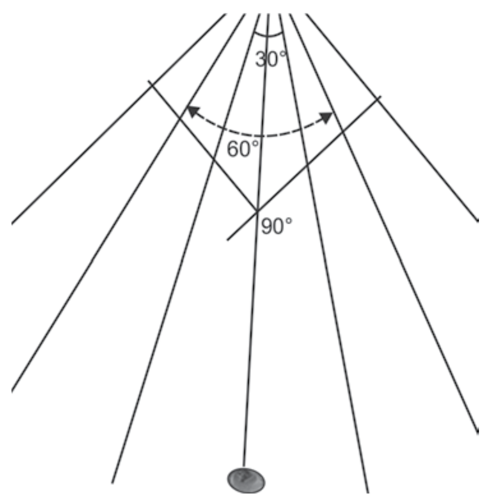
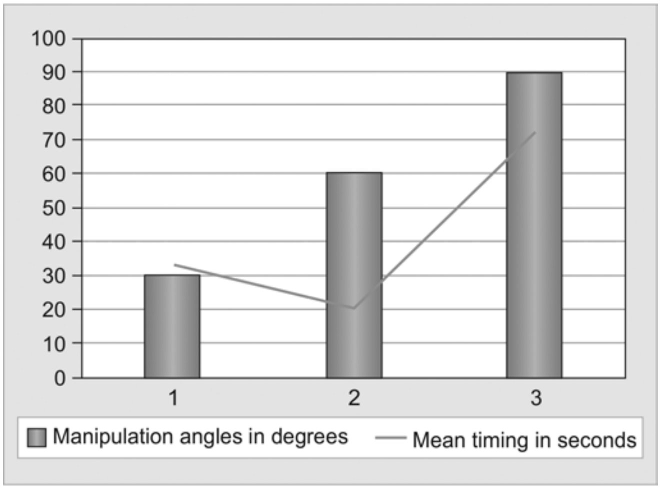


Fig. 8: Estimation of manipulation angles determining ports' positions on the dry lab anterior abdominal wall

Fourth: Tables 4A to D showed readings of timing taken for ring transfer in the pelvic region of the dummies at different manipulation angles, which were validated by χ^2 test and average obtained (Figs 6 to 9). The average timing in seconds for 30, 60 and 90º were 33.20, 20.10 and 72.35 respectively. Here, only the readings at 60º manipulation angle were reproducible at p-value (30.144), 5% level of significance: which further support any port position that



Graph 4: Timing of ring transfer in the pelvis

Fig. 9: Instruments and ports at different positions of task performance

Table 5A: Time for surgeon's knotting in pelvis with manipulation angle 30º

Sl. no.	Observed time in sec. (O)	Expected time (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
1	156	160.60	–4.6	21.16	0.13
2	169		8.4	70.56	0.44
3	156		–4.6	21.16	0.13
4	162		1.4	1.96	0.01
5	159		–1.6	2.56	0.02
6	137		–23.6	556.96	3.47
7	159		–1.6	2.56	0.01
8	182		21.4	457.96	2.85
9	161		0.4	0.16	0.00
10	139		–21.4	466.56	2.91
11	142		–18.6	345.96	2.15
12	144		–16.6	275.56	1.72
13	184		23.4	547.56	3.41
14	162		1.4	1.96	0.01
15	182		21.4	457.96	2.85
16	161		–0.4	0.16	0.00
17	156		–4.6	21.16	0.13
18	182		21.4	457.96	2.85
19	156		–4.6	21.16	0.13
20	163		2.4	5.76	0.04
	Average time = 160.60				χ^2 = 23.26

p-value > χ^2, data are reproducible

Table 5B: Time for surgeon's knotting in pelvis with manipulation angle 60º

Sl. no.	Observed time in sec. (O)	Expected time (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
1	120	116.50	3.5	12.25	0.11
2	120		3.5	12.25	0.11
3	121		4.5	20.25	0.17
4	118		1.5	2.25	0.48
5	109		–7.5	56.25	0.02
6	115		–1.5	2.25	1.05
7	120		3.5	12.25	0.02
8	115		–1.5	2.25	0.17
9	121		4.5	20.25	0.02
10	118		1.5	2.25	0.48
11	109		–7.5	56.25	0.17
12	112		–4.5	20.25	0.05
13	111		–5.5	30.25	0.26
14	119		2.5	6.25	0.05
15	114		–1.5	2.25	0.02
16	118		1.5	2.25	0.02
17	125		8.5	72.25	0.62
18	115		–1.5	2.25	0.02
19	119		2.5	6.25	0.05
20	121		4.5	20.25	0.17
	Average time = 116.50				χ^2 = 4.08

p-value (30.144) > χ^2, so data are reproducible

Table 5C: Time for surgeon's knotting in pelvis with manipulation angle 90º

Sl. no.	Observed time in sec (O)	Expected time (E)	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
1	190	210.55	–20.55	422.30	2.01
2	220		9.45	89.30	0.42
3	197		–13.55	183.60	0.87
4	182		–28.55	815.10	3.87
5	182		–28.55	815.10	3.87
6	172		–38.55	1486.10	7.06
7	183		–27.55	759.00	3.60
8	224		13.45	180.90	0.86
9	221		10.45	109.20	0.52
10	235		25.55	652.80	3.10
11	272		61.45	3776.0	17.93
12	208		–13.55	183.60	0.87
13	223		12.45	155.00	0.74
14	204		–6.55	42.90	0.20
15	207		–3.55	12.60	0.056
16	219		8.45	71.40	0.34
17	226		15.45	238.70	1.13
18	240		29.45	867.30	4.12
19	234		23.45	549.90	2.61
20	224		13.45	180.90	0.86
	Average time = 210.55				χ^2 = 59.17

p-value (30.144) < χ^2, data are nonreproducible

Table 5D: Average timing for surgeon's knotting in the pelvis

Manipulation angle in degrees	30	60	90
Mean timing in seconds	160.60	116.50	210.55
χ^2	23.26	4.08	59.17

will provide working angle of 60º as the ideal. This is shown in Graph 4.

Fifth: Tables 5A to D showed readings of timing of surgeon's knotting in the pelvic cavity of dummies at different manipulation angles which were validated by χ^2 tests and average obtained (Figs 9 and 10). The average timing in seconds for 30, 60 and 90º were 160.60, 116.50 and 210.55 respectively. Despite the facts that, the first two readings were reproducible at p-value (30.144), 5% level of significance: it has clearly demonstrated that the 60º angle has shorter operative time than that of 30º. The readings of 90º angle were nonreproducible for surgeons knotting in the pelvis indicating increased difficulties and time consumption when ports are positioned in such a way that will give working angle of 90º and above (Figs 10 and 11).

This is shown in Graph 5.

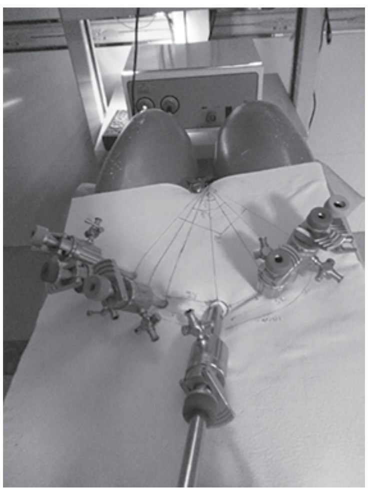
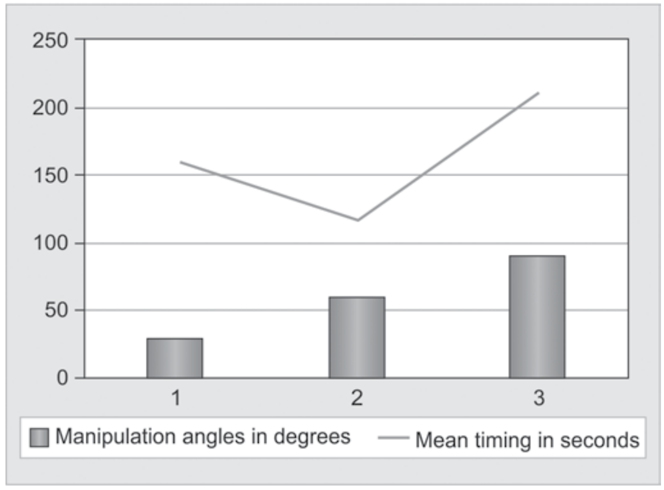
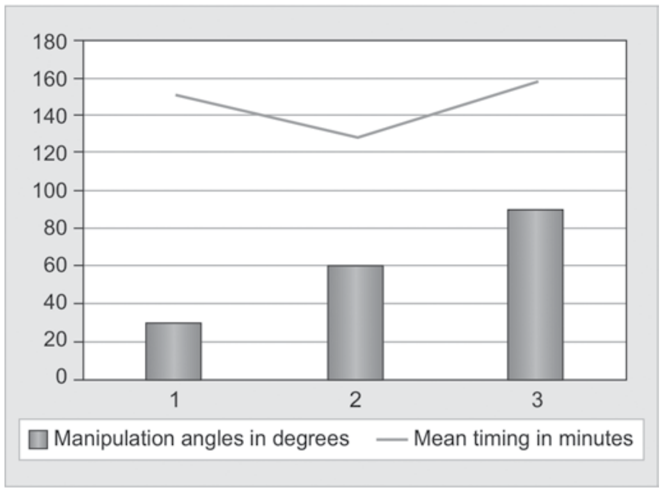


Fig. 10: Description of ports' sites on the anterior abdominal wall

Fig. 11: Performing a task with 90° manipulation angle in the pelvis



Graph 5: Average timing of surgeon's knotting in the pelvis



Graph 6: Laparoscopic donor nephrectomy

Table 6A: Timing of laparoscopic donor nephrectomy with approximate 30º manipulation angle

Sl. no	*Observed (O)*	*Expected (E)*	*O-E*	*(O-E)²*	*(O-E)²/E*
1	157	151.50	5.5	30.25	0.20
2	157		5.5	30.25	0.20
3	159		7.5	56.25	0.37
4	157		5.5	30.25	0.20
5	132		–19.5	380.25	2.51
6	147		–4.5	20.25	0.13
Mean	151.50				χ^2 = 3.61

p-value > (11.070) χ^2, so data are reproducible

Table 6B: Timing of laparoscopic donor nephrectomy with approximate 60º manipulation angle

Sl. no.	*Observed (O)*	*Expected (E)*	*O-E*	*(O-E)²*	*(O-E)²/E*
1	122	128.50	–6.5	42.25	0.33
2	121		–7.5	56.25	0.44
3	136		7.5	56.25	0.44
4	137		8.5	72.25	0.56
5	188		–10.5	110.25	0.86
6	137		8.5	72.25	0.56
Mean in minutes	128.50				χ^2 = 3.19

p-value (11.070) > χ^2, so data are reproducible

Sixth: Tables 6A to D showed readings of timing taken for laparoscopic donor nephrectomy and manipulation angles were approximated nearest to 30, 60 and 90º. The readings obtained in minutes were validated by χ^2 tests and average obtained. The averages were 151.50, 128.50 and 158.83 respectively. Although, all the readings were reproducible at p-value (11.070), 5% level of significance: it has clearly demonstrated that the 60º angle has shorter operative time followed by 30º and then 90º, and the angle 60º followed by 30º were more reproducible than 90º. This is shown in Graph 6 (Figs 12 to 19).

Table 6C: Approximate manipulation angle of 90º and timing of donor nephrectomy in minutes

Sl. no.	*Observed (O)*	*Expected (E)*	*O-E*	*(O-E)^2*	*$\frac{(O-E)^2}{E}$*
1	142	158.83	–16.83	283.43	1.78
2	186		29.17	850.89	3.36
3	138		–20.83	433.89	2.73
4	159		0.17	0.03	0.00
5	148		–10.83	117.29	0.74
6	180		21.17	448.17	2.82
Mean in minutes	158.83				χ^2 = 10.43

p-value (11.070) > χ^2, so data are reproducible

Table 6D: Average duration of laparoscopic donor nephrectomy in minutes

Manipulation angles in degree	30	60	90
Mean timing in minutes	151.50	128.50	158
χ^2	3.61	3.19	10.43

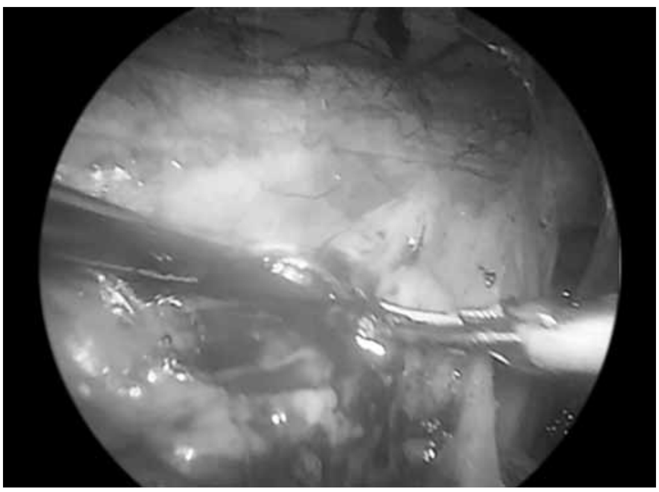


Fig. 12: The working angle at one of the ports' positions in a donor nephrectomy

Fig. 13: Ports' positions for left laparoscopic donor nephrectomy

Fig. 14: Ports' positions

Fig. 15: Sites of ports' positions after left donor nephrectomy

Fig. 16: Picture of manipulation angle

Fig. 17: Ports' positions

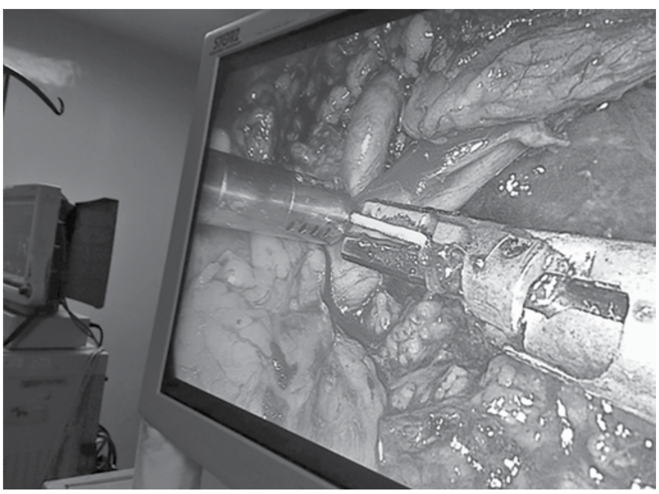


Fig. 18: Manipulation angle at the hilum (crucial target of dissection)

Final: From all the discussions above, the average timing of all laparoscopic tasks were shorter with 60º manipulation and all were reproducible irrespective of the difficulty of the tasks then followed by 30º. The 90º angle has the longest operative time and, in some cases, nonreproducible, indication the closer the manipulation angle is to the 90º and above, the more the likely to take longer operative time and the higher it approaches nonreproducibility due to fatigue from increased elevation angle and shoulder overstretching. This is in keeping with the Baseball Diamond concepts of port positioning.

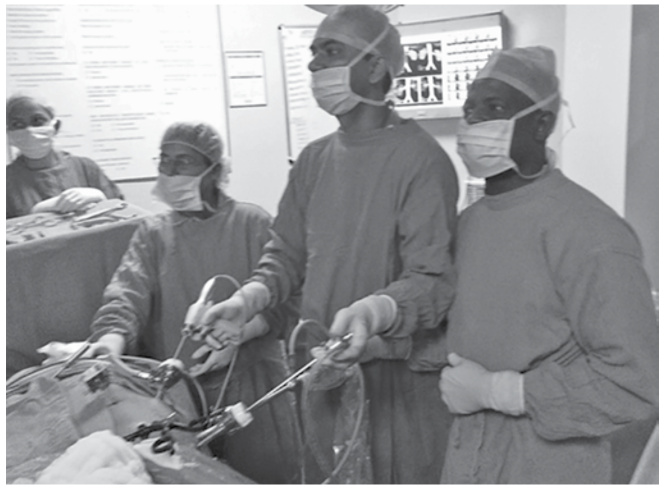


Fig. 19: Laparoscopic surgical team of the investigator

CONCLUSION

There is no 'ideal port position in urological laparoscopic procedures based on anatomical landmarks, but the closer the ports' positions are to make a manipulation angle of 60º (Baseball Diamond), the closer to ideal it will be.

RECOMMENDATIONS

More work is to be done on the newly emerging laparoscopic urology particularly in the developing world.

REFERENCES

1. Supe AN, Kulkarni GV, Supe PA. Ergonomics in laparoscopic surgery. J Min Access Surg 2010;6:31-36.
2. Karthik S, Augustine AJ, Shibumon MM, Pai MV. Analysis of laparoscopic port site complications: a descriptive study. J Min Access Surg 2013;9:59-64.
3. Greberg CF, Gettman MT. Instrumentation for natural orifice transluminal endoscopic surgery and laparoendoscopic single-site surgery. Ind J Urol 2010;26:385-388.
4. Gupta NP, Gautam G. Laparoscopic nephrectomy for benign non-functioning kidneys. J Min Access Surg 2005;149-154.
5. Maurya K, Sivanandam SE, Sukumar S, Bhat S, Kumar G, Nair B. Concomitant laparoscopic urological procedures: does it contribute to morbidity? J Min Access Surg 2009;5:67-71.
6. World Laparoscopy Hospital. Cyberciti, DLF Phase II, NCR Delhi, Gurgaon, 122 002, India. Port position in Laparoscopy.
7. Gupta N, Raina P, Kumar A. Laparoscopic donor nephrectomy. J Min Access Surg 2005;155-164.
8. McDougall EM, Finley D, Clayman RV, et al. Basic urologic laparoscopy: a standardized guideline for training programs. Am Urol Assoc Educ Res 2005;20-25.
9. Veenstra GM, Fossion LMCL, de Laet K, Luijten AAPM. Synchronous laparoscopic radical nephrectomy left and contralateral right hemicolectomy during the same endoscopic procedure. J Laparoendosc Adv Surg Tech 2004.

10. Chung BI, Liao JC. Laparoscopic radical nephrectomy in a pelvic ectopic kidney: keys to success. JSLS 2010;14:126-129.
11. Ganpule AP, Sharma R, Thimmegawda M, Veeramani M, Desai MR. Laparoscopic radical nephrectomy versus open radical nephrectomy in T1-T3 renal tumours: an outcome analysis. Ind J Urol 2008;24:39-43.
12. Rais-Bahrami S, Waingankar N, Richstone L. Upper tract urologic laparoendoscopic single site surgery. Ind J Urol 2012;28:60-64.
13. Kopp RP, Silbestin JL, Derweesh I. Laparoendoscopic single site radical nephrectomy with renal vein thrombectomy: initial report. BMC Urology 2010;8:10.
14. Raman JD, Cadeddu JA. Single access laparoscopic nephrectomy. Ind J Urol 2008;24:457-460.
15. Greberg CF, Gettman MT. Instrumentation for natural orifice transluminal endoscopic surgery and laparoendoscopic single site surgery. Ind J Urol 2010;26:385-388.
16. Thiel DD. Navigating the difficult robotic assisted pyeloplasty. ISRN Urol 2012;2:34.
17. Singh O, Gupta SS, Hastir A, Arvind NK. Laparoscopic transperitoneal pyelo-pyelostomy and ureteroureterostomy of retrocaval ureter: report of two cases and review of the literature. J Min Access Surg 2010;6:53-55.
18. Faddegon S, Tan YK, Olweny EO, Park SK, Sara L. Best BS, Cadeddu JA. Laparoendoscopic single-site (LESS) pyeloplasty for horseshoe ureteropelvic junction obstruction. JSLS 2012; 16:151-154.
19. Bansal P, Gupta A, Mongha R, Narayan S, Kundu AK, Chakraborty SC, et al. Laparoscopic versus open pyeloplasty: comparison of the two surgical approaches—a single centre experience of three years. J Min Access Surg 2008;3:76-79.
20. Mellon MJ, Sethi A, Sundaram CP. Laparoscopic adrenalectomy: surgical techniques. Ind J Urol 2008;24:583-589.
21. Kumar S, Bera MK, Vijay MK, Dutt A, Tiwari P, Kundu AK. Laparoscopic adrenalectomy: a single center experience. J Min Access Surg 2010;6:100-105.
22. Dalvi AN, Thapar PM, Kumar KV, Kamble RS, Rege SA, Deshpande AA, Shah NS, Menon PS. Laparoscopic adrenalectomy: gaining experience by graded approach. J Min Access Surg 2006;2:59-66.
23. Sasaki, et al. Laparoscopic single site adrenalectomy: initial results of cosmetic satisfaction and the potential for postoperative pain reduction. BMC Urology 2013;13:21.
24. Nagraj HK, Kishore TA, Nagalakshmi S. Transperitoneal laparoscopic approach for retrocaval ureter. J Min Access Surg 2006;2:81-82.
25. Agrawal V, Bajaj J, Acharya H, Chanchalani R, Raina VK, Sharma D. Laparoscopic management of pediatric renal and ureteric stone. JP Urol 2013;9:230-233.
26. Ahlawat RK, Gaulam G. Suprapubic transvesical single-port technique for control of lower end of ureter during laparoscopic nephroureterectomy for upper tract transitional cell carcinoma. Ind J Urol 2011;27:190-195.
27. Cestari A, Buffi NM, Scapaticci E, et al. Simplifying patient positioning and port placement during robotic assisted laparoscopic prostatectomy. European Urology 2010;57:530-533.
28. Ashis C, Adnan Q, Aziz A, Edward MD. Optimal port placement during laparoscopic radical prostatectomy. Can J Urol 2012; 19:6142-6146.
29. Columbo JR, Santos B, Hafron J, Gianduzzo T, Haber GP, Kaouk JH. Robotic assisted radical prostatectomy: surgical techniques. Int Braz J Urol 2007;33:803-809.
30. Pow-Sang JM, Velasquez J, Myers MD, Rodriguez AR, Kang LC. Pure laparoscopic and robotic-assisted laparoscopic radical prostatectomy in the management of prostate cancer. Cancer Control 2007;14:250-257.
31. Gerullis H, Kuemniel C, Popken G. Laparoscopic cystectomy with extracorporeal-assisted urinary diversion: experience with 34 patients. European Urology 2007;51:193-198.
32. Cansino JR, Cisneros J, Aloso S, et al. Laparoscopic radical cystectomy: initial series and analysis of result. European Urology Suppl 2006;5:956-961.
33. Vordos D, Hoznek A, Gettman M, Abbon CC. Laparoscopic cystectomy: evolution of a new technique. EAU Series 2005;3: 147-155.
34. Peterson AC, Lance RS, Ahuja SK. Laparoscopic hand assisted radical cystectomy with ileal conduit urinary diversion. J Urol 2002;168:2103-2105.
35. Chan P. Management options of varicocele. Ind J Urol 2011;27: 65-73.
36. Link BA, Kruska JD, Wong C, Kropp BP. Two trocar laparoscopic varicocelectomy: approach and outcomes. JSLS 2006;10: 151-154.
37. Ivovic J. Laparoscopic surgery for varicocele in subfertile men. European Urology Suppl 2009;8:626-627.
38. Capolicchio JP, El-Sherbiny M, Brzezinski A, Eassa W, Jednak R. Dye-assisted lymphatic-sparing laparoscopic varicocelectomy. JP Urol 2013;9:33-37.
39. Moreira-Pinto J, Osorio A, Carvalho F, de Castro JR, de Sousa J, Enes C, Reis A, Cidade-Rodrigues J. Varicocelectomy in adolescents: laparoscopic versus open high ligation technique. Afr J Paediatr Surg 2011;8:40-43.
40. Nerli RB, Reddy M, Devraju S, Prabha V, Hiremath MB, Jali S. Laparoscopic mitrafanoff appendicovesicostomy: our experience in children. Ind J Urol 2012;28:28-31.
41. Available at: www.worldlaparoscopyhospital.com/laparoscopic treatment training and research.

10.5005/jp-journals-10033-1222

REVIEW ARTICLE

Adhesion Prevention in Operative Gynecology: How Realistic are Our Expectations?

[1]Shyjus Puliyathinkal, [2]KP Abdul Vahab, [3]N Umadevi, [4]KC Geetha, [5]P Mumtaz, [6]Aswathy Govind
[7]Pavithra Mahesh, [8]Ayisha Hashim

ABSTRACT

The purpose of this review is to critically analyze the effectiveness of adhesive barriers in adhesion prevention in terms of incidence and extent of postoperative adhesions and to help one choose the best and the most cost-effective, among those available in market today.

Materials and methods: We analyzed 18 published articles to critically look at the effectiveness of adhesive barriers in operative gynecology. A literature research was performed using internet.

Discussion: Oxidized regenerated cellulose (Interceed) was found to be an effective adhesion barrier with treated sidewalls showing significantly less area involved with adhesions ($p < 0.05$). With 4% icodextrin solution (ADEPT), no significant reduction of *de novo* adhesions was found in patients undergoing laparoscopic surgery for removal of myomas or endometriotic cysts ($p = 0.909$). With use of hyaluronic acid (Intergel), a significant difference was found in the mean adhesion severity scores ($p < 0.05$). The Sepracoat group had a significantly lower incidence of *de novo* adhesions in terms of proportion of sites involved, percentage of adhesion free patients as well as adhesion extent and severity. Oxiplex was found to prevent an increase in adhesion score when compared to placebo.

Conclusion: The decision whether to use an adhesion barrier or not, need to be a well thought out one after weighing the balance between the efficacy of the material against the cost implications involved. The quest for the best of the adhesive barriers still continues.

Keywords: Adhesion barriers, Oxidized regenerated cellulose, Interceed, Icodextrin, ADEPT, Hyaluronic acid, Intergel/Hyalobarrier, Sepracoat, Viscoelastic gel, Oxiplex.

How to cite this article: Puliyathinkal S, Vahab KPA, Umadevi N, Geetha KC, Mumtaz P, Govind A, Mahesh P, Hashim A. Adhesion Prevention in Operative Gynecology: How Realistic are Our Expectations? World J Lap Surg 2014;7(2):88-91.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Abnormal fibrous connections joining tissue surfaces are termed as adhesions.[1] Tissue damage caused by surgical trauma is the primary contributing factor. Infection, ischemic damage and exposure to foreign materials can significantly contribute to this.[2]

Adhesions can be primary or *de novo* adhesions *vs* secondary or reformed adhesions. The former are freshly formed ones, on locations devoid of adhesions before and the latter are those adhesions that undergo adhesiolysis and recur at the same location.[3] Adhesions may also be classified based on the location, as intra-abdominal or intrauterine. Virtually, any surgical procedure performed transperitoneally can lead to adhesions ranging from minimal scarring of serosal surface to firm agglutination of structures.

The formation of adhesions following an open approach in gynecology is more than a common entity. It has been reported that intra-abdominal adhesions occur in 60 to 90% of women who have undergone major gynecological procedures.[4,5] Further, a recent study by[6] conducted in Scotland reported that women undergoing an initial open surgery for gynecological conditions had a 5% likelihood of being rehospitalized because of adhesions over the next 10 years.

Though many adhesions resulting from gynecological surgery have little or no detrimental effect on patients, a considerable proportion of them can result in serious short and long-term complications, including infertility,[7] pelvic pain[8] and intestinal obstruction, resulting in a reduced quality of life[9] often requiring readmission to hospital and additional more complicated surgical procedures and indeed increased surgical costs.[10]

Propensity to form adhesions are thought to be patient specific. The nutritional status, disease entities like diabetes and the presence of concurrent infectious processes also contribute. They impair leukocyte and fibroblast function in these patients, potentially increasing adhesion formation. It has also been shown that postsurgical adhesions increase with the age of the patient, the number of previous surgeries and the type and complexity of surgical procedures.[11] When lysed, adhesions have a tremendous propensity to reform.

Since, its first introduction in gynecological surgery in 1986, laparoscopy with its minimal access to the peritoneal cavity has been claimed to be associated with reduced rates of adhesion formation[12] and related complications, compared with open approach. Conclusive evidence is available from current studies, that a comparable or

[1,4,5,7]Associate Professor, [2,3]Professor, [6,8]Assistant Professor

[1-8]Department of Obstetrics and Gynecology, MES Medical College, Perinthalmanna, Kerala, India

Corresponding Author: Shyjus Puliyathinkal, Associate Professor, Department of Obstetrics and Gynecology, 315 Sana Apartments, Puthanangadi Post, Malappuram District Kerala, India, Phone: +919747355709, +914933253305 e-mail: shyjusnair7479@gmail.com

reduced adhesion formation rate is seen in women who undergo laparoscopic procedures. An epidemiologic study by Lower et al (2004)[13] reported on data from 24,046 patients undergoing laparoscopy or laparotomy for gynecological conditions and partially contrasted with the results from the previous studies. Data from this study have supported the concept that laparoscopy is less adhesiogenic than laparotomy but this stands only with respect to laparoscopic tubal sterilization procedures, which represented a considerable proportion of laparoscopies (59%), and the vast majority of those categorized as having 'low-risk' of directly adhesion-related readmission within the first year of surgery. However, for 'high-risk' (laparoscopic adhesiolysis and cyst drainage) and 'medium-risk' (other interventions not otherwise categorized) laparoscopies, which constituted 40% of gynecological procedures, the risk of adhesion-related readmission has been shown to be considerable (1 in 80 and 1 in 70 respectively) and substantially higher than for the conventional approach (1 in 170) . In the background of such controversies related to the occurrence of more or comparable or lesser incidence of adhesions in laparoscopy, this article specifically attempts to look at the realistic expectations from adhesion barriers in the field of gynecological laparoscopy.

Adhesion Barriers

It was quite a logical thought process of the initial days that mechanical separation of peritoneal surfaces of the pelvic organs during the early days of the healing postoperatively, is a way to prevent postoperative adhesions. Intra-abdominal instillates and solid barriers were the options available. The ideal barrier should be noninflammatory, nonimmunogenic, persist during the remesothelialization, remain in place without suture, remain active in the presence of blood and be completely biodegradable.

MATERIALS AND METHODS

A literature search was performed using Google, Yahoo, Springerlink and Highwire Press.

The following search terms were used: adhesion barriers, oxidized regenerated cellulose, Interceed, icodextrin, ADEPT, hyaluronic acid (HA), intergel/hyalobarrier, sepracoat, viscoelastic gel, oxiplex.

Though there are numerous adhesion barrier agents and devices available in market today (Table 1), we decided to critically evaluate the evidence available about the most commonly used ones in the field of operative gynecology.

DISCUSSION

Oxidized regenerated Cellulose (Interceed)

The most relevant data related to this comes from a study conducted by Sekiba K (1992).[14] They evaluated Interceed (TC7) in a randomized, multicenter clinical study. Sixty-three infertility patients had bilateral pelvic sidewall adhesions removed at laparotomy. One pelvic sidewall was covered by Interceed and the other was left uncovered. The deperitonealized areas (N = 205) of all sidewalls were divided into three groups: less than 100 mm^2, N = 72; 100-1000 mm^2, N = 95; and more than 1000 mm^2, N = 38. The effectiveness of interceed was evaluated at laparoscopy 10 to 98 days after laparotomy. Significantly more adhesions were observed at laparoscopy on the control pelvic sidewalls (48 of 63, 76%) than on the treated sides (26 of 63, 41%) ($p < 0.0001$). The interceed treated sidewalls also had significantly less area involved with adhesions at laparoscopy ($p < 0.05$, $p < 0.001$ and $p < 0.001$ in the three groups, respectively) (Table 2). Twenty-eight women with severe endometriosis also had significantly more adhesions on the control side (23 of 28, 82%) than on the treated side (14 of 28, 50%) ($p < 0.05$).

Icodextrin (ADEPT)

The best of the available evidence regarding this adhesion barrier comes from a study done in 2011 by Trew et al.[15] This randomized, double-blind study comprising of 498 subjects was designed to assess the efficacy and safety of 4% icodextrin solution (ADEPT) in the reduction of *de novo* adhesion compared to lactated Ringer's solution (LRS)

Table 1: List of commercially available adhesion barriers

Materials	*Trade name*	*Mechanism*
Oxidized regenerated cellulose	Interceed	Changes into a gelatinous mass covering the injured peritoneum
Icodextrin	ADEPT	Gets metabolized to glucose by α-amylase in the circulation and gets slowly absorbed from the peritoneal cavity
Hyaluronic acid	Intergel/hyalobarrier	Transformation into a highly viscous solution coating serosal surfaces (application before injury)
Solution of HA	Sepracoat	Transforms into a viscous liquid or gel coating serosal surfaces and minimizing desiccation (application before injury)
Viscoelastic gel	Oxiplex/AP	Transformation into a viscous gel coating surgical sites
Hydrogel	Spray Gel	Solidification after spraying into a gel strongly adherent to the sites of application
Fibrin sealants	Beriplast	Rolled fibrin sheets to be placed on surgical wounds

in patients undergoing laparoscopic surgery for removal of myomas or endometriotic cysts. The mean number of *de novo* adhesions was 2.58 (2.11) for ADEPT and 2.58 (2.38) for LRS. This difference was not found to be significant (Table 3).

Hyaluronic Acid (Intergel)

The study which investigated the efficacy of this autocross-linked barrier was done in 2006 by Mais et al.[16] Fifty-two patients aged 22 to 42 years, undergoing surgery at four centers, were randomly allocated to receive either the gel or no adhesion prevention. The incidence and severity of postoperative adhesions were assessed laparoscopically after 12 to 14 weeks in a blinded, scored fashion.

A higher proportion of patients receiving the gel were free from adhesions compared with control patients. In subjects undergoing myomectomy without any concomitant surgery, though there was no significant difference in the proportion of adhesion free patients , a significant difference was found in the mean severity scores (Table 4). In subjects without uterine adhesions prior to myomectomy, a significant difference was found in the severity of uterine adhesions.

Solution of HA (Sepracoat)

It was the study by Diamond[17] in 1998 which looked at patients who underwent gynecologic procedures by means of a prospective, randomized, blinded, placebo-controlled multicenter study. Surgeons assessed their adhesions during second-look laparoscopy approximately 40 days later. The Sepracoat group had a significantly lower incidence of *de novo* adhesions than the placebo group as assessed by the proportion of sites involved and the percentage of patients without *de novo* adhesions as well as significantly reduced adhesion extent and severity (Table 5).

Oxiplex

The study of 2005 by Young et al[18] was aimed at patients undergoing laparoscopic surgery with pelvic adhesions, tubal occlusion, endometriosis, and/or dermoids. They were randomized to receive Oxiplex or no further treatment after surgery.

The mean baseline (American Fertility Society adhesion score) AFS score for each group was 8.0 (Table 6). At second look, treated adnexa had the same score (8.1), whereas in control adnexa the score increased (8.0-11.6).

CONCLUSION

The decision whether to use an adhesion barrier or not, need to be well thought out one. We need to weigh the balance between the efficacy of the material used against the cost implications involved. The reasonable conclusions that we were able to reach in the light of the available evidence are mentioned below.

Oxidized regenerated cellulose (Interceed) effectively helps to reduce the incidence and extent of postoperative adhesions, even in high risk groups (including patients with severe endometriosis). Though icodextrin (ADEPT) was found to be safe in laparoscopic surgery, no beneficial clinical effects could be established with its use. Auto-cross linked hyaluron gel appears to have a favorable safety profile as well as an efficacious antiadhesive action following laparoscopic gynecological procedures with the available data. Sepracoat appears to be one of the most promising adhesive barriers, in not only being safe but also significantly reducing the incidence, extent and severity of *de novo* adhesions at

Table 2: Sekiba K (1992)

Parameter assessed	*Interceed*	*Control*	*p-value*
Percentage of patients with adhesions	41%	76%	< 0.0001
Area involved in adhesions	Significantly less	NA	< 0.001
Percentage of patients with adhesions in high risk group	50%	82%	< 0.05

Table 3: Trew et al (2011)

Parameter assessed	*Icodextrin*	*Ringer's lactate*	*p-value*
Mean number of *de novo* adhesions	2.58 (2.11)	2.58 (2.38)	0.909

Table 4: Mais et al (2006)

Parameter assessed	*Hyaluron gel*	*No barrier*	*p-value*
Percentage of patients free of adhesions	62%	41%	NS
Mean severity scores for adhesions (for myomectomy alone)	Less severe		< 0.05
Mean severity scores for adhesions (in adhesion free patients prior to myomectomy)	Less severe		< 0.05

NS: Nonsignificant

Table 5: Diamond (1998)

Parameter assessed	*Sepracoat*	*Placebo*	*p-value*
Percentage of adhesion free patients	13%	4.6%	< 0.05
Proportion of sites involved	0.23	0.30	< 0.05
Adhesion severity	Significantly less		< 0.05

Table 6: Young et al (2005)

Parameter assessed	*Oxiplex*	*Placebo*	*p-value*
Increase in AFS score	8-8.1	8-11.6	
Percentage of patients with increase in AFS score	34%	67%	

multiple sites indirectly traumatized by gynecologic surgery. Oxiplex too appears to be an adhesion barrier for the future with its safety and efficacy being demonstrated, though larger study results are still being awaited.

REFERENCES

1. Baakdah H, Tulandi T. Adhesion in gynecology. Complication, cost and prevention: a review. Surg Technol Int 2005;14(1): 185-190.
2. Diamond MP, Freeman ML. Clinical implications of postsurgical adhesions. Hum Reprod Update 2001;7(6):567-576.
3. Hellebrekers BW, Trimbos-Kemper TC, Trimbos JB, et al. Use of fibrinolytic agents in the prevention of postoperative adhesion formation. Fertil Steril 2000;74(2):203-212.
4. Metwally M, Watson A, Lilford R, et al. Fluid and pharmacological agents for adhesion prevention after gynaecological surgery. The Cochrane Database of Systematic Reviews. Issue 2. Art No.: CD001298.pub3.
5. Liakakos T, Thomakos N, Fine PM, et al. Peritoneal adhesions: etiology, pathophysiology and clinical significance. Dig Surg 2001;18(1):260-273.
6. Lower AM, Hawthorn RJ, Ellis H, et al. The impact of adhesions on hospital readmissions over 10 years after 8849 open gynaecological operations: an assessment from the surgical and clinical adhesions research study. BJOG 2000;107(1):855-862.
7. Milingos S, Kallipolitis G, Loutradis D, et al. Adhesions: laparoscopic surgery versus laparotomy. Ann NY Acad Sci 2000; 900(2):272-285.
8. Hammoud A, Gago LA, Diamond MP. Adhesions in patients with chronic pelvic pain: a role for adhesiolysis? Fertil Steril 2004;82(1):1483-1491.
9. Menzies D, Hildago Pascual M, et al. Use of icodextrin 4% solution in the prevention of adhesion formation following general surgery: from the multicentre ARIEL registry. Ann Roy Coll Surg Engl 2006;88(3):375-382.
10. Ivarsson ML, Holmdahl L, Franzen G, Risberg B. Cost of bowel obstruction resulting from adhesions. Eur J Surg 1997;163(9): 679-684.
11. De Cherney AH, diZerega GS. Clinical problem of intraperitoneal postsurgical adhesion formation following general surgery and the use of adhesion prevention barriers. Surg Clin North Am 1997;77(1):671-688.
12. Kavic M. Adhesions and adhesiolysis: the role of laparoscopy. JSLS 2002;6(2):99-109.
13. Lower AM, Hawthorn RJ, Clark D, et al. Surgical and clinical research (SCAR) group. Adhesion-related readmissions following gynaecological laparoscopy or laparotomy in Scotland: an epidemiological study of 24,046 patients. Hum Reprod 2004; 19(1):1877-1885.
14. Sekiba K. Use of Interceed (TC7) absorbable adhesion barrier to reduce postoperative adhesion reformation in infertility and endometriosis surgery. The Obstetrics and Gynecology Adhesion Prevention Committee. Obstet Gynecol 1992;79(1):518-522.
15. Trew G, Pistofidis G, Pados G, Lower A, Mettler L, Wallwiener D, Korell M, Pouly JL, et al. Gynaecological endoscopic evaluation of 4% icodextrin solution: a European, multicentre, double-blind, randomized study of the efficacy and safety in the reduction of de novo adhesions after laparoscopic gynaecological surgery. Hum Reprod 2011;26(8):2015-2027.
16. Mais V, Bracco GL, Litta P, et al. Reduction of postoperative adhesions with an auto-crosslinked hyaluronan gel in gynaecological laparoscopic surgery: a blinded, controlled, randomized, multicentre study. Hum Reprod 2006;21(1):1248-1254.
17. Diamond MP. Reduction of de novo postsurgical adhesions by intraoperative precoating with Sepracoat (HAL-C) solution: a prospective, randomized, blinded, placebo-controlled multicenter study. The Sepracoat Adhesion Study Group. Fertil Steril 1998;69(2):1067-1074.
18. Young P, Johns A, Templeman C, et al. Reduction of post-operative adhesions after laparoscopic gynaecological surgery wuth Oxiplex/AP gel: a pilot study. Fertil Steril 2005;84(1):1450-1456.

10.5005/jp-journals-10033-1223

SURGICAL TECHNIQUE

Laparoscopic Rectopexy: Is It Useful for Persistent Rectal Prolapse in Children?

[1]Medhat M Ibrahim, [2]Mohammed Abd El Razik, [3]Ahmed M Abdelkader

ABSTRACT

Rectal prolapse is a relatively common, usually self-limiting illness in children. Peak incidence is between 1 and 3 years. The intervention is required for the persistent rectal prolapse (PRP). Only scanty experience is available with laparoscopic rectopexy in children. There is available work using both mesh and suture laparoscopic rectopexy in literature. This work is unique in that it presents our clinical experience with both mesh and suture laparoscopic rectopexy in children.

This is a prospective clinical study for the outcome of laparoscopic rectopexy (LRP) by both mesh and suture technique in children with persistent rectal prolapse.

Materials and methods: Fourteen cases of PRP were managed with LRP from February 2008 to August 2012.

Results: Of the 14 children, 10 (71.42%) were males and 4 (28.57%) were females. Male to female ratio was 2:1. The mean age of presentation was 5 years (3-8 years). The presenting complaints were mass descending per rectum along with bleeding per rectum lasting from 1 to 3 years. All had rectal prolapse of 5 to 7 cm in length. Twelve out of 14 children had recurrence even after sclera-therapy before referral to laparoscopic rectopexy. The mean duration of surgery was 30 minutes (20-60 minutes). No intraoperative complications were reported, only one case get constipation and managed conservatively and no recurrence.

Conclusion: LRP is safe, feasible in children and gives satisfactory results after failure of all conservative even sclera-therapy injection.

Keywords: Laparoscopy, Rectopexy, Rectal prolapse.

How to cite this article: Ibrahim MM, Razik MAE, Abdelkader AM. Laparoscopic Rectopexy: Is It Useful for Persistent Rectal Prolapse in Children? World J Lap Surg 2014;7(2):92-96.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Rectal prolapse describes a condition in which the entire layer of the rectal wall protrudes through the anal canal. Rectal prolapse is classified into two types: complete or full-thickness prolapse and incomplete or partial thickness prolapse. Complete prolapse represents a protrusion of the entire layer of the rectum to the outside of the anus and, thus, shows concentric folds. Incomplete prolapse is defined as a condition in which the protruding rectal wall is limited to the inside of the anal canal, which is also referred to as occult rectal prolapse or internal rectal intussusception. In clinical practice, mucosal prolapse is readily confused with rectal prolapse. Mucosal prolapse is not a protrusion of the whole layer of the rectal wall, but a portion of the rectal wall or only the anal mucosa. It should be differentiated from rectal prolapse as the surgical treatments are different.

Rectal prolapse in children is a relatively common, usually self-limiting illness in children. Peak incidence is between 1 and 4 years.[1,2] The intervention is required for the persistent rectal prolapse (PRP). Laparoscopic rectopexy (LRP) is in vogue for adults; however, only scanty experience is available with this technique in children. We present our experience with laparoscopic rectopexy for persistent rectal prolapse at the pediatric surgery unite.

MATERIALS AND METHODS

This is a prospective clinical study of 14 children managed with LRP (mesh and suture techniques) for PRP from April 2008 to September 2012. The conservative management of nutritional support, bowel habit regulation, and dietary manipulation for managing the prolapse had failed in all cases and were referred for surgical intervention. Twelve of the 14 patients were managed with sclerotherapy using ethanolamine oleate injected submucosally in three to four sittings before being referred to laparoscope rectopexy. Cases with rectal prolapse who did not respond to conservative management over 2 years were defined as PRP and were subjected to LRP. The decision to operate was based on the age of patient, duration of conservative management was more than 18 months, and frequency prolapse was more than two episodes requiring manual reduction per month, rectal bleeding, edema, ulceration, difficult reduction. The age, sex, weight, and initial presentation, duration of symptoms, precipitating events and comorbidities were maintained. Preoperative evaluation included history and physical examination, routine laboratory investigation, MRI pelvic floor muscle and spinal bone and lateral view, defecography,

[1,2]Assistant Professor, [3]Registrar

[1,2]Pediatric Surgery Unit, Faculty of Medicine, Al-Azhar University, Nasr City, Cairo, Egypt

[3]General Surgery Unit, Royal Commission Medical Center Yanbu Industrial City, Saudi Arabia

Corresponding Author: Medhat M Ibrahim, Assistant Professor Pediatric Surgery Unit, Faculty of Medicine, Al-Azhar University Nasr City, Cairo, Egypt, e-mail: dr_medhat_ibrahem@yahoo.com

proctoscopy and EMG anal sphincter and pelvic floor in all patients. Computed tomography (CT) scan was done for the two children with neurological problem. The authorized person was informed by the full details about the procedure and consented.

All children were given enemas each 6 hours 1 day before the surgery. Prophylactic antibiotics were given at the time of induction of anesthesia. All were operated under general anesthesia with endotracheal intubation. After full anesthesia and under complete sterilization catheter inserted to evacuate the urinary bladder. Supraumbilical transverse skin incision was done for 5 mm Ethicon XCEL port with 5 mm 00 scope introduction to the peritoneum under vision on the laparoscope monitor, then CO_2 insufflation to peritoneum up to 12 mm Hg intra-abdominal pressure was operand with hemodynamic and respiratory monitoring by anesthesia. Introduction of 5 mm, 30º scope at umbilicus port and two 5 mm working ports in midclavicular line followed this over the line joining midinguinal point and both costal margins. The position of the working ports varied with the child height and abdominal cavity size, ensuring acceptable ergonomics according to the child body built. Trendelenburg position removed the bowel away from the pelvis.

The rectosigmoid was grasped and mobilized after dividing the right side peritoneal fold starting from the sacral promontory (Fig. 1) and posterior rectal wall dissection to create a cave between the sacrum and the rectum with out opening the left peritoneal fold (Fig. 2). Both the ureters were identified and safe guarded. Rectum was mobilized from the sacral promontory to the lateral ligaments, and until the surface of the sacrum was clearly felt with an instrument and continue dissection down to the anal sphincter (Fig. 3). Ethicon Physiomesh® was inserted between the rectum and the sacral surface (Fig. 4). Rectum was then pulled up and fixed with the presacral fascia, mesh and the bone of sacral promontory of the sacrum on either side with two to three (2 cm between each suture in the rectum) seromuscular sutures of PDS size 3/0 using intracorporeal knotting (Fig. 5). Closure of the right peritoneal window with interrupted 3/0 absorbable suture was done to cover the mesh and close the cavity (Fig. 6). Patients were kept nil orally till the return of bowel sounds. Postoperatively, stool softeners were routinely prescribed for at least 12 weeks.

RESULTS

Of the 14 children, 10 (71.42%) were males and four (28.57%) were females. Male to female ratio was 2:1. The mean age of presentation was 5 years (3-8 years). The presenting complaints were mass descending per rectum along with bleeding per rectum lasting from 1 to 3 years. All had rectal prolapse of 5 to 7 cm in length. Two children were under neuropsychiatric treatment and one had walking problem. The two neuropsychiatric children were both males and weighted 17.4 and 18.2 kg at ages 7 and 9 years, respectively. The child with walking problem was a female aged 6 years and weighted 13.8 kg, which was below the 5th centile as per NCHS weight for age charts. The remaining 11 out of 14 children were normal in weight and fell between the 20th and 50th centile by NCHS standards.

The mean duration of surgery was 30 minutes (20-60 minutes). No intraoperative complications were reported. Redundancy of rectosigmoid was noticed in all patients except the two with neuropsychiatric problem. Pelvic floor laxity was found in those two cases. No intraoperative problems were encountered and no case required conversion. Mean postoperative hospitalization was 3 days (2-5 days). All were followed up for an average of 10 months (4-12 months), with no recurrence reported in any case during the follow-up period. One child complained of postoperative constipation, which improved with dietary manipulation and stool softeners. Also, there was no urinary or fecal control problem in all cases at the follow-up period.

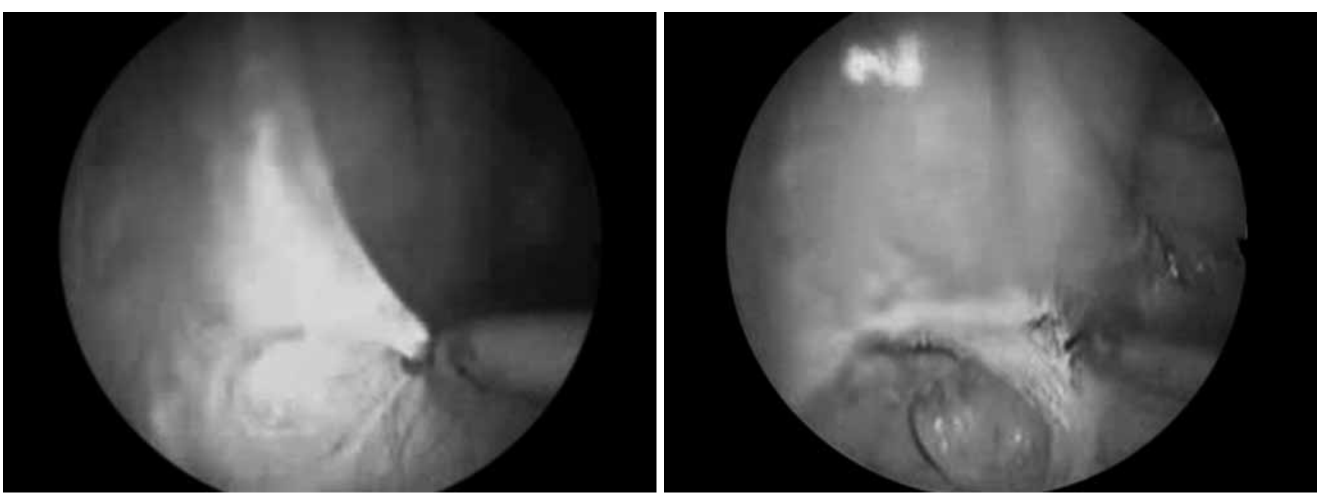


Fig. 1: Dividing the right side peritoneal fold starting from the sacral promontory

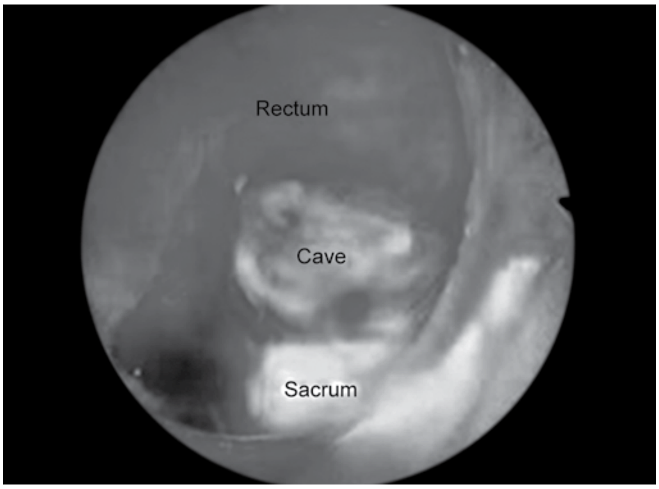


Fig. 2: Dissection to create a cave between the sacrum and the rectum

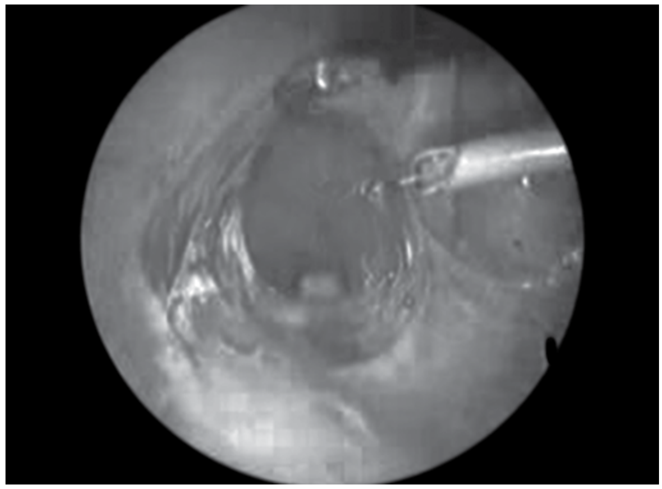


Fig. 3: Dissection continued down to the anal sphincter

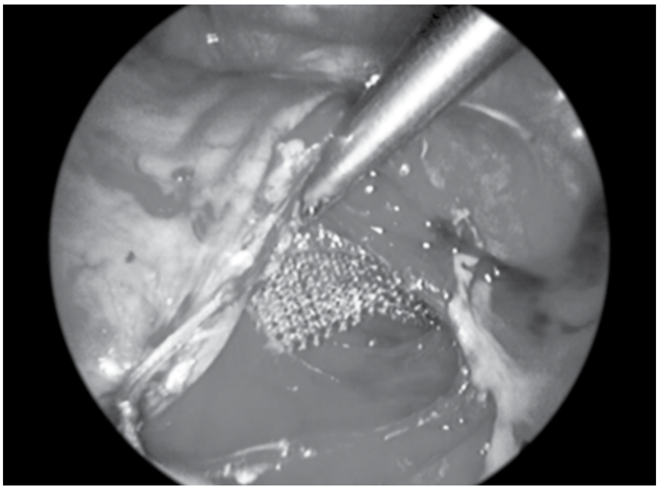


Fig. 4: Mesh was inserted between the rectum and the sacral surface

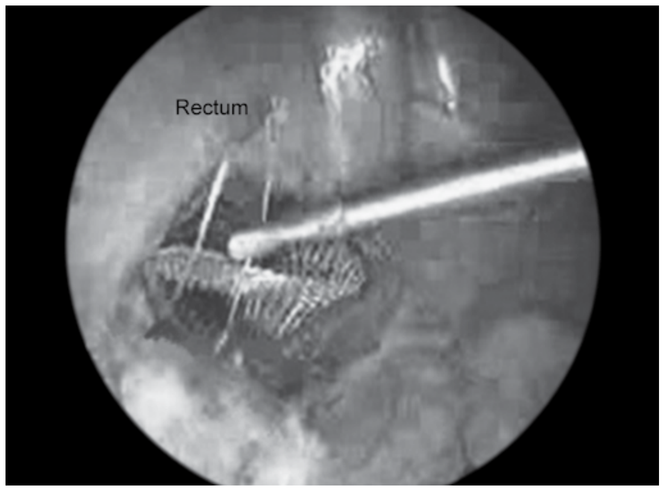


Fig. 5: Rectum fixed with the presacral fascia, mesh and the bone of sacral promontory of the sacrum

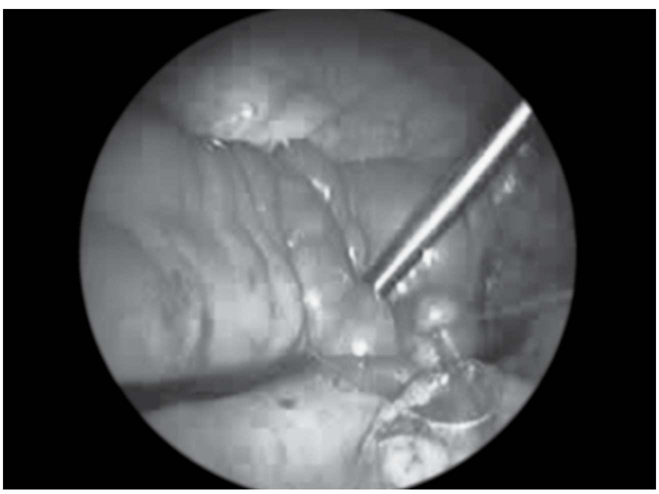


Fig. 6: Closure of the right peritoneum reflection

DISCUSSION

The etiology of rectal prolapse in children is unknown. Several anatomic considerations were suggested to be a cause of rectal prolapse in children, such as shallow or vertical configuration of the sacrum, disorders of the sacral nerve root innervations, greater mobility of the sigmoid colon, and a loosely attached rectal mucosa to the underlying muscularis, absence of Houston's valves in approximately 75% of infants younger than 1 year of age was suggested, vertical course of the rectum, poor levator support, relatively low position of the rectum in the pelvis, loss of retrorectal fat due to malnutrition, chronic constipation, and/or straining during defecation.[3-5] The extent of the herniation varies from 1 to 2 cm to extensive prolapse that may result in incarceration of the rectal wall with vascular compromise.[1] Patients with rectal prolapse have lowered basal and squeeze pressures with anorectal manometry than normal control subjects.[6,7] Rectal prolapse usually presents as a self-limiting disorder in children younger than 4 years of age.[8,9] In the pediatric population, the condition is usually diagnosed by the age of 3 years, with an equal sex distribution.[10] Male preponderance has been noted by Shalaby et al[11] and our study reaffirmed a male preponderance with 70% of patients being males.

Conservative treatment is usually successful,[9] however, the prolapse may persist indefinitely in some children, requiring surgical intervention. The percentage of children requiring surgical intervention, eventually, after failure of conservative management varies from 14 to 20%.[5] Surgery is indicated in rare cases with intractable rectal prolapse and may be considered in patients who are not spontaneously cured in 12 months of follow-up.[5] The mean period of conservative management in this study could actually be ascertained as this study was conducted at a tertiary care hospital, whereas the patients were managed from the start. However, a trial of at least 24 months of conservative management was given before the patients were referred to laparoscopic rectopexy.

Literature is replete with several treatment modalities, such as conservative treatment by regulation of toilet habit and modulation of diet,[4] injection of sclerotherapy,[13-15] linear cauterization,[16] encircling the anus,[17,18] trans anal resection, abdominal rectopexy,[19] posterior repair and suspension.[3,12] Each one of these techniques has its advantages and limitations which is a testimony to the lack of consensus over an ideal procedure. The operative procedures can be classified as abdominal[20] or perineal.[3,12,21,22] the less invasive procedure as injection sclerotherapy and encircling the anus reported success rate of nearly 90% in different series.[9,15] In this study, the conservative procedure was tried. Injection scleratherapy and liner cauterization was triad also before referral to laparoscopic rectopexy. This makes our procedure an effective valuable method for management of the persistent rectal prolapse in children with evident recurrence.

Pediatric surgeons gained good experience in laparoscopic approach and improved the surgical results.[5,23,24] Laparoscopic surgery has the advantages of good accessibility, butter visualization of the narrow pelvic space anatomy during surgery, less postoperative pain, shorter hospital stay and early recovery, as compared with laparotomy. Apart from these advantages, the results are similar to those with the open procedures irrespective of the method used (suture, resection or posterior mesh).[10] We used the rational that was described by Ashcraft et al in 1990 as the 'levator repair and posterior suspension procedure' for rectal prolapse.[3] The technique surgically accomplishes the objectives of nonoperative and operative methods of treatment through minimal invasive procedure. Advanced laparoscopic techniques in children need experience and require specific settings that may not be available in all centers but our technique is easy to be performed.

Both conventional and laparoscopic abdominal rectopexy approaches still carries the risk of bladder dysfunction and impotence.[17] This is not observed in our procedure due to the minimal pelvic dissection. Laparoscopic mesh rectopexy could avoid the morbidity of a large perineal or abdominal incision. It has been reported that prosthetic materials are not necessary in all cases.[25]

Shalaby et al, in their study, reported the mean duration of surgery as 40 minutes (30-55 minutes).[11] Rintala et al reported a median operation time of 80 minutes (62-90 minutes) for laparoscopic suture rectopexy and a median hospital time of 6 days (3-8 days).[5] The mean hospitalization time was 3 days.[11] Experience with LRP in this study further reinforces these findings; also continuous laparoscopic use will improve the operative procedure, operative time, and make the hospital stay shorter. The mean duration of surgery was 30 minutes (20-60 minutes). No intraoperative complications were reported. Mean postoperative hospitalization was 6 days (4-10 days).

The recurrence rates reported for PRP are as much as 6.9% at 5 years and 10.8% at 10 years.[11] Recurrent cases can be treated by laparoscopic resection rectopexy with or without mesh.[15,24] Some investigators reported that laparoscopic rectopexy with or without mesh is safe, rapid, and effective and can improve functional outcome without recurrence.[11] However, Rintala and Pakarinen prefer laparoscopic suspension of the rectum to anterior sacrum without mesh and they claimed that this approach is successful in several patients.[5] In this study, after a mean follow-up of 6 months, we had no recurrence because the sutures will fixe the rectum strongly in the sacral promontory that acted as a dock, while the mesh is going to create a port for the rectum to seal over it.

Shalaby et al reported only one case of postoperative constipation out of 52 cases operated with laparoscopic mesh rectopexy.[11] Rintala[5] reported two patients with postoperative constipation. They added that constipation is the only postoperative problem and is frequently worsened. In this study, we had just one case of postoperative constipation, managed conservatively in spite the longer use of the postoperative laxative and diet manipulation to prevent the constipation. This stands in stark contrast to high rate (35%) of postoperative constipation reported earlier by Kariv et al. All our 14 children were continent to solid with some difficult control of gas and fluid at the time of presentation. None of them had any incontinence issues in the postoperative setting even the gas and fluid improved.

Although this is a single center experience without a control group, the results are satisfactory. Whereas larger randomized control studies are required to secure conclusive evidence for the superiority of our procedure over the conventional open procedure and also other laparoscopic technique, paucity of PRP cases in a single center remains the limiting factor. We conclude that LRP is an effective and safe minimal invasive procedure alternative to the open and laparoscopic procedures with similar success rates and no additional complications.

REFERENCES

1. Siafakas C, Vottler TP, Andersen JM. Rectal prolapse in pediatrics. Clin Pediatr 1999;38:63-72.
2. Qvist N, Rasmussen L, Klaaborg KE, Hansen LP, Pedersen SA. Rectal prolapse in infancy: conservative versus operative treatment. J Pediatr Surg 1986;21:887-888.
3. Ashcraft KW, Garred JL, Holder TM, Amoury RA, Sharp RJ, Murphy JP. Rectal prolapse: 17-year experience with the posterior repair and suspension. J Pediatr Surg 1990;25: 992-995.
4. Sanaka MR, Ferguson DR, Ulrich S, Sargent R. Polyp associated with rectal prolapse. Gastro Intest Endosc 2004;59:871-872.
5. Rintala RJ, Pakarinen M. Disorders of the anus and rectum, anorectal function. In: O'Neill JA, Coran AG, Fonkalsrud E, Grosfeld JL, editors. Pediatric surgery. 6th ed. Philadelphia: Mosby; 2006. p. 1595-1596.
6. Gourgiotis S, Baratsis S. Rectal prolapse. Int J Colorectal Dis 2007;22:231-243.
7. Theuerkauf FJ Jr, Beahrs OH, Hill JR. Rectal prolapse: causation and surgical treatment. Ann Surg 1970;171:819-835.
8. Corman ML. Rectal prolapse in children. Dis Colon Rectum 1985;28:535-539.
9. Abes M, Sarihan H. Injection sclerotherapy of rectal prolapse in children with 15% saline solution. Eur J Pediatr Surg 2004;14: 100-102.
10. Madiba TE, Baig MK, Wexner SD. Surgical management of rectal prolapse. Arch Surg 2005;140:63-73.
11. Shalaby R, Ismail M, Abdelaziz M, Ibrahem R, Hefny K, Yehya A, et al. Laparoscopic mesh rectopexy for complete rectal prolapsed in children: a new simplified technique. Pediatr Surg Int 2010;26:807-813.
12. Pearl RH, Ein SH, Churchill B. Posterior sagittal anorectoplasty for pediatric recurrent rectal prolapse. J Pediatr Surg 1989;24: 1100-1102.
13. Chan WK, Kay SM, Laberge JM, Gallucci JG, Bensoussan AL, Yazbeck S. Injection sclerotherapy in the treatment of rectal prolapse in infants and children. J Pediatr Surg 1998;33:255-258.
14. Dutta BN, Das AK. Treatment of prolapse rectum in children with injections of sclerosing agents. J Indian Med Assoc 1977; 69:275-276.
15. Fahmy MA, Ezzelarab S. Outcome of submucosal injection of different sclerosing materials for rectal prolapse in children. Pediatr Surg Int 2004;20:353-356.
16. Hight DW, Hertzler JH, Philippart AI, Benson CD. Linear cauterization for the treatment of rectal prolapse in infants and children. Surg Gynecol Obstet 1982;154:400-402.
17. Sander S, Vural O, Unal M. Management of rectal prolapse in children: Ekehorn's rectosacropexy. Pediatr Surg Int 1999;15:111-114.
18. Abcarian H. Prolapse and procidentia. In: Shackelford RT, Zuidema GD, editors. Surgery of the alimentary tract. 2nd ed. Philadelphia: Saunders; 1991. p. 331-348.
19. Berman IR. Sutureless laparoscopic rectopexy for procidentia. Technique and implications. Dis Colon Rectum 1992;35:689-693.
20. Safar B, Vernava AM. Abdominal approaches for rectal prolapse. Clin Colon Rectal Surg 2008;21:94-99.
21. Tsugawa C, Matsumoto Y, Nishijima E, Muraji T, Higashimoto Y. Posterior plication of the rectum for rectal prolapse in children. J Pediatr Surg 1995;30:692-693.
22. Wyllie GG. The injection treatment of rectal prolapse. J Pediatr Surg 1979;14:62-64.
23. Saxena AK, Metzelder ML, Willital GH. Laparoscopic suture rectopexy for rectal prolapse in a 22-month-old child. Surg Laparosc Endosc Percutan Tech 2004;14:33-34.
24. Bonnard A, Mougenot JP, Ferkdadji L, Huot O, Aigrain Y, De Lagausie P, et al. Laparoscopic rectopexy for solitary ulcer of rectum syndrome in a child. Surg Endosc 2003;17:1156-1157.
25. Laituri CA, Garey CL, Fraser JD, Aguayo P, Ostlie DJ, St Peter SD, et al. Fifteen-year experience in the treatment of rectal prolapse in children. J Pediatr Surg 2010;45:1607-1609.

10.5005/jp-journals-10033-1224

SURGICAL HISTORY

Practice of Laparoscopy Principles from Pages of Ancient History and Mythology

[1]Aswini Misro, [2]Naim Kadoglou

ABSTRACT

It is interesting to note that the practice of same core principles in the pages of history and mythology. Laparoscopic surgery being a virtual surgery, the surgeon is guided by the camera image rather than actual visual perception. It is intriguing that some of the gallantry warrior of the past fought and won utilising the same principle.

Keywords: Laparoscopy, History, Mythology, Surgery.

How to cite this article: Misro A, Kadoglou N. Practice of Laparoscopy Principles from Pages of Ancient History and Mythology. World J Lap Surg 2014;7(2):97.

Source of support: Nil

Conflict of interest: None

The principles of laparoscopic and robotic surgery are fascinating. These have brought unprecedented transformation in the field of surgery. It is quite interesting to note the practice of same core principles in the pages of history and mythology. Laparoscopic surgery being a virtual surgery, the surgeon is guided by the camera image rather than actual visual perception. It is intriguing that some of the gallantry warrior of the past fought and won utilizing the same principle.

This example is from the Indian epic, Mahabharata. Incontrovertibly, Arjun was a most brilliant and stalwart archer of Mahabharata times. A number of princes were vying for the hand of a beautiful princess called Draupadi in the arena of King Drupad. In order to win the hand of the princess, Arjun had to shoot an arrow into a golden fish attached to a revolving wheel on the ceiling by viewing at its reflection in a pan of water below. Arjun, undeterred and unmoved by all the other warrior's futile attempts, accomplished the task by looking at its reflection in the water below with unmistakable precision, amidst the tumultuous plaudits of the multitude gathered in the court.

Similar description is also found in the Greek Mythology during the beheading of a repugnant demon, Medusa by Greek demigod Perseus on order of King Polydectes of Seriphus. Medusa was a grotesque looking Gorgon who is said to have venomous snakes in place of locks of hair. This demon was almost invincible as the unfortunate ones who would gaze into her petrifying eyes would transform into stone and lose their existence. An ingenious Perseus was able to achieve this seemingly impossible task by meticulously pursuing the demon's reflection on his shield, gifted by the goddess Athena while avoiding visual confrontation. Finally, with a mighty blow, he dismembered her head from her body by the 'adamantine' sword.

Just like an archer envisaging the trajectory of an arrow and power of bow-cord based on real time mirror image information about the distance and movement of a target object, a laparoscopy surgeon operates on the organs based on the virtual real time image displayed on the laparoscopic monitor. This is titled as hand eye coordination which is the essential competency skill for performing these surgeries. Arena of abdominal compartment is dynamic with peristaltic bowels, pulsatile blood vessels, elusive bleeders and moving organs (due to breathing and heart movements), challenging the surgeons to choose the right weapon from their armamentarium and operate in the right direction, depth and momentum.

Clarence Darrow said 'History repeats itself, and that is one of the things that is wrong with history'. Whether we call it history or mythology, it is intriguing to note these repeats.

[1,2]Surgeon

[1,2]Department of Surgery, Ealing NHS Trust, Southall, United Kingdom

Corresponding Author: Aswini Misro, Surgeon, Department of Surgery, Ealing NHS Trust, Southall, United Kingdom e-mail: draswini@gmail.com

10.5005/jp-journals-10033-1225

CASE REPORT

Laparoscopic Segmental Colectomy as Management of a Delayed Post Colonoscopic Polypectomy Bleeding: A Case Report in Yaoundé (Cameroon)—A Third World Country

[1]Blondel Oumarou Nana, [2]GA Bang, [3]Oumarou Ousmana, [4]YM Boukar Ekani, [5]A Essomba, [6]S Takongmo, [7]M Sosso

ABSTRACT

Colonic polypectomy reduces the subsequent rate of development of colonic cancers. However, serious complications can occur and postpolypectomy bleeding being the commonest. In most cases, postpolypectomy bleeding can be controlled endoscopically. We report a case of a 54 years old patient who present with a delayed postpolypectomy bleeding which could not be managed by endoscopic methods. We then performed a segmental colectomy by laparoscopy.

Keywords: Colonic polyp, Postpolypectomy bleeding, Laparoscopy.

How to cite this article: Nana BO, Bang GA, Ousmana O, Ekani YMB, Essomba A, Takongmo S, Sosso M. Laparoscopic Segmental Colectomy as Management of a Delayed Post Colonoscopic Polypectomy Bleeding: A Case Report in Yaoundé (Cameroon)—A Third World Country. World J Lap Surg 2014;7(2):98-100.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

With the improvement of equipment, a colonoscopic polypectomy is a procedure that can be performed safely, and it is becoming the standard for the treatment of polyps. However, various complications are associated with the procedure, and among them, the most common is hemorrhage accounting for 1 to 6% of polypectomies.[1-3] Postpolypectomy hemorrhage is divided into immediate bleeding occurring during surgery and delayed bleeding developing between a few hours and 2 weeks after surgery. The risk is related to the type and size of polyp, the technique of polypectomy, and the coagulation status of the patient.[4] In most cases, postpolypectomy bleeding can be controlled endoscopically.[5,6] We report a case of a 54 years old patient referred in our department for a delayed post-colonic polypectomy bleeding managed unsuccessfully by endoscopic methods, for who a laparoscopic segmental colectomy was performed.

OBSERVATION

Mister NJ, a 54 years old patient, was referred to the visceral and laparoscopic unit of the National Social Insurance Fund Health Center of Yaoundé (Cameroon), a third health structure for the management of a noncontrolled delayed post-colonic polypectomy bleeding.

Two months ago, he noticed intermittent rectal bleeding without abdominal pain. He took metronidazole in automedication without any improvement. He then consulted a gastroenterologist who performed a total colonoscopy which revealed a sessile polyp at 50 cm of the anal margin (Fig. 1).

He then performed a hot biopsy and noticed and immediate bleeding (Fig. 2).

This immediate bleeding was managed successfully by toilet of cold saline, cautery and injection of epinephrine. The patient was observed during 24 hours and then discharge.

Six days later, he suddenly have a massive rectal bleeding with weakness and dizziness. The gastroenterologist performed a second colonoscopy which revealed an active bleeding alternating jet and seepage on the site of the polypectomy. He tried to perform cautery and epinephrine injection without success. Hemoclips, loops and band ligators were not available. The patient was then referred to our department.

At admission, the patient was conscious, complaining of abdominal pain and dizziness. At physical examination, he had a blood pressure of 110/60 mm Hg, a pulse of 110/min. No signs of peritonitis were found.

A full blood count revealed a hemoglobin rate at 9.3 gm/dl without leukocytosis. We decided to realize an explorative laparoscopy.

[1-7]Surgeon

[1]Department of Visceral and Laparoscopic Surgery Unit National Social Insurance Fund Health Center; Department of Surgery, Faculty of Medicine and Biomedical Sciences University of Yaoundé I, Yaoundé, Cameroon

[2-4]Department of Visceral and Laparoscopic Surgery Unit National Social Insurance Fund Health Center, Yaoundé Cameroon

[5-7]Department of Surgery, Faculty of Medicine and Biomedical Sciences, University of Yaoundé I, Cameroon

Corresponding Author: Blondel Oumarou Nana, Surgeon Department of Visceral and Laparoscopic Surgery Unit National Social Insurance Fund Health Center, Yaoundé Cameroon, e-mail: nanablondel@yahoo.fr

The patient was supine with legs bent with a vesical probe. We introduce the first 10 mm trocart supraumbilical by 'open-coelioscopy' and two others of 5 mm in right iliac fossa and left hypochondrium. The operative table was then tilted in a maximum Trendelenburg position with maximum right roll. The exploration of the peritoneal cavity revealed a serous hematoma at the top of sigmoid loop with a pre-perforative injury (Fig. 3).

We realized a wide resection of omentum separation with mobilization of splenic flexure. A 5 cm incision was subsequently made to the left iliac fossa and the sigmoid externalized. A segmental colectomy with 5 cm of margin around the lesion was performed, followed by a colo-colonic end-to-end anastomosis. We did not use a skirt because it was not available. The sigmoid was reintroduced into the peritoneal cavity (Fig. 4). We verified that the colon had not been twisted, we made a peritoneal toilet with saline.

We introduced a short antibioprophylaxy. The post-operative course was uneventful with recovery of liquid feed at the first postoperative day, with discharge at day 4. The patient no longer had to note rectorragies. Cytopathological analysis of the resected specimen (Fig. 5) showed a tubular villous adenoma with high-grade dysplasia. A monitoring schedule was introduced.

The cosmetic result was good (Fig. 6).

DISCUSSION

Colorectal carcinoma is one of the commonest cancers in the world. Most colorectal cancers are thought to arise from adenomatous polyps and its take an average of 10 years for a less than 1 cm polyp to transform into invasive colorectal carcinoma.[7,8] Colonoscopy offers a way of screening for polyps and its subsequent surveillance.

Colonic polypectomy by colonoscopy reduces colorectal cancer incidence by 76 to 90%.[9,10] Complications that develop after colonoscopic polypectomy are hemorrhage, perforation and postpolypectomy syndrome.[1] Delayed postpolypectomy bleeding occurs in approximatively 0.95 to 2% of all patient.[11] Delayed bleeding is difficult to predict and a massive hemorrhage may occur after discharge, in which fatal problems may develop.[1] In several studies, delayed bleeding after a colonoscopic polypectomy has been reported to occur preferentially after resection of large polyp

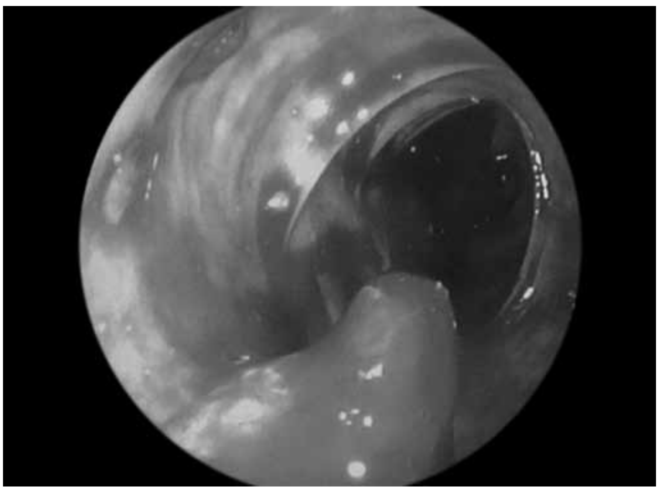


Fig. 1: Sessile polyp at 50 cm of anal margin

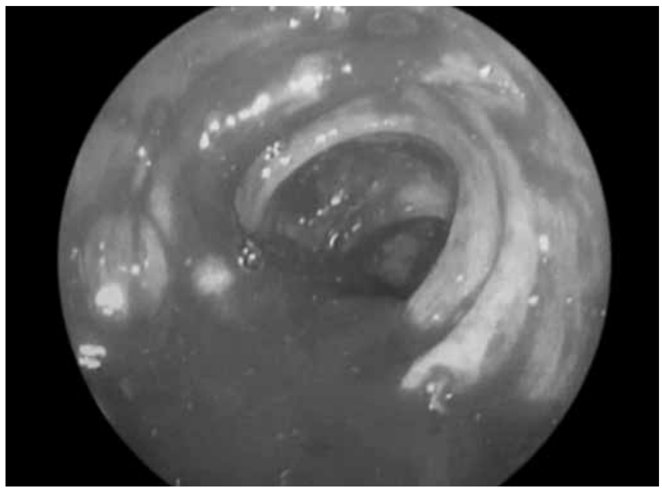


Fig. 2: Immediate bleeding following polypectomy

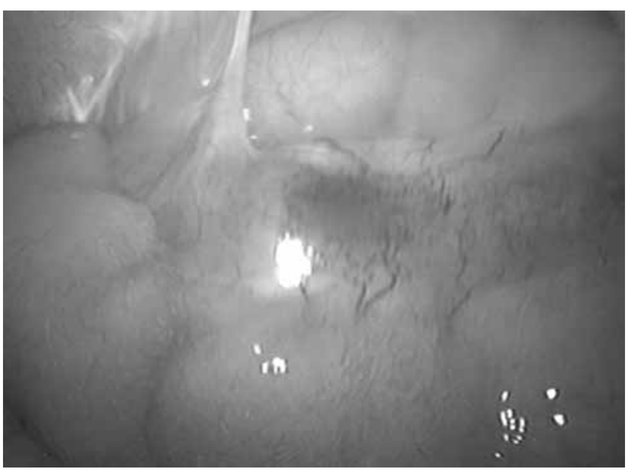


Fig. 3: Laparoscopic view of the sigmoid with serous hematoma with preperforative injury

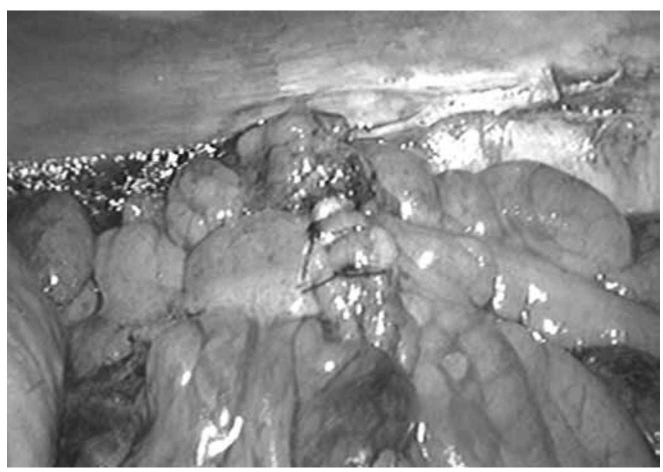


Fig. 4: Colo-colonic end-to-end anastomosis

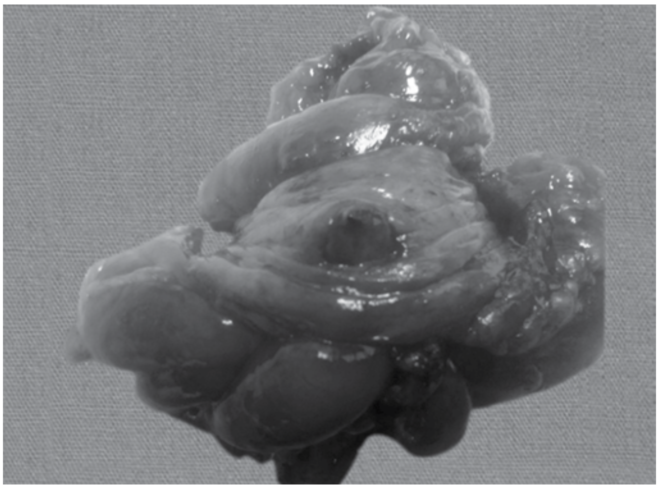


Fig. 5: Segmental colectomy piece

Fig. 6: Cosmetic result

of the right large bowel by endoscopic mucosal resection in patients older than 65 years.[1,4,12-14]

In our case, we had a sessile polyp of sigmoid removed by hot biopsy and complicated by immediate and delayed bleeding. The management of the immediate bleeding was successful after toilet by cold water, cautery and epinephrine injection. But after 6 days, it occurs a delayed bleeding probably due to the shedding of coagulation necrotic tissues and the resolution of the edema which open the closed blood vessels again. Unfortunately, the gastroenterologist could not managed it. This can be explain by the limited technical tea (hemoclips, loop and band ligators non available in our country), and the learning curve. Indeed, interventional gastroenterology is new in our country and practice of polypectomy in infrequent.

Recourse to surgery in case of postpolypectomy bleeding is exceptional, around 0.4%.[14] In these cases, laparoscopy is the first suitable way. Compared to open surgery, it allows a mini-invasive approach, a shorted hospital stay, less use of analgesics postoperatively and a better cosmetic result. But, the main difficulty during laparoscopy may be to identify the bleeding site. In our case, this location has been facilitate by the coexistence of a preperforative injury. This is the first time we realize a colonoscopy in our department for this indication.

CONCLUSION

Bleeding is the most common complication of colonoscopic polypectomy. The risk is related to the type and size of polyp, the technique of polypectomy and the coagulation status of the patient. In most cases, postpolypectomy bleeding can be controlled endoscopically. Therefore, endoscopist should be aware of various techniques of colonoscopic hemostasis. But, in exceptional cases, as our one of the failure of endoscopic management, laparoscopy with segmental resection can be an alternative.

REFERENCES

1. Kim HS, Kim KU, Park WK, et al. Delayed bleeding in a colonoscopic polypectomy: an experience with 5,236 polypectomies. J Korean Soc Coloproctol 2000;16:462-468.
2. Levin TR, Zhao W, Conell C, et al. Complications of colonoscopy in an integrated health care delivery system. Ann Intern Med 2006;145:880-886.
3. Dobrowolski S, Dobosz M, Babicki A, et al. Blood supply of colorectal polyps correlated with risk of bleeding after colonoscopic polypectomy. Gastrointest Endosc 2006;63:1004-1009.
4. Sung PH. How do I manage postpolypectomy bleeding? Clin Endosc 2012;45:282-284.
5. Singaram C, Torbey CF, Jacoby RF. Delayed postpolypectomy bleeding. Am J Gastroenterol 1995;90:146-147.
6. Kapetanos D, Beltsis A, Chatzimavroudis G, et al. Postpolypectomy bleeding: incidence, risk factors, prevntion and management. Surg Laparosc Endosc Percutan Tech 2012;22:102-107.
7. Morson BC. The evolution of colorectal carcinoma. Clin Radiol 1984;35:425-431.
8. Stryker ST, Wolff BG, Culp CE, et al. Natural history of untreated colonic polyps. Gastroenterology 1987;93:1009-1013.
9. Citarda F, Tomaselli G, Capocaccia R, et al. Efficacy in standard clinical practice of colonoscopic polypectomy in reducing colorectal cancer incidence. Gut 2001;48:812-815.
10. Thiis-Evensen E, Hoff GS, Sauar J, et al. Population-based surveillance by colonoscopy: effect on the incidence of colorectal cancer. Telemark Polyp Study I. Scand J Gastroenterol 1999; 34:414-420.
11. Kim DH, Lim SW. Analysis of delayed postpolypectomy bleeding in a colorectal clinic. J Korean Soc Coloproctol 2011;27(1):13-16.
12. Tolliver KA, Rex DK. Colonoscopic polypectomy. Gastroenterol Clin North Am 2008;60:414-418.
13. Kim SM, Yun SY, Choi H, et al. A case of delayed massive hemorrhage after endoscopic resecting of a rectal carcinoid tumor. Korean J Gastrointest Endosc 2009;38:111-115.
14. Choo WK, Javaid Subhani. Complications rates of colonic polypectomy in relation to polyp characteristics and techniques: a district hospital experience. J Interv Gastroenterol 2012;2(1): 8-11.

10.5005/jp-journals-10033-1226

CASE REPORT

Primary Pancreatic Leiomyosarcoma: Laparoscopic Distal Pancreatosplenectomy

[1]Jitendra H Mistry, [2]Alankar Gupta, [3]Harshad Soni, [4]Atul Shah, [5]KS Patel, [6]Sanjiv Haribhakti

ABSTRACT

Leiomyosarcoma of the pancreas is an extremely rare mesenchymal tumor, less than 50 cases have been reported till now. It accounts for 0.1% of pancreatic malignancy. Prognosis of this tumor is very poor, fewer are in resectable state. Surgical resection is the best possible option if feasible. We are reporting a case of leiomyosarcoma of pancreas underwent laparoscopic distal pancreatosplenectomy.

Keywords: Laparoscopic distal pancreatectomy, Pancreatosplenectomy, Pancreatic leiomyosarcoma, Mesenchymal tumor.

How to cite this article: Mistry JH, Gupta A, Soni H, Shah A, Patel KS, Haribhakti S. Primary Pancreatic Leiomyosarcoma: Laparoscopic Distal Pancreatosplenectomy. World J Lap Surg 2014;7(2):101-102.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Leiomyosarcoma of pancreas is an extremely rare mesenchymal tumor, less than 50 cases have been reported till now.[1] It accounts for 0.1% of pancreatic malignancy.[2] Prognosis of this tumor is very poor,[3] fewer are in resectable state. Surgical resection is the best possible option if feasible. We are reporting a case of leiomyosarcoma of pancreas underwent laparoscopic distal pancreatosplenectomy.

CASE REPORT

A 78-year-old gentleman visited our institution with complaint of pain at left upper quadrant of abdomen for 2 years with significant weight loss of 10 kg over a period of last 6 months and occasional vomiting. Examination revealed deep tenderness in left hypochondrium, no palpable mass or any other findings noted. Further evaluation in form of contrast enhanced computed tomography (Fig. 1A) of abdomen revealed heterogeneously enhancing soft tissue lesion in distal body and tail of pancreas with solid and cystic components. Splenic vessels were encased within the tumor. Fat planes with surrounding organs were preserved. He underwent laparoscopic distal pancreatectosplenectomy, the specimen was retrieved within the Endobag from the Pfannenstiel incision (Figs 1B and C). The procedure took 177 minutes with around 100 cc of blood loss. Postoperative recovery was uneventful and was discharged on postoperative day 6. Histopathological examination of specimen revealed intermediate grade leiomyosarcoma. All the margins and lymphnodes were free of tumor and there was no lymphovascular involvement (Figs 2A to C). Immunohistochemistry examination showed tumor cells positive for smooth muscle actin (SMA) and h-Caldesmon. Now with 6 months of follow-up, patient is doing well without any recurrence or complications.

DISCUSSION

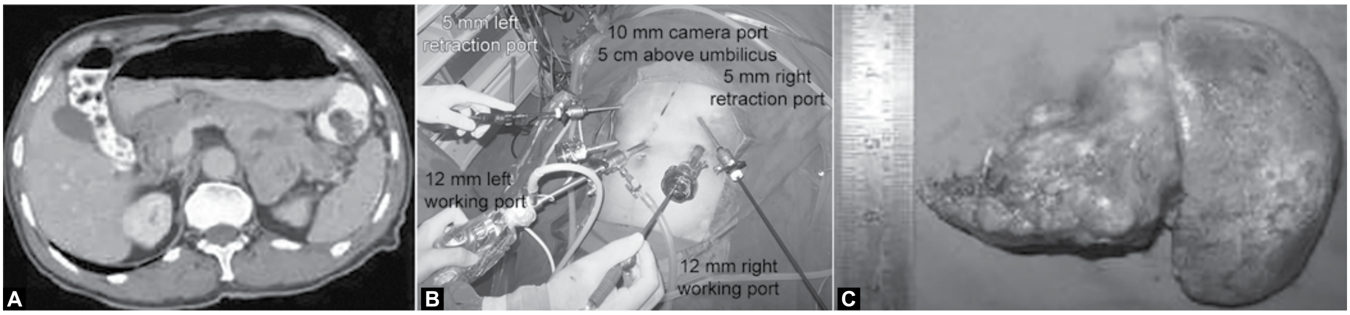
Mesenchymal tumor of pancreas are extremely rare, as of now less than 50 cases of pancreatic leiomyosarcoma have been reported in literature,[1] many of them had metastatic tumor. Literature suggests that it usually occurs in patients over 50 years of age,[4] as it was in our case. Origin of these mesenchymal tumor is usually pancreatic duct or blood vessels within the pancreas.[5] These tumors more commonly arise in the body and tail of the pancreas[5] which was seen in our patient also. It usually metastatize via hematogenous route and common site of metastasis are lung, liver, brain and spine.[1] Surgery is the preferred treatment for pancreatic leiomyosarcoma which offers the best survival. There are very few cases of laparoscopic distal pancreatosplenectomy reported for leiomyosarcoma in literature. Due to the magnification of vision we feel that oncological clearance is better with the laparoscopic approach. We did not find any difficulty while laparoscopic resection. Literature support laparoscopic distal pancreatectomy over open distal pancreatectomy for benign and low grade malignant tumors but the experience for high grade malignant is limited and needs long-term data.[6] Histopathological examination revealed pancreatic leiomyosarcoma. Most leiomyosarcomas are positive for SMA, desmin, cadesmon and vimentin.[1] In our case, the tumor was positive for SMA and h-Caldesmon.

[1]Consultant HPB and GI Oncosurgeon, [2]DNB Trainee
[3]Consultant GI and Laparoscopic Surgeon
[4,5]Consultant GI Surgeon, [6]Chairman

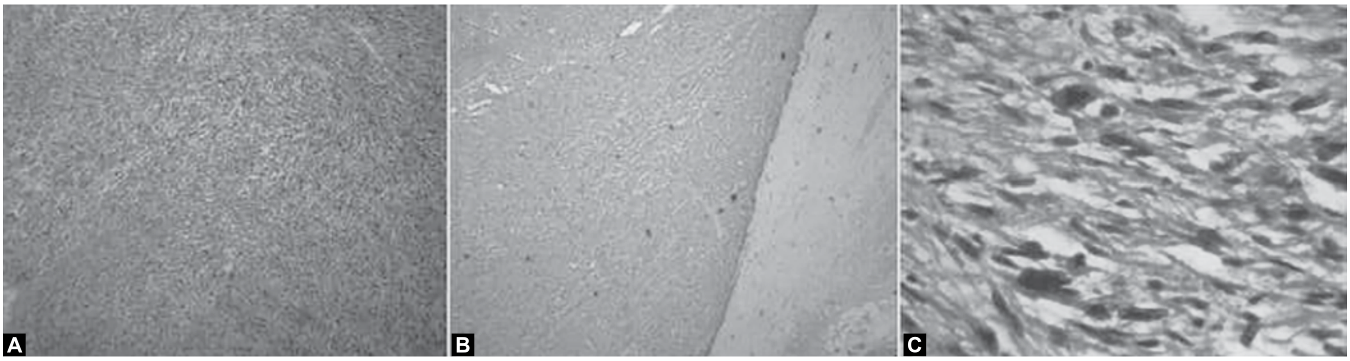
[1]Department of Surgical Gastroenterology, Baroda Laparoscopic Hospital, Vadodara, Gujarat, India

[2-6]Kaizen Hospital, Institute of Gastroenterology and Research Centre, Ahmedabad, Gujarat, India

Corresponding Author: Jitendra H Mistry, Consultant HPB and GI Oncosurgeon, Department of Surgical Gastroenterology Baroda Laparoscopic Hospital, Vadodara, Gujarat, India, e-mail: jitlap@gmail.com



Figs 1A to C: (A) Axial section CT scan of abdomen showing heterogeneously enhancing lesion in body and tail of pancreas with cystic components, (B) port placements and (C) specimen of distal pancreatosplenectomy



Figs 2A to C: (A) H&E staining, (B) bizarre spindle cells and (C) h-Caldesmon

CONCLUSION

Pancreatic leiomyosarcoma is very rare tumor with poor prognosis. Although, it is too early to recommend but laparoscopic resection of this tumor is feasible.

REFERENCES

1. Riddle ND, Quigley BC, Browarsky I, Bui MM. Leiomyosarcoma arising in the pancreatic duct: a case report and review of the literature. Case Report in Medicine. Article ID 252364;2010: 1-4.
2. Hur YH, Kim HH, Park EK, Seoung JS, Kim JW, Jeong YY, Lee JH, Koh YS, Kim JC, Kim HJ, Cho CK. Primary leiomyosarcom of the pancreas. J Korean Surg Soc 2011;81:s69-73.
3. American Cancer Society: facts and figures. Atlanta, GA; 2002.
4. Dimicoli S, Feugier P, Delaby P, et al. Granulocyte sarcoma of the pancreas without extrapancreatic involvement. Presse Medicale 2002;31(22):1024-1026.
5. Aihara H, Kawamura YJ, Toyama N, Mori Y, Konishi F, Yamada S. A small leiomyosarcoma of the pancreas treated by local excision. HPB 2002;4(3):145-148.
6. Jusoh AC, Ammori BJ. Laparoscopic versus open distal pancreatectomy: a systematic review of comparative studies. Surg Endosc 2012;26(4):904-913.