The Egyptian Journal of Surgery

The official organ of the Egyptian Society of Surgeons

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Last updated September 2014

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Histopathological changes in subcutaneous tissue of post bariatric patients, a possible cause of defective healing

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Background
After bariatric surgery, many patients are contented with the progress in loosing weight; but on the other hand, they become frustrated by the developing fat apron. At this point, patients should perform body contouring and to work out a proper treatment plan. The most common body contouring surgical procedure after massive weight loss is abdominoplasty.

Methods
The study started from January 2014 to January 2015 in Elfayoum University hospital , this study included 25 post bariatric consecutive patients. We presented data on patient demographics, operative procedures, wound complications and revision surgeries.All excised specimen was sent for histopathology. The aim of the study is to detect the histopathological changes in subcutaneous fatty layer and its correlation with post bariatric wound healing complications.

Results
Wound complications occurred in 15 abdominoplasty patients, surgical revision was necessary in 9 of these patients. These problems were associated with microscopic findings, applied on the cutaneous and subcutaneous tissue taken from the horizontal scar during abdominoplasty.

Conclusions
With the increasing number of high weight loss patients, the need for body-contouring surgeries increases. Surgeons operating on post bariatric patients should be concerned that they are not handling healthy structures, therefore, accurate knowledge of microscopic changes in these patients is necessary for a better choice of reconstructive procedure and avoidance of complications.

Key words:
body contouring, microscopic changes, post bariatric, wound healing

Egyptian J Surgery 35:79–82

1110-1121

Introduction

Obesity is one of the leading health problems in our country. After bariatric surgery, many patients are content with the progress in weight loss, but they become frustrated with the developing fat apron. At this point, patients should undergo body contouring and work out a proper treatment plan. The most common body-contouring surgical procedure after massive weight loss is abdominoplasty [1–14]. Fraccalvieri *et al*. [4] found that the complication rate in the postobese patient is higher than the complication rate in cosmetic patients in their 4-year clinical experience with abdominoplasties.

The aim of the study was to detect the histopathological changes in the subcutaneous fatty layer and its correlation with postbariatric wound-healing complications.

Patients and methods

This study was conducted on 25 consecutive post bariatric patients (20 Laparoscopic Sleeve Gastrectomy (LSG) and 5 Laparoscopic Greater Curvature Plication (LGCP)) from January 2014 to January 2015 in El Fayoum University Hospital. Informed consent was taken from all patients. The time interval between bariatric and body-contouring surgeries was 6 months (Figs. 1–3). The preoperative laboratory tests of three patients revealed only mild anemia, which was treated with iron supplements before surgery, but there was no disturbance of liver and kidney function tests and albumin levels were normal. Five patients had controlled diabetes.

All excised specimens were sent for histopathology after abdominoplasty.

Results

Wound complications occurred in 15 abdominoplasty patients, surgical revision was necessary in 9 of these patients (Fig. 4a and b). These problems were associated with microscopic findings, applied on the tissues taken from the horizontal scar during abdominoplasty, we documented anomalies of the dermal elastic

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(overgrowth, and polyfragmented aspect) and collagen (degenerated and sclerosed) fibers (Figs. 5 and 6) with collapsed adipocytes (Fig. 7).

All these results were compared by a study which was done with non post bariatric patients undergoing abdominoplasty which included 20 patients. Abdominoplasty was done successfully in all patients (Fig. 8). Complication rate was 20% in the form of seromas, but no major complications were recorded.

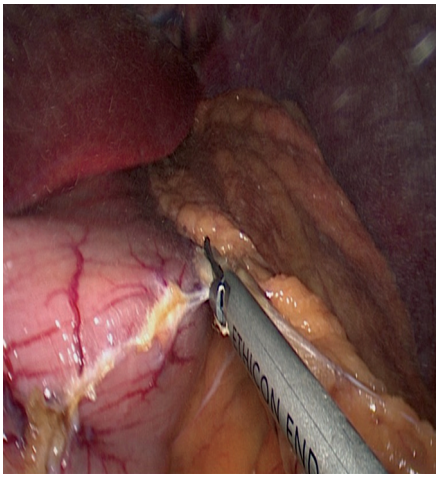
Discussion

With the increasing rate of morbidly obese patients and the need for bariatric surgery, an increasingly larger number of patients are seeking extensive body-contouring procedures. Nowadays, relatively more lower body lift surgeries are performed instead of classic abdominoplasties alone. In our study wound complications occurred in 15 abdominoplasty patients (3.75%), and surgical revision was necessary in nine of these patients. These problems were associated with microscopic findings from tissues taken from the horizontal scar during abdominoplasty. We documented anomalies in the dermal elastic (overgrowth, serpiginous, and polyfragmented) and collagen (degenerated and sclerosed) fibers.

Furthermore, Fraccalvieri and other authors found seroma as the most frequent complication of abdominoplasties [2,4,5,12,15]. Walgenbach *et al.* [16] found a new approach to decrease seroma formation using TissueGlu (Cohera Medical, Inc., USA) Surgical Adhesive, which is used in the management of wound drainage following abdominoplasty.

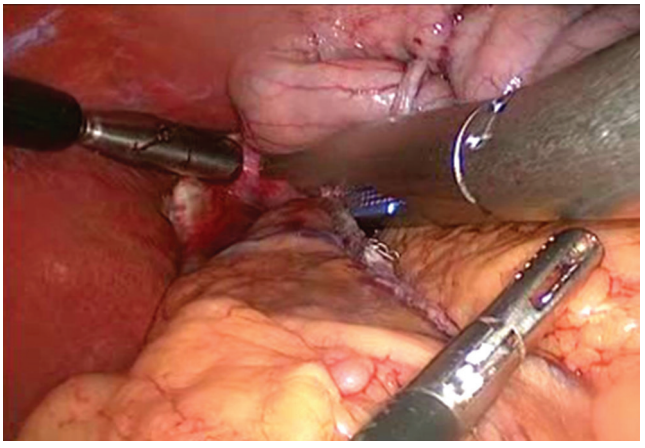
Fang *et al.* [17] found that flap elevation in a plane superficial to the standard suprafascial approach during abdominoplasty may decrease seroma formation. In my own surgical practice in a previous paper for abdominoplasty after bariatric surgeries, I preserved the costomarginal branch of the deep superior epigastric artery during undermining to ensure adequate vascular supply to the superior flap, and limited lateral undermining not extending past the anterior axillary line as well as limited the excision

Figure 1



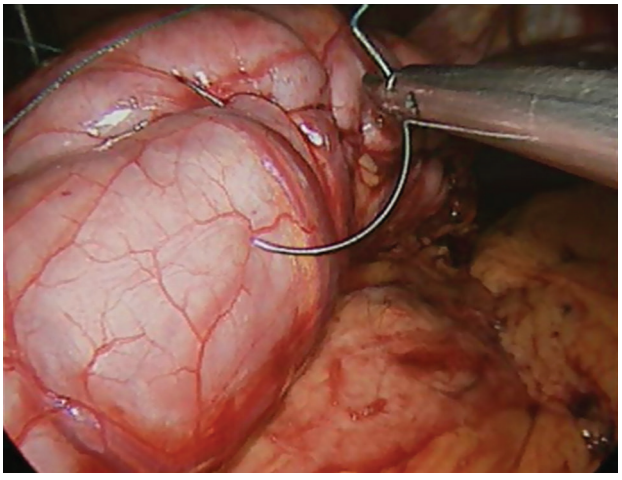
Division of the vascular supply of the greater curvature of the stomach.

Figure 2



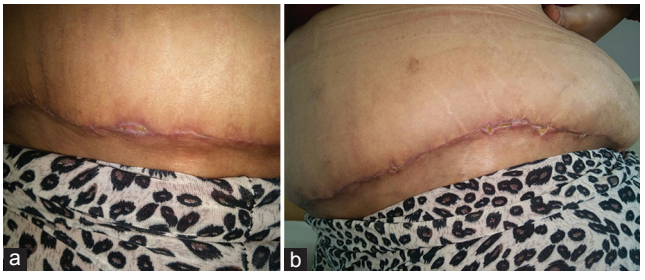
Gastrectomy using a stapler 6cm proximal to the pylorus LSG.

Figure 3



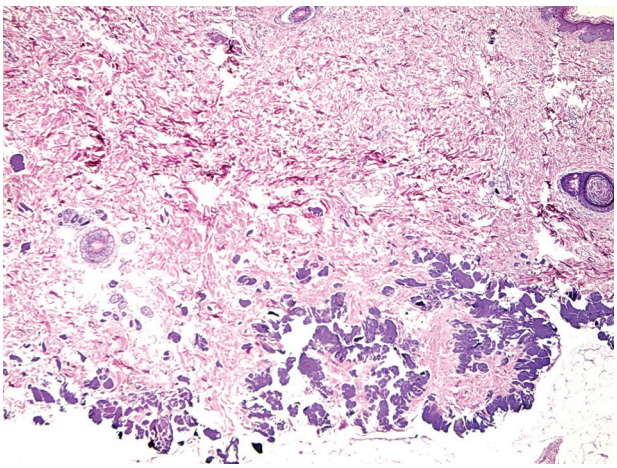
Plicated stomach.

Figure 4



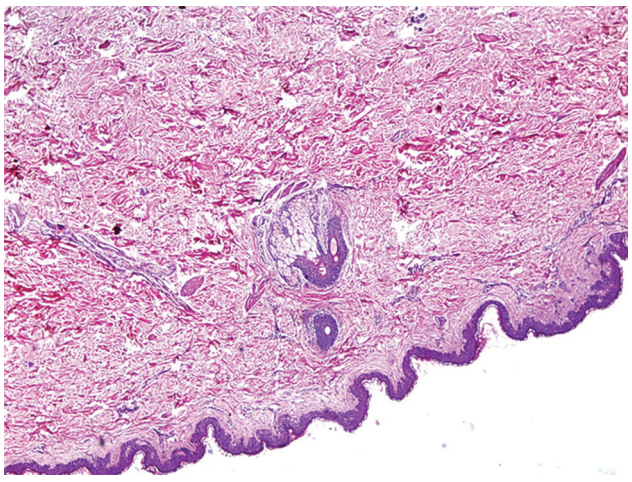
(a and b) Abdominoplasty after bariatric surgery.

Figure 5



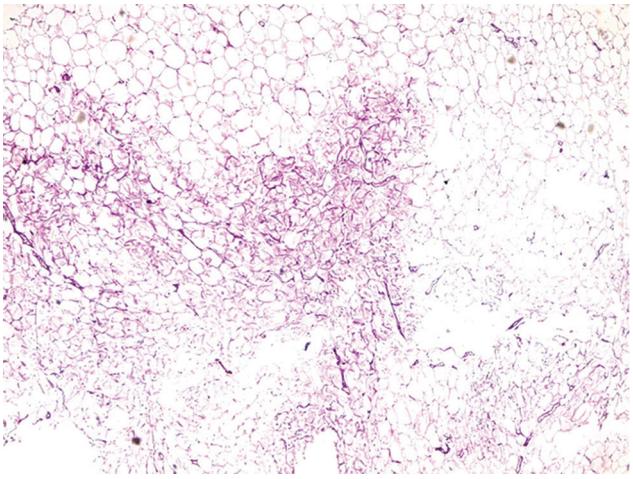
Dermal elastic (overgrowth, and polyfragmented aspect) and collagen (degenerated and sclerosed) fibers.

Figure 6



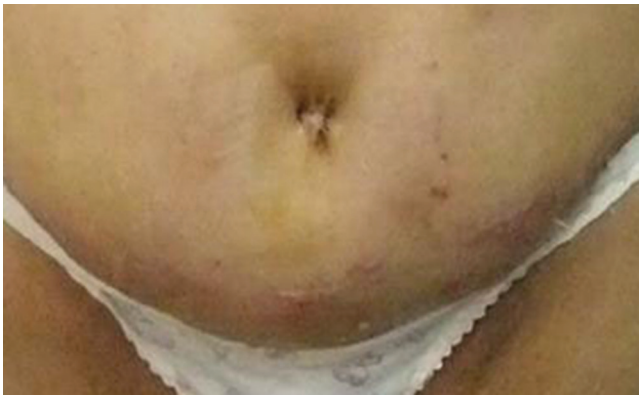
Dermal elastic (overgrowth, and polyfragmented aspect) and collagen (degenerated and sclerosed) fibers.

Figure 7



Collapsed adipocytes.

Figure 8



Abdominoplasty Post Non bariatric surgery weight loss.

or suction in order to reduce the risk for flap necrosis; I also undermined the skin and subcutaneous tissue superficial to the suprafascial plane, thus decreasing the rate of seroma [18].

In contrast, several publications show higher rates for wound-healing deficits than seromas, which correspond with my personal findings. In their review of body contouring in super obese patients Mericli and Drake [1] found wound-healing deficits in 32% and seromas in 13%. Also, Taylor and Shermak [9] reported in their work on body contouring following massive weight loss a higher rate of wound breakdowns (20%) than seromas (16%). Vico *et al.* [10] showed in the study on circumferential body contouring in bariatric and nonbariatric patients similar low rates of 3.5–5% as ours for seromas.

Conclusion

With the increasing number of high weight loss patients, the need for body-contouring surgeries has increased. Surgeons operating on postbariatric patients should take into consideration the fact that they are not handling healthy body structures, and therefore accurate knowledge of microscopic changes in these patients is necessary for a better choice of reconstructive procedures and for avoidance of complications.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Mericli AF, Drake DB. Abdominal contouring in super obese patients: a single-surgeon review of 22 cases. Ann Plast Surg 2011; 66(5): 523–527.

2 Stewart KJ, Stewart DA, Coghlan B, Harrison DH, Jones BM, Waterhouse N. Complications of 278 consecutive abdominoplasties. J Plast Reconstr Aesthet Surg 2006; 59(11): 1152–1155.

3 Zuelzer HB, Ratliff CR, Drake DB. Complications of abdominal contouring surgery in obese patients: current status. Ann Plast Surg 2010; 64(5): 598–604.

4 Fraccalvieri M, Datta G, Bogetti P, Verna G, Pedrale R, Bocchiotti MA, *et al*. Abdominoplasty after weight loss in morbidly obese atients: a 4-year clinical experience. Obes Surg 2007; 17:1319–1324.

5 Neaman KC, Hansen JE. Analysis of complications from abdominoplasty: a review of 206 cases at a university hospital. Ann Plast Surg 2007; 58(3): 292–298.

6 Shermak MA. Body contouring. Plast Reconstr Surg 2012;129:963e–968e.

7 Shermak MA, Rotellini-Coltvet LA, Chang D. Seroma development following body contouring surgery for massive weight loss: patient risk factors and treatment strategies. Plast Reconstr Surg 2008; 122(1): 280–288.

8 Shermak MA, Chang D, Magnuson TH, Schweitzer MA. An outcomes analysis of patients undergoing body contouring surgery after massive weight loss. Plast Reconstr Surg 2006;118(4): 1026–1031.

9 Taylor J, Shermak M. Body contouring following massive weight loss. Obes Surg 2004; 14(8): 1080–1085.

10 Vico PG, De Vooght A, Nokerman B. Circumferential body contouring in bariatric and non-bariatric patient. J Plast Reconstr Aesthet Surg 2010; 63(5): 814–819.

11 Colwell AS. Current concepts in post-bariatric body contouring. Obes Surg 2010; 20(8): 1178–1182.

12 Greco JA 3rd, Castaldo ET, Nanney LB, Wendel JJ, Summitt JB, Kelly KJ, *et al*. The effect of weight loss surgery and body mass index on wound complications after abdominal contouring operations. Ann Plast Surg 2008; 61(3): 235–242.

13 Agha-Mohammadi S, Hurwitz DJ. Enhanced recovery after body-contouring surgery: reducing surgical complication rates by optimizing nutrition. Aesthetic Plast Surg 2010; 34(5): 617–625.

14 Richter DF, Stoff A. Lower body contouring procedures. Chirurg. 2011; 82(9): 797–800.

15 Spiegelman JI, Levine RH. Abdominoplasty: a comparison of outpatient and inpatient procedures shows that it is a safe and effective procedure for outpatients in an office-based surgery clinic. Plast Reconstr Surg 2006; 118(2): 517–522. (discussion 523–534).

16 Walgenbach KJ, Bannasch H, Kalthoff S, Rubin JP. Randomized, prospective study of TissuGlu® surgical adhesive in the management of wound drainage following abdominoplasty. Aesthetic Plast Surg 2012; 36(3): 491–496.

17 Fang RC, Lin SJ, Mustoe TA. Abdominoplasty flap elevation in a more superficial plane: decreasing the need for drains. Plast Reconstr Surg 2010; 125(2): 677–682.

18 Morshed G. Abdominoplasty following weight loss: what is new? Kasr El-Aini Med J 2012; 18:57–61.

Prospective comparative study between laparoscopic Roux-en-Y gastric bypass and sleeve gastrectomy in the management of morbid obesity and its comorbidities

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Background
Laparoscopic Roux-en-Y gastric bypass (LRYGB) is one of the most widely used bariatric procedures today, and laparoscopic sleeve gastrectomy (LSG) as a single-stage procedure for the treatment of morbid obesity is becoming increasingly popular.

Objective
The aim of this study was to compare the results between LRYGB and LSG in the management of morbid obesity and its comorbidities.

Methods
Between January 2010 and January 2015, 434 morbid obese patients were randomized, operated upon, and followed up for 2 years in Al Ahli Hospital, Doha, Qatar. A total of 214 patients underwent LSG, and 220 patients underwent LRYGB. The mean BMI of all patients was 44 ± 10.8 kg/m^2; their mean age was 43 ± 4.9 years; and 72% of them were female. Patients were followed up at 3, 6, and 9 months and at 1 and 2 years. Operative time, length of hospital stay, weight loss, comorbidity improvement or resolution, postoperative complications, reinterventions and mortality were evaluated.

Results
Age, sex, BMI, and comorbidities were equal in both groups. The mean operative time for LSG was 86.9 ± 51.6 min and that for LRYGB was 108.4 ± 41.8 min. The conversion rate was 0.9% in both groups. Minor complications occurred more often in LRYGB than in LSG (17.2 vs. 8.4%). However, the difference in major complications did not reach statistical significance (4.5% for LRYGB vs. 1.4% for LSG). One-year excessive BMI loss was similar between the two groups (71.8 ± 21.9% for LSG and 77.2 ± 21.3% for LRYGB). The comorbidities were significantly improved after both procedures, except for gastroesophageal reflux disease, which showed a higher resolution rate after LRYGB.

Conclusion
Two years after surgery, both procedures were almost equally efficient regarding weight loss and improvement of comorbidities, except gastroesophageal reflux disease. LSG was associated with shorter operation time and fewer complications compared with LRYGB. Long-term follow-up data are needed to confirm these results.

Keywords:
gastric bypass, morbid obesity, sleeve gastrectomy

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1110-1121

Introduction

Severe obesity is one of the major problems in the world and is associated with several comorbidities and disabling diseases [e.g. cardiovascular disease, metabolic syndrome, type 2 diabetes mellitus (T2DM), infertility, certain tumor types, and increased mortality] [1–3]. Bariatric surgery is the most effective treatment for morbid obesity and, depending on the type of operation, is also very effective in the resolution of diabetes. This effect usually occurs even before the start of weight loss owing to changes in the gut hormones and the patient's diet [4].

A variety of surgical procedures are available and, currently, it is difficult to identify the most effective option based on patient characteristics and comorbidities. Furthermore, little is known regarding the effect of the various surgical procedures on glycemic control and T2DM remission [5–7]. Laparoscopic Roux-en-Y gastric bypass (LRYGB) is currently the preferred bariatric operation, involves two surgical alterations: restriction of the gastric volume and diversion of the ingested nutrients away from the proximal small intestine [8]. In contrast, laparoscopic sleeve gastrectomy (LSG) preserves the integrity of the

pylorus and does not include the intestinal bypass. LSG is the restrictive part of the biliopancreatic diversion and was initially applied as an isolated operation for super obese patients with severe comorbidities as a staged concept [9].

The promising short-term results of LSG have somewhat altered the paradigm for LSG from a two-stage procedure to a stand-alone definitive bariatric procedure [10]. LSG is perceived to be less invasive, technically simpler, and easier to perform compared with LRYGB. The possible long-term benefits of LSG include an intact gastrointestinal tract, the absence of internal hernias, and the lack of malabsorption requiring lifelong follow-up of nutritional status [11]. LSG could thus become the procedure of choice in treating morbid obesity provided that the long-term results of LSG are comparable with LRYGB regarding weight loss, the resolution of comorbidities, and improvement in the quality of life [12]. In 2012, the American Society for Metabolic and Bariatric Surgery published a revised position statement, which proposed that LSG is a valid alternative operation technique to LRYGB [13].

Methods

The current study was carried out in Al Ahli Hospital, Doha, Qatar, between January 2010 and January 2015. It included 434 morbid obese patients who were randomized and divided into two groups: the LSG group (n = 214) and the LRYGB group (n = 220). The procedure was explained in detail to all patients, including possible complications and postoperative dietary plan. An IRB form and written consent forms were obtained from all patients for the surgery and consent to share in this study. All patients were evaluated preoperatively by a bariatric surgeon, nutritionist, endocrinologist, and a psychiatrist. Upper gastrointestinal endoscopy, barium meal study, and abdominal ultrasound were routinely performed for all cases.

The inclusion criteria for the study were as follows: (a) BMI of at least 40 or BMI of at least 35 with a significant comorbidity associated with morbid obesity (T2DM, hypertension, obstructive sleep apnea, dyslipidemia, and arthritis); (b) age 18–60 years; and (c) previous failed adequate diet and exercise program. The exclusion criteria included BMI greater than 60, significant psychiatric disorder, active alcohol or substance abuse, active gastric ulcer disease, severe gastroesophageal reflux disease (GERD) with a large hiatal hernia, and previous bariatric surgery. Both study groups were similar regarding age, sex, BMI, and comorbidities. The primary endpoint of the study was weight loss. The secondary endpoints assessed the improvement of obesity-related comorbidities, and the overall morbidity and mortality of the procedures.

Surgical technique

Laparoscopic sleeve gastrectomy

A 36 Fr bougie was used along the lesser curvature for calibration of the gastric tube; longitudinal resection of the stomach was done from ~ 4 to 6 cm orally of the pylorus to the angle of His. No buttress material was used, and oversuturing of the staple line was only over the bleeding points (Fig. 1a and b).

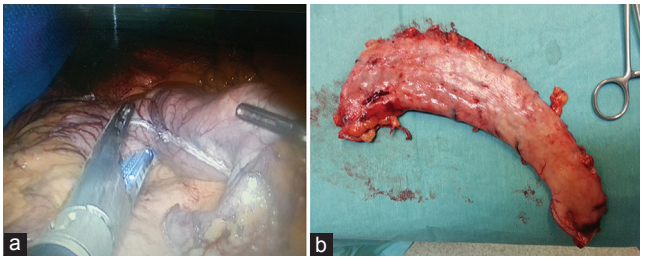
Laparoscopic Roux-en-Y gastric bypass

An antecolic and antegastric Roux-en-Y gastric bypass was performed with a 150 cm alimentary limb with either a linearly stapled or circularly stapled (25 mm) gastrojejunostomy according to the preference of the surgeon. A 50-cm-long biliopancreatic limb was chosen (Fig. 2).

In both procedures intraoperative methylene blue leak test was routinely performed, and a wide bore drain was applied near the staple line or anastomosis.

The postoperative follow-up of the patients was in the outpatient clinic at 3-month intervals for the first year and then after 2 years. All the data concerning weight loss, state of obesity-related comorbidities, and possible complications were thoroughly recorded. Postoperatively obesity-related comorbidities were classified as 'persisting' (medication is the same as preoperatively), 'improved' (reduction in medication), or 'resolved' (no more need for medication) after the endocrinologist's visit. Postoperative complications were classified as major or minor; morbidity resulting in death or a reoperation, a hospital stay exceeding 7 days, or a need for blood transfusions of four or more units constituted a major complication. All other postoperative problems were evaluated as minor complications.

Figure 1



(a) Resection of the outer part of the stomach using endo-GI stapler during sleeve gastrectomy. (b) Excised part of the stomach after sleeve gastrectomy. GI, gastrointestinal.

Statistical analysis

Data analysis was performed using SPSS for Windows (SPSS Inc., Chicago, Illlinois, USA). Values were reported as mean ± SD. Descriptive statistics were used for demographic variables such as age, weight, and BMI. A *P* value of less than 0.05 was considered statistically significant.

Results

This study included 434 patients. Their BMI ranged between 35 and 60 kg/m^2. They were randomized into two groups: the LSG group (214 patients) and the LRYGB group (220 patients). All of the patients completed the first-year follow-up (100%), but only 224 patients completed the second-year follow-up (109 from LSG group and 115 from LRYGB group).

There was no statistical difference between the two groups regarding age, sex, BMI, and rate of comorbidities associated with obesity (Table 1).

All procedures were completed laparoscopically, except four that were converted to open surgery. Two of them were in the LRYGB group because of excess intra-abdominal fat and large liver size. The other two cases were in the LSG group because of intraoperative bleeding that could not be controlled laparoscopically. Thus, conversion rate was similar in both groups (0.9%).

The mean operative time for LRYGB was 108.4 ± 41.8 min, higher than that for LSG, which was 86.9 ± 51.6 min (P = 0.003). The mean hospital stay was 6 days in the LRYGB group and 5 days in the LSG group.

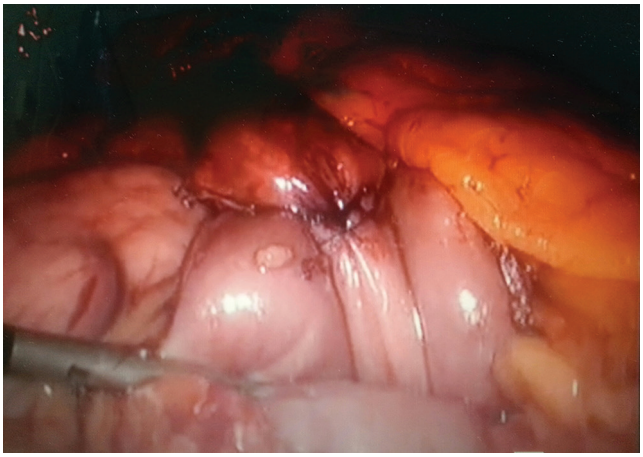
The postoperative complications were classified into minor and major as discussed in the methods. Major complications that required reoperation were 10 cases in the LRYGB group (4.5%) versus three cases in the LSG group (1.4%; P = 0.21). The reasons for reoperation in the LRYGB group (10 cases) were two leakages at the gastrojejunostomy, two obstructions at the biliopancreatic limb, four intra-abdominal abscesses, and two pleural empyemas. And the reasons for reoperation in the LSG group (three cases) were two leakages from the staple line and one left subphrenic abscess.

One patient in the LRYGB group developed leakage from the gastrojejunostomy, which was reoperated and complicated by aspiration pneumonia followed by acute respiratory distress syndrome and multiorgan failure and finally death. Table 2 demonstrates the postoperative complications, reoperation, and mortality.

There was no significant statistical difference between the two groups with respect to weight loss and excess body mass index loss (EBMIL) during the follow-up period. We noticed that most of the weight loss and EBMIL occurred during the first year in both groups, and then there was a tendency toward a lower weight loss and EBMIL and even weight regain in the LSG group than in the LRYGB group at the end of the second year (Tables 3–5).

There was marked improvement in comorbidities in both groups 1 year after surgery. There was no significant statistical difference between the LSG group and the LRYGB group regarding the remission of comorbidities or improvement rate, except for the remission of GERD. Patients undergoing LSG experienced a slightly higher rate of new-onset

Figure 2



Gastrojejunostomy (pouch-jejunostomy) during Roux-en-Y gastric bypass.

Table 1 Patient demographics and comorbidities

Items	LSG	LRYGB	*P*
Preoperative BMI	43.9±4.9	44.4±5.4	NS
First year after surgery	30.8±5.1	30.1±4.9	NS
Second year after surgery	31.3±4.5	30.3±5.2	NS

LRYGB, laparoscopic Roux-en-Y gastric bypass; LSG, laparoscopic sleeve gastrectomy; NS, nonsignificant.

Table 2 Postoperative complications, reoperation, and mortality

Comorbidities	LSG (*n*=214) (%)		LRYGB (*n*=220) (%)		*P*
	Cured	Improved	Cured	Improved	
Hypertension	31.8	57.2	32.2	62.8	NS
T2DM	58.1	40.9	68.4	27.6	NS
Dyslipidemia	25.8	59.2	46.3	49.7	NS
OSAS	51.1	43.9	32.5	66.5	NS
Joint pain	21.6	67.4	16.3	71.7	NS
GERD	14.2	35.8	24.7	50.3	S

GERD, gastroesophageal reflux disease; LRYGB, laparoscopic Roux-en-Y gastric bypass; LSG, laparoscopic sleeve gastrectomy; NS, nonsignificant; OSAS, obstructive sleep apnea syndrome; S, significant; T2DM, type 2 diabetes mellitus.

GERD (13.5 vs. 3.9%; $P = 0.12$), and among those who already presented with GERD before the operation the rate of improvement was significantly lower than among those who underwent LRYGB (50 vs. 75%; $P = 0.008$). Table 6 demonstrates the percentage of patients who were cured or showed improvement in their comorbidities.

Discussion

The positive effects of bariatric surgery on weight loss and obesity-related comorbidities are no longer doubted. In addition, these procedures can also be performed safely with low mortality and morbidity [14]. There are few randomized controlled trials comparing the two most commonly performed bariatric procedures – that is, LRYGB and LSG – with regard to actual weight loss and/or improvement in obesity-related comorbidities in the mid and long term [15].

My study included 434 patients with BMI 35–60 kg/m^2, which matches with most of the similar studies that was conducted on the same BMI group [16–19]. However, Yang *et al.* [20] conducted a similar study on a lower BMI group (28–35 kg/m^2) comparing both procedures in the treatment of Chinese T2DM.

The follow-up period in my study was 2 years. All of the patients completed the first-year follow-up but only 224 patients completed the second-year follow-up during data analysis, which could be considered a weak point in the study. Helmiö *et al.* [19] completed their study within 6 months' follow-up. Albeladi *et al.* [21] followed up their study group for 18 months, and Vidal *et al.* [22] completed 4 years of follow-up in their study.

I found that the mean operative time for LSG was significantly shorter than that for LRYGB ($P = 0.003$), and also the mean hospital stay was shorter in the LSG group than in the LRYGB group (5 vs. 6 days). The same results were obtained by different similar studies [15,20,23].

I noticed higher rates of minor and major postoperative complications in the LRYGB group than in the LSG group but the difference was not statistically significant (17.3 vs. 8.4% and 4.5 vs. 1.4%, respectively). This result matches with the study by Leyba *et al.* [24], whereas Boza *et al.* [25] found that the rate of early complications was significantly higher in the LRYGB group than in the LSG group ($P < 0.001$).

My results showed that most of the weight loss and BMIL occurred during the first year in both groups, and then there was a tendency toward a lower weight loss and EBMIL and even weight regain in the LSG group than in the LRYGB group at the second year but the differences were not statistically significant. A systematic review revealed that the EWL after 24 months is not statistically different between RYGB and SG [26]. There are reports from nonrandomized trials on tendency for weight regain after LSG at 3–5 years following surgery [27,28]. However, this is a general phenomenon following bariatric surgery, and it is not specifically related only to LSG. In contrast,

Table 3 Changes in the body weight (mean±SE)

Items	LSG (*n*=214)	LRYGB (*n*=220)	*P*
Minor complications			
Dysphagia	8	6	
Wound infection	2	6	
Atelectasis, pleural effusion	8	26	
Total (*n* (%))	18 (8.4)	38 (17.3)	NS
Major complications			
Leakage	2	2	
Obstruction	0	2	
Intra-abdominal infection	1	4	
Empyema	0	2	
Total (*n* (%))	3 (1.4)	10 (4.5)	NS
Mortality	0	1	NS

LRYGB, laparoscopic Roux-en-Y gastric bypass; LSG, laparoscopic sleeve gastrectomy; NS, nonsignificant.

Table 4 Changes in BMI (mean±SE)

Items	LSG	LRYGB	*P*
Preoperative body weight	124.1±18.7	125.3±20.2	NS
First year after surgery	87.3±17.2	85.2±17.1	NS
Second year after surgery	89.1±17.6	84.8±18.2	NS

LRYGB, laparoscopic Roux-en-Y gastric bypass; LSG, laparoscopic sleeve gastrectomy; NS, nonsignificant.

Table 5 Excess body mass index loss (mean±SE (%))

Items	LSG (*n*=214)	LRYGB (*n*=220)	*P*
Age (mean±SD) (years)	43.4±10.8	42.4±11.3	NS
Male (*n* (%))	60 (28)	62 (28)	NS
Female (*n* (%))	154 (72)	158 (72)	NS
Weight (mean±SD) (kg)	124.1±18.7	125.3±20.2	NS
BMI±SD (kg/m^2)	43.9±4.9	44.4±5.4	NS
Hypertension (%)	62.8	59.3	NS
T2DM (%)	23.9	25.8	NS
Dyslipidemia (%)	67.3	51.2	NS
OSAS (%)	47.8	42.3	NS
Joint pain (%)	61.2	67.7	NS
GERD (%)	43.7	45.9	NS

GERD, gastroesophageal reflux disease; LRYGB, laparoscopic Roux-en-Y gastric bypass; LSG, laparoscopic sleeve gastrectomy; NS, nonsignificant; OSAS, obstructive sleep apnea syndrome; T2DM, type 2 diabetes mellitus.

Table 6 Percentage of cure and improvement in comorbidities in both groups 1 year after operation

Items (%)	LSG	LRYGB	*P*
First year after surgery	71.8±21.9	77.2±21.3	NS
Second year after surgery	69.3±21.2	76.9±20.8	NS

LRYGB, laparoscopic Roux-en-Y gastric bypass; LSG, laparoscopic sleeve gastrectomy; NS, nonsignificant.

Boza *et al.* [10] have reported excellent results of 1000 consecutive LSG procedures with a mean EWL of 84.5% at 3-year follow-up and with minimal weight regain after the first postoperative year.

The technical aspects of LSG somewhat lack standardization. The use of a smaller bougie size as calibration during the operation has been reported to be associated with a better weight loss and resolution of comorbidities, but on the contrary also with a higher leak rate [29,30]. Similarly, the preservation of the antrum and the use of reinforced staple lines have been controversial issues. An expert panel consensus statement on best practice guidelines for LSG was published addressing several of these technical issues as well as indications and contraindications for LSG and also evaluating both management and prevention of complications [31]. In my study, all the sleeves were created narrow, using a 36 Fr bougie. The distal resection was started 4–6 cm proximal to the pylorus, and the staple lines were oversutured only at the bleeding points.

From the obesity-related comorbidities, I observed the rate of cure and improvement of hypertension, T2DM, dyslipidemia, obstructive sleep apnea syndrome, joint pain, and GERD. There was marked improvement in comorbidities in both groups 1 year after surgery. There was no significant statistical difference between the LSG group and the LRYGB group regarding the remission of comorbidities or improvement rate except for the remission of GERD. The same results were obtained from different studies on the same subject, even with a lower BMI group, especially the rapid improvement in T2DM after both procedures [20,23,32,33].

In the past, there has been skepticism regarding LSG and GERD, because the anatomical structure of the angle of His is no longer intact after LSG. Furthermore, there is still a large proportion of remaining parietal cells. Accordingly, the new-onset rate of GERD has been reported to be as high as 21% after LSG [28]. In line with this, I observed a significantly lower rate of GERD remission and a clear trend of new-onset GERD after LSG compared with LRYGB. Prachand and Alverdy [34] also concluded that the incidence of GERD seems to be more frequent after LSG, whereas LRYGB is considered a therapeutic option in patients with GERD. Nevertheless, the course of GERD after LSG is controversial, and definite evidence supporting either side does not exist [35–37].

Conclusion

LSG and LRYGB are equally efficient regarding weight loss and improvement of comorbidities except GERD in the mid term. Moreover, LSG has shorter operative time than LRYGB, with fewer postoperative complications. Therefore, I believe that LSG is a valuable surgical alternative for selected patients with morbid obesity. On the other hand, patients with preexisting GERD are at risk for deterioration after LSG and should rather undergo LRYGB. Long-term follow-up data are needed to confirm these results.

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Conflicts of interest

There are no conflicts of interest.

References

1 Toghaw P, Matone A, Lenbury Y, De Gaetano A. Bariatric surgery and T2DM improvement mechanisms: a mathematical model. Theor Biol Med Model 2012; 9: 16.

2 Musella M, Milone M, Bellini M, Fernandez ME, Fernandez LM, Leongito M, Milone F. The potential role of intragastric balloon in the treatment of obese-related infertility: personal experience. Obes Surg 2011; 21(4): 426–430.

3 Musella M, Milone M, Bellini M, Sosa Fernandez LM, Leongito M, Milone F. Effect of bariatric surgery on obesity-related infertility. Surg Obes Relat Dis 2012; 8(4): 445–449.

4 Rubino F, Kaplan LM, Schauer PR, Cummings DE, Diabetes Surgery Summit Delegates The Diabetes Surgery Summit consensus conference: recommendations for the evaluation and use of gastrointestinal surgery to treat type 2 diabetes mellitus. Ann Surg 2010; 251(3): 399–405.

5 Lee WJ, Chong K, Ser KH, Lee YC, Chen SC, Chen JC, *et al.* Gastric bypass vs sleeve gastrectomy for type 2 diabetes mellitus: a randomized controlled trial. Arch Surg 2011; 146(2): 143–148.

6 Kim Z, Hur KY. Laparoscopic mini-gastric bypass for type 2 diabetes: the preliminary report. World J Surg 2011; 35(3): 631–636.

7 Cutolo PP, Nosso G, Vitolo G, Brancato V, Capaldo B, Angrisani L Clinical efficacy of laparoscopic sleeve gastrectomy vs laparoscopic gastric bypass in obese type 2 diabetic patients: a retrospective comparison. Obes Surg 2012; 22(10): 1535–1539.

8 Suter M, Donadini A, Romy S, Demartines N, Giusti V. Laparoscopic Roux-en-Y gastric bypass: significant long-term weight loss, improvement of obesity-related comorbidities and quality of life. Ann Surg 2011; 254(2): 267–273.

9 Chopra A, Chao E, Etkin Y, Merklinger L, Lieb J, Delany H. Laparoscopic sleeve gastrectomy for obesity: can it be considered a definitive procedure? Surg Endosc 2012; 26(3): 831–837.

10 Boza C, Salinas J, Salgado N, Pérez G, Raddatz A, Funke R, *et al.* Laparoscopic sleeve gastrectomy as a stand-alone procedure for morbid obesity: report of 1000 cases and 3-year follow-up. Obes Surg 2012; 22(6): 866–871.

11 Sarela AI, Dexter SP, O'Kane M, Menon A, McMahon MJ. Long-term follow-up after laparoscopic sleeve gastrectomy: 8–9-year results. Surg Obes Relat Dis 2012; 8(6): 679–684.

12 Spyropoulos C, Argentou MI, Petsas T, Thomopoulos K, Kehagias I, Kalfarentzos F. Management of gastrointestinal leaks after surgery for clinically severe obesity. Surg Obes Relat Dis 2012; 8 (5): 609–615.

13 Rosenthal RJ, Diaz AA, Arvidsson D, Baker RS, Basso N, Bellanger D, *et al.*International Sleeve Gastrectomy Expert Panel International Sleeve Gastrectomy Expert Panel Consensus Statement: best practice guidelines based on experience of>12 000 cases. Surg Obes Relat Dis 2012; 8(1): 8–19.

14 Helmiö M, Victorzon M, Ovaska J, Leivonen M, Juuti A, Jaser N, *et al.* SLEEVEPASS: a randomized prospective multicenter study comparing laparoscopic sleeve gastrectomy and gastric bypass in the treatment of morbid obesity: preliminary results. Surg Endosc 2012; 26(9): 2521–2526.

15 Peterli R, Borbély Y, Kern B, Gass M, Peters T, Thurnheer M, *et al*. Early results of the Swiss Multicentre Bypass or Sleeve Study (SM-BOSS): a prospective randomized trial comparing laparoscopic sleeve gastrectomy and Roux-en-Y gastric bypass. Ann Surg 2013; 258(5): 690–694(discussion 695).

16 Lim DM, Taller J, Bertucci W, Riffenburgh RH, O'Leary J, Wisbach G. Comparison of laparoscopic sleeve gastrectomy to laparoscopic Roux-en-Y gastric bypass for morbid obesity in a military institution. Surg Obes Relat Dis 2014; 10(2): 269–276.

17 Zhang Y, Zhao H, Cao Z, Sun X, Zhang C, Cai W, *et al*. A randomized clinical trial of laparoscopic Roux-en-Y gastric bypass and sleeve gastrectomy for the treatment of morbid obesity in China: a 5-year outcome. Obes Surg 2014: 24(10): 1617–1624.

18 Li K, Gao F, Xue H, Jiang Q, Wang Y, Shen Q, *et al*. Comparative study on laparoscopic sleeve gastrectomy and laparoscopic gastric bypass for treatment of morbid obesity patients. Hepatogastroenterology 2014; 61(130): 319–322.

19 Helmiö M, Victorzon M, Ovaska J, Leivonen M, Juuti A, Peromaa-Haavisto P, *et al*. Comparison of short-term outcome of laparoscopic sleeve gastrectomy and gastric bypass in the treatment of morbid obesity: a prospective randomized controlled multicenter SLEEVEPASS study with 6-month follow-up. Scand J Surg 2014; 103(3): 175–181.

20 Yang J, Wang C, Cao G, Yang W, Yu S, Zhai H, *et al*. Long-term effects of laparoscopic sleevegastrectomy versus roux-en-Y gastric bypass for the treatment of Chinese type 2 diabetes mellitus patients with body mass index28–35 kg/m2. BMC Surg 2015;15:88.

21 Albeladi B, Bourbao-Tournois C, Huten N. Short- and midterm results between laparoscopic Roux-en-Y gastric bypass and laparoscopic sleeve gastrectomy for the treatment of morbid obesity. J Obes 2013; 2013:934653.

22 Vidal P, Ramón JM, Goday A, Benaiges D, Trillo L, Parri A, *et al*. Laparoscopic gastric bypass versus laparoscopic sleeve gastrectomy as a definitive surgical procedure for morbid obesity. Mid-term results. Obes Surg 2013; 23(3): 292–299.

23 Fischer L, Wekerle AL, Bruckner T, Wegener I, Diener M, Frankenberg M, *et al*. BariSurg trial: sleeve gastrectomy versus Roux-en-Y gastric bypass in obese patients with BMI 35-60 kg/m2 – a multi-center randomized patient and observer blind non-inferiority trial. BMC Surg 2015;15:87.

24 Leyba JL, Llopis SN, Aulestia SN. Laparoscopic Roux-en-Y gastric bypass versus laparoscopic sleeve gastrectomy for the treatment of morbid obesity. A prospective study with 5 years of follow-up. Obes Surg 2014; 24(12): 2094–2098.

25 Boza C, Gamboa C, Salinas J, Achurra P, Vega A, Pérez G. Laparoscopic Roux-en-Y gastric bypass versus laparoscopic sleeve gastrectomy: a case–control study and 3 years of follow-up. Surg Obes Relat Dis 2012; 8(3): 243–249.

26 Müller-Stich BP, Fischer L, Kenngott HG, Gondan M, Senft J, Clemens G, *et al*. Gastric bypass leads to improvement of diabetic neuropathy independent of glucose normalization – results of a prospective cohort study (DiaSurg 1 study). Ann Surg 2013; 258(5): 760–765(discussion 765–766).

27 D'Hondt M, Vanneste S, Pottel H, Devriendt D, Van Rooy F, Vansteenkiste F. Laparoscopic sleeve gastrectomy as a single-stage procedure for the treatment of morbid obesity and the resulting quality of life, resolution of comorbidities, food tolerance, and 6-year weight loss. Surg Endosc 2011; 25(8): 2498–2504.

28 Himpens J, Dobbeleir J, Peeters G. Long-term results of laparoscopic sleeve gastrectomy for obesity. Ann Surg 2010; 252(2): 319–324.

29 Atkins ER, Preen DB, Jarman C, Cohen LD Improved obesity reduction and co-morbidity resolution in patients treated with 40-French bougie versus 50-French bougie four years after laparoscopic sleeve gastrectomy. Analysis of 294 patients. Obes Surg 2012; 22(1): 97–104.

30 Aurora AR, Khaitan L, Saber AA. Sleeve gastrectomy and the risk of leak: a systematic analysis of 4888 patients. Surg Endosc 2012; 26(6): 1509–1515.

31 Rosenthal RJ, Diaz AA, Arvidsson D, Baker RS, Basso N, Bellanger D, *et al*. International Sleeve Gastrectomy Expert Panel International Sleeve Gastrectomy Expert Panel Consensus Statement: best practice guidelines based on experience of>12000 cases. Surg Obes Relat Dis 2012; 8 (1): 8–19.

32 Maggard-Gibbons M, Maglione M, Livhits M, Ewing B, Maher AR, Hu J, *et al*. Bariatric surgery for weight loss and glycemic control in nonmorbidly obese adults with diabetes: a systematic review. JAMA 2013; 309(21): 2250–2261.

33 Schauer PR, Bhatt DL, Kirwan JP, Wolski K, Brethauer SA, Navaneethan SD, *et al*. Bariatric surgery versus intensive medical therapy for diabetes – 3-year outcomes. N Engl J Med 2014; 370(21): 2002–2013.

34 Prachand VN, Alverdy JC. Gastroesophageal reflux disease and severe obesity: fundoplication or bariatric surgery? World J Gastroenterol 2010; 16:3757–3761.

35 Zhang N, Maffei A, Cerabona T, Pahuja A, Omana J, Kaul A. Reduction in obesity-related comorbidities: is gastric bypass better than sleeve gastrectomy? Surg Endosc 2013; 27(4): 1273–1280.

36 Petersen WV, Meile T, Küper MA, Zdichavsky M, Königsrainer A, Schneider JH. Functional importance of laparoscopic sleeve gastrectomy for the lower esophageal sphincter in patients with morbid obesity. Obes Surg 2012; 22 (3): 360–366.

37 Elazary R, Phillips EH, Cunneen S, Burch MA. Comments on 'increase in gastroesophageal reflux disease symptoms and erosive esophagitis 1 year after laparoscopic sleeve gastrectomy among obese adults' (doi: 10.1007/s00464-012-2593-9). Surg Endosc 2013; 27(10): 3935–3936.

A prospective randomized trial comparing modified Limberg flap and cleft lift procedure in the treatment of uncomplicated sacrococcygeal pilonidal disease

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Background
Sacrococcygeal pilonidal disease (SPD) is a common and frustrating problem, but there is still no consensus on the optimal treatment. Many studies recommend off-midline closure if any excision is to be done. The aim of this study was to compare the modified Limberg flap (MLF) and cleft lift procedures.

Patients and methods
From February 2010 to February 2013, the authors prospectively studied 200 patients with SPD who presented at two hospitals. The patients were randomly assigned to undergo either MLF transposition (n = 100) or the cleft lift procedure (n = 100). Surgical findings, complications, recurrence rates, and degree of patient satisfaction were compared.

Results
Operation time was longer in the MLF group. There was no significant difference between the two groups in terms of time to complete healing, time off work, complication rate, and recurrence rates. The two groups reported similar rates of satisfaction. Length of hospital stay was slightly longer in the MLF group because of delay in drain removal. During the follow-up period of 21.5 ± 6.8 months for group 1 and 22 ± 7.6 months for group 2, a single case of recurrence (1%) was detected in group 2 versus two patients (2%) in group 1.

Conclusion
On the basis of the results of this study, the MLF technique and the cleft lift procedure appear to generate comparable results in the management of SPD. Both techniques are safe and easy to learn and have now become our standard procedures for treating chronic, symptomatic SPD.

Keywords:
cleft lift, modified Limberg, pilonidal sinus disease

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Introduction

Sacrococcygeal pilonidal sinus disease (SPD) is a common chronic disease occurring in the natal cleft of the sacrococcygeal region and it is more common among young adults [1]. It is generally considered an acquired pathology caused by the presence of hair within a deep natal cleft [2]. Thus, for treatment and prevention, these causative factors must be eliminated [3]. A number of therapeutic strategies have been proposed, ranging from mostly conservative methods to more dramatic procedures such as fasciomyocutaneous flap techniques that incorporate specialized vascular supplies [4]. Although different surgical approaches have been used to manage SPD, none of these approaches eliminate the postoperative morbidity, including delayed wound healing, discomfort, and high rate of recurrence, which range between 1 and 43% in different studies [5]. Wide excision carried out to the sacrococcygeal fascia with an open wound is probably the most popular treatment with a recurrence rate of 5–13% [6]. Management of the resultant defect in the tense sacral region appears to be the most important issue in the surgical treatment of pilonidal disease because this step is closely related to postoperative morbidity and recurrence [7,8]. A midline scar seems to put patients at higher risk for poor wound healing and recurrence [9]. A theoretical option aiming to improve surgical outcomes and reduce the median recurrence rate involves the lateralization of the natal cleft [2,9]. Skin flaps have been described to cover a sacral defect after wide excision; this keeps the scar off the midline and flattens the natal cleft. The techniques available include cleft closure, advancement flap (Karydakis procedure), local advancement flap (V-Y advancement flap), and rotational flap [Limberg flap, modified Limberg flap (MLF), gluteus maximus myocutaneous flap] [10–12]. Although the rhomboid excision and Limberg flap techniques promise successful results, the recurrence rate following Limberg flap procedures has been reported to range

from 0 to 7% and has primarily been encountered at the lower portion of the incision left on the intergluteal sulcus [13,14]. The MLF procedure for pilonidal disease was described by Mentes and colleagues in 2004. The recurrence rate in his study was 0% and healing time was 2 weeks [12,15]. Asymmetric closure techniques have been described by both Karydakis [16] and Bascom [17]. Bascom describes a thin skin flap mobilization, leaving the deep inflamed tissue in place, and skin closure. Both methods share excellent results. Karydakis reports a less than 1% recurrence rate and Bascom reports a 100% healing rate after minor revisions or a second cleft lift in 9–10% of his patients with refractory pilonidal sinus disease [18]. The best operations that allow the wound to be closed lateral to the midline and induce flattening of the natal cleft are MLF and Bascom cleft lift. However, there have been few clinical studies comparing the two, and information as to which of these two approaches is better is lacking. In this prospective study, the results and perioperative findings including short-term and long-term outcomes were analyzed and compared with the evaluation of patient satisfaction and comfort toward the surgical techniques.

Patients and methods

We conducted a prospective study during the period from February 2010 and February 2013.

A total of 232 patients with symptomatic pilonidal disease were referred to our outpatient clinics. In all, 200 of them were eligible for the study as the patients who presented with acute pilonidal abscesses were excluded from the study and all patients were healthy adults without coexisting disease of American Society of Anesthesiologists (ASA) category 1.

Before starting our study, approval was obtained from the ethics committee of each hospital, and each patient was informed about the goal and nature of the study, and written consent was obtained.

Patients were randomized through a computer-generated schedule to undergo either the MLF (group 1) or cleft lift procedure (group 2).

Surgical procedure

All patients were admitted to the hospital on the day of surgery. The natal cleft was shaved at the time of surgery. Patients underwent surgery under general anesthesia. A dose of prophylactic cephalosporin was given intravenously during the induction of anesthesia. The patient was placed in the prone Jack-Knife position with legs apart, an elevating cushion beneath the pelvis, with two adhesive straps in each gluteal region to allow better visualization of the natal cleft. The operation side was cleaned with 10% povidone-iodine.

Group 1: rhomboid excision and the modified Limberg flap technique

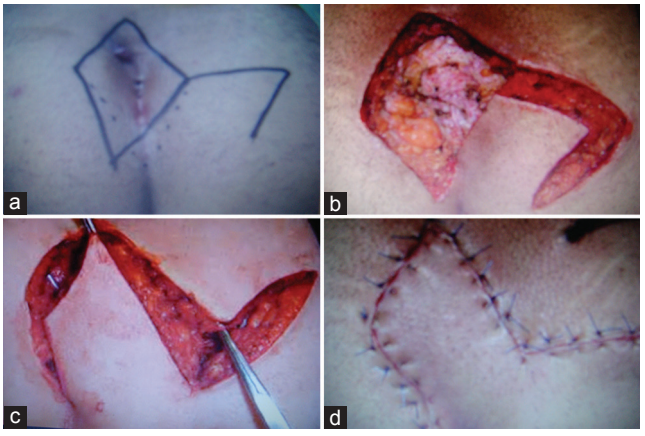
MLF operation was performed according to the technique described by Mentes *et al*. [12]. At the beginning of the procedure we marked the incision and wide rhomboid excision including postsacral fascia, taking care to remove all sinus tracts en block plus a rim of healthy tissue surrounding the cyst and sinuses. The inferior apex of the excised rhomboid area was placed ~1.5–2 cm lateral to the midline on the side opposite to the donor area. A right or left fasciocutaneous Limberg flap was elevated off the gluteal fascia contralateral to the asymmetric lower corner with careful dissection to avoid damaging the feeding arteries located in the inferior aspect of the flap. Then the flap was transposed medially to fill the defect without tension. The defect on the gluteal region was closed primarily. The subcutaneous layers were approximated with 2-0 vicryl interrupted over a vacuum drain, and the skin was closed with 2-0 proline interrupted sutures, which were removed on postoperative day 14, as shown in Fig. 1.

Group 2: Bascom cleft lift technique

The operative technique was essentially performed as previously described by Dr John Bascom [17].

The airless cleft (defined as the region of the natal cleft that is warm, moist, and airless when the patient is seated) was marked. The patients were placed in prone position with the buttocks taped apart to expose the deep intergluteal cleft. An ellipse of skin 4-cm wide including all pilonidal sinus openings and scars was removed

Figure 1



(a) Incision marking, (b) Elevation of the flap, (c) Rotation of the flap, (d) Wound closure.

asymmetrically from the most affected side of the intergluteal cleft while sparing subcutaneous fat. The sinuses remaining in the deeper tissues were curetted thoroughly. The covering skin flap from the opposite side was undermined and elevated to a distance required to allow primary closure of the defect away from the midline without tension. Hemostasis is maintained and a suction drain was placed deep in the entire length of the wound. The subcutaneous tissue was approximated in two layers with an absorbable suture while the skin was closed with a nonabsorbable intradermal suture that was removed after 14 days, as shown in Fig. 2.

Postoperative care and follow-up

Oral intake was started 6 h after surgery and patients were allowed to walk 12 h after surgery but instructed not to overextend the sacral region until they were free of pain and tension.

Vacuum drain was removed when 24 h output was 10 ml or less; patients were kept in the hospital for one more day to observe the wound and then discharged.

Patients were instructed to avoid prolonged sitting until 4 weeks postoperatively to avoid wound disruption, to avoid heavy sports for 3 months, and were asked to improve local hygiene and to depilate hair around their gluteal area.

Patients were seen at our outpatient clinics 2 weeks and 1 month after discharge and regularly examined every 3 months for the first year, and annually thereafter.

Data obtained during the in-hospital period included patient demographics, duration of operation, mobilization time (time needed for the patient to move without pain), length of hospital stay, surgical drain use and removal time, and early complications.

During follow-up, patients were asked to answer a questionnaire that included postoperative visual analogue scale for pain from 0 (no pain) to 10 (worst pain), questions on time taken to be able to sit without pain, time taken to be able to walk without pain, time taken to feel completely healed, degree of satisfaction, and whether they would recommend this surgical technique to other pilonidal sinus patients.

Postoperative complications (seroma, flap edema or necrosis, wound dehiscence) and recurrence were recorded. All obtained data were entered into another specially prepared chart.

The operation was considered early failure if the patient suffered from purulent discharge, abscess formation, or complete wound disruption that required further treatment within 4 weeks of the operation.

Statistical analysis

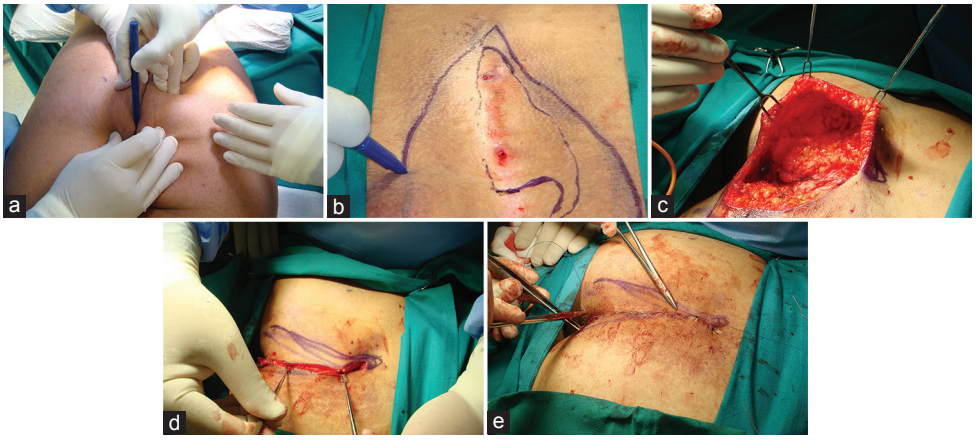
Data on both groups were collected and statistically analyzed using SPSS for Windows 10 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were described as mean ± SD and qualitative data as frequency and proportion. To test the statistically significant difference between groups, the Student *t*-test was used to compare quantitative data and the χ^2-test and Fisher's exact test were used for qualitative data.

A *P* value of less than 0.05 was taken to indicate statistical significance.

Results

A total of 200 patients were included in our study, 155 male and 45 female. They were randomly divided into two groups. Group 1 underwent MLF; the median age of the group was 23 years (range

Figure 2



(a) Approximation of buttocks, (b) Incision marking (c) Elevation of the flap, (d) Approximation of two edges, (e) Wound closure.

18–44 years). Group 2 underwent Bascom cleft lift procedure with a median age of 22 years (range 19–52 years). Intermittent discharge and pain were the main presenting symptoms in both groups. There were no significant differences between the two groups in terms of demographic data, duration of disease, and symptoms of presentation, as shown in Table 1.

Data collected during the in-hospital and early postoperative period are shown in Table 2.

Significant difference was found between the two groups in term of operative time (46.3 ± 10.3 min for MLF vs. 34.5 ± 14.7 min for Bascom cleft lift procedure, $P < 0.001$) and hospitalization period, with patients in the MLF group staying longer in the hospital because of delay in drain removal. No significant difference was found between the two groups in terms of pain score, period off work, and healing period. With respect to the incidence of early complications, there was no significant difference between the two groups. Most of the complications were detected during the period of hospitalization or during the first outpatient visit. Five patients in the MLF group and three patients in the Bascom cleft lift group suffered from minor collection (seroma and/or hematoma), but prolonged antibiotic use and/or simple drainage solved the problem. Temporary flap edema occurred in seven patients in both groups but no flap necrosis was detected. Four patients in each group experienced variable degrees of healing failure and wound separation. Three patients in the Bascom cleft lift group had minimal superficial wound separation requiring only top dressing without packing, which healed completely without surgical intervention, and the fourth had more significant breakdown that failed to heal by secondary intention and was considered as recurrence. Regarding the MLF group, two patients required partial suture removal and healing by secondary intention, but the other two had complete reopening of the wound and failure to heal, which was considered as recurrence.

The data collected through the questionnaire are shown in Table 3.

Both groups showed comparable results with no significant difference regarding the use of analgesia and time taken to be able to sit on a chair or ride a car without pain. Patients in both groups showed similar degrees of satisfaction as two patients in each group were not satisfied (patients who suffered wound dehiscence and recurrence) and four patients in each group will not recommend the procedure to others.

Discussion

SPD is a chronic inflammatory disease that generally affects adults under the age of 45 years [19].

Pilonidal sinus disease was believed to be caused by congenital remnant [20,21].

Nowadays SPD is believed to be an acquired disease explained by endocrine changes with the initiation of puberty, as the secretion of sebaceous glands becomes more viscous, accumulation of keratin distends the hair follicles in the midline [14,22], increased depth of intergluteal sulcus leads to anaerobic media and

Table 1 Demographic data and presentation of disease

Characteristic	Modified Limberg flap (group 1) (*n*=100)	Bascom cleft lift (group 2) (*n*=100)	*P* value
Age (years)	23 (18-44)	22 (19-52)	NS
Male: female	80/20	75/25	NS
Follow-up (months)	21.5±6.8	22±7.6	NS
Symptom duration (years)	1.6	1.5	NS
Preoperative symptoms			NS
Discharge	80	78	
Pain	65	67	
Pruritus	6	4	
Granulation tissue	4	3	

Table 2 Outcome after surgical treatment

Clinical outcome	Modified Limberg flap (group 1) (*n*=100)	Bascom cleft lift (group 2) (*n*=100)	*P* value
Operative time (min)	46.3±10.3	34.5±14.7	<0.001
Mobilization time	1.6	1.5	1.000
Pain score (VAS)	3.4±1.5	3.7±1.6	0.495
Hospital stay (days)	3.8±1.6	2.1±1.2	<0.001
Period off work	21.4±7.5	18.7±7.6	0.087
Healing period (days)	19.6±16.7	23.5±8.5	0.148
Early complications (*n* (%))	13 (13)	10 (10)	0.467
Seroma and/or hematoma	5	3	
Flap edema	4	3	
Wound dehiscence	4	4	
Recurrence (*n* (%))	2 (2)	1 (1)	

VAS, visual analogue scale.

Table 3 Comparison of the results obtained using a questionnaire

	Modified Limberg flap (group 1) (*n*=100)	Bascom cleft lift (group 2) (*n*=100)	*P* value
Use of analgesia (days)	4.6±1.5	4.3±1.4	NS
Sitting without pain (days)	10±5.3	9.2±4.2	NS
Degree of satisfaction			NS
Excellent	80	83	
Good	16	13	
Poor	2	2	
Unsatisfied	2	2	
Number of patients recommending operation to others (*n* (%))	96 (96)	96 (96)	NS

increased anaerobic bacterial content [3,23], and the vacuum effect between heavy buttocks sucks the anaerobic bacteria, hair and debris into subcutaneous fat tissue and initiates the pilonidal disease [14,24].

Moreover, studies have reported that obesity, excessive sweating, bad hygiene, long period of sitting, and hirsutism can cause SPD [14,21,25].

Most standard techniques for treating SPD have a significant failure rate because they fail to address the underlying factors that result in persistent nonhealing or recurrence [26]. The ideal technique should be simple, quick, and cost-effective, should not require a long hospital stay, should involve easy wound care, low complication and recurrence rates, and should allow the patient to return to normal activities rapidly [27,28].

Complete excision of the sinus is widely practiced, but controversy remains about what to do with the wound after excision [10]. Recurrence rate after excision with packing, with marsupilization, and with primary closure was 22, 23, and 25%, respectively [14]. Almost all of the postoperative recurrences and complications were encountered in the midline, and the problems related to a continuing natal cleft after pilonidal sinus surgery have prompted surgeons to discover techniques to eliminate the gluteal furrow [3].

Since Karydakis and Bascom emphasized the principles of off-midline closure and flattening of the natal cleft owing to the importance of depth of the natal cleft, the recurrence rate of pilonidal disease has significantly decreased, but these techniques may fail in those with branching fistulas far from midline, extending to each side of the buttocks [14,16,29].

The aim of this technique is to relocate hair follicles away from the midline and to prevent the frictional forces associated with insertion in the natal cleft. Initially, the rhomboid flap technique was reserved for complex or recurrent pilonidal disease not responding to simple conservative operative techniques, but it has been subsequently recommended as first-line management for all types of chronic SPD [2,30]. The only weak point of the classical rhomboid excision and Limberg flap transposition is that the lower pole of the flap stays in the intergluteal sulcus, and all of the recurrences are encountered at this site [14]. Different modifications of Limberg flap have been proposed to overcome this problem: Mentes *et al.* [12] obtained 0% recurrence rate and 0.8% wound infection rate without any dehiscence or flap necrosis. Kaya *et al.* [28] found 4.2% recurrence, 5.3% wound infection rate, and 1.1% wound dehiscence rate. Afsarlar *et al.* [14] reported 0% recurrence.

In our study, we compared two widely used approaches to determine the most appropriate treatment modality for SPD.

As a rule in surgery, the surgical procedure selected should be as simple as possible. In the present study, the duration of operation was significantly shorter for cleft lift procedure and this was attributed to the shorter time needed for mobilization of a flap without real transposition, although there was only a mean difference of 12 min between the two procedures.

Length of hospital stay is an indicator of higher morbidity of the surgical technique. In our study, the duration of hospital stay in patients treated with MLF was 3.8 ± 1.6 days, which was significantly higher than that for the cleft lift group (2.1 ± 1.2 days). This could be explained by the delay in drain removal in the MLF group because of more dissection and more wide dead space. An overview of the literature published recently shows that the mean length of hospital stay ranged from 2 to 4 days for patients undergoing MLF [4–12–15] and 1–2 days for patients undergoing cleft lift [17,18]. On the basis of our work and others, neither of the two procedures offers a clear advantage over the other.

There were no differences between the two groups in terms of the time required for them to return to work, which was 21.4 ± 7.5 for the MLF group, which was similar to that reported by Can *et al.* [4] and Karaca *et al.* [15], and 18.7 ± 7.6 for the cleft lift group, which is comparable to the results of Rushfeldt *et al.* [18] and Nordon *et al.* [31].

The time required to feel completely healed was longer in the cleft lift group than in the MLF group (23.5 ± 8.5 vs. 19.6 ± 16.7, respectively), but the difference was not significant. This could be attributed to more tension exerted on the midline because of lateral dissection in the cleft lift group. We found that it is difficult to include bilaterally situated orifices in the excised islands in the cleft lift group, and in this situation MLF is preferred. Can *et al.* [4] showed a longer period for healing in the MLF group (36.2 ± 10.1 days), and Karaca *et al.* [15] showed results similar to our study. For cleft lift procedure Nordon *et al.* [31] and Gendy *et al.* [26] showed comparable results.

In the current study, there were no significant differences between the two groups in terms of postoperative pain scores (visual analogue scale scores) (3.4 ± 1.5 in the MLF group and 3.7 ± 1.6 in the cleft lift group).

The main measure in our study was the overall complication rate, and in this regard our two groups were similar with complication rate of 13% in the

MLF group (5% seroma, 4% flap edema without necrosis, and 4% wound dehiscence) and 10% in the cleft lift group (3% seroma, 3% flap edema, and 4% dehiscence). In a series of studies examining the MLF flap, an infection rate of 0.8% was noted; no flap necrosis or wound dehiscence occurred, similar to the results of Mentes *et al.* [12]. Karaca *et al.* [15] reported a complication rate of 4.2%, with only 4.2% seroma and no dehiscence or wound infection, and Yildiz *et al.* [21] reported 6.2% wound dehiscence and seroma. In contrast, for cleft lift procedure Gendy *et al*. [26] and Bascom [17] showed 15 and 10% degree of wound dehiscence, respectively, but 97.4 and 100% showed complete healing later on.

Most of the complications encountered in our patients were recognized at the time of follow-up within the first month postoperatively. These patients did not fully comply with the instructions we provided them regarding regional hygiene, hair removal, and sitting habits.

Preventing recurrence is a major concern in the surgical treatment of pilonidal sinus. The documented incidence of recurrence after cleft lift procedure is between 0 and 2.6% [17,26,31,32] and between 0 and 5.4% in the MLF procedure. [2,4,14,15]. Those results matched with our study as we had one patient with recurrence in the cleft lift group (1%) and two patients in the MLF group (2%). Our successful results after both types of flaps came from the fact that the deep midline is eliminated.

Degree of satisfaction and quality of life of patients after surgery depend on the development of complications. Ertan *et al.* [33] found more satisfaction with the flap technique than with primary closure in the midline. In another study by Mahdy [3], the superiority of the classic and MLF techniques was documented in terms of patient satisfaction and comfort. In our study, patients in the two groups reported a similar rate of satisfaction with most of them rating the procedure as excellent (80 and 83% in the MLF group and cleft lift group, respectively). Ninety-six percent in each group stated that they would recommend the operation to others who have the same diagnosis.

Conclusion

The results of our study suggest that MLF transposition and cleft lift procedure have no superiority over each other. Earlier healing, shorter time off work, low recurrence rate, and shorter hospital stay are the main advantages of both techniques. Both operations are safe, simple, and easy to learn and should be used in noninfected pilonidal sinus disease to cover the excised defect.

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Conflicts of interest

There are no conflicts of interest.

References

1 Bertelsen CA. Cleft-lift operation for pilonidal sinuses under tumescent local anesthesia: a prospective cohort study of peri- and postoperative pain. Dis Colon Rectum 2011; 54(7): 895–900.

2 Limongelli P, Brusciano L, Di Stazio C, del Genio G, Tolone S, Lucido FS, *et al.* D-shape asymmetric and symmetric excision with primary closure in the treatment of sacrococcygeal pilonidal disease. Am J Surg 2014; 207(6): 882–889.

3 Mahdy T, Mahdy T, Gaertner WB, Hagerman GF, Goldberg SM, Finne CO III. Surgical treatment of the pilonidal disease: primary closure or flap reconstruction after excision. Dis Colon Rectum 2008; 51(12): 1816–1822.

4 Can MF, Sevinc MM, Hancerliogullari O, Yilmaz M, Yagci G. Multicenter prospective randomized trial comparing modified Limberg flap transposition and Karydakis flap reconstruction in patients with sacrococcygeal pilonidal disease. Am J Surg 2010; 200(3): 318–327.

5 Azab AS, Kamal MS, el Bassyoni F. The rationale of using the rhomboid fasciocutaneous transposition flap for the radical cure of pilonidal sinus. J Dermatol Surg Oncol 1986; 12(12): 1295–1299.

6 Søndenaa K, Nesvik I, Andersen E, Søreide JA. Recurrent pilonidal sinus after excision with closed or open treatment: final result of a randomised trial. Eur J Surg 1996; 162(3): 237–240.

7 Hurst DW. The evolution of management of pilonidal sinus disease. Can J Surg 1984; 27(6): 603–605.

8 Søndenaa K, Andersen E, Søreide JA. Morbidity and short term results in a randomised trial of open compared with closed treatment of chronic pilonidal sinus. Eur J Surg 1992; 158(6–7): 351–355.

9 Petersen S, Koch R, Stelzner S, Wendlandt TP, Ludwig K. Primary closure techniques in chronic pilonidal sinus: a survey of the results of different surgical approaches. Dis Colon Rectum 2002; 45(11): 1458–1467.

10 Elshazly WG, Said K. Clinical trial comparing excision and primary closure with modified Limberg flap in the treatment of uncomplicated sacrococcygeal pilonidal disease. Alexandria J Med 2012; 48:13–18.

11 Spivak H, Brooks VL, Nussbaum M Friedman I. Treatment of chronic pilonidal disease. Dis Colon Rectum 1996; 39(10): 1136–1139.

12 Mentes BB, Leventoglu S, Cihan A, Tatlicioglu E, Akin M, Oguz M. Modified Limberg transposition flap for sacrococcygeal pilonidal sinus. Surg Today 2004; 34:419–423.

13 Yamout SZ, Caty MG, Lee YH, Lau ST, Escobar MA, Glick PL. Early experience with the use of rhomboid excision and Limberg flap in 16 adolescents with pilonidal disease. J Pediatr Surg 2009; 44(8): 1586–1590.

14 Afşarlar CE, Yılmaz E, Karaman A, Karaman I, Ozgüner IF, Erdoğan D, *et al.* Treatment of adolescent pilonidal disease with a new modification to the Limberg flap: symmetrically rotated rhomboid excision and lateralization of the Limberg flap technique. J Pediatr Surg 2013; 48(8): 1744–1749.

15 Karaca T, Yoldaş O, Bilgin BÇ, Ozer S, Yoldaş S, Karaca NG. Comparison of short-term results of modified Karydakis flap and modified Limberg flap for pilonidal sinus surgery. Int J Surg 2012; 10(10): 601–606.

16 Karydakis GE. Easy and successful treatment of pilonidal sinus after explanation of its causative process. Aust N Z J Surg 1992; 62(5): 385–389.

17 Bascom J, Bascom T. Utility of the cleft lift procedure in refractory pilonidal disease. Am J Surg 2007; 193(5): 606–609.discussion 609

18 Rushfeldt C, Bernstein C, Nordeval S, Revhaug A. Introduction an asymmetric cleft lift technique as a uniform procedure for pilonidal sinus surgery. Scand J Surg 2008; 97:77–81.

19 Tavassoli A, Noorshafiee S, Nazarzadeh R. Comparison of excision with primary repair versus Limberg flap. Int J Surg 2011; 9(4): 343–346.

20 Gilani SN, Furlong H, Reichardt K, Nasr AO, Theophilou G, Walsh TN. Excision and primary closure of pilonidal sinus disease: worthwhile option with an acceptable recurrence rate. Ir J Med Sci 2011; 180(1): 173–176.

21 Yildiz T, Ilce Z, Kücük A. Modified Limberg flap technique in the treatment

of pilonidal sinus disease in teenagers. J Pediatr Surg 2014; 49(11): 1610–1613.

22 Golladay ES. Outpatient adolescent surgical problems. Adolesc Med Clin 2004; 15(3): 503–520.

23 Miocinovic M, Horzic M, Bunoza D. The prevalence of anaerobic infection in pilonidal sinus of the sacrococygeal region and its effect on the complications. Acta Med 2001; 55:87–90.

24 Arda IS, Güney LH, Sevmiş S, Hiçsönmez A. High body mass index as a possible risk factor for pilonidal sinus disease in adolescents. World J Surg 2005; 29(4): 469–471.

25 Lee SL, Tejirian T, Abbas MA. Current management of adolescent pilonidal disease. J Pediatr Surg 2008; 43(6): 1124–1127.

26 Gendy AS, Glick RD, Hong AR, Dolgin SE, Soffer SZ, Landers H, *et al.* A comparison of the cleft lift procedure vs wide excision and packing for the treatment of pilonidal disease in adolescents. J Pediatr Surg 2011; 46(6): 1256–1259.

27 Akin M, Leventoglu S, Mentes BB, Bostanci H, Gokbayir H, Kilic K, *et al*. Comparison of the classic Limberg flap and modified Limberg flap in the treatment of pilonidal sinus disease: a retrospective analysis of 416 patients. Surg Today 2010; 40(8): 757–762.

28 Kaya B, Eris C, Atalay S, Bat O, Bulut NE, Mantoglu B, Karabulut K Modified Limberg transposition flap in the treatment of pilonidal sinus disease. Tech Coloproctol 2012; 16(1): 55–59.

29 Bascom J, Bascom T. Failed pilonidal surgery: new paradigm and new operation leading to cures. Arch Surg 2002; 137(10): 1146–1150. discussion 1151

30 Akca T, Colak T, Ustunsoy B, Kanik A, Aydin S. Randomized clinical trial comparing primary closure with the Limberg flap in the treatment of primary sacrococcygeal pilonidal disease. Br J Surg 2005; 92(9): 1081–1084.

31 Nordon IM, Senapati A, Cripps NP. A prospective randomized controlled trial of simple Bascom's technique versus Bascom's cleft closure for the treatment of chronic pilonidal disease. Am J Surg 2009; 197(2): 189–192.

32 Abdel-razek EM. Cleft lift operation for recurrent pilonidal sinus repair; two years experience. Egy J Reconstr Surg 2006; 30:7–11.

33 Ertan T, Koc M, Gocmen E, Aslar AK, Keskek M, Kilic M. Does technique alter quality of life after pilonidal sinus surgery? Am J Surg 2005; 190(3): 388–392.

Early laparoscopic adhesiolysis versus conservative treatment of recurrent adhesive small intestinal obstruction: a prospective randomized controlled trial

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Background
Adhesive small bowel obstruction (ASBO) represents a common clinical problem following previous abdominal surgery. The recurrence rate after an ASBO admission is high, especially after conservative treatment. Retrospective studies suggest that laparoscopic approach shortens hospital stays and reduces complications in these patients. However, there are no prospective randomized, controlled trials comparing early laparoscopic adhesiolysis with conservative treatment of recurrent ASBO.

Patients and methods
A prospective, randomized, controlled study was conducted on 51 patients admitted with the diagnosis of recurrent postoperative ASBO to compare early laparoscopic adhesiolysis with conservative treatment in patients with computed tomography-diagnosed ASBO. The outcome of the study was evaluated depending on the length of postoperative hospital stay, passage of stool, commencement of enteral nutrition, 30-day mortality, complications, the length of sick leave, and recurrence of small bowel obstruction during follow-up for 2 years.

Results
A total of 51 patients with a diagnosis of recurrent small bowel obstruction were identified and divided into two groups. A total of 26 patients were treated with laparoscopic adhesiolysis (23 patients were successfully treated and three patients needed open surgery) and showed significantly low recurrence, short hospital stay, and early regain of bowel movement. A total of 25 patients underwent conservative treatment, which was filed in three cases that needed surgical interference. There was no significant difference between the two groups as regards morbidity and mortality.

Conclusion
Laparoscopically treated patients with recurrent ASBO had a lower frequency of recurrence and a longer time interval to recurrence. They also had a shorter hospital stay and early start of oral feeding compared with patients treated nonoperatively. Laparoscopy in well-trained hand may help in the treatment of recurrent ASBO with fewer complications.

Keywords:
adhesion, laparoscopic adhesiolysis, small bowel obstruction

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Introduction

Small bowel obstruction (SBO) is a common surgical emergency most frequently caused by adhesions. A large proportion of the adhesive SBO cases resolve with nonoperative methods such as fasting and ingestion of an oral contrast-media; however, a significant number of patients will need emergency surgery [1].

Because adhesive obstruction commonly follows previous abdominal surgery, surgical treatment may seem like a paradox [2,3].

The recurrent nature of adhesive small bowel obstruction (ASBO) represents a major clinical problem. The recurrence rate after an ASBO admission given in previous studies varies from 19 to 53%. Recurrence rates vary depending on whether or not the patients were operated on, how the recurrence rates were calculated (i.e. whether or not the length of follow-up for each patient was considered), the selection of patients in each study, and the treatment policy of the institution, early operation versus watchful waiting [4,5].

The number of previous ASBO episodes was a significant factor influencing the risk for having a recurrent ASBO admission. Others have found that the method of treatment (surgical or conservative) significantly influenced the risk for recurrence, with patients treated conservatively having the highest recurrence rate [6].

Now, laparoscopic surgery has been established as a first-line option in many elective indications such as colorectal surgery, fundoplication, and cholecystectomy – for example, laparoscopy is also emerging as a viable alternative in emergency surgery [7].

Laparoscopic adhesiolysis in ASBO was used first time in the 1990s. The laparoscopic approach had less complications and faster return of bowel function [8].

The focus of this study was to compare laparoscopic adhesiolysis with conservative treatment in recurrent ASBO as regards the length of postoperative hospital stay, passage of stool, commencement of enteral nutrition, 30-day mortality, complications, pain, the length of sick leave, and recurrence of SBO during follow-up for 2 years.

Patients and methods

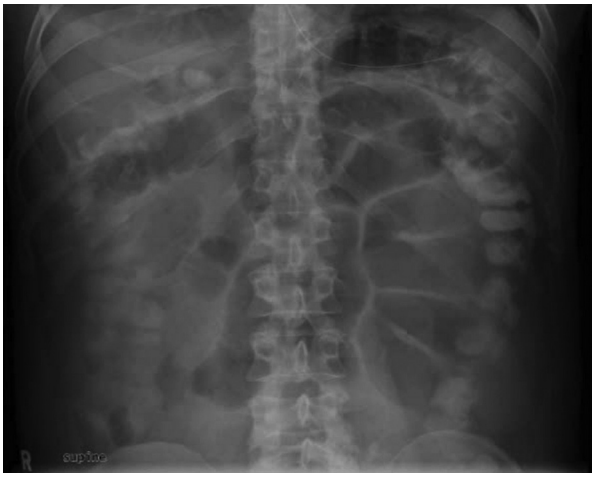
This study was conducted in the General Surgery, Emergency Department of the Zagazig University Hospital, from January 2012 to March 2015 after ethical approval of the institutional ethics committee. This study was designed as a prospective randomized controlled trial to compare immediate laparoscopic adhesolysis with conservative treatment. Fifty-one patients were admitted to our Emergency Department with recurrent adhesive small intestinal obstruction. Our patients gave a history of hospital admission for the same cause in our hospital or other hospitals and they received conservative treatment in the form of nasogastric intubation, intravenous fluid administration, and clinical observation. Complete history with regard to the underlying cause of ASBO was taken from patients and full examination was carried out. All investigations were carried out, including full laboratory investigations, plain erect abdominal radiograph (Fig. 1), abdominal ultrasound, and ECG. The diagnosis of ASBO was confirmed with computed tomography (CT)-scan in all patients of study sample (Fig. 2).

All patients gave history of one or more attacks of ASBO with hospital admission and receiving medical treatment without surgical interference. The previous issue was considered as inclusion criteria of our study sample. The exclusion criteria were as follows: other causes for obstruction other than adhesions in CT-scan, contraindication for laparoscopy, strong suspicion of strangulation, previously confirmed diffuse peritoneal disorders (generalized peritonitis, carcinosis, endometriosis, and diffuse adhesion), abdominal radiotherapy, Crohn's disease, and previous laparotomy for aorta or iliac vessels.

Fifty-one patients admitted to the emergency unit consented to participate in the study and were randomly divided into two groups. The first group included 26 patients (group A) who were scheduled for immediate laparoscopic adhesiolysis within 24 h after full investigations. The second group included 25 patients (group B) who were treated by means of conservative measurement, including nothing by mouth (NPO), insertion of nasogastric tube, intravenous fluids, and correction of electrolyte imbalance. Usually, conservative treatment in the absence of signs of strangulation or peritonitis can be prolonged up to 72 h of adhesive SBO. After 3 days without resolution, surgery is recommended. If ileus persists for more than 3 days and the drainage volume on day 3 is more than 500 ml, surgery for ASBO is recommended.

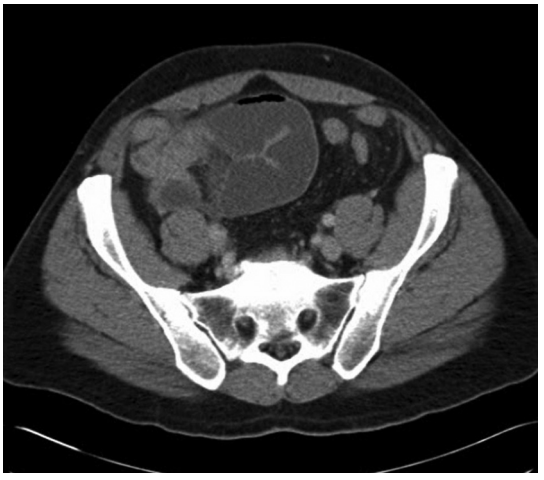
Patients of group A received prophylactic intravenous 1 g ceftriaxone and 500 mg metronidazole 1 h before

Figure 1



Plain erect radiograph of the abdomen.

Figure 2



Computed tomography (CT) of the abdomen.

surgery. Fluid balance and electrolyte disturbance were corrected with nasogastric tube insertion before surgery.

One team of three expert laparoscopic surgeons operated all cases, even the one filed in group B to respond to conservative treatment. They followed all usage guidelines of laparoscopy in adhesiolysis to avoid the technical problem of confined working space in the presence of dilated loops. We inserted the first port using optic port or open approach. Ideally, the initial trocar should be placed 5–10 cm away from the patient's previous scar. Under direct vision, the other ports were inserted according to initial telescopic evaluation of the abdominal cavity and sites of adhesions to make it accessible for cutting. Anatomical landmarks were identified, such as iliocecal junction and ligament of Treitz. Complete examination of the small intestine was carried out to locate the dilated loop (Fig. 3) and site of obstruction with noncrushing forceps. Once the transition site was identified, the obstructing adhesions were divided using sharp scissors (Fig. 4) and the bowel was inspected for vitality. We did not use diathermy for cutting adhesions to avoid the thermal effect on the wall of the intestine and recurrence of adhesions; except there was uncontrolled bleeding. Small perforation occurred in the wall of the intestine in three cases, which was identified and closed by means of intracorporeal stitches using 3/0 vicryl and 3/0 silk. Ports were removed under vision with closure fascial openings and patients were kept NPO until intestinal sound was audible.

Some cases needed open surgery due to small bowel perforation, which was confirmed or suspected and could not be sutured by means of laparoscopy. Other causes of open surgery were diffuse adhesions, cause of obstruction cannot be identified and bowel resection anastomosis.

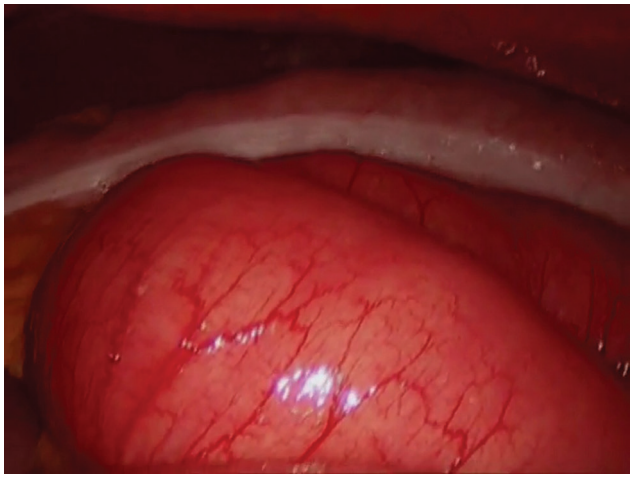
The evaluation of the patients depends on the duration of hospital stay, stool passage, oral feeding, mortality, morbidity, pain, sick leave, and recurrence of intestinal obstruction with 2 years.

Results

Demographic data were collected for age and sex. Data obtained from evaluation of each case included data on first seen, last seen, follow-up, related symptoms, abdominal pain, distension, nausea, vomiting, and bowel sound. Other data on treatment method, duration of hospital stay, and rate of conversion from conservative treatment to surgical procedure by means of laparoscopy or open surgery. The history of previous operations was recorded with regard to the number of prior operations, type, and time-interval between last operations to incidence of SBO. The number of recurrences, treatment, and time-interval to recurrence was documented. Follow-up was based on representation of patients at the Zagazig University Emergency Department or outpatient surgery clinic for any medical condition and ascertainment of the presence or absence of a subsequent SBO. Patients who did not return were not documented as a recurrence. Early recurrent SBO was defined as SBO in patients with prior operations or hospitalization with conservative therapy for SBO.

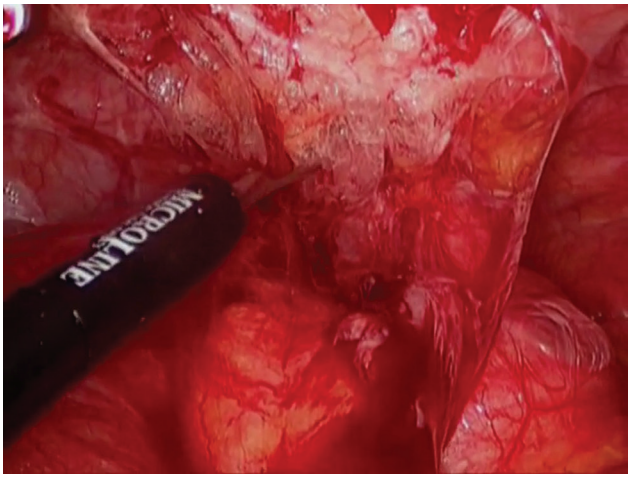
The data were entered into a computerized database and analyzed using SPSS software (IBM, SPSS Statistics 19 core system user Chicago, USA). Difference in continuous variables between nonoperative and operative patients were compared using Student's *t*-test. The χ^2-test was used for assessing proportion between these groups of patients. Those patients who had no recurrence noted on their chart at the time of the review were censored at that timepoint. The time in days to

Figure 3



Laparoscopic view of dilated small bowel.

Figure 4



Laparoscopic adhesiolysis.

recurrence for nonoperative and operative patients was evaluated through survival analysis (Table 1).

There was no significant difference between the two groups as regards sex, but group A showed a significant increase in the number of second episode of ASBO after previous hospital admission for conservative treatment.

On admission of patients of both groups, we evaluated them as regards symptoms and previous operation performed as a cause of the 1st episode of ASBO (Table 2).

Patients in both groups had a similar clinical presentation. Most of the patients had abdominal pain, distension, and constipation. Vomiting was noted in more than 70% of patients. All of the patients had undergone previous abdominal surgery (Table 2), two of whom had undergone more than one operation.

Table 3 shows the outcome of the two groups. The number of recurrences of ASBO after conservative treatment was significantly higher than that in the laparoscopically operated group within 2 years of that hospital admission. The mean length of hospital stay was significantly longer in group B than in group A. Stool passage and start of enteral nutrition were significantly earlier in group A than in group B with improving abdominal distension.

Three patients of group A had complications (two intestinal perforation and one urinary tract infection). In the conservative group, two patients had complications in the form pneumonia and other two patients had nostril erosion. Both groups had no significant difference as regards complications and 30-day mortality.

Group B patients requested a significant duration of sick leave in comparison with the patients of group A. We observed a significant recurrence of ASBO attacks in group B in relation to group A and required open or laparoscopic adhesiolysis except three cases. In operated cases, the indications of surgery were peritonitis, fever, failure of treatment, leukocytosis, and intractable pain. All recurrent cases of group A showed good response to conservative treatment without recurrence within the period of observation.

Discussion

SBO due to postoperative adhesions develops in 6–11% of all patients undergoing laparotomy [9]. It may occur at any time after the initial laparotomy and results in frequent readmissions in subsequent years [10,11].

Open surgical treatment of ASBO may lead to additional formation of adhesions, possibly contributing to recurrent episodes of ASBO [12,13]. As laparoscopic surgery is becoming more common in emergency surgery, adhesive SBO is the obvious next target for a laparoscopic approach [1].

This trial aimed to evaluate early laparoscopic adhesiolysis as a minimal invasive technique in the treatment of recurrent ASBO. As regards recurrence of ASBO after the first attack, our series showed a significant increase in the incidence of hospital admission for a second attack of an ASBO, which was not obvious in the study by Fevang *et al.* [8].

Abdominal pain was the main symptom in our series during attack ASBO. This was different from the series

Table 1 Summary of data analysis

	Laparoscopy-operated group (group A) (*n*=26) (*n* (%))	Conservative group (group B) (*n*=25) (*n* (%))	*P* value (<0.05)
Mean age (years)	47.5	56.1	NS
Male	12 (46.1)	12 (48)	NS
Female	14 (53.9)	13 (52)	NS
2 ASBO episodes	20 (77)	16 (64)	0.007*
3 ASBO episodes	2 (8)	3 (12)	NS
4 ASBO episodes	4 (15)	6 (24)	NS

ASBO, adhesive small bowel obstruction. *Significance difference (*P*<0.05)

Table 2 Symptoms and previous operations

Symptoms	Laparoscopy-operated group (group A) (*n*=26)	Conservative group (group B) (*n*=25)
Abdominal pain	26	25
Distension	22	23
Constipation	20	19
Vomiting	19	18
Pervious operations		
Stomach	7	6
Appendectomy	5	4
Colon	4	4
Rectum	1	2
Liver, biliary, and pancreases	3	2
Gynecological	5	6
Others	1	1

Table 3 Outcome of the study

	Laparoscopy-operated group (group A)	Conservative group (group B)	*P* value
Hospital stay (days) (mean±SD)[a]	1.6±0.5	6.5±1.2	0.0001*
Stool passage[a]	1.2±0.4	3.9±0.9	0.0001*
Sick leave[a]	7 (3.3)	15 (5.3)	0.001*
Enteral nutrition[a]	2.8±0.5	4.3±0.9	0.0001*
30-day mortality[b]	2	5	0.2
Complications[b]	3	4	0.7
Recurrent ASBO[b]	3	15	0.0002*
Surgical interference[b]	3 open (11.5%)	1 lap 2 open (12%)	0.7

ASBO, adhesive small bowel obstruction. [a]The values are calculated using the independent *t*-test. [b]The values are calculated using the χ^2-test. *Significant difference ($P \leq 0.05$).

of Miller and colleagues, as only 71–87% of patients were suffering pain. Other studies considered the incidence of abdominal crampy pain within 40% of previously operated patients as normal [14,15]. The incidence of vomiting, distension, and constipation was the same as that reported in other studies for recurrent ASBO [1,2,5].

The previous operations that caused small intestinal adhesion in our series showed no significant difference between the two groups, and this is in agreement with the study by Wang *et al.* [16].

Various authors have debated the proper course of treatment for SBO. The focus has been on the natural history and length of treatment at the time of obstruction. Seror *et al.* [17] reported a 73% success rate with conservative management of SBO, one of the highest in the literature. However, other studies range widely, from 20 to 62% resolution, without surgery. Our successful conservative therapy rate of 88% compares well with this report, but without significant difference between the two groups as regards the success of treatment. A major concern of surgeons is that patients who are operated for ASBO will tend to develop recurrent attacks compared with those who are managed conservatively. This study adheres to the dictum 'The sun should never rise or set on a small bowel obstruction'. It uses laparoscopy as a minimally invasive technique to minimize recurrence, which was significantly increased in the conservative group, and this is in agreement with the study by Fevang *et al.* [8] and Niyaf *et al.* [18].

Our patients treated with operation experienced a short hospital stay with a median of 1.6 versus 6.5 days for those patients who underwent conservative treatment. Miller *et al.* [3] reported virtually the same numbers, whereas Landercasper *et al.* [19] found an even greater difference in hospital stay (3 vs. 12 days). This significant difference between the two groups is also applied to an early stool passage, early start of oral feeding, and sick leave requested after treatment.

Although previous retrospective series have shown an association of less complications and mortality rate with the laparoscopic approach, all previous retrospective series are more or less biased, as the easiest cases are selected for laparoscopic approach [6]. This is in agreement with our study, which showed no significant difference between the two groups as regards these items.

Despite advances in surgery, 15–30% require surgical intervention primarily or due to failure of conservative management [18]. Our results as regards the conservative group were near this range (12%). However, conversion rate from laparoscopic adhesiolysis to open surgery was 11.5%, which is not in agreement with the Irish systematic review of over 2000 cases of ASBO. In this study, 1284 (64%) patients were successfully treated with a laparoscopic approach, 6.7% were lap-assisted, and 0.3% were converted to hernia repair; the overall conversion rate to midline laparotomy was 29% [1].

Conclusion

Recurrent ASBO is a common disease. Conservative management should be attempted in the absence of signs of peritonitis or strangulation. Surgically treated patients had a lower frequency of recurrence and a longer time-interval to recurrence; however, they also had a longer hospital stay compared with patients treated nonoperatively. Laparoscopic approach appears to be safe and feasible in the hands of experienced laparoscopic surgeons and in selected patients, because there are less overall complications, prolonged ileus rates, and pulmonary complication associated with its use. We found a significant difference between early use of laparoscopy in adhesiolysis versus conservative management as regards hospital stay, stool passage, enteral nutrition, and recurrence of ASBO. This will change the previously established concept about the treatment of bowel obstruction caused by adhesions and opens wider horizons for the use of laparoscopy in such cases.

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Equipment used: CT and laparoscopy.

Criteria for inclusion in the authors'/contributors list: 2 years of laparoscopic surgery experience.

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Conflicts of interest

There are no conflicts of interest.

References

1 Di Saverio S, Coccolini F, Galati M, Smerieri N, Biffl WL, Ansaloni L, *et al.* Bologna guidelines for diagnosis and management of adhesive small bowel obstruction (ASBO): 2013 update of the evidence-based guidelines from the world society of emergency surgery.

2 Ayman M, Hassanien MD, Sarwat M. Laparoscopic adhesiolysis for recurrent small bowel obstruction with ultrasonically activated shears. Egypt J Surg 2004;23:67–73.

3 Miller G, Boman J, Shrier I, Gordon PH. Natural history of patients with adhesive small bowel obstruction. Br J Surg 2000; 87(9): 1240–1247.

4 Di Saverio S, Catena F, Kelly MD, Tugnoli G, Ansaloni L. Severe adhesive small bowel obstruction. Front Med 2012; 6(4): 436–439.

5 Markogiannakis H, Messaris E, Dardamanis D, Pararas N, Tzertzemelis D, Giannopoulos P, *et al*. Acute mechanical bowel obstruction: clinical presentation, etiology, management and outcome. World J Gastroenterol 2007; 13(3): 432-437.

6 Salminen P, Koivukangas V, Haukijärvi E. Laparoscopic versus open adhesiolysis for small bowel obstruction – a multicenter, prospective, randomized, controlled trial. BMC Surg 2014; 14: 1471–2482.

7 Clotteau JE, Premont M. Occlusion by adhesions treated by celioscopic section. Presse Med 1990; 19(25): 1196.

8 Fevang BT, Fevang J, Lie SA, Søreide O, Svanes K, Viste A. Long-term prognosis after operation for adhesive small bowel obstruction. Ann Surg 2004; 240(2): 193–201.

9 Zielinski MD, Bannon MP. Current management of small bowel obstruction. Adv Surg 2011; 45:1–29.

10 Tanphiphat C, Chittmittrapap S, Prasopsunti K. Adhesive small bowel obstruction. A review of 321 cases in a Thai hospital. Am J Surg 1987; 154(3): 283–287.

11 Ellis H, Moran BJ, Thompson JN, Parker MC, Wilson MS, Menzies D, *et al*. Adhesion-related hospital readmissions after abdominal and pelvic surgery: a retrospective cohort study. Lancet 1999; 353(9163): 1476–1480.

12 Ellis H. The causes and prevention of intestinal adhesions. *Br J Surg* 1982; 69(5): 241–243.

13 Jones PF, Munro A. Recurrent adhesive small bowel obstruction. World J Surg 1985; 9(6): 868–875.

14 Miller G, Boman J, Shrier I, Gordon PH. Readmission for small-bowel obstruction in the early postoperative period: etiology and outcome. Can J Surg 2002; 45(4): 255–258.

15 Adelman AM, Revicki DA, Magaziner J, Hebel R. Abdominal pain in an HMO. Fam Med 1995; 27:321–325.

16 Wang Q, Hu ZQ, Wang WJ, Zhang J, Wang Y, Ruan CP Laparoscopic management of recurrent adhesive small-bowel obstruction: long-term follow-up. Surg Today 2009; 39(6): 493–499.

17 Seror D, Feigin E, Szold A, *et al*. Scientific papers: how conservatively can postoperative small bowel obstruction be treated? Am J Surg 1993; 165:121–126.

18 Niyaf A, Bhandari RS, Singh KP. Management of adhesive intestinal obstruction. J Inst Med 2010; 32:18–20.

19 Landercasper J, Cogbill TH, Merry WH, Stolee RT, Strutt PJ. Long-term outcome after hospitalization for small-bowel obstruction. Arch Surg 1993; 128(7): 765–770.discussion 770–771.

Sucralfate ointment reduces pain and improves healing following haemorrhoidectomy: a prospective, randomized, controlled and double-blinded study

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Background
It has been clinically observed that posthaemorrhoidectomy pain is the most feared symptom by the patient, often leading to avoiding surgery altogether. Opioids and NSAIDs are used to control posthaemorrhoidectomy pain, but they have short duration of action and well-known side effects and may be expensive. These factors justify the need to search for new treatments to decrease posthaemorrhoidectomy pain.

Patients and methods
A total of 90 patients who had undergone surgery for third-degree and fourth-degree haemorrhoids were included in this prospective, randomized, controlled and double-blinded study. The patients were randomly assigned to two groups. Group A received topical sucralfate in petrolatum base and group B received plain petrolatum base. Patients were evaluated at days 1, 7 and 14 for the severity of pain (using the visual analogue pain scale) and for the amount of analgesia used. On day 28 patients were evaluated for wound healing.

Results
Patients in the sucralfate group suffered significantly less pain and required less analgesics (narcotic and nonsteroidal) on days 1, 7 and 14 postoperatively ($P < 0.001$). Also, the rate of wound healing was significantly better in the sucralfate group (37/45) than in the control group (28/45) ($P < 0.05$).

Conclusion
Topical sucralfate ointment significantly decreases pain at days 1, 7 and 14 after haemorrhoidectomy and significantly accelerates wound healing.

Keywords:
posthaemorrhoidectomy pain, sucralfate, wound healing

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Introduction

Haemorrhoid disease is the most frequent proctologic complaint, affecting a considerable proportion of adults of any age (haemorrhoids very rarely occur in children) and sex. This disease has been well described since ancient times (Hammurabi Codex ~1750 BC in Babilonia, Ebers Papyrus 1550 BC in Egypt) [1].

It is estimated that 38.9% of the population suffers from haemorrhoids, with grades III and IV representing 8.16 and 0.53%, respectively [2].

A wide variety of treatment options are available for treating haemorrhoids, both medical and surgical, with haemorrhoidectomy being the most effective treatment to reduce recurrent symptoms in patients of grades III or IV [3].

Haemorrhoidectomy, in which the haemorrhoidal complexes and associated connective tissues are sharply excised and the mucosal defect is closed, at least partially, is very effective but very painful [4].

It is clinically observed that posthaemorrhoidectomy pain is the most feared symptom by the patient, often leading to avoiding surgery altogether. Opioids and NSAIDs are used to control posthaemorrhoidectomy pain, but they have short duration of action and well-known side effects and may be expensive. These factors justify the need to search for new treatments to decrease posthaemorrhoidectomy pain.

Sucralfate, a common antiulcer medication, is a basic aluminium salt of sucrose octasulfate. It has been shown to act as a mechanical barrier because of a strong electrostatic interaction of the drug with proteins at the ulcer site. Moreover, sucralfate has shown antibacterial activity [5].

Few researchers have studied the effect of topical sucralfate on posthaemorrhoidectomy pain [6,7]

with encouraging results. The aim of the study was to evaluate the effect of using 10% sucralfate ointment on posthaemorrhoidectomy pain and wound healing.

Patients and methods

The study was carried out on patients presenting to the General Surgery Department, Menoufia University Hospital, between July 2014 and November 2015 and was approved by the ethical committee of the hospital. Informed consent was obtained from each patient. Inclusion criteria were as follows: indication for haemorrhoidectomy for third-degree and fourth-degree haemorrhoids and surgery conducted following the standard Milligan–Morgan technique for open haemorrhoidectomy [8].

Exclusion criteria included the following: presence of anal or rectal pathologies (e.g. fistulae, prolapse, abscess …), age younger than 21 years or older than 60 years; and noncompletion of the study protocol.

All surgeries were carried out by the same surgeon and following the same anaesthesia protocol in order to abolish any interpersonal variation.

The study was prospective, randomized, controlled and double-blinded. Randomization was carried out at the end of the surgery, where a closed envelope method was used to allocate the patient to either group A (the sucralfate group) or group B (the control group). Neither the surgeon nor the patient was aware of the result of randomization, which was kept confidential by an independent observer until the end of the follow-up of each patient. The two jars of drugs containing sucralfate in petrolatum and plain petrolatum were identical. The sucralfate concentration in the ointment was 10% in an inert petrolatum base. The ointment was applied at the end of the surgery and 8-h thereafter. The amount used was determined with a special spoon that measures roughly 1 g of the ointment.

Patients were evaluated regarding their response to the visual analogue pain scale and the amount of analgesics needed to control their pain, as well as wound healing. On the visual analogue pain scale, 0 denoted no pain and 10 denoted severest pain. In the first 24 h, patients were offered intermittent doses of pethidine. Starting from the second day, patients were instructed to use sodium diclofenac tablets (50 mg) to control their pain. A daily phone call was made to record the amount used. Patients were evaluated on day 1, day 7 and day 14 for posthaemorrhoidectomy pain. On day 28, patients were examined for wound healing.

Statistical analysis

It was estimated that 44 patients in each group would be required to detect a reduction of 20% in pain severity on the visual analogue pain scale and wound-healing rates. Data were analysed using SPSS package for Windows (version 16) (USA, Chicago, SPSS Inc.). All the tests were used as tests of significance at *P* value less than 0.05.

Results

Ninety patients completed the study, with 45 in each group. The study included 41 men and 49 women. Other demographic data are shown in Table 1. There was no significant difference in the demographic characteristics of the patients enrolled in the two groups ($P > 0.05$).

Table 2 shows the average score on the visual analogue pain scale at days 1, 7 and 14. There was a highly significant difference ($P < 0.001$) in favour of sucralfate. This was also noticed on days 7 and 14 ($P < 0.05$).

Table 3 shows the average amount of narcotic analgesia needed by patients to control their pain in the first 24 h following surgery. The sucralfate group needed significantly less amount of narcotic analgesia than the control group ($P < 0.05$).

Table 4 shows that at 1 week and at 2 weeks the sucralfate group needed significantly less diclofenac to control their pain ($P < 0.001$).

Table 5 shows the rate of wound healing at 28 days. This also shows a favourable healing rate for the sucralfate group ($P < 0.05$).

Table 1 Comparison of demographic characteristics between the two groups

Point of comparison	Sucralfate group	Control group	*P* value
Age (mean±SD) (years)	37.6±10.4	36.9±11.2	0.73
Male: female	20 : 25	21 : 24	0.81
Number of piles removed	2.81±1.1	2.62±1.2	0.69
Grade III: grade IV ratio	37 : 8	35 : 10	0.34

Table 2 Comparison between the two groups regarding the severity of pain on the visual analogue pain scale at days 1, 7 and 14 postoperatively

Visual analogue pain scale	Sucralfate group	Control group	*P* value
Day 1	5.2±1.37	6.7±1.48	<0.05
Day 7	2.6±0.75	3.8±0.92	<0.001
Day 14	0.9±0.44	1.64±0.59	<0.001

Table 3 Comparison between the two groups regarding the amount of pethidine needed to control posthaemorrhoidectomy pain

Point of comparison	Sucralfate group	Control group	*P* value
Amount of pethidine used (mg)	107±24	122±31	<0.05

Table 4 Comparison between the two groups regarding the amount of diclofenac used to control posthaemorrhoidectomy pain

Diclofenac use (mg)	Sucralfate group	Control group	*P* value
Day 7	116±27	158±33	<0.001
Day 14	56±15	81±22	<0.001

Table 5 Comparison between the two groups regarding the degree of wound healing at 28 days postoperatively

	Sucralfate group	Control group	*P* value
Complete wound healing	37/45	28/45	<0.05

Discussion

Sucralfate has long been known as an antiulcer drug. Its mechanisms of action are diverse. It attaches to proteins on the surface of ulcers, such as albumin and fibrinogen, to form stable insoluble complexes [9].

These complexes serve as protective barriers at the ulcer surface, preventing further damage through prevention of the release of cytokines from damaged cells. Recently, it has been proved that sucralfate also stimulates the increase of prostaglandin E_2 and b-fibroblast growth factors. Basic fibroblast growth factor stimulates the production of granulation tissue, angiogenesis and re-epithelization, thus improving the quality of ulcer healing [10,11]. Sucralfate has well-proven antibacterial activity [12]. Sucralfate proved effective in reducing pain and in improving wound-healing rates in oral ulcers [13], ENT surgery [14], radiation proctitis [15], rectal ulcers [16] and burns [17].

Posthaemorrhoidectomy pain is related mainly to the incision itself or to the subsequent tissue inflammation and infection. The incision causes denuded epithelium, trauma to smooth muscle fibers and its subsequent spasm and the ligatures causing tissue strangulation.

In this study, patients who received topical sucralfate following haemorrhoidectomy suffered less pain. This was evidenced in the difference between the visual analogue pain scale score in both the sucralfate group and the control group. The observation is that sucralfate has an analgesic effect that is more pronounced with the passage of time (Table 2; *P* value less than 0.05 on day 1 and less than 0.001 on days 7 and 14). This can be attributed to the protective effect of sucralfate through the formation of insoluble complexes on the wound surface. The same observation was noticed by Ala *et al.*[6] in 2013.

Also, the average visual analogue pain scale score on day 7 was below 3 in the sucralfate group. A score of 3 or less is regarded as mild tolerable pain. In the control group and at day 7, the average visual analogue pain scale score was above 3, indicating more intense pain.

The analgesic effect of sucralfate was also noticed in the amount of narcotic analgesics needed on the first postoperative day. Patients who received topical sucralfate needed significantly less amount of narcotic analgesia than the control group (Table 3, $P < 0.05$).

The analgesic effect of sucralfate was observed not only early in the postoperative period but also on days 7 and 14. This was reflected in the amount of diclofenac needed by patients to control their pain (Table 4) ($P < 0.001$ on 7 and 14 days). The same finding was reported by Gupta *et al*. [7].

Sucralfate is not the only drug used topically to reduce acute posthaemorrhoidectomy pain. Similar results were reported with cholestyramine ointment[18] and metronidazole cream [19].

Another hypothesis behind the action of sucralfate is that it increases wound-healing rates through its affinity to bind to b-fibroblast growth factors and release it locally in the wound in high concentration [10]. This is evidenced in this study. At 28 days, 82% (37/45) of patients in the sucralfate group showed complete healing of wounds on anoscopic examination. In the control group the healing rate was 62% (28/45). The difference was statistically significant ($P < 0.05$).

Conclusion

Topical sucralfate is effective in reducing posthaemorrhoidectomy pain (thus reducing the amounts of the needed analgesia) and improving wound-healing rates.

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Conflicts of interest

There are no conflicts of interest.

References

1 Altomare DF, Giuratrabocchetta S. Conservative and surgical treatment of haemorrhoids. Nat Rev Gastroenterol Hepatol 2013; 10(9): 513–521.

2 Riss S, Weiser FA, Schwameis K, Riss T, Mittlböck M, Steiner G, Stift A. The prevalence of hemorrhoids in adults. Int J Colorectal Dis 2012; 27(2): 215–220.

3 Lohsiriwat V. Hemorrhoids: from basic pathophysiology to clinical management. World J Gastroenterol 2012; 18(17): 2009–2017.

4 Jacobs D. Hemorrhoids. N Engl J Med 2014; 371:944–951.

5 Rahimi R, Abdollahi M. A systematic review of the topical drugs for post hemorrhoidectomy pain. Int J Pharmacol 2012; 8:628–637.

6 Ala S, Saeedi M, Eshghi F, Rafati M, Hejazi V, Hadianamrei R. Efficacy of 10% sucralfate ointment in the reduction of acute postoperative pain after open hemorrhoidectomy: a prospective, double-blind, randomized, placebo-controlled trial. World J Surg 2013; 37(1): 233–238.

7 Gupta PJ, Heda PS, Kalaskar S, Tamaskar VP. Topical sucralfate decreases pain after hemorrhoidectomy and improves healing: a randomized, blinded, controlled study. Dis Colon Rectum 2008; 51(2): 231–234.

8 Milligan ETC, Morgan CN, Jones L, Officer R. Surgical anatomy of the anal canal, and the operative treatment of haemorrhoids. Lancet 1937, 230:1119–1124.

9 Brown S, Singh-Radcliff N. Gastric Medications, Chapter 10. In: Pharmacology in Anesthesia Practice, Edited by Anita Gupta, Nina Singh-Radcliff. Oxford, Oxford University Press; 2013. p. 155-62.

10 Szabo S, Folkman J, Shing Y, Kusstatscher S, Sandor Z. Sucralfate: Role of endogenous sulphhydryls and basic fibroplast groth factor (bFGF). In: Sucralfate: From Basic Science to the Bedside. Hollander D, Tytgat G, editors. Ch. 16. New York: Plenum medical book company; 1995. p. 167-8.

11 Sandor Z, Nagata M, Kusstatscher S, Szabo S. Stimulation of mucosal glutathione and angiogenesis: new mechanisms of gastroprotection and ulcer healing by sucralfate. Scand J Gastroenterol Suppl 1995; 210:19–21.

12 Welage L, Carver P, Welch K. Antibacterial activity of sucralfate versus aluminum chloride in simulated gastric fluid. Eur J Clin Microbiol Infect Dis 1994; 13(12): 1046–1052.

13 Taylor J, Glenny AM, Walsh T, Brocklehurst P, Riley P, Gorodkin R, *et al*. Interventions for the management of oral ulcers in Behçet's disease. Cochrane Database Syst Rev 2014;9.

14 Gautham MK, Ravishankara S, Naik SM, Sathya P, Appaji M, Bhat S. Comparison of local infiltration of ropivacaine, bupivacaine, topical application of sucralfate in the tonsillar fossa on post-tonsillectomy pain. Otolaryngol Online J 2014; 4:105–116.

15 McElvanna K, Wilson A, Irwin T. Sucralfate paste enema: a new method of topical treatment for haemorrhagic radiation proctitis. Colorectal Dis 2014; 16(4): 281–284.

16 Da Fonseca LM, Souza Fde L, Arantes V, da Silva RG. Giant refractory solitary rectal ulcer syndrome treated with topical sucralfate. Int J Colorectal Dis 2010; 25(8): 1025–1026.

17 Beheshti A, Shafigh Y, Zangivand AA, Samiee-Rad F, Hassanzadeh G, Shafigh N. Comparison of topical sucralfate and silver sulfadiazine cream in second degree burns in rats. Adv Clin Exp Med 2013; 22(4): 481–487.

18 Ala S, Eshghi F, Enayatifard R, Fazel P, Rezaei B, Hadianamrei R. Efficacy of cholestyramine ointment in reduction of postoperative pain and pain during defecation after open hemorrhoidectomy: results of a prospective, single-center, randomized, double-blind, placebo-controlled trial. World J Surg 2013; 37(3): 657–662.

19 Gahlot SK, Katiyar SK. Topical metronidazole and sucralfate can reduce pain after surgery and pain on defection in postoperative haemorrhoidectory. J Evol Med Dent Sci 2012;1 (4):387-90.

Predictive value of axillary nodal mapping after neoadjuvant chemotherapy in breast cancer

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Purpose
The aim of the study was to determine the feasibility and accuracy of sentinel lymph node biopsy (SLNB) in patients with advanced breast cancer after preoperative chemotherapy.

Patients and methods
A prospective study was conducted on 73 patients with advanced operable breast carcinoma previously treated with preoperative chemotherapy. Sentinel lymph node (SLN) mapping was performed at the time of surgery. Following surgery all patients received comprehensive postoperative radiotherapy at 50 Gy/5 weeks.

Results
Seventy-three patients with a median age of 52 years who had been previously treated with preoperative chemotherapy at Menofia University Hospital and National Cancer Institute (NCI) between May 2006 and May 2013 were selected for this study. The SLN detection rate was 79.5%. Thirty-three of 58 patients (56.9%) had successfully mapped positive SLNs. The false-negative rate was 22.4%.

Conclusion
This study confirms the feasibility of SLNB after preoperative chemotherapy in the case of advanced operable breast cancer. According to the detection rate and false-negative rate SLNB may predict metastatic disease in the axilla of patients with tumor response following preoperative chemotherapy.

Keywords:
advanced breast cancer, neoadjuvant chemotherapy, sentinel lymph node biopsy

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Introduction

Breast cancer is the most common site-specific cancer in women and is the leading cause of death from cancer among women aged 20–59 years. It accounts for 26% of all newly diagnosed cancers in women and is responsible for 15% of cancer-related death in them [1]. The three most common pathological types of breast cancers are invasive mammary (ductal) carcinoma (75%), ductal carcinoma *in situ* (13%), and invasive lobular carcinoma (5%) [2].

Axillary staging is performed in all patients with invasive breast cancer. Axillary lymph node status is the most prognostic factor in patients with invasive breast cancer. Identifying patients with axillary lymph node metastases has important implications as regards prognosis, regional treatment, and local control [3].

Neoadjuvant chemotherapy (NAC) is being increasingly used in the management of patients with large (T2) and locally advanced (T3, T4, or N2) breast cancers. Such treatment is administered with the aim of reducing the size of the primary tumor to increase the likelihood of breast conservation and to treat occult systemic metastases to improve survival [4]. NAC downstages 20–40% of pretherapy documented axillary metastatic lymph nodes, with a complete pathologic response in 32% [5].

Sentinel lymph node biopsy (SLNB) has become a validated technique that replaced axillary lymphadenectomy for axillary staging in patients with early breast cancer (N0) and is associated with less morbidity [6]. SLNB after NAC may predict axillary lymph node status for patients with clinically negative lymph node status following NAC. This procedure could help patients who have had their axillary lymph node status downstaged from positive to negative, and patients with large tumors qualify as appropriate candidates for SLNB [7].

After NAC, the method of choice with mastectomy or breast conservative surgery (BCS) is level I and level II axillary lymphadenectomy [8]. SLNB provides a

minimally invasive approach to detect lymph node metastases, thus defining a group of lymph node-negative patients who may be spared the morbidity associated with an axillary lymph node dissection [9].

Patients and methods

The study included 105 patients with breast cancer admitted for NAC at Menofia University Hospital and National Cancer Institute (NCI) between May 2006 and May 2013 after obtaining approval from the Ethical Committee of the Faculty of Medicine, Menofia University, and National Cancer Institute. Their primary nodal status was as follows: 70 cases with N1 status and 35 cases with N2 status. Reassessment after NAC revealed 32 cases with N1 nodal stage and 73 patients with N0 stage. This prospective study was conducted on the latter 73 patients; they were classified as stage II or III according to the American Joint Committee on Cancer (AJCC). NAC consisted of three courses of NAC (TAC: docetaxel 75 mg/m^2, doxorubicin 50 mg/m^2 and cyclophosphamide 500 mg/m^2).

All patients underwent routine workup including the following:

(1) Full history taking, general and local examination, routine laboratory investigations, and full metastatic workup.
(2) Fine needle aspiration cytology or Tru-cut needle biopsy for pathological assessment and for detecting ER, PR, and Her2 status for every patient.

Inclusion criteria included the presence of operable, noninflammatory, large breast tumor diagnosed by fine-needle aspiration cytology or core needle biopsy and treated with NAC. Axillary status was clinically free of nodes (N0). Patients with inflammatory cancer, clinically fixed axillary lymph nodes, previous breast surgery (even excisional biopsy), and premature interruption of NAC for cancer progression were excluded from the study.

Inclusion criteria included the presence of operable, noninflammatory, large breast tumor diagnosed by fine-needle aspiration cytology or core needle biopsy and treated with NAC. Axillary status was clinically free of nodes (N0). Patients with inflammatory cancer, clinically fixed axillary lymph nodes, previous breast surgery (even excisional biopsy), and premature interruption of NAC for cancer progression were excluded from the study.

Lymphatic mapping procedure

In all patients, definitive surgical therapy through BCS or mastectomy and axillary dissection was done. Sentinel lymph node (SLN) mapping was performed at the time of surgery; all patients were injected with 1 ml of 1% patent blue dye peritumorally at 12, 3, 6, and 9 o'clock (total 4 ml) into the breast parenchyma. Gentle massage was performed for 10–15 min before axillary incision and sentinel node identification, followed by completion of axillary lymphadenectomy.

Pathologic analysis

No intraoperative histopathologic examination was performed. SLNs were submitted by the surgeons separately from other axillary lymphadenectomies. The microscopic report stated the number of axillary SLNs, the total number of nodes, and the number of nodes containing macrometastasis or micrometastasis (sentinel and nonsentinel) using the definition of the last AJCC staging system.

Radiotherapy

After surgery all patients received comprehensive radiotherapy to the intact breast or to the chest wall in case of mastectomy and to the supraclavicular lymph node at a dose of 50 Gy/25 fractions/5 weeks followed by a booster dose of 10 Gy/5 fractions to the tumor bed in breast cancer patients who had undergone BCS and those who were less than 60 years old.

Studied parameters

Clinical breast tumor size and axilla assessment were obtained before any treatment by physical examination. The detection rate was defined as the number of patients whose axillary SLN was successfully identified in relation to the total number of patients included.

The average number of SLNs collected was calculated according to the SLN definition. The false-negative rate of SLN was defined as the proportion of patients with a negative SLNB among those with positive nonsentinel nodes. The false-positive rate of SLN was defined as the proportion of patients with a positive SLNB among those with negative nonsentinel nodes. Accuracy was defined as the ratio of patients in whom SLNB correctly diagnosed axillary lymph node status. The results of the detection rate and false-negative rate were stratified according to clinical tumor characteristics.

Statistical analysis

Data were analyzed using IBM SPSS Advanced Statistics version 20.0 (SPSS Inc., Chicago, Illinois, USA). The χ^2-test (Fisher's exact test) was used to examine the relation between qualitative variables. The

κ-test was used as a measure of agreement between SLNB results and axillary of nonsentinel nodes. A *P* value less than 0.05 was considered significant.

Results

The mean age of the involved 73 patients was 49.0 ± 9.3 years (range: 32–38 years). Tumor characteristics before and after chemotherapy are summarized in Table 1. Management comprised BCS in 44 patients (60.3%) and modified radical mastectomy in 29 (39.7%). NAC significantly downstaged tumor size in 75.3% of cases ($P < 0.001$) and nodal stage in 70% of cases ($P < 0.001$). The SLN detection rate was 71.2% (52 out of 73 cases were successfully mapped). The number of SLNs per patient ranged from one to four nodes. No complications were observed as a result of dye injection in any of the patients.

Table 2 shows factors affecting the success of SLN mapping. The only factor associated with successful SLN mapping was tumor site. The success rate was higher in tumors involving the outer breast quadrant compared with the lower quadrant ($P < 0.001$). Clinical T-stage, N-stage before NAC, and positive lymphovascular invasion were not related to the success of mapping.

The number of positive SLNs was 29/52 (55.8%). Table 3 shows the relation between SLN positivity and tumor characteristics. SLN positivity was not affected by any tumor characteristic, including initial nodal status.

After definitive surgical treatment and pathological examination of axillary nodes, 30 patients (57.7%) were seen to have positive nonsentinel nodes and 22 (42.3%) had negative nodes. Positive SLN correctly predicted 18/30 of the positive nonsentinel nodes – that is, a false-negative rate for SLN of 40%. Negative SLN correctly predicted 11/22 of the negative nonsentinel nodes – that is, a false-positive rate for SLN of 50%. Generally, accuracy of SLN was 55.8%; 29 out of 52 cases were correctly diagnosed (κ-value of 0.099; i.e. no agreement between the two tests) (Table 4).

Table 1 Tumor characteristics of the studied group

	No.	%
Tumor Site		
UOQ	34	46.6
LOQ	11	15.1
LIQ	10	13.7
UIQ	14	19.2
Contralateral	4	5.5
Pathological Type		
IDC	61	83.6
ILC	8	11.0
Mixed	4	5.5
T-Stage before NAC		
T2	23	31.5
T3	45	61.6
T4	5	6.8
Grade		
I	3	4.1
II	38	52.1
III	32	43.8
N-Stage before NAC		
N1	50	68.5
N2	23	31.5
Lymphovascular invasion		
Yes	21	28.8
No	52	71.2
Ultrasound of LNs		
Suspicious	46	63.0
Malignant	24	32.9
Normal	3	4.1
T-Stage after NAC		
T1	17	23.3
T2	44	60.3
T3	11	15.1
T4	1	1.4

Discussion

This study demonstrated a 40% false-negative rate of SLN pathology in cases with locally advanced breast cancer following NAC. Positive SLN correctly identified only 18 out of 30 cases with positive nonsentinel nodes. False-positive rate of SLN was even higher (50%). There was no agreement between SLN and nonsentinal nodal pathological findings (κ=0.099). SLN showed accuracy of 55.8% in predicting non-SLN status. SLN positivity was not affected by preneoadjuvant nodal status ($P = 0.157$). In this group of advanced breast cancer patients, mapping of SLN was successful in 71.2% of cases. We did not record any complications as a result of dye injection in any of the patients.

The main hypotheses to explain axillary mapping failures after NAC are an alteration of the lymphatic pathway owing to fibrosis of lymphatic channels, the potential obstruction of lymphatic channels with cellular material or tumor emboli, fibrosis of lymph vessels, and a fatty degeneration owing to the apoptosis of tumor cells [10]. However, in a retrospective analysis of 192 patients who had undergone axillary lymph node dissections and NAC, Straver *et al.* [11] confirmed the feasibility and even importance of adequate lymph node dissection to provide precise prognostic information.

To avoid difficulties resulting from pathologic modifications of the lymphatic pathway secondary

Table 2 Tumor characteristics and their relation with success of SNL mapping

	Sentinel lymph node mapping (%)		*P* value
	Success (*n*=52)	Failure (*n*=21)	
Tumor site			
UOQ	28 (82.4)	6 (17.6)	
LOQ	8 (72.7)	3 (27.3)	< 0.001
LIQ	10 (10.0)	0 (0.0)	
UIQ	2 (14.3)	12 (85.7)	
Contralateral	4 (100.0)	0 (0.0)	
Pathological type			
IDC	41 (67.2)	20 (32.8)	0.265
ILC	7 (87.5)	1 (12.5)	
Mixed	4 (100.0)	0 (0.0)	
T-Stage before NAC			
T2	17 (73.9)	6 (26.1)	0.322
T3	33 (73.3)	12 (26.7)	
T4	2 (40.0)	3 (60.0)	
Grade			
I	2 (66.7)	1 (33.3)	0.822
II	26 (68.4)	12 (31.6)	
III	24 (75.0)	8 (25.0)	
N-Stage before NAC			
N1	33 (66.0)	17 (34.0)	
N2	19 (82.6)	4 (17.4)	0.145
Lymphovascular invasion			
Yes	12 (57.1)	9 (42.9)	0.152
No	40 (76.9)	12 (23.1)	
Ultrasound of LNs			
Suspicious	31 (67.4)	15 (32.6)	
Malignant	18 (75.0)	6 (25.0)	0.589
Normal	3 (100.0)	0 (0.0)	

Table 3 Relation between SNL positivity and tumor characteristics

	Pathology sentinel (%)		*P* value
	Positive (*n*=29)	Negative (*n*=23)	
Tumor site			
UOQ	21 (75.0)	7 (25.0)	
LOQ	3 (37.5)	5 (62.5)	*
LIQ	3 (30.0)	7 (70.0)	
UIQ	2 (100.0)	0 (0.0)	
Contralateral	0 (0.0)	4 (100.0)	
Pathological type			
IDC	26 (63.4)	15 (36.6)	*
ILC	2 (28.6)	5 (71.4)	
Mixed	1 (25.0)	3 (75.0)	
T-Stage before NAC			
T2	10 (58.8)	7 (41.2)	1.000
T3	18 (54.5)	15 (45.5)	
T4	1 (50.0)	1 (50.0)	
Grade			
I	0 (0.0)	2 (100.0)	0.237
II	14 (53.8)	12 (46.2)	
III	15 (62.5)	9 (37.5)	
N-Stage before NAC			
N1	21 (63.6)	12 (36.4)	
N2	8 (42.1)	11 (57.9)	0.157
Lymphovascular invasion			
Yes	7 (58.3)	5 (41.7)	1.000
No	22 (55.0)	18 (45.0)	
Ultrasound of LNs			
Suspicious	17 (54.8)	14 (45.2)	
Malignant	9 (50.0)	9 (50.0)	0.343
Normal	3 (100.0)	0 (0.0)	

to NAC, some authors suggested performing SLNB before NAC. According to this strategy, women with involved SLNs before NAC must undergo axillary lymphadenectomy after NAC. This strategy has two main disadvantages: first, each woman with involved SLNs will experience two separate axillary surgical procedures, before and after NAC; second, women with lymph node metastasis at presentation, eradicated by NAC, will undergo an unnecessary lymphadenectomy. SLNB performed after NAC eliminates the need for two axillary surgical procedures in patients with involved sentinel nodes, and may avoid a systematic axillary lymphadenectomy in the case of lymph node downstaging [12].

The methods of SLN detection have an impact on both the detection rate and the false-negative rate [13]. Sentinel node identification using blue dye alone is a difficult technique to learn and requires a wider exposure of the surgical wound to trace the afferent lymphatics to the tail of the breast. Meta-analysis showed that SLN identification rate is lower and the false-negative rate higher than when using radiocolloid in isolation or a combination of techniques [14].

To reduce the SLNB false-negative rate after NAC, an axillary intraoperative ultrasound assessment after SLNB to explore the nonsentinel region for additional suspicious lymph nodes was proposed [15]. In the current study, there was no significant association between lymph node status on ultrasonography and SLN positivity; suspicious nodes were positive in 55% and negative in 45% of cases ($P = 0.343$).

Accuracy of SLNB in predicting axillary lymph node status after NAC is currently debatable. Most of the reported experience with SLNB includes patients with clinical stage T1–T2 N0. Locally advanced breast cancer was even considered one of the contraindications. However, recent studies have shown that SLNB can be considered if axillary lymph nodes are negative for metastases even in locally advanced breast cancer [16,17]. The two studies underwent SLNB before NAC and reported that mapping the SLN of these patients with clinically node-negative disease before NAC is accurate, sensitive, and specific.

During their study in locally advanced cases, Cox and colleagues reported on a series of 89 patients with locally advanced breast cancer subjected to SLNB

Table 4 Agreement between Pathology of SLN and non-sentinel nodes

	Pathology of NSLNs		Total
	+ve (*n*=30)	−ve (*n*=22)	
Pathology of SLNs			
+ve			
Count	18	11	29
% within SLNs	62.1%	37.9%	100.0%
% within NSLNs	60.0%	50.0%	55.8%
−ve			
Count	12	11	23
% within SLNs	52.2%	47.8%	100.0%
% within NSLNs	40.0%	50.0%	44.2%

before NAC. Twenty-seven percent of their patients had a complete pathologic axillary response; these patients had a significantly higher overall survival than did patients with residual disease. Their study validated the prognostic stratification of patients with a complete pathological axillary response to NAC [17].

Xing and colleagues in 2006 conducted a meta-analysis of 21 studies (total of 1273 patients) that examined the results of SLNB after chemotherapy. The sensitivity of SLNB in the individual studies ranged from 67 to 100%; the negative predictive value ranged from 56 to 100%; and the overall accuracy ranged from 77 to 100%. The majority of patients in these studies had stage II breast cancer with negative axillary nodes at presentation [18].

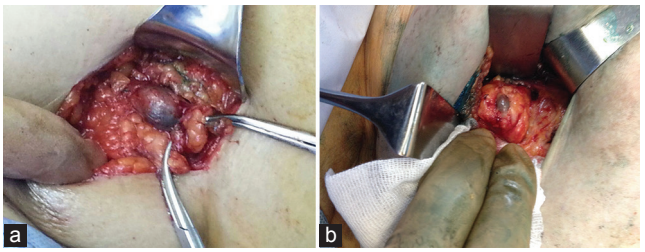
Another systematic review of 27 studies reported a pooled false-negative rate of 10.5% with accuracy of 89.0%. However, authors did not find sufficient evidence to recommend SLNB as a standard procedure after NAC [19].

A more recent meta-analysis reported a 6% false-negative rate and hence concluded that SLNB predicts the pathology of the axilla in patients who are clinically node-negative after NAC with accuracy comparable to that of SLNB for patients with early breast cancer [20].

The high false-negative rate (40%) in the current study precludes the use of SLNB in advanced breast cancer cases. This recommendation was confirmed in previous studies even with lower rates. Ozmen *et al.* [21] reported a 13.7% false-negative rate. Pecha *et al.* [22] concluded that SLNB cannot be recommended as a reliable predictor of axillary lymph node status after NAC. Similarly, Han *et al.* [23] found that general application of SLNB after NAC should be avoided based on a false-negative rate of 10.4%.

The SENTINA study was designed to evaluate optimum timing of SLNB for breast cancer patients treated with NAC. It was a prospective, four-arm multicenter study.

Figure 1



(a, b) Identification of sentinel lymph node.

In this study, arm C was similar to the current study; it involved patients who converted after NAC from N+ to N0. The false-negative rate was 14.2% [24].

In the present study, despite a small sample size, we have shown that SLNB is applicable in locally advanced breast cancer after NAC. Use of patent blue dyes rarely causes complications but has been associated with severe allergic reactions in the literature. Employing two complementary techniques for sentinel node identification will logically improve the sentinel node identification rate and reduce false-negative biopsies (patent blue dye and radioactive colloid) (Fig. 1).

Conclusion

The results of our study support the concept of SLNB feasibility and safety in large primary breast cancer patients who received NAC. Patent blue dye is a safe procedure and none of the patients developed any complications from dye injection. Our accuracy rate, identification rate, and false-negative rate are comparable to reports in the literature on node-negative large primary breast cancer patients after chemotherapy. Consequently, we did not recommend SLNB in these cases as it is unreliable in the prediction of axillary pathology and may lead to an inappropriate management approach.

Lymphatic mapping may not be successful after NAC in large primary breast cancer because of excessive fibrosis of primary tumor and lymphatics and blockage of lymphatic channels with viable or dead materials. Thus we recommend SLNB in clinically node-negative patients before NAC to detect and document axillary nodal disease.

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Conflicts of interest
There are no conflicts of interest.

References

1 Jemal A, Siegel R, Ward E, Hao Y, Xu J, Murray T, Thun MJ. Cancer statistics, 2008. CA Cancer J Clin 2008; 58(2):71-96.

2 Gonzalez-Angulo AM, Morales-Vasquez F, Hortobagyi GN. Overview of resistance to systemic therapy in patients with breast cancer. Adv Exp Med Biol 2007; 608:1–22.

3 Feig BW, Ching CD. Chapter 2: Invasive breast cancer (axillary lymph node staging). In: The MD Anderson Surgical Oncology Handbook. Feig BW and Ching CD.Lippincott Williams & Wilkins Handbook Series) 5th ed 2012pp56.

4 Smith IC, Heys SD, Hutcheon AW, Miller ID, Payne S, Gilbert FJ, *et al.* Neoadjuvant chemotherapy in breast cancer: significantly enhanced response with docetaxel. J Clin Oncol 2002; 20(6):1456–1466.

5 Newman EA, Sabel MS, Nees AV,Schott A, Diehl KM, Cimmino VM, *et al.* Sentinel lymph node biopsy performed after neoadjuvant chemotherapy is accurate in patients with documented node-positive breast cancer at presentation. Ann Surg Oncol 2007; 14(10):2946–2952.

6 Fleissig A, Fallowfield LJ, Langridge CI,Johnson L, Newcombe RG Dixon JM, *et al.* Post-operative arm morbidity and quality of life. Results of the ALMANAC randomised trial comparing sentinel node biopsy with standard axillary treatment in the management of patients with early breast cancer. Breast Cancer Res Treat 2006; 95(3):279–293.

7 Kinoshita T. Sentinel lymph node biopsy is feasible for breast cancer patients after neoadjuvant chemotherapy. Breast Cancer 2007; 14(1):10–15.

8 Thomas A, Ohlinger R, Hauschild M, Mustea A, Blohmer JU, Kümmel S. Options and limits of surgery after pre-operative chemotherapy in breast cancer. Anticancer Res 2006; 26(2C):1677–1682.

9 Shen J, Gilcrease MZ, Babiera GV, Ross MI, Meric-Bernstam F, Feig BW, *et al.* Feasibility and accuracy of sentinel lymph node biopsy after preoperative chemotherapy in breast cancer patients with documented axillary metastases. Cancer 2007; 109(7):1255–1263.

10 Classe JM, Bordes V, Campion L, Mignotte H, Dravet F, Leveque J, *et al.* Sentinel lymph node biopsy after neoadjuvant chemotherapy for advanced breast cancer: results of Ganglion Sentinelle et Chimiotherapie Neoadjuvante, a French prospective multicentric study. J Clin Oncol 2009; 27(5):726–732.

11 Straver ME, Rutgers EJ, Oldenburg HS, Wesseling J, Linn SC, Russell NS, Vrancken Peeters MJ. Accurate axillary lymph node dissection is feasible after neoadjuvant chemotherapy. Am J Surg 2009; 198(1):46–50.

12 Jones JL, Zabicki K, Christian RL, Gadd MA, Hughes KS, Lesnikoski BA, *et al.* A comparison of sentinel node biopsy before and after neoadjuvant chemotherapy: timing is important. Am J Surg 2005; 190(4):517–520.

13 Kim T, Giuliano AE, Lyman GH. Lymphatic mapping and sentinel lymph node biopsy in early-stage breast carcinoma: a metaanalysis. Cancer 2006; 106(1):4–16.

14 Cody HSIII. Clinical aspects of sentinel node biopsy. Breast Cancer Res 2001; 3:104–108.

15 Yu JC, Hsu GC, Hsieh CB, Yu CP, Chao TY. Role of sentinel lymphadenectomy combined with intraoperative ultrasound in the assessment of locally advanced breast cancer after neoadjuvant chemotherapy. Ann Surg Oncol 2007; 14(1):174–180.

16 Grube BJ, Christy CJ, Black D, Martel M, Harris L, Weidhaas J, *et al.* Breast sentinel lymph node dissection before preoperative chemotherapy. Arch Surg 2008; 143(7):692–699.discussion 699–700.

17 Cox CE, Cox JM, White LB, Stowell NG, Clark JD, Allred N, *et al.* Sentinel node biopsy before neoadjuvant chemotherapy for determining axillary status and treatment prognosis in locally advanced breast cancer. Ann Surg Oncol 2006; 13(4):483–490.

18 Xing Y, Foy M, Cox DD, Kuerer HM, Hunt KK, Cormier JN. Meta-analysis of sentinel lymph node biopsy after preoperative chemotherapy in patients with breast cancer. Br J Surg 2006; 93(5):539–546.

19 Van Deurzen CH, Vriens BE, Tjan-Heijnen VC, van der Wall E, Albregts M, van Hilligersberg R, *et al.* Accuracy of sentinel node biopsy after neoadjuvant chemotherapy in breast cancer patients: a systematic review. Eur J Cancer 2009; 45(18):3124–3130.

20 Tan VK, Goh BK, Fook-Chong S, Khin LW, Wong WK, Yong WS. The feasibility and accuracy of sentinel lymph node biopsy in clinically node-negative patients after neoadjuvant chemotherapy for breast cancer-a systematic review and meta-analysis. J Surg Oncol 2011; 104(1):97–103.

21 Ozmen V, Unal ES, Muslumanoglu ME, Igci A, Canbay E, Ozcinar B, *et al.* Axillary sentinel node biopsy after neoadjuvant chemotherapy. Eur J Surg Oncol 2010; 36(1):23–29.

22 Pecha V, Kolarik D, Kozevnikova R, Hovorkova K, Hrabetova F, Halaska M, *et al.* Sentinel lymph node biopsy in breast cancer patients treated with neoadjuvant chemotherapy. Cancer 2011; 117:4606–4616.

23 Han A, Moon HG, Kim J, Ahn SK, Park IA, Han W, Noh DY Reliability of sentinel lymph node biopsy after neoadjuvant chemotherapy in breast cancer patients. J Breast Cancer 2013; 16(4):378–385.

24 Kuehn T, Bauerfeind I, Fehm T, Fleige B, Hausschild M, Helms G, *et al.* Sentinel-lymph-node biopsy in patients with breast cancer before and after neoadjuvant chemotherapy (SENTINA): a prospective, multicentre cohort study. Lancet Oncol 2013; 14(7):609–618.

Privilege of adding noncontrast fluoroscopy to the standard duplex ultrasound-guided percutaneous transluminal angioplasty: a comparative study

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Background
The use of contrast agents in the context of conventional percutaneous transluminal angioplasty (PTA) may pose considerable risks for patients with pre-existing renal impairment, and/or allergic disorders. Duplex ultrasound-guided PTA is one of the established alternative modalities to avoid the risk for contrast use; however, it has its limitations.

Aim
The aim of the present study was to address the values of combining noncontrast fluoroscopy to duplex ultrasound-guided PTA to overcome the limitations of using the later alone, and to improve the overall outcome.

Patients and methods
The study was conducted from January 2012 to October 2014 on a total of 32 patients with severe chronic ischemia mainly due to significant femoropopliteal disease, with concomitant iliac and/or tibial lesions in some of them. Patients were randomized equally between two groups, duplex ultrasound-guided PTA and combined noncontrast fluoroscopy and duplex ultrasound-guided PTA. Both groups were compared regarding technically related points and also 6 and 12-month patency rates.

Results
In the duplex ultrasound-guided PTA group, the technical success rate was achieved in 13/16 (81.2%) patients. Balloon angioplasty was carried out in nine patients (eight with noncompliant balloon); stenting was needed in three patients, whereas hybrid treatment was needed in one patient. At 6 and 12 months, primary patency rates were 76.9 and 61.5%, respectively. In contrast, in the combined noncontrast fluoroscopy and duplex ultrasound-guided PTA group, technical success rate was achieved in 15/16 (87.5%) patients. Balloon angioplasty was carried out in 11 patients (seven with noncompliant balloon); stenting was needed in two patients whereas hybrid treatment was needed in two other patients. At 6 and 12 months, primary patency rates were 80 and 66.6%, respectively.

Conclusion
In this study, a pioneer step forward was assumed to improve the overall technicality in such situations by adding noncontrast fluoroscopic guidance to duplex guided-PTA, with significantly better periprocedural outcome.

Keywords:
duplex ultrasound-guided percutaneous transluminal angioplasty, noncontrast fluoroscopy, renal impairment

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Introduction

Percutaneous transluminal angioplasty (PTA) is a well established, minimally invasive procedure for the treatment of atherosclerotic occlusive disease. Patients who have impaired kidney functions and are indicated for PTA pose a management dilemma, as the use of contrast agent in such a category of patients can lead to the deterioration of the renal function in up to 12% of them [1,2]. In such situations, apart from using CO_2 angiography with its still doubtful image clarity, one of the other alternatives is to use duplex ultrasound-guidance. The evidence supporting these modalities is still lacking because of the lack of sufficient reports comparing them with conventional fluoroscopically guided PTA [3,4].

In this comparative study, we aimed to sort out the privilege of adding noncontrast fluoroscopy to standard duplex ultrasound-guided PTA in patients with impaired kidney functions focusing on the technical success, technical ease, complications, and patency rate.

Patients and methods

This study was conducted from January 2012 through October 2014 on 32 patients (23 men and nine women). Their mean age was 63 ± 11 years. The study patients had significant femoropopliteal disease, and concomitant iliac and/or tibial lesions were encountered in some of them. The study comprised a total of 51 attempted balloon angioplasties ± stenting for the above mentioned lesions. Variable presentations of severe ischemia were the indications for intervention in all patients: Rutherford class 3 in five patients, class 4 in 13, class 5 in 10, and class 6 in four patients.

Renal impairment due to chronic kidney disease was the main inclusion criterion. Other comorbidities included diabetes, hypertension, smoking, and coronary artery disease in 78.1, 71.8, 46.8, and 37.5% of patients, respectively. The Trans-Atlantic Inter-Society Consensus (TASC) classification was used for morphologic description of different arterial segment lesions. The studied patients were mainly TASC A and B, and few cases belonged to TASC C and D. Each patient was evaluated through proper history-taking, clinical examination, and color Doppler ultrasonography, with the occasional need for magnetic resonance angiogram without contrast in some patients.

Patients were randomized into two groups (16 patients each): PTA was carried out under duplex ultrasound-guidance in the first group (D-PTA), and PTA was carried out under combined noncontrast fluoroscopy and duplex ultrasound-guidance in the second group (FD-PTA). Furthermore, according to the type of balloon used for PTA, each group was subdivided into two equal subgroups (PTA using semicompliant balloon in the first subgroup and noncompliant balloon in the second subgroup). Randomization was carried out by selecting sealed envelopes containing the name of the group and subgroup. This was done by the patients in the operating theater. Both groups were compared regarding technical success, technical ease, procedural complications, and 6- and 12-month patency.

The potential benefits and risks of the procedure were explained to each patient, and informed written consent was obtained. The whole study was approved by the ethical committee, Faculty of Medicine, Cairo University.

Procedure

Before starting the procedure, reassessment by duplex scanning was carried out to confirm the preoperative data both hemodynamically and anatomically, and to mark the site of the lesion (s) on the skin using a marker pen for the D-PTA group and radio-opaque stickers for the FD-PTA group. The availability of all the needed tools to perform safe PTA was insured with special attention to the presence of different sizes and lengths of both semicompliant and noncompliant balloons.

The procedure was routinely performed in the Cath Lab, where both duplex ultrasound and noncontrast radiological guidance were available. The duplex ultrasound operator stands on the contralateral side of the vascular surgeon with the screens of both fluoroscopy and ultrasonography amenable to the visual field of all the operators. Although fluoroscopy was not used for the D-PTA group, it was adjusted as a standby; whereas in the FD-PTA group, it was used hand in hand with duplex guidance from the start. Occasionally, the procedure was performed in the operating room when a hybrid technique was planned, using a multipurpose C-arm with vascular intervention capabilities.

The rest of the procedure was completed according to the adopted basic endovascular rules with special concern for hemodynamically significant dissection flaps (causing diameter reductions >30% and peak systolic velocity ratios>2), which were stented with self-expandable stents. Completion duplex examinations and ankle-brachial indices (ABIs) were obtained routinely before hospital discharge.

Mainly on the basis of the results of this study, together with the past experience of the operating team in performing PTA for failing arteriovenous fistulae and superficial femoral artery (SFA) stenotic lesions using duplex guidance alone, the benefits and tips of combining fluoroscopy in addition were compared regarding the following details:

(1) The overall technical success in terms of successful lesion dilatation and/or recanalization with improvement in hemodynamics.
(2) Technical ease in terms of the ease of access site puncture, precise sheath positioning, the speed of wire/catheter maneuverability to reach the site of the lesion, the ease of wire/catheter manipulation to negotiate and cross the site of the lesion, clarity of visualization of proper balloon placement and full inflation/deflation, precise stent deployment and also the procedure time.
(3) Complications either at the access or the lesion sites.
(4) Primary patency rates at 6 and 12 months.

All the previous study points were compared not only in the two main groups but also in their subgroups. The primary end point was technical success together with

clinical improvement in the functional status, intended as ABI and maximum peak velocity ratio (PVR) improvement and maintenance through follow-up. The secondary end point was limb salvage rate and primary patency rate detected at 6 and 12 months. Continuous variables were described as mean ± SD. Categorical variables are described as *n* (%). Primary patency rates were calculated by using the Kaplan–Meier analysis. Statistical significance was set at 0.05.

Results

The study population in the two equal randomized groups (D-PTA and FD-PTA) were comparable regarding their age, sex, risk factors, and TASC classification (Table 1).

In the D-PTA group, initial technical success was achieved in 13 (81.2%) patients; the three case of failure were a femoropopliteal TASC D lesion, and two tibial TASC C (n = 1) and TASC D (n = 1) lesions. In successful patients, PTA was accomplished by using balloon angioplasty in 9/13 (69.2%) patients (eight with noncompliant balloon); stenting was needed in 3/13 (23%) patients, whereas hybrid treatment was needed in 1/13 (7.6%) patient. The mean ABI improved from 0.53 ± 0.07 at baseline to 0.83 ± 0.05 after the procedure. Maximum PVR decreased from 5.2 to 1.1 at the treated segment. The mean intervention time was 105 ± 29 min (range: 75–130 min). Two patients were complicated by access site hematoma; one of them required open surgical control and repair.

Table 1 Patients' demographics and clinical features

Characteristics	D-PTA group	FD-PTA group	*P* value
Age (mean±SD (range)) (years)	60.87±7.01 (49-71)	61.18±6.75 (50-73)	>0.05
Sex (male: female)	12 : 4	13 : 3	>0.05
Renal impairment	16	16	>0.05
Diabetes	12	13	>0.05
Hypertension	12	11	>0.05
Smoking	6	9	>0.05
Coronary artery disease	5	7	>0.05
Severity of ischemia			
Rutherford class 3	2	3	
Rutherford class 4	7	6	
Rutherford class 5	6	4	
Rutherford class 6	1	3	
TASC classification			
TASC A	7	6	
TASC B	5	9	
TASC C	2	1	
TASC D	2	2	
Location of treated lesions			
Femoral	18	15	
Popliteal	6	7	
Iliac	-	1 (TASC A), 1 (TASC D)	
Tibial	1 (TASC C), 1 (TASC D)	1 (TASC A)	

D-PTA, duplex ultrasound-guided percutaneous transluminal angioplasty; FD-PTA, combined noncontrast fluoroscopy and duplex ultrasound-guidance percutaneous transluminal angioplasty; TASC, Trans-Atlantic Inter-Society Consensus.

In the FD-PTA group, initial technical success was achieved in 15/16 (87.5%) patients; the failure case was an iliac TASC D lesion. However, the other iliac case belonged to TASC A and was successfully managed through a hybrid technique for an occluded and recently performed femoropopliteal ePTFE bypass graft. The iliac lesion in this case was missed at the time of the previous operation, and when the cause of graft failure was investigated, such iliac lesion was discovered and incriminated. The plan was to carry out graftotomy for both graft thrombectomy and deployment of iliac stent. In successful patients, PTA was accomplished by balloon angioplasty in 11/15 (73.3%) patients (seven with noncompliant balloon), stenting was needed in 2/15 (13.3%) patients, whereas hybrid treatment (noncompliant balloon was used in one) was needed in 2/15 (13.3%) patients. The mean ABI improved from 0.54 ± 0.08 at baseline to 0.85 ± 0.06 after the procedure. Maximum PVR decreased from 5.3 to 1 at the treated segment. The mean intervention time was 95 ± 20 min (range: 60–110 min). No significant complications were encountered in this group. Procedure details and outcome are shown in Table 2.

The mean duration of follow-up was 11 ± 6 months (range: 12–29 months). The overall 30-day survival rate was 100%. At 6 and 12 months, the overall limb salvage rates were 92.3 and 84.6%, respectively, in the D-PTA group, whereas they were 94.3 and 86.6%, respectively, in the FD-PTA group. Six- and 12-month primary patency rates were 76.9 and 61.5%, respectively, in the D-PTA group, whereas they were 80 and 66.6%, respectively, in the FD-PTA group. Fig. 1 shows the primary patency rate at 6 and 12 months.

Discussion

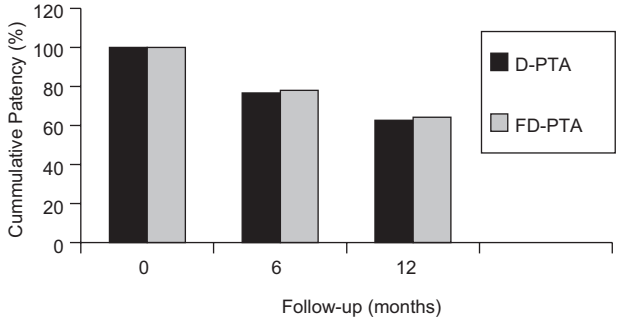
The use of contrast material for PTA in patients with impaired kidney functions is associated with considerable morbidity and mortality from the potential risk of contrast-induced nephropathy (CIN). Several mechanisms have been postulated to explain the role of contrast in CIN pathogenesis, ranging from vasoconstriction at the renal corticomedullary junction, impaired autoregulatory capacity of the kidney and ending to overt acute tubular necrosis [1]. The incidence of CIN depends on two main factors:

Table 2 Procedures and outcome

Group and subgroup	D-PTA (*n*=16)		FD-PTA (*n*=16)		*P* value
	Semicompliant balloon (*n*=8)	Noncompliant balloon (*n*=8)	Semicompliant balloon (*n*=8)	Noncompliant balloon (*n*=8)	
Initial technical success (*n* (%))	13 (81.2)		15 (87.5)		0.03
	5	8	7	8	
Procedure in technically successful cases					
Balloon angioplasty	9		11		
	1	8	4	7	
Stenting	3		2		
	3	-	2	-	
Hybrid procedure	1		2		
PTA + endarterectomy)	1	-	-	1	
Graft thrombectomy + Iliac stenting	-		1	-	
Operative time (mean±SD) (min)	15.48 (105±29)		11.07 (95±20)		0.021
	115.5±31.9	95.45±26.36	104.5±23	82.6±17.3	
Complications	Two access site hematoma One required surgery		-		0.01
Limb salvage rate (%) (months)					
6	92.3		94.3		>0.05
12	84.6		86.6		
Primary patency rate (%) (months)					
6	76.9		80		>0.05
12	61.5		66.6		

D-PTA, duplex ultrasound-guided percutaneous transluminal angioplasty; FD-PTA, combined noncontrast fluoroscopy and duplex ultrasound-guidance percutaneous transluminal angioplasty.

Figure 1



Primary patency rate at 6 and 12 months. D-PTA, duplex ultrasound-guided percutaneous transluminal angioplasty; FD-PTA, combined noncontrast fluoroscopy and duplex ultrasound-guidance percutaneous transluminal angioplasty.

intrinsic contrast media-related factors (osmolarity, ionicity, and molecular structure) and its volume. It is well known that using low volume of iso-osmolar, nonionic, high-quality contrast media is associated with lower risk for CIN. However, the amount of contrast that can be safely administered to patients with baseline chronic kidney disease to prevent CIN is not known [4]. Therefore, the surest method to avoid CIN is to avoid using contrast totally if possible.

CO_2 digital angiography and duplex ultrasound-guided PTA have been suggested as adjunctive contrast-sparing techniques that can be used when intravascular contrast injection is considered hazardous [5]. CO_2 injection has been proven to be a safe and effective method for the evaluation of peripheral arterial disease; however, its therapeutic role in the form of CO_2 angiography-guided endovascular therapy has not been proven. Moreover, not many prospective randomized controlled studies have proven the efficacy and safety of CO_2 angiography-guided endovascular therapy yet [6].

Several reports have proved the feasibility of duplex ultrasound-guided PTA as an alternative to conventional PTA with patency rate mounting to 93% [7]. In addition to avoiding radiation and contrast exposure, duplex ultrasound helps to confirm the adequacy of PTA by the combined hemodynamic and imaging parameters [8]. In spite of the advantages D-PTA offers, its results are still checked by the availability of an experienced sonographer. In addition, severe arterial calcification comprises a challenge because of the difficult insonation and limited field of view [9].

Being devoid of contrast enhancement, noncontrast fluoroscopy lacks opacified arterial tree visualization. However, it still has the ability to visualize radio-opaque structures, whether bony landmarks, arterial calcifications, or endovascular tools. This advantage was interpreted in this study in terms of technical feasibility, success rate, and complication rate when combined with D-PTA.

Duplex guidance was valuable in the visualization of the common femoral artery (CFA) and its bifurcation,

and, hence, identifying safe puncture site especially in obese patients. In addition, duplex ultrasound allows the visualization of healthy proximal segment of SFA for safe insertion of access sheath. On the other side, noncontrast fluoroscopy facilitates easier access to a proper puncture site opposite the medial one-third of femur head, which guarantees a safe effective compression and control after completion of the procedure. In the current study, patients who were subjected to duplex guidance alone experienced puncture site hematoma in two cases, whereas those with combined duplex and noncontrast fluoroscopy guidance were free from such complications, with its possible drastic consequences from either retroperitoneal or upper thigh hematoma. This is explained by the variable site of bifurcation of the CFA in relation to the head of femur, and, therefore, if the puncture targeted the CFA just above the bifurcation, it could be high or low in comparison with the femur head. Although ultrasonography can do this task, it is more easy and clearer with fluoroscopic guidance.

The addition of fluoroscopy with its panoramic capability in the FD-PTA group guides the easier passage of the guide wire into the SFA rather than into the profunda femoris artery by detecting the wire course while it is going down parallel rather than crossing the upper one-third of the femur. Duplex alone lacks this panoramic view with clear bone visualization. In the same context, the ghost of arterial calcification is a good landmark for fluoroscopic guidance in the FD-PTA group, whereas it was a true limiting factor of arterial insonation in the D-PTA group.

The shape and behavior of the catheter/guide-wire assembly on moving towards, negotiating, and then crossing the lesion in the FD-PTA group was definitely easier than in the D-PTA group. This can be explained by two main factors; the first is that the ability to follow the moving wire by fluoroscopy is easily achieved by just following it, while moving the table or the tower while the tip is always in the field of vision. Whereas, doing the same job by using duplex necessitates following the vessel and then searching for the wire inside, which can be lagging behind or proceeding forward. The second factor is that the way you visualize the whole wire (shaft, tip, and possible loops) in fluoroscopy is simply gained depending on its radio-opacity, whereas the same cannot be easily gained by duplex alone as wire visualization varies according to its lie inside the vessel in comparison with the ultrasound probe. It could be seen either as a hyperechoic dot or a line and then to interpret it accordingly – for example, if you see two adjacent dots, this means that the wire had made a loop.

The site of the lesion, whether stenotic or CTO, was identified and marked by the aid of duplex. However, it is interesting to know that the indentation of a gently pulled (not pushed), half-inflated, semicompliant balloon was very helpful in identifying and confirming the sites of previously marked significant nearby stenotic lesions and their lengths.

In chronic total occlusion lesions, although duplex guidance is more confirmatory of crossing the lesion and re-entry to the true lumen (by visualization of the wire not in the wall of the vessel but moving freely within its lumen), we cannot ignore the added tremendous role of noncontrast fluoroscopy during the step of crossing itself on the basis of its panoramic view.

Duplex use in either group has its distinct role in the assessment of hemodynamics and the visualization of possible flaps to assure completeness of angioplasty. The behavior of a characteristic atherosclerotic waist under fluoroscopy was an easy guide to indicate the completeness of lesion dilatation but it could not exclude the presence of post-deflation flow-limiting flaps. The use of noncompliant balloons in their corresponding subgroups obviated the need for stenting as it paved out these dissection flaps.

A combined procedure of noncontrast fluoroscopy and duplex ultrasound-guided PTA could be carried out effectively and safely. The technique offered easier safe identification of the anatomical landmarks, wire manipulation, lesion characteristics, and efficiency of balloon dilatation with overall impact on procedure time. The study indicated significant statistical superiority of the FD-PTA group in terms of technical success and technical ease with lower incidence of complications. However, there was no significant difference in patency rates in the successful cases from the two groups.

It is concluded that the pearls of combining duplex and noncontrast fluoroscopic guidance are gained when the pros of one compensate for the cons of the other. This means that the ease and precision are sometimes elicited when duplex guidance is added, and sometimes when noncontrast fluoroscopy is added. Therefore, both are complementary without predilection superiority when combined. Although, this technique holds considerable potential, longer follow-up will help to fully evaluate its broader applicability.

Conclusion

It is well known that when conventional PTA cannot be carried out because of contrast-related factors; the

alternatives are either using duplex ultrasound or CO_2 angiographic guidance. Yet, in this study, a pioneer step forward was assumed to improve the overall technicality in such situations by adding noncontrast fluoroscopic guidance to duplex guided-PTA, with significantly better periprocedural outcome.

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Conflicts of interest
There are no conflicts of interest.

References

1 Schillinger M, Haumer M, Mlekusch W, Schlerka G, Ahmadi R, Minar E. Predicting renal failure after balloon angioplasty in high-risk patients. J Endovasc Ther 2001; 8(6): 609–614.

2 Tepel M, van der Giet M, Schwarzfeld C, Laufer U, Liermann D, Zidek W. Prevention of radiographic-contrast-agent-induced reductions in renal function by acetylcysteine. N Engl J Med 2000; 343(3): 180–184.

3 Katzenschlager R, Ahmadi A, Atteneder M, Ugurluoglu A, Koppensteiner R, Minar E, Ehringer H. Colour duplex sonography-guided local lysis of occlusions in the femoro-popliteal region. Int Angiol 2000; 19(3): 250–254.

4 MS Davenport, RH Cohan1, JH Ellis. Contrast media controversies in 2015: Imaging patients with renal impairment or risk of contrast reaction. Am J Roentgenol 2015; 204:1174–1181.

5 Scalise F, Novelli E, Auguadro C, Casali V, Manfredi M, Zannoli R. Automated carbon dioxide digital angiography for lower-limb arterial disease evaluation: safety assessment and comparison with standard iodinated contrast media angiography. J Invasive Cardiol 2015; 27(1): 20–26.

6 Shaw DR, Kessel DO. The current status of the use of carbon dioxide in diagnostic and interventional angiographic procedures. Cardiovasc Intervent Radiol 2006; 29(3): 323–331.

7 Ascher E, Marks NA, Hingorani AP, Schutzer RW, Mutyala M. Duplex-guided endovascular treatment for occlusive and stenotic lesions of the femoral-popliteal arterial segment: a comparative study in the first 253 cases, J Vasc Surg 2006; 44(6): 1230–1237 discussion 1237–1238.

8 Nadolski GJ, Stavropoulos SW. Contrast alternatives for iodinated contrast allergy and renal dysfunction: options and limitations. J Vasc Surg 2013; 57(2): 593–598.

9 Pollak AW, Norton P, Kramer CM. Multimodality imaging of the lower extrimity peripheral arterial disease: Current role and future directions. Circ Cardiovasc Imaging 2012; 5(6):797–807.

Endoscopic thoracic sympathecotomy for Morbus Raynaud's phenomenon (Mansoura University Hospital experience)

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Background
Endoscopic thoracic sympathecotomy (ETS) is used for the treatment of a wide range of upper limb disorders. The aim of this study was to represent our experience with ETS as a minimally invasive procedure in the treatment of Morbus Raynaud's phenomenon (RP).

Patients and methods
From January 2012 to March 2015, 29 patients complaining of Morbus RP underwent ETS in the Vascular Surgery Department, Mansoura University Hospital. Eleven patients (38%) presented with digital ulceration despite intensive medical therapy, and 18 patients (62%) presented with severe ischemia without ulceration.

Results
Twenty-nine patients were subjected to 58 ETS. There were eight male (27.55%) and 21 female patients (72.5%) with a mean age of 38 years (range 21–67 years). The mean operative time was 30 ± 6 min (range 22–45 min). There were no deaths or major intraoperative complications. Initial improvement of symptoms with ulcer healing was achieved in 28 of 29 patients (96.5%). Recurrence of the symptoms occurred in 15 patients (52%); however, the symptoms were less severe compared with preoperative symptoms. There was no recurrence of digital ulceration.

Conclusion
ETS for RP has good initial effect despite a high rate of recurrence. However, the symptoms were less severe compared with preoperative symptoms and without recurrence of digital ulceration. ETS is a preferred treatment modality for Morbus RP.

Keywords:
Raynaud's phenomenon, sympathecotomy, upper limb ischemia, vasospastic diseases

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Introduction

Thoracic sympathectomy (TS) is a procedure to interrupt the adrenergic effect of the central nervous system on the upper extremity. The major effects of sympathectomy are diminution in vasomotor tone and reduction in peripheral vascular resistance [1].

TS is indicated for the treatment of some upper limb disorders, mainly hyperhidrosis, Raynaud's phenomenon (RP), and complex regional pain syndrome [2].

Management of RP by means of open cervicothoracic sympathectomy was first reported by Adson and Brosen [3]. Thoracic endoscopic sympathectomy was first described by Kux [4], and it had the advantage of being a minimally invasive procedure.

Maurice Raynaud, in 1862, was the first to describe the phenomenon of acral vasospasm presented with pallor, cyanosis, and hyperemic phase, sometimes accompanied by pain. Subsequent authors in the next decades have termed this condition as Raynaud's disease, which may be primary RP or secondary RP caused by an underlying definite pathology, mainly connective tissue autoimmune disorders such as systemic sclerosis, systemic lupus erythematosus, and Sjogren's syndrome [5,6].

RP is characterized by episodic digital ischemia provoked by cold [7]: clinically manifested as classical a color triad sequence of pallor due to vasospasm, cyanosis due to venous stasis, and redness caused by reactive hyperemia following the return of blood flow [8].

In primary RP, treatment is mostly prophylactic by avoiding cold exposure or the use of vasospastic drugs, whereas secondary RP is seen in connective tissue disorders and treatment is directed to the underlying cause [9].

Medical treatment for RP includes vasodilators, anticoagulants, and more specific drugs such as endothelin-1 receptor antagonists, calcium channel

blockers, angiotensin-converting enzyme inhibitors and angiotensin II receptor blockers, prostacyclin analogs, α-adrenergic blockers, and phosphodiesterase-5 inhibitors [10].

In either type of RP the symptoms may progress and digital ulcerations develop despite conservative treatment. TS may relieve symptoms in these patients [11].

Different methods of surgical sympathectomy have been reported, including resection, electrocauterization, transection, and clipping of various levels from T2, T3, T4, and sympathetic rami communicants [12].

Immediately after endoscopic thoracic sympathectomy (ETS) all the patients were completely cured with warm and dry hands, however, after6-8 months recurrence usually occurs but to a lesser extent than the pre-intervention. This is not due to nerve regeneration but due to hypersensitivity of the noradrenergic receptors, which regulate the precapillary sphincters lowering the threshold of their stimulation [11,13].

This study aimed to represent our experience in managing Morbus Raynaud's by means of endoscopic transthoracic sympathectomy in Mansoura University Hospitals.

Patients and methods

From January 2012 to March 2015, 29 patients complaining of Morbus RP were subjected to ETS in the Vascular Surgery Department, Mansoura University Hospital. Ater approval of our institution review board (IRB)

After explanation of the nature of the disease and possible treatment, informed consent was obtained from the patients included in the study.

All patients were subjected to thorough history taking with emphasis on previous treatment modalities.

Patients who presented with ulceration or severe ischemia without ulceration despite intense medical treatment were included in the study, whereas patients with no previous medical treatment were excluded.

Operative technique

Surgical technique: patients were positioned in supine semisitting position with arms abducted. General anesthesia was induced with a single-lumen endotracheal tube. Pneumothorax was achieved with a Verses needle using carbon dioxide insufflation with about 2 l at a pressure of 8 mmHg. Thereafter, two ports were introduced (sixth intercostal space midaxillary line and fourth intercostal space anterior axillary line). In addition, a third port may be used for adhesiolysis, in case of extensive adhesions. The first port is used for the endoscope and the second for dissection and diathermy [14].

After collapse of the lung, the sympathetic chain is identified under the parietal pleura, running vertically over the necks of the ribs in the upper costovertebral region. If the sympathetic chain is difficult to visualize, it can be identified by rolling it under the grasping forceps, and then sympathectomy will be performed (T2–T4).

Thereafter, the anesthetist reinflats the lung until it reaches the intercostal muscles, with positive pressure until closure of the wound was performed.

The pain visual analog scale is a single-item scale for pain intensity; the scale is most commonly anchored by 'no pain' (score of 0) and 'pain as bad as it could be' or 'worst imaginable pain' (score of 100). The following points on the pain visual analog scale have been recommended: no pain (0–4 mm), mild pain (5–44 mm), moderate pain (45–74 mm), and severe pain (75–100 mm) [15].

The patients were asked to point to the site on the line that represents their pain intensity. Using a ruler, the score is determined by measuring the distance (mm) on the 10 cm line between the 'no pain' anchor and the patient's mark, providing a range of scores from 0 to 100 [16].

Follow-up

All patients were followed up postoperatively with radiograph and discharged 24 h later unless complications occurred. Two weeks after discharge, the patients were followed up at the outpatient clinic, and the stitches were removed. Thereafter, the patients were followed up every 3 months for relief of symptoms, recurrence of symptoms or healing of ulcers, or both.

Statistical analysis

The statistical analysis of data was carried out using Excel program and SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.

Data were presented as mean ± SD for quantitative data and as frequency and proportion for qualitative data.

Results

Between January 2012 and March 2015, 29 patients underwent 58 ETS; all patients underwent the operation after failure of conservative treatment.

Eight patients (27.5%) were male and 21 patients (72.5%) were female.

The mean age was 38 years (range 21–67 years).

The mean operative time was 30 ± 6 min (range 22–45 min) (Table 1).

There was no death or major intraoperative complication (Tables 2 and 3).

Initial improvement of symptoms with ulcer healing was achieved in 28 of 29 patients (96.5%).

Recurrence of the symptoms was observed in 15 patients (52%) during the follow-up period, but symptoms were less severe compared with preoperative symptoms (Table 4).

No recurrence of digital ulceration

There were no intraoperative complications but postoperative complications occurred in two patients. One patient had pneumothorax discovered by means of postoperative radiography and managed with intercostal tube, which was removed after 3 days from the insertion. Another patient developed segmental atelectasis that improved during follow-up with physiotherapy.

Table 1 Demographic data and operative time

Age (years) (mean (range))	38 (21-67)
Sex (female, male)	21, 8
Primary Raynaud's	23
Secondary	6
Operative time (min) (mean (range))	30±6 (22-45)

Table 2 Hospital stay, complications, and follow-up

Mean hospital stay (days)	1±0.4
Number of postoperative complications	2
Mean follow-up period (months)	25±6.2

Table 3 Postoperative outcome

	Primary Raynaud's	Secondary Raynaud's
Initial improvement of the symptoms		
Symptom-free patients (28 of 29)	23/23	5/6
Ulcer healing (10 of 11)	8/8	2/3
Long-term results (mean 25±6 months)		
Recurrence of symptoms but better than that preoperatively (15 patients)	11/23	4/6
Recurrence of digital ulcer	0	0

Table 4 Visual analog scale for pain

	VAS (mean±SD)	*P* value
Preoperative	91.1±0.3	
Early postoperative	15.8±0.7	0.01*
3 months postoperatively	37.7±0.4	0.03*
6 months postoperatively	72.2±0.2	0.08
12 months postoperatively	81.1±006	0.2

VAS, visual analog scale.

Discussion

RP is classified into primary Raynaud's and secondary Raynaud's. Primary Raynaud's is idiopathic, and secondary Raynaud's is related to an underlying disease [17]. Later, it was described in 1826 as an episodic syndrome of emotionally triggered digital cyanosis, rubor, and pallor [14].

Earlier, an abnormal vasospastic response was considered as a cause of this syndrome. Therefore, cervicothoracic sympathectomy was adopted as a treatment option for RP [3,18]. Later, with the introduction of endoscopic surgery, TS, being a less invasive surgical technique, was considered the preferred treatment option for patients with severe RP with no response to conservative treatment [18].

In our study, recurrence of the symptoms was observed in 52% of patients during follow-up period; however, the symptoms were less severe compared with preoperative symptoms. These findings are in contrast to previous reports of a high recurrence rate by Claes [11], who found that the recurrence rate was 100%. However, Matsumoto reported a recurrence rate of 82% and Nicholson *et al.* [19] reported a recurrence rate 50%.

The exact mechanism of recurrence of symptoms is unknown, but recurrence may be caused by technical error (incomplete sympathectomy) [20], sympathetic renervation, hypersensitivity of the digital vessels to circulating catecholamines [21], or progression or the underlying disease (e.g., vasculitis or connective tissue disorder).

As for digital ulceration of the Raynaud's, healing occurred in 10 of 11 patients (91%) after only 1 month after surgery. There was no recurrence or new ulcer formation during the follow-up period (range 6–44 months). This is nearly similar to the results reported by Khan *et al.* [22], who reported that healing of the ulcer occurred in 91% of the patients. However, Thune *et al.* [8] and Matsumoto *et al.* [2] found that ulcer healing occurred in 100% of patients.

It is unclear as why ETS produces healing of digital ulcer despite the high recurrence rate of RP. However, we think that RP with digital ulcer has both functional and organic (microvessel obstruction because of vasculitis) problems, and ETS improves the microvascular circulation of the

finger and promotes long-term healing of ulcer, and its preventive effect for abnormal, vasospastic response lasts for a few months [2]. However, if the patient had complete obstruction, there will be less chance for healing, similar to the patient in our study.

The mean hospital stay in our study was an average of 1 day, which is similar to the average hospital stay in the study by Claes [23].

This study represents our experience in Mansoura University Hospital on ETS for Morbus RP during a follow up of 25 ± 6.2 months, which was similar to that reported in studies by Thune *et al.* [8] and Coveliers *et al.* [17].

Conclusion

ETS for RP has a good initial effect despite a high rate of recurrence. However, the severity of the symptoms recurring is much less compared with the presenting symptoms, without recurrence of digital ulceration. ETS can be used as a last option for the management of Morbus RP when conservative management fails.

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Conflicts of interest

There are no conflicts of interest.

References

1 Krasna MJ. Thoracoscopic sympathectomy: a standardized approach to therapy for hyperhidrosis. Ann Thorac Surg 2008; 85(2): 764–767.

2 Matsumoto Y, Ueyama T, Endo M, Sasaki H, Kasashima F, Abe Y, Kosugi I. Endoscopic thoracic sympathicotomy for Raynaud's phenomenon. J Vasc Surg 2002; 36(1): 57–61.

3 Adson AW, Brosen GE. The treatment of Raynaud's disease by resection of the upper thoracic and lumber sympathetic ganglia and trunks. Surg Gynecol Obster 1929; 48:577–603.

4 Kux E. The endoscopic approach to the vegetative nervous system and its therapeutic possibilities; especially in duodenal ulcer, angina pectoris, hypertension and diabetes. Dis Chest 1951; 20(2): 139–147.

5 LeRoy EC, Medsger TA Jr. Raynaud's phenomenon: a proposal for classification. Clin Exp Rheumatol 1992; 10(5): 485–488.

6 Skopouli FN, Talal A, Galanopoulou V, Tsampoulas CG, Drosos AA, Moutsopoulos HM Raynaud's phenomenon in primary Sjögren's syndrome. J Rheumatol 1990; 17(5): 618–620.

7 Belch J. Raynaud's phenomenon. Cardiovasc Res 1997; 33:25–30.

8 Thune T, Ladegaard L, Licht PThoracoscopic sympathectomy for Raynaud's phenomenon – a long term follow-up study. Eur J Vasc Endovasc Surg 2006; 32:198–202.

9 Thompson AE, Pope JE. Calcium channel blockers for primary Raynaud's phenomenon: a meta-analysis. Rheumatology (Oxford) 2005; 44(2): 145–150.

10 Botzoris V, Drosos AA. Management of Raynaud's phenomenon and digital ulcers in systemic sclerosis. Joint Bone Spine 2011; 78(4): 341–346.

11 Claes G. Indications for endoscopic thoracic sympathectomy. Clin Auton Res 2003; 13(Suppl 1):I16–I19.

12 Kopelman D, Hashmonai M. The correlation between the method of sympathetic ablation for palmar hyperhidrosis and the occurrence of compensatory hyperhidrosis: a review. World J Surg 2008; 32:2343–2356.

13 Coveliers H, Hexum F, Rouwerda J, Wisselink W. Endoscopic thoracic sympathectomy for upper limb ischemia. A 16 year follow up in a single centre. Surgeon 2015 [Epub ahead of print].

14 Lemmens HJ. Importance of the second thoracic segment for the sympathetic denervation of the hand. Vasc Endovascular Surg 1982; 16:23–26.

15 Jensen MP, Karoly P, Braver S. The measurement of clinical pain intensity: a comparison of six methods. Pain 1986; 27(1): 117–126.

16 Jensen MP, Chen C, Brugger AM. Interpretation of visual analog scale ratings and change scores: a reanalysis of two clinical trials of postoperative pain. J Pain 2003; 4(7): 407–414.

17 Coveliers HM, Hoexum F, Nederhoed JH, Wisselink W, Rauwerda JA Thoracic sympathectomy for digital ischemia: a summary of evidence. J Vasc Surg 2011; 54(1): 273–277.

18 Sayers RD,Jenner RE, Barrie WW. Transhoracic endoscopic sympathectomy for hyperhidrosis and Raynaud's phenomenon. Eur J Vasc Surg 1994; 8:627–631.

19 Nicholson ML, Dennis MJ, Hopkinson BR. Endoscopic transthoracic sympathectomy: successful in hyperhidrosis but can the indications be extended? Ann R Coll Surg Engl 1994; 76(5): 311–314.

20 Felder DA, Simeone FA, Linton RR, Welch CE. Evaluation of sympathetic neurectomy in Ravnaud's disease; based on follow-up study of 40 patients. Surgery 1949; 26:1014–1033.

21 Machlcdcr HI, Wheeler E, Barker WF. Treatment of upper extremity ischemia by cervico-dorsal sympathectomy. Vasc Endovascular Surg 1979; 13:399–404.

22 Khan MI, Tariq M, Rehman A, Zafar A, Sheen SN. Efficacy of cervicothoracic sympathectomy versus conservative management in patients suffering from incapacitating Raynaud's syndrome after frost bite. J Ayub Med Coll Abbottabad 2008; 20(2): 21–24.

23 Claes G. Indication for endoscopic thoracic sympathectomy. Clin Auton res 2003; 13:I16–I19.

Clinicopathological features and surgical outcomes of esophagogastric junction adenocarcinoma single center experience: a retrospective cohort study

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Background
The esophagogastric cancers (EGCs) are rapidly increasing in Western countries. This study was conducted to elucidate the distribution and surgical outcomes of EGC.

Patients and methods
We retrospectively studied 90 patients who underwent curative surgery for esophagogastric junction cancer according to Siewert's classification during the period between January 2005 and July 2014. The collected information included preoperative, operative, and postoperative data. We also compared these data among the EGC subtypes.

Results
A total of 90 patients were eligible and were included in the study. The median follow-up period was 17.68 (0.2–130.92) months. Thirty-five patients had type I (38.9%), 32 had type II (35.6%), and 23 patients had type III tumors (25.6%). There were no significant differences in age, sex, and Borrmann macroscopic types between the three subtypes. Thoracotomy was used most often in type I tumors (74.3%) as compared with type II (28.1%) and type III (13%) tumors (P = 0.0001). Multivariate analysis confirmed that only tumor size (P = 0.023) and lymph node metastasis (P = 0.020) and presence of Borrmann macroscopic appearance of type II tumor (0.039) were significant and independent prognostic indicators for survival after curative resection for EGC.

Conclusion
The selection of the surgical approach for resection of EGC carcinoma should be tailored and achieving tumor-free safety margin. Tumor size and lymph node metastasis and presence of Borrmann macroscopic appearance of type II tumor were significant and independent prognostic indicators for survival after curative resection for EGC.

Keywords:
esophageal carcinoma, esophagogastric junction, gastric carcinoma, Siewert's classification, thoracotomy

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Introduction

Gastric carcinoma is the most common tumor arising from the upper gastrointestinal tract in Eastern countries [1–3]. Because of a vague definition of the cardia, the correct classification of esophagogastric cancers (EGCs) is still difficult even in experienced oncologic centers [3–8]. EGCs consist of the tumors arising from both the distal esophagus and proximal part of the stomach. The incidence of gastric cancer, EGCs, and esophageal cancer was determined to be 75.8, 4, and 20.2%, respectively, in Eastern countries and 40.2, 35.9, and 23.9%, respectively, in Western countries [2–4]. Although the incidence of gastric adenocarcinoma is more common in Eastern than in Western countries, EGCs are rapidly increasing in Western countries and not increasing in Eastern countries [5,7,9–11].

Siewert and Stein[6] categorized EGC into three subtypes in 1996 according to the site of the tumor center in relation to the anatomical esophagogastric junction (EGJ). This classification was approved by the International Gastric Cancer Association (IGCA) and the International Society for Diseases of the Esophagus (ISDE) and has been accepted worldwide [7–9].

The allocation of the three types of EGCs differs markedly between Eastern and Western countries. In Eastern countries, the incidence of type II and type III cancers is higher compared with type I cancers, whereas in Western countries the distribution is nearly the same between the three types [4,10,11].

Clinicopathological features vary for each type, providing the classification a useful tool for making optimal managements [12,13]. Although complete tumor resection (R0 resection) with lymphadenectomy is the goal of surgical treatment for GEJ cancers, the operative approaches still remain argumentative, especially the need for thoracotomy [9]. The surgical approaches to achieve R0 resection for GEJ carcinoma differs widely from esophagectomy transthoracic or transhiatal to total gastrectomy with transhiatal resection [1–3]. Although surgery is the most effective curative management of EGCs, the incidence of R1 and R2 resection is high and the prognosis still unsatisfactory [7–11].

These differences in the clinicopathological feature of EGC between Eastern and Western countries may be attributed to genetic factors, gastroesophageal reflux, Barrett's esophagus, smoking, obesity, and alcohol consumption [3–7]. No studies have discussed clinicopathological features of EGC in middle-east countries [12–15]. This study was planned to evaluate the incidence, clinicopathological features, and oncological outcomes of EGCs in Egypt to clarify the difference between EGCs in middle-east and in Western and Eastern countries according to the Siewert classification of EGCs. We examined databases for both esophageal and gastric cancer to elucidate the distribution and clinical outcomes of EGC at a single center in Egypt.

Patients and methods

We retrospectively studied patients who underwent curative surgery for EGJ adenocarcinoma (Siewert's types I, II, and III) at Gastroenterology Surgery Center, Mansoura University, Egypt, between January 2005 and July 2014. EGCs were defined as a tumor whose center is within 5 cm proximal and distal of the anatomical cardia [8]. Exclusion criteria included prior history of surgery for gastric cancer, squamous cell carcinoma of EGJ, or gastric stump cancer. Informed consent was obtained from all patients to undergo surgery after a careful explanation of the nature of the disease and possible treatment with its complications. This study was approved by the institutional review board.

EGC was divided according to the Siewert classification into three types. Type I is defined as tumors in which the center is located 1–5 cm above the EGJ, regardless of invasion to the EGJ; type II is defined as tumors invading the EGJ, in which the center is located between 1 cm above and 2 cm below the EGJ; and type III is defined as tumors invading the EGJ, in which the center is located 2–5 cm below the EGJ.

Preoperative assessment

All patients were evaluated preoperatively by means of clinical presentation, routine blood tests, upper gastrointestinal endoscopy with biopsy, barium study, abdominal computed tomography, and cardiopulmonary assessment. Cancer of the EGJ was classified on the basis of the findings of endoscopy determining the relationship between EGJ and the center of the tumor, intraoperative findings, and postoperative histopathological findings.

Operative procedure

The choice of operative approach depended on the radicality of the tumor and achieving complete macroscopic and microscopic removal of the lesion with proper lymph node dissection. The surgical approach and extent of lymphadenectomy depend on tumor location, preoperative staging, nodal status, and patient comorbidity. In general, abdominal gastrectomy with resection of the distal esophagus with at least 6 cm of macroscopic surgical margin of the tumor was performed [6,9,12]. To ensure clear resection margins in the distal esophagus, intraoperative frozen sections were prepared. The transhiatal approach was applied in selected patients when abdominal approach alone could not achieve complete resection. Thoracotomy was conducted to achieve adequate tumor-free safety margin above the tumor. Thoracotomy was needed if abdominal and transhiatal approaches failed to achieve tumor-free safety margin.

Reconstruction was performed with a narrow gastric tube in proximal gastrectomy with distal esophagectomy. An end-to-side esophagojejunostomy performed with a circular stapler or manual and Roux-en-Y bile diversion was the reconstruction of choice after total gastrectomy with distal esophagectomy.

Postoperative assessment

Postoperative complications were graded using the Clavien–Dindo classification [16]. Procedure-related mortality was defined as death in hospital or death within 30 days of operation.

All tumors were pathologically staged using the AJCC/UICC TNM Cancer Staging Manual (7th ed.) [17]. The macroscopic appearances of the tumors were divided according to Borrmann's classification [18].

Patients were followed up with computed tomography scan of the chest and abdomen, as well as an endoscopy during the first year. Follow-up visits were carried out at 3-month intervals during the first year, and then at 6-month intervals in the second and third year, and afterwards at 12-month intervals.

The collected data included demographic parameters, clinical data, preoperative radiological and endoscopic findings, operative data, histomorphologic tumor characteristics, and short-term and long-term outcomes. We also compared these data among the EGC subtypes.

Statistical analysis

Continuous variables were expressed as mean (SD) and compared using the one way analysis of variance test or expressed as median (range) and compared using the Kruskal–Wallis test depending on whether or not they were normally distributed. Categorical variables were expressed as percentages and compared using the X^2-test. The groups' overall and disease-free survival times were calculated using the Kaplan–Meier method and compared using a log-rank test. Univariate and multivariate analysis were performed using the Cox regression models to identify the prognostic factors. A P value less than 0.05 was considered significant. All statistical calculations were carried out using computer program SPSS (Statistical Package for the Social Sciences; SPSS Inc., Chicago, Illinois, USA) version 20 for Microsoft Windows.

Results

Between January 2005 and July 2014, 287 patients underwent gastrectomy for gastric carcinoma and 107 patients underwent esophagectomy for esophageal carcinoma at Gastroenterology Surgery Center, Mansoura University, Egypt. Of these 394 patients, 90 patients fulfilled the definition of the Siewert classification and were eligible to be included in the study. The ratios of true esophageal cancer, EGCs, and true gastric cancer were 46 (11.7%), 90 (22.8%), and 258 (65.5%). Thirty-five (38.9%) patients had type I, 32 (35.6%) patients had type II, and 23 (25.6%) patients had type III tumor.

Demographic and clinical characteristics of the patients are presented in Table 1. The mean age was 52.49 ± 10.53 years. Sixty-two (68.9%) patients were men. There were no significant differences in age, sex, and Borrmann macroscopic types between the three subtypes.

Initial symptoms were dysphagia (91.1%) (grade I: 15.6%, II: 25.6%, III: 38.9%, IV: 11.1%), weight loss (66.7%), nausea and vomiting (43.3%), abdominal pain (33.3%), reflux and heart burn (20%), and bleeding (10%). Dysphagia was significantly more apparent in type I and II as compared with type III. However, weight loss was significantly more apparent in type III than in type I.

Table 2 summarizes the intraoperative data. The median duration of surgery was 240 (120–600) min, with no difference between the subtypes. Thoracotomy was needed in type I tumors (74.3%) as compared with type II (28.1%) and type III (13%) tumors (P = 0.0001). Fifty-eight (64.4%) and 32 (35.6%) patients underwent proximal gastrectomies and total gastrectomies, respectively. Total gastrectomy was performed in 82.6% of patients with type III versus 11.4% with type I and 28.1% with type II tumors, whereas proximal gastrectomy was more common in type I (88.6%) and type II (71.9%) as compared with type III (17.4%) (P = 0.0001).

The pathological tumor characteristics are presented in Table 3. Tumor size was significantly larger in type III (6.78 ± 1.10 cm) than in types I (4.78 ± 1.85 cm) and II (4.10 ± 1.81 cm). There were no significant differences with regard to resection margin, differentiation, tumor depth, TNM stage, LN metastasis, and microvascular and perineural invasion between the subtypes.

An overall 62% of the patients had lymph node metastases and the frequency of lymph node metastases was higher in types II and III. The common nodal involvement were paracardiac (61%), lesser curvature (58%), greater curvature (18%), paraesophageal (12%), mediastinal lymph node (12%), and left gastric (2.5%) [19].

At least one postoperative complication was observed in 13 (37.1%) patients with type I, 11 (34.4%) patients with type II, and four (17.4%) patients with type III tumors (P = 0.250). No significant difference was detected in the distribution of the type of postoperative complications apart from pulmonary complications and anastomotic leakage (Table 4).

Anastomotic leakage occurred in nine cases of type I tumors, three cases of type II, and in one case of type III tumors (P = 0.035). All leakages (13 cases, 14.4%) were treated conservatively apart from one case, which needed re-exploration. Conservative treatment consisted of a nasogastric feeding tube in 11 patients and endoscopic stenting in one patient. Anastomotic stricture occurred in two cases (one was treated with

Table 1 Demographic and clinical characteristics

	Total	Type I	Type II	Type III	*P* value
Patient number (*n* (%))	90	35 (38.9)	32 (35.6)	23 (25.5)	
Age	52.49±10.53	51.31±10.88	53.13±11.10	53.39±9.42	0.702
Sex (M : F ratio)	62 : 28	25 : 10	22 : 10	15 : 8	0.882
	68.9 : 31.1%	71.4 : 28.6%	68.8 : 31.2%	65.2 : 34.8%	
BMI	26.04±5.82	24.94±4.90	26.93±4.62	26.75±8.34	0.619
Smoking	34.2%	26.9%	27.6%	52.4%	0.119
Macroscopic type (*n* (%))					0.445
Borrmann I	24 (26.7)	12 (34.3)	8 (25)	4 (17.4)	
Borrmann II	16 (17.8)	6 (17.1)	5 (15.6)	5 (21.7)	
Borrmann III	20 (22)	7 (20)	5 (15.6)	8 (34.8)	
Borrmann IV	30 (33.3)	10 (28.6)	14 (43.8)	6 (26.1)	
Abdominal pain (*n* (%))	30 (33.3)	10 (28.6)	8 (25)	12 (52.2)	0.081
Dysphagia	82 (91.1%)	35 (100%)	30 (93.8%)	17 (73.9%)	0.002
Grading					I:III=0.001 II:III=0.040
Grade I	14 (15.6%)	7 (20%)	3 (9.4%)	4 (17.4%)	0.034
Grade II	23 (25.6%)	10 (28.6%)	9 (28.1%)	4 (17.4%)	I:III=0.010 II:III=0.023
Grade III	35 (38.9%)	13 (37.1%)	13 (40.6%)	9 (39.1%)	
Grade IV	10 (11.1)	5 (14.3)	5 (15.6)	0	
Reflux symptoms (*n* (%))	18 (20)	9 (25.7)	7 (21.9)	2 (8.7)	0.270
GI bleeding (*n* (%))	9 (10)	3 (8.6)	2 (6.3)	4 (17.4)	0.372
Weight loss	60 (66.7%)	18 (51.4%)	23 (71.9%)	19 (82.6%)	0.035 I:III=0.016
Nausea, vomiting (*n* (%))	39 (43.3)	14 (40)	15 (46.9)	10 (43.5)	0.851

GI, gastrointestinal.

Table 2 Intraoperative data

	Total	Type I	Type II	Type III	*P* value
Thoracotomy (*n* (%))	38 (42.2)	26 (74.3)	9 (28.1)	3 (13)	0.0001 I:II, I:III
Extent of resection					0.0001 I:II, II:III=0.0001
Proximal gastrectomy with distal esophagectomy	58 (64.4%)	31 (88.6%)	23 (71.9%)	4 (17.4%)	0.0001 I:III=0.0001, II:III=0.0001
Total gastrectomy with distal eosophagectomy	32 (35.6%)	4 (11.4%)	9 (28.1%)	19 (82.6%)	
Splenectomy	48 (53.3%)	15 (42.9%)	20 (62.5%)	13 (56.5%)	0.257
Reconstruction (*n* (%))					0.264
Hand sewn	79 (87.8)	33 (94.3)	26 (81.3)	20 (87)	
Stapler	11 (12.2)	2 (5.7)	6 (18.8)	3 (13)	
Drainage procedure (*n* (%))	58 (64.4)	31 (88.6)	23 (71.9)	4 (17.4)	
Pyloroplasty (*n* (%))	40 (69)	20 (64.5)	17 (73.9)	3 (75)	0.734
Pyloromyotomy (*n* (%))	18 (31)	11 (35.5)	6 (26.1)	1 (25)	
Duration of surgery (min)	240 (120-600)	240 (180-360)	240 (120-600)	240 (180-360)	0.355
Blood loss	75 (0-1500)	125 (50-1500)	50 (50-800)	200 (0-1300)	0.801
Blood transfusion	0 (0-1500)	0 (0-1500)	0 (0-1000)	0 (0-1000)	0.184
Neoadjuvant ttt (*n* (%))	2 (2.2)	0	2 (6.3)	0	0.157
Adjuvant ttt (*n* (%))					0.26
Chemotherapy	28 (31.1)	9 (25.7)	9 (28.1)	10 (43.5)	
Chemoradiotherapy	30 (33.3)	10 (28.6)	11 (34.4)	9 (39.1)	

endoscopic stenting and the other was treated with endoscopic dilatation).

There was no significant difference in the severity of complications according to the Clavien–Dindo grade among the groups. Hospital stay tended to be longer in type I patients, but with no significant difference ($P = 0.063$).

There were six hospital deaths (6.7%) (three cases in type I, two cases in type II, and one case in type III): two cases in type I due to sepsis secondary to anastomotic leakage, one case in type I due to live cell failure, two cases in type II due to cardiopulmonary causes, and one case in type III due to anastomotic leakage.

Survival outcomes

In all, 1-, 3-, and 5--year survival rates for all patients were 57, 24, and 13%, respectively. Also, 1-, 3-, and 5--year disease-free survival rates for all patients were 51, 28, and 24%, respectively.

Table 3 Pathological tumor characteristics

	Total	Type I	Type II	Type III	*P* value
Tumor size	5.49±2.13	4.78±1.85	4.10±1.81	6.78±1.10	0.0001 I:III=0.001, II:III=0.0001
Cut margin R0/R1 (*n* (%))	70/20 (77.8/22.2)	27/8 (77.1/22.9)	26/6 (81.3/18.7)	17/6 (73.9/26.1)	0.806
Grading (*n* (%))					
Grades I and II	76 (84.4)	30 (85.7)	29 (90.6)	17 (73.9)	0.23
Grades III and IV	14 (15.6)	5 (14.3)	3 (9.4)	6 (26.1)	
Number of LN removed	21 (13-33)	19 (10-30)	21 (11-29)	22 (12-33)	0.35
Number of LN infiltrated	6 (0-18)	4 (0-15)	5 (0-16)	7 (0-18)	0.45
Patients with lymph node infiltration (*n* (%))	62 (68.9)	21 (60)	23 (71.9)	18 (78.3)	0.52
Tumor depth (*n* (%))					
T1	6 (6.7)	1 (2.9)	4 (12.5)	1 (4.3)	0.14
T2	41 (45.6)	15 (42.9)	12 (37.5)	14 (60.9)	
T3	40 (44.4)	18 (51.4)	16 (50)	6 (26.1)	
T4	3 (3.3)	1 (2.9)	0	2 (8.7)	
LN metastasis (*n* (%))					0.52
N0	28 (31.1)	14 (40)	9 (28.1)	5 (21.7)	
N1	24 (26.7)	11 (31.4)	7 (21.9)	6 (26.1)	
N2	23 (25.6)	7 (20)	9 (28.1)	7 (30.4)	
N3	15 (16.7)	3 (8.6)	7 (21.9)	5 (21.7)	
Venous invasion (*n* (%))	5 (5.6)	3 (8.6)	1 (3.1)	1 (4.3)	0.597
Perineural invasion(*n* (%))	11 (12.2)	4 (11.4)	4 (12.5)	3 (13)	0.982

Table 4 Postoperative complications

	Total	Type I	Type II	Type III	*P* value
Cases with complication (*n* (%))	28 (31.1)	13 (37.1)	11 (34.4)	4 (17.4)	0.250
Clavien-Dindo grade (*n* (%))					0.462
I	62 (68.9)	22 (62.9)	21 (65.6)	19 (82.6)	
II	8 (8.9)	3 (8.6)	5 (15.6)	0	
III	14 (15.6)	7 (20)	4 (12.5)	3 (13)	
V	6 (6.7)	3 (8.6)	2 (6.3)	1 (4.3)	
Anastomotic leakage	13 (14.4%)	9 (25.7%)	3 (9.4%)	1 (4.3%)	0.046 I:III=0.035
Postoperative hemorrhage	2 (2.2%)	0	1 (3.1%)	1 (4.3%)	0.498
Pulmonary complications	24 (26.7%)	13 (37.1%)	10 (31.3%)	1 (4.3%)	0.017 I:III=0.004 II:III=0.014
Ilius (*n* (%))	1 (1.1)	1 (2.9)	0	0	0.452
Postoperative abdominal collection (*n* (%))	2 (2.2)	1 (2.9)	0	1 (4.3)	0.530
Anastomotic stricture (*n* (%))	2 (2.2)	0	2 (6.3)	0	0.157
Depression (*n* (%))	1 (1.1)	1 (2.9)	0	0	
UTI (*n* (%))	1 (2.2)	0	1 (3.1)	0	0.400
Sepsis (*n* (%))	8 (8.9)	4 (11.4)	4 (12.5)	0	0.219
Diaphragmatic hernia (*n* (%))	1 (1.1)	1 (2.9)	0	0	0.452
Hospital stay	11 (7-65)	12 (8-65)	11 (8-37)	11 (7-36)	0.063
Hospital mortality (*n* (%))	6 (6.7)	3 (8.6)	2 (6.3)	1 (4.3)	0.814
Readmission (*n* (%))	13 (14.4)	6 (17.1)	6 (18.8)	1 (4.3)	0.275

UTI, urinary tract infection.

The survival curves for each Siewert type are shown in (Figs. 1 and 2). Overall survival time and disease-free survival time tended to be lower in type III tumor, although the difference was not statistically significant (Table 5).

Univariate analysis showed that the following seven factors were associated with survival: tumor size (P = 0.014), lymph node metastasis (P = 0.002), presence of Borrmann macroscopic appearance of type II tumors (P = 0.021), and positive resection margin (P = 0.031). Subsequent multivariate analysis confirmed that only tumor size (P = 0.023) and lymph node metastasis (P = 0.020) and presence of Borrmann macroscopic appearance of type II tumors (0.039) were significant and independent prognostic indicators for survival after curative resection for EGC (Table 6 and Figs. 1–6).

Discussion

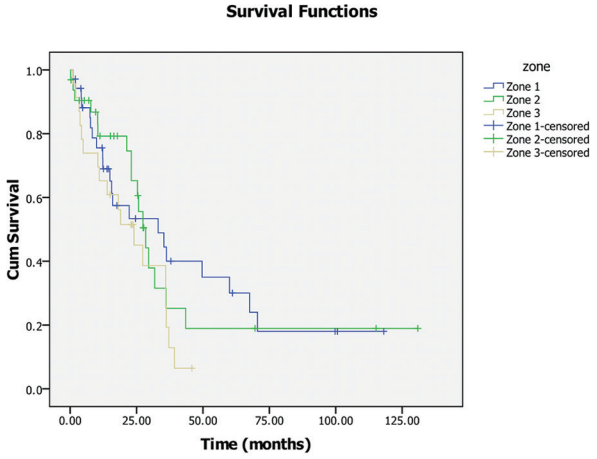
The incidence of EGCs is increasing dramatically in Western countries but not in Eastern countries. In

1996, Siewert categorized EGCs into three subtypes based on the anatomic location of the tumor center to the cardia [1–5]. These tumors show a high incidence of early lymphatic dissemination and lymph node metastases [5–8]. In Eastern countries, the ratios of esophageal cancer, EGCs, and gastric cancer were 20.2, 4, and 75.8%, respectively, and in Western countries the ratios were 23.9, 35.9, and 40.2% [4,10,11,19–23]. In our study, the ratios of true esophageal cancer, EGCs, and true gastric cancer were 46 (11.7%), 90 (22.8%), and 258 (65.5%). Thirty-five (38.9%) patients had type I, 32 (35.6%) patients had type II, and 23 (25.6%) patients had type III tumor. These findings differ from reports in Western nations and in Eastern nations. The incidence of Siewert type I tumors is more frequent in our study (38.9%) than in Eastern countries (3.4%) and Western countries (20.3%) [2–5]. The high frequency of type I EGCs may be explained by a higher prevalence of gastroesophageal reflux, obesity, and *Helicobacter pylori* infection [1,19–25].

In this study, 62 (68.9%) patients who had EGCs were men and the male-to-female ratio was 2.2: 1. There were no significant differences in age, sex, and Borrmann macroscopic types between the three subtypes. Zhang *et al* [19]. reported that no significant differences were found in age and sex among the three types of EGC cancers. Type III tumors were larger and associated with more weight loss compared with type I and type II tumors. Five-year survival rates were 15, 21, and 0% for types I, II and III, respectively. Lymph node metastasis, lymphovascular infiltration, large tumor size, and Borrmann type II were significant and independent factors for poor prognosis after R0 resection of the tumor.

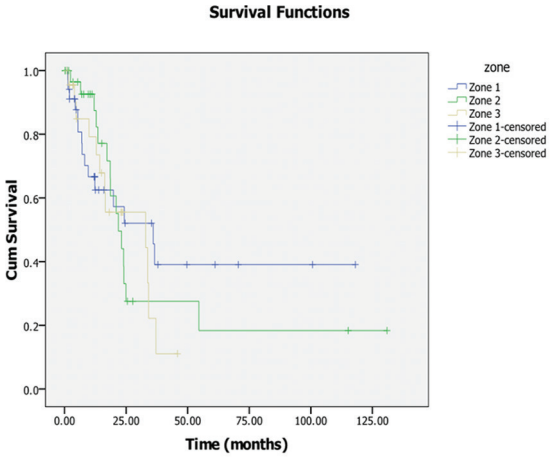
Management of patients with EGCs continues to be a matter of debate. Despite their rising incidence, there are marked difference in the definition of EGCs, the selection of surgical approach, and surgical outcomes. The surgical approaches to these tumors have been controversial. The selection

Figure 1



Actuarial survival (Kaplan–Meier analysis) after resection of esophagogastric cancer (EGC): influence of zone.

Figure 2



Actuarial survival (Kaplan–Meier analysis) after resection of esophagogastric cancer (EGC): overall disease-free survival influence of zone.

Table 5 Long-term follow-up and oncologic outcome

	Total	Type I	Type II	Type III	*P* value
Follow-up period (months)	17.68 (0.2-130.92)	14.95 (1-118.1)	22.16 (0.2-130.92)	18.99 (0.95-45.83)	0.966
Median overall survival time (months)	28.28	30.67	30.19	24.08	0.237
Overall survival rate					0.408
1-year survival rate	57%	55%	66%	50%	
3-year survival rate	24%	41%	21%	4%	
5-year survival rate	13%	15%	21%	0	
Median overall disease-free survival time (months)	24.92	34.13	21.63	24.95	0.754
Overall disease-free survival rate					0.702
1-year disease-free survival rate	51%	60%	40%	52%	
3-year disease-free survival rate	28%	41%	26%	7%	
5-year disease-free survival rate	24%	41%	18%	0%	

of the surgical approach for resection of GEJ carcinoma should be tailored for achieving macroscopic and microscopic tumor resection with lymphadenectomy [1,26,27]. The surgical approaches for achieving R0 resection for GEJ carcinoma differs widely from esophagectomy transthoracic or transhiatal to total gastrectomy with transhiatal resection [1–3,19–22]. Many studies reported that the surgical approach should be based on obtaining at least 6 cm safety margin to avoid residual tumor [1,23–26].

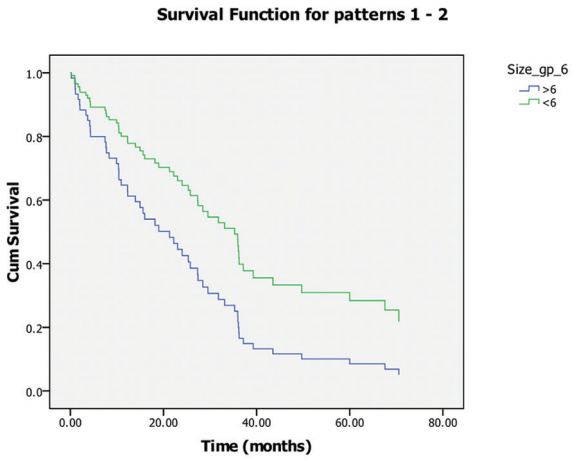
In the present study, the majority of patients with type III carcinomas underwent total gastrectomy with distal esophagectomy using an abdominal approach. Thoracotomy was required in 74.3% of type I patients but only in 28.1% of type II patients and 13% of

Table 6 Univariate and multivariate predictors of overall survival

Variables	No	Univariate analysis *P* value (HR (95% CI))	Multivariate analysis *P* value (HR (95% CI))
Age			
<60	72	0.715 (1.13 (0.59-2.14))	
>60	18		
Sex			
Male	62	0.534 (1.20 (0.67-2.14))	
Female	28		
Siewert type			
Type I or II	67	0.094 (1.63 (0.92-2.90))	
Type III	23		
Histologic grade			
G1, G2	76	0.153 (1.60 (0.84-3.05))	
G3, G4	14		
Venous invasion			
Negative	85	0.687 (1.27 (0.39-4.11))	
Positive	15		
Perineural invasion			
Negative	79	0.699 (1.18 (0.50-2.78))	
Positive	11		
T stage			
T1, T2	47	0.067 (1.65 (0.97-2.81))	
T3, T4	43		
Cut margin			
Negative	70	0.031 (1.98 (1.06-3.67))	0.171 (1.58 (0.82-3.02))
Positive	20		
Tumor size (cm)			
<6	58	0.014 (1.96 (1.14-3.35))	0.019 (1.93 (1.11-3.33))
>6	32		
N stage			
+ LN	62	0.002 (2.68 (1.42-5.07))	0.009 (2.40 (1.24-4.63))
– LN	28		
Borrmann			
II	16	0.021 (2.07 (1.11-3.85))	0.019 (2.12 (1.33-3.99))
I, III, and IV	74		

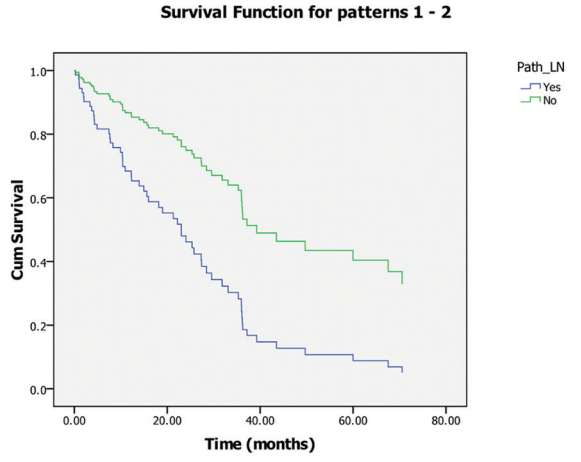
CI, confidence interval; HR, hazard ratio.

Figure 3



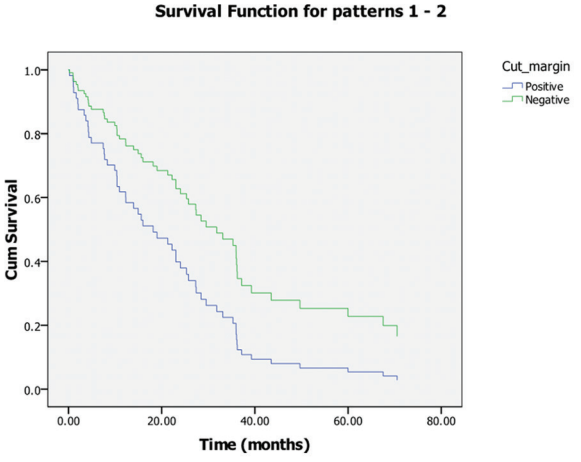
Actuarial survival (Kaplan–Meier analysis) after resection of esophagogastric cancer (EGC): influence of tumor size.

Figure 4



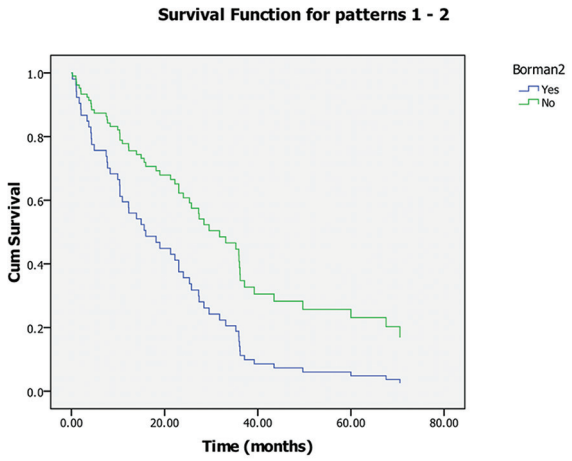
Actuarial survival (Kaplan–Meier analysis) after resection of esophagogastric cancer (EGC): influence of LN status.

Figure 5



Actuarial survival (Kaplan–Meier analysis) after resection of esophagogastric cancer (EGC): influence of safety margin.

Figure 6



Actuarial survival (Kaplan-Meier analysis) after resection of esophagogastric cancer (EGC): influence of the presence of Borrmann II.

type III patients. In recent years, total gastrectomy has emerged as the standard procedure to treat type III EGCs [19]. Abdominal total gastrectomy is frequently performed for GEJ carcinoma in east country, whereas thoracoabdominal approach is frequently performed in the west [11–15,19].

Hasegawa *et al* [11]. reported that postoperative morbidities were reported in 40% of type I cases, but only in 21.9% of type II cases and 8.3% of type III cases. In our study, at least one postoperative complication was observed in 37.1% of patients with type I, 34.4% of patients with type II, and 17.4% of patients with type III. The differences in surgical approaches may be the cause of these differences.

In our study, the tumor differentiation was more in type II tumors than in type III tumors. Siewert *et al*.[7] found that the difference of differentiation among subtypes is present. Hasegawa *et al* [11]. reported that the grade of differentiation was poor in type III tumors than in type II tumors. Zhang *et al* [19]. reported that type III tumors were more larger, deeper, and aggressive compared with type II tumors, with a higher rate of lymph node metastases and are more difficult to diagnose early. Siewert type I tumors are usually associated with intestinal metaplasia and Barrett's esophagus and Siewert type III is subcardiac gastric carcinoma infiltrating EGJ and usually undifferentiated [1,26,27].

The lymphatic flow of any type of EGCs is directed toward the abdominal lymph node (pericardia, lesser curvature, greater curvature, para-aortic lymph node). Metastases to lower mediastinal lymph node commonly occurred in all types of EGCs, and so dissection of this area is necessary in all types of EGCs. Nodal metastases to upper and middle mediastinal from type II and type III is uncommon and so thoracotomy and mediastinal lymphadectomy are not required in both types [1,11–15,26,27]. In this study, lymph node metastases were more frequently noticed in type III tumors than in other types. Abdominal lymph node metastases were frequently affected in types II and III. Mediastinal lymph node metastases frequently occurred in types I and II. This could be explained by the difference in the number of cases that underwent thoracotomy [11–15,17]. Zhang and colleagues reported that 72.8% of patients had lymph node metastases and the frequency of lymph node metastases was higher in types II and III. The common nodal involvement were paracardiac (67.3%), lesser curvature (66.5%), greater curvature (12.9%), paraesophageal (2.9%), and left gastric (2.5%) [19].

Carcinoma of GEJ are biologically aggressive and usually diagnosed at late stage, and so the prognosis is bad even after curative resection. Overall survival time and disease-free survival time tended to be lower in type III tumor, although the difference was not statistically significant. This may be related to the nature of type III tumors, which include cardia cancer centered 2–5 cm below the EGJ that enlarges, and then infiltrates the EGJ. It may also be more difficult to diagnose early cancer around the cardia than in the distal esophagus by means of screening endoscopy [13]. Compared with type III cancer, type I or II cancers might be diagnosed earlier when the tumor is small, given the tumor's proximity to the esophageal junction and the earlier appearance of signs of obstruction [12]. This trend has been reported by other groups [12,13,25]. In contrast, Chung *et al* [1]. reported that type I has poorer prognosis. Fang *et al* [10]. reported similar survival rates between types II and III (59.6 vs. 63.5%). Indeed, the Siewert type remains an anatomic classification and should not be confused with a prognostic classification. It can be used in the preoperative assessment for the determination of the surgical approach [10].

We reported hospital death in 6.7% of cases. This rate is higher than the rate reported by Siewert and colleagues, which was 3.8%. This may attributed to preoperative nutritional status, liver condition, and age of presentation of our Egyptian patients. In present study, pulmonary and anastomotic leakage complications were more common in type I tumors. This may be related to thoracotomy, which was performed in most type I tumors.

Preoperative chemoradiotherapy (CRT) followed by surgery is the standard treatment for resectable EGCs in Western countries. The preoperative CRT increased R0 resection compared with surgery alone and improved 5-year overall survival (47% surgery with CRT vs. 34% surgery alone). In Eastern countries, postoperative adjuvant chemotherapy is the standard treatment for resectable EGCs as it improves 5-year overall survival (71.7% in the postoperative chemotherapy group vs. 61.1% in the surgery alone group) [1–5,23–25].

The present study has some limitations as it is a retrospective study and single center experiences. Although it was carried out in a referral specialized center, the number of patients still small. Our center is a referral specialized center for Delta area in Egypt (more than 6 governments). This study reveals experience of EGJ in Egypt in middle east.

Conclusion

The incidence of EGCs is increasing dramatically in Western countries but not in Eastern countries. The selection of the surgical approach for resection of GEJ carcinoma should be tailored for achieving macroscopic and microscopic tumor resection. The surgical approach should be based on obtaining at least 6 cm safety margin. In all, 1-, 3-, and 5-year disease-free survival rates for all patients were 51, 28, and 24%, respectively. Tumor size and lymph node metastasis and presence of Borrmann macroscopic appearance of type II tumors were significant and independent prognostic indicators for survival after curative resection for EGC. Overall survival time and disease-free survival time tended to be lower in type III tumor.

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Conflicts of interest

There are no conflicts of interest.

References

1 Chung JW, Lee GH, Choi KS, Kim DH, Jung KW, Song HJ, *et al.* Unchanging trend of esophagogastric junction adenocarcinoma in Korea: experience at a single institution based on Siewert's classification. Dis Esophagus 2009; 22 (8):676–681.

2 Blot WJ, Devesa SS, Kneller RW, Fraumeni JF Jr. Rising incidence of adenocarcinoma of the esophagus and gastric cardia. JAMA 1991; 265 (10):1287–1289.

3 Devesa SS, Blot WJ, Fraumeni JF Jr. Changing patterns in the incidence of esophageal and gastric carcinoma in the United States. Cancer 1998;83 (10):2049–2053.

4 Okabayashi T, Gotoda T, Kondo H, Inui T, Ono H, Saito D, *et al.* Early carcinoma of the gastric cardia in Japan: is it difference from that in the West? Cancer 2000; 89:2555–2559.

5 Hasegawa S, Yoshikawa T. Adenocarcinoma of the esophagogastric junction: incidence, characteristics, and treatment strategies. Gastric Cancer 2010;13 (2):63–73.

6 Siewert JR, Stein HJ. Carcinoma of the cardia: carcinoma of the gastroesophageal junction–classification, pathology and extent of resection. Dis Esophagus 1996;9:173–182.

7 Siewert JR, Feith M, Stein HJ. Biologic and clinical variations of adenocarcinoma at the esophago-gastric junction: relevance of a topographic-anatomic subclassification. J Surg Oncol 2005;90 (3):139–146. Discussion 146.

8 JR Siewert, HJ Stein. Classification of adenocarcinoma of the oesophagogastric junction. Br J Surg 1998;85:1457–1459.

9 Von Rahden BH, Stein HJ, Siewert JR. Surgical management of esophagogastric junction tumors. World J Gastroenterol 2006;12 (41):6608–6613.

10 Fang WL, Wu CW, Chen JH, Lo SS, Hsieh MC, Shen KH, *et al.* Esophagogastric junction adenocarcinoma according to Siewert classification in Taiwan. Ann Surg Oncol 2009;16 (12):3237–3244.

11 Hasegawa S, Yoshikawa T, Cho H, Tsuburaya A, Kobayashi O. Is adenocarcinoma of the esophagogastric junction difference between Japan and Western countries? The incidence and clinicopathological features at a Japanese high-volume cancer center. World J Surg 2009;33:95–103.

12 Rüdiger Siewert J, Feith M, Werner M, Stein HJ. Adenocarcinoma of the esophagogastric junction: results of surgical therapy based on anatomical/topographic classification in 1,002 consecutive patients. Ann Surg 2000;232 (3):353–361.

13 Hosokawa Y, Kinoshita T, Konishi M, Takahashi S, Gotohda N, Kato Y, *et al.* Clinicopathological features and prognostic factors of adenocarcinoma of the esophagogastric junction according to Siewert classification: experiences at a single institution in Japan. Ann Surg Oncol 2012;19 (2):677–683.

14 Kodera Y, Yamamura Y, Shimizu Y, Torii A, Hirai T, Yasui K, *et al.* Adenocarcinoma of the gastroesophageal junction in Japan: relevance of Siewert's classification applied to 177 cases resected at a single institution. J Am Coll Surg 1999;189 (6):594–601.

15 Yuasa N, Miyake H, Yamada T, Ebata T, Nimura Y, Hattori T. Clinicopathologic comparison of Siewert type II and III adenocarcinomas of the gastroesophageal junction. World J Surg 2006;30 (3):364–371.

16 Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg 2004;240 (2):205–213.

17 American Joint Committee on Cancer. *AJCC cancer staging manual*. 7th ed. New York: Springer-Verlag; 2009.

18 Borrmann R. Tumors of the stomach and duodenum. In: Henke F, Lubarsh O, eds. Handbook of Special Pathology Anatomy and histology. Berlin: Springer; 1926. vol. 4, p. 865.

19 Zhang H, Wang W, Cheng Y, Song Y, Zhu K, Dang C. Adenocarcinomas of the esophagogastric junction: experiences at a single institution in China. World J Surg Oncol 2013; 11:155.

20 Kubo A, Corley DA. Body mass index and adenocarcinomas of the esophagus or gastric cardia: a systematic review and meta-analysis. Cancer Epidemiol Biomarkers Prev 2006; 15:872–878.

21 Chow WH, Blot WJ, Vaughan TL, Risch HA, Gammon MD, Stanford JL, *et al.* Body mass index and risk of adenocarcinomas of the esophagus and gastric cardia. J Natl Cancer Inst 1998;90 (2):150–155.

22 Chow WH, Blaser MJ, Blot WJ, Gammon MD, Vaughan TL, Risch HA, *et al.* An inverse relation between cagA + strains of *Helicobacter pylori* infection and risk of esophageal and gastric cardia adenocarcinoma. Cancer Res 1998; 58 (4):588-590.

23 *Helicobacter pylori* in developing countries. World Gastroenterology Organisation Global Guidelines (2010).

24 Salazar-Martinez E, Allen B, Fernandez-Ortega C, Torres-Mejia G, Galal O, Lazcano-Ponce E. Overweight and obesity status among adolescents from Mexico and Egypt. Arch Med Res 2006;37 (4):535–542.

25 Siewert JR, Stein HJ, Feith M. Adenocarcinoma of the esophago-gastric junction. Scand J Surg 2006;95 (4):260–269.

26 Ito H, Clancy TE, Osteen RT, Swanson RS, Bueno R, Sugarbaker DJ, *et al.* Adenocarcinoma of the gastric cardia: what is the optimal surgical approach? J Am Coll Surg 2004;199 (6):880–886.

27 Kim KT, Jeong O, Jung MR, Ryu SY, Park YK. Outcomes of abdominal total gastrectomy for type II and III gastroesophageal junction tumors: single center's experience in Korea. J Gastric Cancer 2012; 12 (1): 36–42.

Open preperitoneal mesh repair versus laparoscopic transabdominal preperitoneal repair of groin hernia under spinal anesthesia: results of a prospective randomized multicenter trial

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Background
It is difficult to decide on which is the best surgical procedure for groin hernia repair. Several studies have compared laparoscopic groin herniorrhaphy with open Lichtenstein repair. The Lichtenstein procedure is premuscular but laparoscopic repair is preperitoneal. This prospective study compared open preperitoneal modified Kugel procedure with transabdominal preperitoneal (TAPP) laparoscopic repair under spinal anesthesia.

Patients and methods
A total of 200 patients scheduled for unilateral inguinal hernia repair were randomly divided into two groups to undergo either laparoscopic TAPP (group A) or open modified Kugel procedure (group B) under spinal anesthesia in our hospitals (three hospitals) between September 2010 and September 2012. Recurrence was the outcome measure in our comparison, and short-term and long-term complications were also assessed.

Results
There was no significant difference between the two groups in terms of their demographic data. Operative time was significantly shorter in the TAPP group than in the open group (37.8 ± 18.4 vs. 64.1 ± 20.1 min; $P < 0.001$). There was significant difference between the two groups in terms of postoperative pain, hospital stay, and recovery with return to work ($P < 0.001$), but no significant difference in terms of intraoperative complications ($P = 0.54$), short-term postoperative complications ($P = 0.72$), wound infection ($P = 1.0$), and urine retention ($P = 0.62$). During the follow-up period of 32 months (range = 22–50 months), there were no cases of mortality and no significant difference in terms of recurrence ($P = 1.0$). Chronic pain and dysesthesia were significantly higher in the open group ($P = 0.03$ and 0.02, respectively).

Conclusion
Both open and laparoscopic preperitoneal groin hernia repair under spinal anesthesia are effective and safe with low recurrence rates. The laparoscopic approach is better in terms of operative time, return to normal activity, and chronic pain.

Keywords:
groin hernia, modified Kugel, preperitoneal repair, transabdominal preperitoneal

Egyptian J Surgery 35:132–139

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Introduction

Groin hernia repair is one of the most common surgical procedures [1]. It remains challenging for the surgeons because of its short-term and long-term complications and the fear of recurrence [2]. Several operative techniques have been described. The traditional techniques are tissue-based repair or tension-free repair using an open approach. In recent times, the laparoscopic repair of inguinal hernia has been described using either a totally extraperitoneal or a transabdominal preperitoneal (TAPP) approach [3,4]. Several studies have established tension-free mesh repair as the gold standard in open inguinal hernia repair [5]. Other studies have shown laparoscopic repair to be safe and efficient. It offers the patient the advantages of minimally invasive surgery and the associated recurrence rate does not differ from that of the classic open tension-free mesh technique. It can be used as a first-line option even for repair of unilateral primary inguinal hernias [6–8]. Many randomized, controlled trials have been conducted to compare open and laparoscopic procedures. Lichtenstein herniorrhaphy, the open procedure used in most trials, applies a mesh on the premuscular layer and not in the preperitoneal space, unlike the totally extraperitoneal or TAPP laparoscopic technique. This difference in mesh location caused some discrepancies in the comparison between the two approaches, as a result of which the results may not give an exact distinction between the two [9–11].

Kugel developed a preperitoneal tension-free technique combining the utility of the open operation technique with the advantages of minimal access procedures (smaller incision, preperitoneal mesh placement, avoidance of neuropathic pain) [12,13]. Transinguinal preperitoneal (TIPP) repair using a modified Kugel (MK) patch is a classic open anterior preperitoneal technique for tension-free herniorrhaphy, performed through the preperitoneal space by means of the internal ring for indirect hernias or Hesselbach's triangle for direct and femoral hernias [1,14].

Traditionally, general anesthesia is required to perform laparoscopic hernia repair and laparoscopic surgery in general. However, studies have evaluated the efficacy of spinal anesthesia for hernia repair laparoscopically [6,15].

The layer where the mesh is placed in the preperitoneal space and the regions covered by the mesh in the MK procedure are completely identical to those in the TAPP laparoscopic techniques. The only difference is their approach, open versus laparoscopic. Therefore, we undertook this prospective randomized multicenter study to compare the outcomes of the open MK and laparoscopic TAPP procedures performed under spinal anesthesia taking into consideration immediate postoperative pain during the first 24 h, short-term complications such as urinary retention, seroma, hematoma, and infection, and long-term complications such as recurrence and chronic pain.

Patients and methods

Patients

Between September 2010 and September 2012, we conducted this regional prospective randomized study in three hospitals, after obtaining approval from the local ethics committee and informed consent before the operation from the patients. Adult patients admitted for inguinal hernia repair were included in the study. The inclusion criteria were (a) having a unilateral hernia and (b) being of American Society of Anesthesiologists (ASA) grade I, II or III. Exclusion criteria were (a) having bilateral or recurrent hernia or (b) irreducible or strangulated hernia, (c) being of ASA grade IV or V, (d) receiving anticoagulants as treatment, and (e) having a past history of lower abdominal operation. In all, 200 patients were randomly divided into two equal groups: group A underwent laparoscopic TAPP polypropylene mesh repair and group B underwent open MK preperitoneal mesh repair. A computer-generated randomized sequence allocated patients into either group. A single dose of first-generation cephalosporin was given at the time of anesthesia induction. All patients underwent hernia repair by surgeons who performed at least 20 open or laparoscopic repairs [16].

Anesthetic techniques

We used spinal anesthesia in both groups to eliminate the effect of type of anesthesia on the outcome of surgery. Patients were placed in the right lateral decubitus position and a 25-G spinal needle was introduced under complete aseptic technique into the subarachnoid space at the L2-L3 intervertebral space; thereafter, 3 ml of hyperbaric bupivacaine 0.5%, 0.25 mg of morphine, and 20 μg of fentanyl were injected intrathecally. Patients were monitored well and any intraoperative incidents related to the anesthesia or pneumopertioneum, such as changes in cardiopulmonary functions and hemodynamic status, shoulder pain, and nausea, were recorded and patients were informed to ask for conversion of anesthesia at any stage of the procedure.

Laparoscopic procedure (transabdominal preperitoneal)

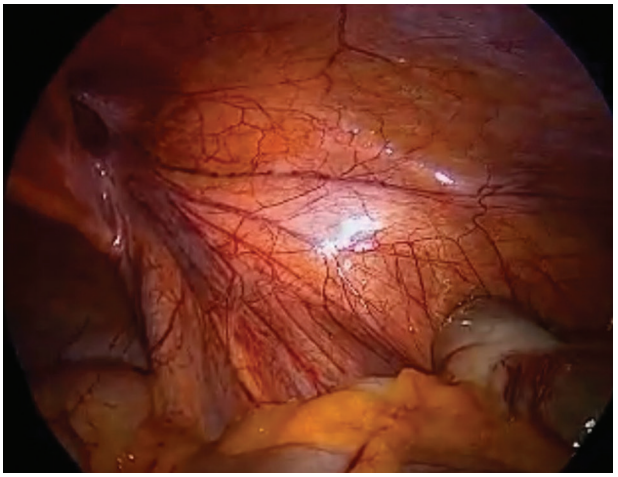
The procedure was performed as previously described [17]. All patients were placed in the supine position in Trendelenburg position (10–20°) to move the bowel away from the operative field, with both arms tucked against their sides. A Veress needle through supraumbilical incision is used to create pneumoperitoneum up to 15 mmHg. A 10-mm port was inserted through the supraumbilical incision and the abdominal cavity was examined. Two 5-mm ports were placed as working ports, one on each side at the level of the umbilicus in the midclavicular line.

The hernia was inspected and its type confirmed and any contralateral asymptomatic hernia sac was identified and dealt with. The contents of the inguinal hernia were reduced whenever present (Fig. 1).

Peritoneal flap was prepared from the level of the anterior superior iliac spine to the lateral umbilical ligament 2 cm above the internal ring (Fig. 2). Direct and small indirect hernia sacs were fully reduced. Larger indirect sacs were partially dissected and resected and its distal part left *in situ*. The anatomy now is clear (Cooper's ligament, inferior epigastric vessels and the spermatic cord). The iliac vessels are not dissected but their positions are clearly identified. The dissection is carried to the symphysis medially.

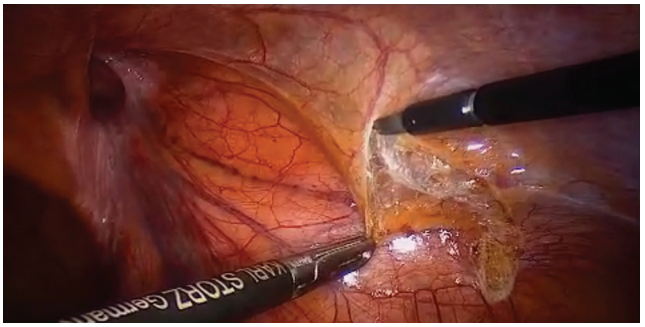
A polypropylene mesh of 15×12 cm was used for the repair. The mesh was introduced into the operating field through the 10-mm umbilical port after removing the telescope to cover the entire myopectineal orifice

Figure 1



Indirect inguinal hernia.

Figure 2



Incision of the peritoneum and creation of preperitoneal space.

and was fixed to Cooper's ligament and the anterior abdominal wall with tacks (Fig. 3). The medial border of the mesh is adjacent to the symphysis pubis and the upper part is placed at least 2–3 cm over the hernia defect and internal ring. The peritoneum is then reapproximated with the tacks (Fig. 4). The carbon dioxide gas was evacuated to empty the abdominal cavity and scrotum. All trocars were removed; the 10-mm trocar site was closed with vicryl sutures. Skin incisions were closed with simple sutures.

Open procedure (modified Kugel)

The open MK procedure was performed as described [14]. We started with a transverse skin crease incision 5–6 cm long, deepened to the external oblique aponeurosis, and delivery of the cord; indirect sacs were dissected from the cord (Fig. 5) up to the extraperitoneal fat and inverted into the deep ring after elevation of the inferior epigastric vessels anteromedial to create the preperitoneal space (Fig. 6). Gauze was inserted through the internal ring to keep the peritoneal sac inverted. The direct sac was isolated and the transversalis fascia around its neck was circumcised and the preperitoneal space reached directly. Dissection of the preperitoneal space can be done with Gauze swabs (Fig. 7). We continued dissection to the pubic tubercle medially, the iliac vessel laterally, and Cooper's ligament caudally.

We used an MK hernia patch (monofilament knitted polypropylene mesh 13.0 × 9.5 or 12.0 × 8.0 cm in size, which comprised a double layer containing a pocket, strap, and memory recoil ring), which was inserted into the preperitoneal space (Fig. 8) covering the entire groin area including indirect, direct, and femoral orifices. Once the patch was in place, its position was checked by inserting the index finger into the preperitoneal space between the inguinal ligament and mesh with boundaries of mesh covering Cooper's ligament caudally, iliac vessels laterally, and the rectus abdominis medially. Straps of patch were fixed to the transversalis fascia with vicryl suture and the mesh was fixed in place with abdominal pressure. After closure of the external oblique and Scarpa's fascia with a running 3-0 vicryl suture, the skin incision was closed with a running subcuticular stitch.

Data collection

Type of hernia, duration of operation, visual analogue scale (VAS) at 24 h, length of hospital stay, intraoperative complications, short-term and long-term postoperative complications, and incidence of recurrence were recorded.

Patients were examined in the outpatient clinic 2 weeks, 1 month, 3 months, and 1 year postoperatively and then annually for complications or recurrence.

Statistical analysis

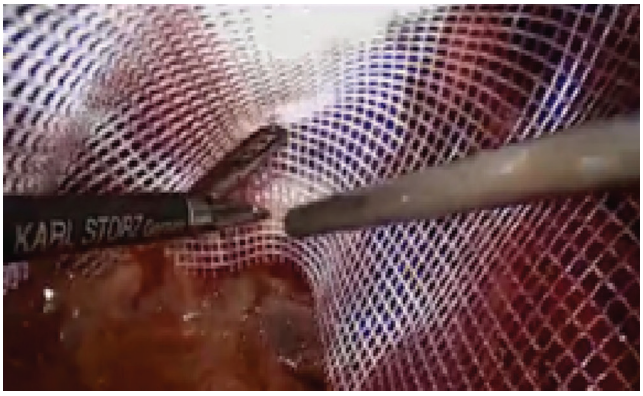
Continuous data were presented as mean±SD and compared using the Student *t*-test (two-tailed). Frequencies were compared using the Pearson χ^2-test and Fisher's exact test. Data analysis was performed using SPSS for windows version 13 (SPSS, Inc, Chicago, IL).

A *P* value less than 0.05 was considered statistically significant.

Results

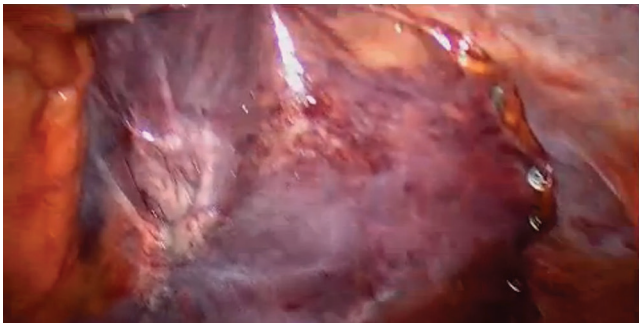
Between September 2010 and September 2012, 200 patients were included in this study and were divided into two groups: group A (100 patients) underwent laparoscopic TAPP repair and group B (100 patients) underwent the open MK procedure.

Figure 3



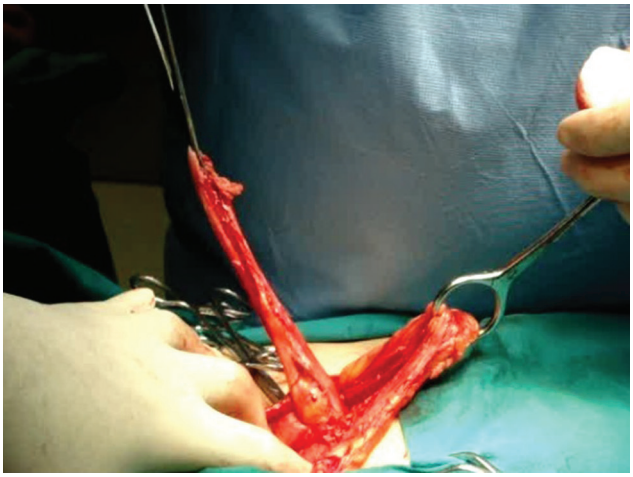
Mesh fixation by tucker.

Figure 4



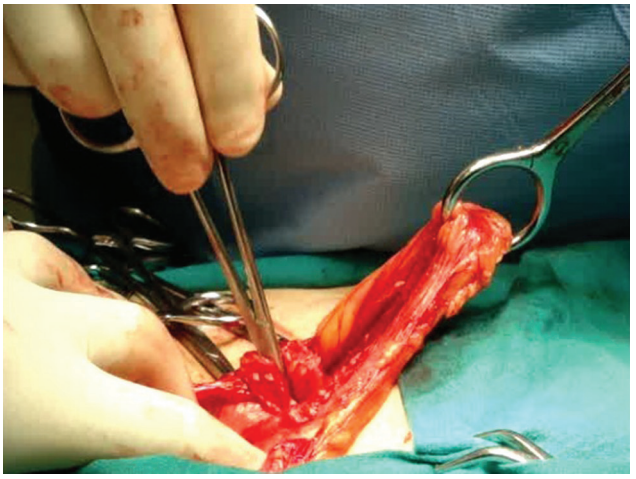
Peritoneum reapproximation.

Figure 5



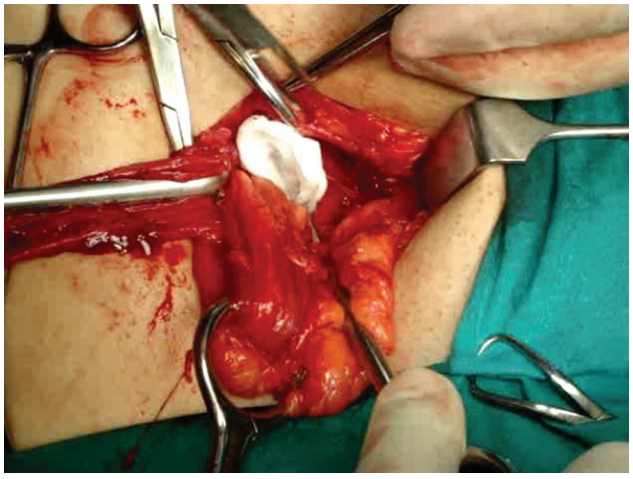
Indirect sac dissected.

Figure 6



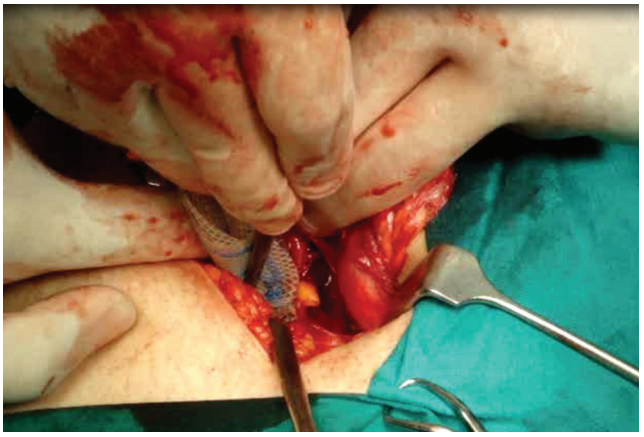
Sac inverted into deep ring.

Figure 7



Dissection of preperitoneal space using gauze.

Figure 8



Mesh inserted into preperitoneal space.

Table 1 shows the demographic data of the patients according to the treatment group. There were no significant differences between the two groups. Most of the patients were male; hernia was mostly on the right side and contralateral; clinically occult inguinal hernia was detected in 10 patients (10%) in the TAPP group and was managed at the same time; according to Nyhus classification indirect and direct types of hernia were the most common.

Intraoperative data and all postoperative complications during the follow-up period of 32 months (range = 22–50 months) were recorded. Follow-up

included a physical examination at the outpatient clinic 2 weeks, 3 months, and 1 year after surgery and then annually thereafter to detect the long-term postoperative complications.

Table 2 shows the operative data and short-term postoperative complications.

The operative time in the laparoscopic group was shorter than that in the open group (37.8 ± 18.4 for TAPP vs. 64.1 ± 20.1 for MK) and the difference was significant ($P < 0.001$).

Length of hospital stay was longer in the open group and the difference from the laparoscopic group was significant (1.4 ± 0.57 for TAPP vs. 1.7 ± 0.53 for MK; $P < 0.001$). In addition, the laparoscopic group had lower VAS scores and patients returned to work earlier than did the patients of the open group and the difference was significant ($P < 0.001$).

The overall complication rate of the laparoscopic group was lower than that of the open group (14 vs.18%) ($P = 0.028$) as both groups showed comparable results regarding intraoperative and short-term postoperative complication rates, as shown in Table 2, and the open group had a higher long-term complication rate, as shown in Table 3.

The most serious complication we faced during our study was inferior epigastric vessel injury, with two cases in the laparoscopic group and three cases in the open group, which was controlled intraoperatively by ligation of the artery using clips or ligature. Urinary bladder injury occurred in one patient in the laparoscopic group, which was a small tear discovered intraoperatively and repaired with sutures and Foley's catheter insertion for 1 week with antibiotic cover, and the patient was discharged without further treatment.

Early postoperative complications were minimal in both groups; seroma was the most common complication and occurred in patients with a large sac that was not dissected completely; all patients with seroma were treated conservatively with scrotal support. There was no significant difference between the two groups in terms of postoperative seroma.

No significant difference in the incidence of postoperative wound infection was observed between the two groups as we had two patients in each group with minimal postoperative wound infection, which was treated conservatively with dressing under antibiotic cover.

Intraoperative and short-term complications related to spinal anesthesia (the type of anesthesia we used in both groups) were minimal; only shoulder pain and/or discomfort occurred in 18 patients (18%) under the laparoscopic approach, which was managed with medications alone. Bradycardia, seen in 15 patients (15%), was the main drawback in the open group, which reversed easily with atropine.

Table 1 Demographic data of the patients in the two groups

	Group A (TAPP) (*n*=100)	Group B (MK) (*n*=100)	*P* value
Age (years)	38±12.9	41±9.1	0.45
Sex			
Male	93	94	0.77
Female	7	6	
Site of hernia			
Right	62	59	0.66
Left	38	41	
ASA			
I	46	50	0.84
II	36	33	
III	18	17	
Nyhus classification			
I	15	16	0.97
II	20	22	
IIIA	17	18	
IIIB	45	42	
IIIC	3	2	

ASA, American Society of Anesthesiologist; MK, modified Kugel; TAPP, transabdominal preperitoneal.

Table 2 Operative data and short-term post operative complications

	Group A (TAPP)	Group B (MK)	*P* value
Operative time (min)	37.8±18.4	64.1±20.1	<0.001*
VAS	1.1±1	3.39±1.1	<0.001*
Hospital stay (days)	1.4±0.57	1.7±0.53	<0.001*
Return to work (days)	13.9±5.1	16.8±4.4	<0.001*
Intraoperative complications (*n* (%))	3 (3)	3 (3)	
Vessel injury	2	3	0.54
Urinary bladder injury	1	0	
Short term postoperative complications (*n* (%))	5 (5)	8 (8)	0.72 (NA)
Seroma	5	6	
Hematoma	0	0	
Wound infection	2	2	1.0
Urine retention	35	31	0.62

ASA, American Society of Anesthesiologist; MK, modified Kugel; TAPP, transabdominal preperitoneal; VAS, Visual analogue scale.
*Significant value.

Table 3 Long-term postoperative complications

	Group A (TAPP) (*n* (%))	Group B (MK) (*n* (%))	*P* value
Recurrence rate	1 (1)	1 (1)	1
Chronic pain	1 (1)	7 (7)	0.03*
Port site hernia	1 (1)	NA	NA
Dysesthesia	5 (5)	15 (15)	0.02*
Mortality	0	0	NA

MK, modified Kugel; TAPP, transabdominal preperitoneal.
*Significant value.

Urinary retention is one of the most common short-term complications we faced in the immediate postoperative period (35 vs. 31% in the laparoscopic group and open group, respectively; $P = 0.62$) and manifested as lower abdominal pain. It was managed by hot fomentation to the lower abdomen and/or overnight urinary bladder catheterization.

Long-term postoperative complications are shown in Table 3. The overall recurrence rate in this study was 2% (one case in each group, 1%); all recurrences occurred within the first year postoperatively. One case of port site hernia was detected in the laparoscopic group and there was no mortality related to surgery in our study. There was significant difference between the two groups in term of postoperative dysesthesia and chronic pain (5% in the laparoscopic group vs. 15% in the open group for dysesthesia; and 1% in the laparoscopic group vs. 7% in the open group for chronic pain).

Discussion

Until a few decades ago, the standard method for inguinal hernia repair was suturing fascial structures around the hernia defect, until Lichtenstein *et al.* [18] introduced tension-free repair, which gained widespread recognition worldwide and surgeons mastered the technique rapidly.

Successful hernia treatment should offer high patient satisfaction, low cost, low recurrence rate, and rapid return to work [19]. Laparoscopic and open hernia repairs fulfill these criteria [20]. However, the question about the most appropriate technique still confuses the community of surgeons.

There are advantages and disadvantages to laparoscopic repair. Clinically silent contralateral hernia and other intra-abdominal pathologies are easier to detect with the TAPP approach [8,21]. The laparoscopic TAPP procedure carries some disadvantages such as possible organ injury at the time of trocar entry, port site hernia, and adhesions [22].

Despite excellent long-term outcome after TAPP repair, the use of laparoscopy in hernia repair is still limited [23].

Several studies have compared the laparoscopic and open techniques for inguinal hernia repair; some studies employed open techniques [24], and others adopted the laparoscopic approach [1,25].

Open preperitoneal tension-free repair started with Wantz, but because of its complicated steps and associated major injuries it is less frequently used [26,27]. MK is another open preperitoneal procedure, different from the original Kugel technique in its approach, in that MK adopts the anterior approach, which is familiar to surgeons [28].

Most of these studies compared laparoscopic and Lichtenstein tension-free techniques with different mesh locations, mesh types, and different types of anesthesia.

In our prospective study, we used two different techniques; both were tension free (laparoscopic TAPP and open transinguinal preperitoneal), with different approaches but with similar mesh location. The mesh was placed in the preperitoneal space between the peritoneum and the transversalis fascia, and secured over the myopectineal orifice using intra-abdominal pressure, covering the Hasselbach triangle, the internal inguinal ring, and treating the three most common types of groin hernia: indirect, direct, and femoral hernia.

What facilitated this study is the fact that the MK procedure is frequently used in our centers, which made it easy to compare between the laparoscopic and open approaches for preperitoneal inguinal hernia repair.

Although the most important outcome after repair of inguinal hernia is prevention of recurrence, other factors such as safety of the patients, quality of life, and cost efficiency are very important.

In our study, we found that both open and laparoscopic approaches are effective and safe for preperitoneal repair of inguinal hernia, with low complication and recurrence rates.

Recurrence was the main outcome measure in our study. Our results showed a low and similar recurrence rate in both approaches (1% in both), comparable to the results of Li *et al.* [1], and is within the range of reported recurrence rates after laparoscopic inguinal hernia repair (0–4%) [8,29] or open MK procedure (0–2%) [14].

Adequate dissection of the preperitoneal space with a large enough mesh with flattening and overlapping to cover the whole myopectineal orifice minimizes and avoids recurrence.

The duration of inguinal hernia repair with the TAPP technique has been reported to be between 30 and 65 min [22,30], and that with the MK procedure has been reported to be (30 to 55) min [14,31,32]. The operation time in our study was significantly shorter with the laparoscopic approach (37 ± 18.4 vs.

64.1 ± 20.1 with the open approach; $P < 0.001$). This could be attributed to the new MK technique being practiced in our centers, compared with TAPP.

One of the advantages of the laparoscopic approach over the open approach is less pain postoperatively [1]. In our work, VAS was significantly lower in the TAPP group than in the MK group, which could be attributed to the fact that groin dissection using the open anterior approach causes more trauma and possible injury to the peripheral nerves.

A seroma or hematoma developed in a total of 11% of cases, five patients in the laparoscopic group and six patients in the open group. All cases of seroma or hematoma improved through conservative methods. Our rates were similar to those reported in the literature [8,30].

There was one case of port site hernia in the TAPP group during the follow-up period of 32 months (range = 22–50 months), similar to the results of Oguz *et al.* [8] and those of Helgstrand *et al.* [33], which reported an incidence of port site hernia of between 0 and 3.9%.

There were no major complications in our study. There were only a few cases of inferior epigastric or bladder injury without significant difference between the two groups, which indicates the safety of both techniques.

According to our findings, other significant advantages of the TAPP procedure over MK repair were short hospital stay and earlier recovery. Meta-analysis of multiple randomized controlled trials of TAPP repair showed a return to normal activities 3 days earlier than open repair [34].

The method of anesthesia, in addition to the surgical technique, affects patient satisfaction. The recent use of regional anesthesia in laparoscopic hernia repair has proven its safety and efficacy [4,15,35]. In this study we tried to evaluate the effect of spinal anesthesia on the outcome of surgery, especially laparoscopic surgery; its use seems interesting as two minimally invasive procedures are used together in the same patient. In our series, regional anesthesia was efficient and there was no need for conversion to general anesthesia, nor were there anesthesia-related complications such as headache, blurring, or dizziness. The only drawback of spinal anesthesia is retention of urine, as we faced 35 cases in the TAPP group and 31 cases in the open group. Our results were comparable to the results of other studies using spinal anesthesia in laparoscopic hernia repair [4,6,15,36], but were better than the results of TAPP repair under general anesthesia [8,37]. The question is whether urinary retention is due to anesthesia approach, surgical procedure, or both. We thought it was a combination of both: effect of spinal anesthesia on bladder tone and dissection in the area of the bladder. Despite this most of our patients were satisfied with their operations.

Lastly, regarding chronic pain and dysesthesia, we found significant difference between the two groups (1 and 5% in the TAPP group vs. 7 and 15% in the open group) for chronic pain and dysesthesia, respectively, similar to other studies on the TAPP [4,6,8] and MK procedures [1,4]. In the TAPP procedure, chronic pain is considered to be a result of the compression of the nerves that pass the region and are compressed by the mesh or tacker. We tried to reduce the number of staples applied and avoid nerve injuries, which helps in reduction of postoperative pain. One of the causes of chronic pain in the MK procedure is the presence of the stiff outer ring. At 1-year follow-up, only one patient still had chronic pain.

The advantage of our study is that it is a prospective randomized trial, comparing inguinal hernia repair under the same type of anesthesia (spinal), the same mesh position (preperitoneal), and the same type of mesh (polypropylene).

The limitation of our study is the small number of patients and the relatively short period of follow-up.

Conclusion

A lot of surgical techniques are available for hernia repair, and the choice of best type of surgery depends on several factors. According to our prospective study, both open MK and laparoscopic TAPP preperitoneal repair techniques for inguinal hernia are safe and effective with low recurrence rates.

Laparoscopic approach has better outcome in terms of chronic pain, short operative time, and short duration of hospital stay.

Spinal anesthesia is a safe and effective procedure with no effect on the outcome of repair quality.

Further studies with large sample size and longer follow-up duration are needed to prove our results. Further prospective studies comparing laparoscopic hernia repair under spinal anesthesia and that under general anesthesia are also needed.

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Conflicts of interest

There are no conflicts of interest.

References

1 Li J, Wang X, Feng X, Gu Y, Tang R. Comparison of open and laparoscopic preperitoneal repair of groin hernia. Surg Endosc 2013; 27(12): 4702–4710.

2 Pokorny H, Klingler A, Schmid T, Fortelny R, Hollinsky C, Kawji R, *et al.* Recurrence and complications after laparoscopic versus open inguinal hernia repair: results of a prospective randomized multicenter trial. Hernia 2008; 12:385–389.

3 Hope WW, Bools L, Menon A, Scott CM III, Adams A, Hooks WB 3rd. Comparing laparoscopic and open inguinal hernia repair in octogenarians. Hernia 2013; 17(6): 719–722.

4 Symeonidis D, Baloyiannis I, Koukoulis G, Pratsas K, Georgopoulou S, Efthymiou M, Tzovaras G. Prospective non-randomized comparison of open versus laparoscopic transabdominal preperitoneal (TAPP) inguinal hernia repair under different anesthetic methods. Surg Today 2014; 44(5): 906–913.

5 Perko Z, Rakić M, Pogorelić Z, Družijanić N, Kraljević J. Laparoscopic transabdominal preperitoneal approach for inguinal hernia repair: a five-year experience at a single center. Surg Today 2011; 41(2): 216–221.

6 Tzovaras G, Symeonidis D, Koukoulis G, Baloyiannis I, Georgopoulou S, Pratsas C, Zacharoulis D. Long-term results after laparoscopic transabdominal preperitoneal (TAPP) inguinal hernia repair under spinal anesthesia. Hernia 2012; 16(6): 641–645.

7 Eklund AS, Montgomery AK, Rasmussen IC, Sandbue RP, Bergkvist LA, Rudberg CR. Low recurrence rate after laparoscopic (TEP) and open (Lichtenstein) inguinal hernia repair: a randomized, multicenter trial with 5-year follow-up. Ann Surg 2009; 249(1): 33–38.

8 Oguz H, karagulle E, Turk E, Moray G. Comparison of peritoneal closure techniques in laparoscopic transabdominal preperitoneal inguinal hernia repair: a prospective randomized study. Hernia 2015;:879–885.

9 Singh AN, Bansal VK, Misra MC, Kumar S, Rajeshwari S, Kumar A, *et al.* Testicular functions, chronic groin pain, and quality of life after laparoscopic and open mesh repair of inguinal hernia: a prospective randomized controlled trial. Surg Endosc 2012; 26(5): 1304–1317.

10 Swadia ND. Laparoscopic totally extra-peritoneal inguinal hernia repair: 9 year's experience. Hernia 2011; 15(3): 273–279.

11 Eklund A, Montgomery A, Bergkvist L, Rudberg C. Chronic pain 5 years after randomized comparison of laparoscopic and Lichtenstein inguinal hernia repair. Br J Surg 2010; 97(4): 600–608.

12 Kugel RD. Minimally invasive, non laparoscopic, preperitoneal, and sutureless, inguinal herniorrhaphy. Am J Surg 1999; 178:298–302.

13 Elwan AM, Abomera MA, Abo Al Makarem MA, Mohammedain AH. Laparoscopic transabdominal preperitoneal repair versus open preperitoneal mesh repair for inguinal hernia. J Arab Soc Med Res 2013; 8:38–42.

14 Li J, Zhang Y, Hu H, Tang W. Early experience of performing a modified Kugel hernia repair with local anesthesia. Surg Today 2008; 38(7): 603–608.

15 Zacharoulis D, Fafoulakis F, Baloyiannis I, Sioka E, Georgopoulou S, Pratsas C, *et al.* Laparoscopic transabdominal preperitoneal repair of inguinal hernia under spinal anesthesia: a pilot study. Am J Surg 2009; 198(3): 456–459.

16 Wright D, O'Dwyer PJ. The learning curve for laparoscopic hernia repair. Semin Laparosc Surg 1998; 5(4): 227–232.

17 Felix EL, Michas CA, Gonzalez MH Jr. Laparoscopic hernioplasty. TAPP vs TEP. Surg Endosc 1995; 9(9): 984–989.

18 Lichtenstein IL, Shulman AG, Amid PK, Montllor MM. The tension-free hernioplasty. Am J Surg 1989; 157(2): 188–193.

19 Bobo Z, Nan W, Qin Q, Tao W, Jianguo L, Xianli H. Meta-analysis of randomized controlled trials comparing Lichtenstein and totally extraperitoneal laparoscopic hernioplasty in treatment of inguinal hernias. J Surg Res 2014; 192(2): 409–420.

20 Pisanu A, Podda M, Saba A, Porceddu G, Uccheddu A. Meta-analysis and review of prospective randomized trials comparing laparoscopic and Lichtenstein techniques in recurrent inguinal hernia repair. Hernia 2015; 19(3): 355–366.

21 Bracale U, Melillo P, Pignata G, Di Salvo E, Rovani M, Merola G, Pecchia L. Which is the best laparoscopic approach for inguinal hernia repair: TEP or TAPP? A systematic review of the literature with a network meta-analysis. Surg Endosc 2012; 26(12): 3355–3366.

22 Antoniou SA, Antoniou GA, Bartsch DK, Fendrich V, Koch OO, Pointner R, Granderath FA. Transabdominal preperitoneal versus totally extraperitoneal repair of inguinal hernia: a meta-analysis of randomized studies. Am J Surg 2013; 206(2): 245–252.

23 Smink DS, Paquette IM, Finlayson SR. Utilization of laparoscopic and open inguinal hernia repair: a population-based analysis. J Laparoendosc Adv Surg Tech A 2009; 19(6): 745–748.

24 Neumayer L, Giobbie-Hurder A, Jonasson O, Fitzgibbons RJr, Dunlop D Gibbs J, *et al.* Open mesh versus laparoscopic mesh repair of inguinal hernia. N Engl J Med 2004; 350:1819–1827.

25 Hamza Y, Gabr E, Hammadi H, Khalil R. Four-arm randomized trial comparing laparoscopic and open hernia repairs. Int J Surg 2010; 8(1): 25–28.

26 Wantz GE. Giant prosthetic reinforcement of the visceral sac. Surg Gynecol Obstet 1989; 169(5): 408–417.

27 Matthews RD, Neumayer L, Matthews RD, Neumayer L, Matthews RD, Neumayer L. Inguinal hernia in the 21st century: an evidence-based review. Curr Probl Surg 2008; 45(4): 261–312.

28 Pélissier EP, Ngo P, Gayet B. Transinguinal preperitoneal patch (TIPP) under local anesthesia with sedation. Am Surg 2011; 77(12): 1681–1684.

29 Van den Heuvel B, Dwars BJ. Repeated laparoscopic treatment of recurrent inguinal hernias after previous posterior repair. Surg Endosc 2013; 27(3): 795–800.

30 Bansal VK, Misra MC, Babu D, Victor J, Kumar S, Sagar R, *et al.* A prospective, randomized comparison of long-term outcomes: chronic groin pain and quality of life following totally extraperitoneal (TEP) and transabdominal preperitoneal (TAPP) laparoscopic inguinal hernia repair. Surg Endosc 2013; 27(7): 2373–2382.

31 Van Nieuwenhove Y, Vansteenkiste F, Vierendeels T, Coenye K. Open, preperitoneal hernia repair with the Kugel patch: a prospective, multicentre study of 450 repairs. Hernia 2007; 11(1): 9–13.

32 Misawa T, Sakurai M, Kanai H, Matsushima M, Yamazaki Y, Yanaga K. Kugel herniorrhaphy: clinical results of 124 consecutive operations. Surg Today 2005; 35(8): 639–644.

33 Helgstrand F, Rosenberg J, Bisgaard T. Trocar site hernia after laparoscopic surgery: a qualitative systematic review. Hernia 2011; 15(2): 113–121.

34 Myers E, Browne KM, Kavanagh DO, Hurley M. Laparoscopic (TEP) versus Lichtenstein inguinal hernia repair: a comparison of quality-of-life outcomes. World J Surg 2010; 34(12): 3059–3064.

35 Sinha R, Gurwara AK, Gupta SC. Laparoscopic total extraperitoneal inguinal hernia repair under spinal anesthesia: a study of 480 patients. J Laparoendosc Adv Surg Tech A 2008; 18(5): 673–677.

36 Jensen P, Mikkelsen T, Kehlet H. Postherniorrhaphy urinary retention – effect of local, regional, and general anesthesia: a review. Reg Anesth Pain Med 2002; 27(6): 612–617.

37 Ross SW, Oommen B, Kim M, Walters AL, Augenstein VA, Heniford BT. Tacks, staples, or suture: method of peritoneal closure in laparoscopic transabdominal preperitoneal inguinal hernia repair effects early quality of life. Surg Endosc 2015; 29(7): 1686–1693.

The outcomes of elective versus emergency inguinal hernia repair in cirrhotic patients

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Background
Cirrhotic patients with ascites and Child classification B or C impose certain limitations on decision making as regards the elective repair of their inguinal hernias. The aim of this study was to evaluate and compare the outcomes of inguinal hernia repair in cirrhotic patients undergoing elective intervention and in those undergoing emergency interventions.

Methods
Fifty-six cirrhotic patients (Child B or C) undergoing inguinal hernia repair were evaluated. They were classified into two groups based on the type of intervention, elective and emergency surgical intervention (28 patients in each group). Patients were followed up for 12 months after surgery. Operative and postoperative outcomes and quality of life of these patients were recorded and analyzed.

Results
A total of eight (28.5%) patients died within 30 days after emergency hernia repair. One mortality was recorded in the first 30 days postoperatively in the elective group. Moreover, patients who underwent emergency patients presented with a significantly higher number of perioperative class III–V complications according to the Clavien–Dindo classification (60% in the emergency group vs. 7% in the elective group).

Conclusion
Elective inguinal hernia repair for cirrhotic patients with ascites is a relatively safe procedure. The improvement in quality of life represents a clear indication for elective hernia repair.

Keywords:
ascites, cirrhosis, elective, emergency repair, inguinal hernia

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Introduction

Liver cirrhosis (LC) is a major determinant of postoperative morbidity and mortality, and the presence of ascites is associated with poor surgical outcome due to an increased risk for infection and renal failure. Patients with LC and ascites exhibit peritoneal distension and frequently develop herniation of the weakest structures in the abdominal wall [1].

The incidence of abdominal wall hernias in cirrhotic patients is as high as 20%; in cases of major ascites, this number may increase up to 40% [2,3]. Several factors such as increased abdominal tension due to the presence of tense ascites, malnutrition, and worsening muscle wasting are major risk factors for the development of abdominal hernias in these patients [4]. Moreover, because of the presence of increased surgical risk factors in cirrhotic patients, high perioperative morbidity and mortality are often encountered [5].

It is commonly accepted that surgical correction of inguinal hernias in cirrhotic patients should not be performed electively. The more conservative 'wait-and-see' policy is frequently advocated because of high perioperative morbidity and mortality rates [6].

Conservative management of inguinal hernias in cirrhotic patients is not without risks. Incarceration, obstruction, strangulation, and rupture are all prone to occur. Some studies have shown risks of elective surgery in cirrhotic patients are not prohibitive even in the presence of refractory ascites, under the condition that such procedures are performed in a highly experienced liver center [7]. The model for end-stage liver disease (MELD) has been validated as a prediction tool for postoperative mortality, but its role in predicting morbidity has not been well studied. We sought to determine the role of MELD, among other factors, in predicting morbidity and mortality in patients with nonmalignant ascites undergoing hernia repair [8].

The objectives of our study were to evaluate the outcomes of hernia repair in cirrhotic patients, especially as regards the quality of life (QOL),

postoperative complications, and morbidity in elective and emergency repair during a period of 12 months of follow-up for each patient.

Methods

This prospective study was conducted on patients with documented cirrhosis Child B or C who underwent inguinal hernia repair at the Department of General Surgery, Menoufia University Hospital, and other private hospitals between May 2010 and October 2014. The study was approved by the ethical committee, and informed consent was obtained from each patient.

Patients with LC and ascites, those suffering from inguinal hernia, and those with Child classification B or C were included in the study. The presentation of inguinal hernia is either elective or emergency (e.g. irreducibility, obstruction, etc.). We excluded from this study patients with concomitant severe morbidity in other systems (e.g. pneumonia, heart failure, etc.). Patients received prophylactic broad spectrum antibiotic cefotaxime 1 g just preoperatively and it was continued for 1 week postoperatively, and ciprofloxacin 500 mg twice daily, metronidazole 500 mg was administered three times per day, together with analgesia (tramadol hydrochloride 50 mg twice daily and paracetamol 500 mg three times daily). Patients were advised to follow-up in the outpatient clinic every week for 1 month, and then monthly for 1 year. Patients were advised to avoid carrying heavy objects for 1 year postoperatively and to follow-up with the hepatologyst for at least 3 months postoperatively.

The outcome criteria evaluated were as follows: length of intensive care and hospital stays, morbidity, 30-day mortality rates, and MELD criteria at 12 months of follow-up.

Morbidity was classified according to the Clavien–Dindo classification (Table 1) [9] and class III–V events were considered to be major complications. Hernia recurrence was recorded during the follow-up period, which was diagnosed by means of physical examination, and in equivocal cases ultrasound and/or computed tomographic scan were used to confirm the diagnosis.

Liver disease severity was documented using the Child–Turcotte–Pugh (CTP) classification and MELD score [10].

MELD uses the patient's values for serum bilirubin, serum creatinine, and the international normalized ratio (INR) for prothrombin time to predict survival. It is calculated according to the following formula:

Table 1 The Clavien–Dindo classification

Full scale	
Grades	Definition
Grade I	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic, and radiological interventions
	Allowed therapeutic regimens are drugs such as antiemetics, antipyretics, analgesics, diuretics and electrolytes, and physiotherapy
	This grade also includes wound infections opened at the bedside
Grade II	Cases requiring pharmacological treatment with drugs other than that allowed for grade I complications. Blood transfusions and total parenteral nutrition are also included
Grade III	Cases requiring surgical, endoscopic, or radiological intervention
Grade III-a	Intervention not under general anesthesia
Grade III-b	intervention under general anesthesia
Grade IV	Life-threatening complication (including CNS complications) requiring IC/ICU-management
Grade IV-a	Single organ dysfunction (including dialysis)
Grade IV-b	Multiorgan dysfunction
Grade V	Death of a patient
Suffix 'd'	If the patient suffers from a complication at the time of discharge, the suffix 'd' (for 'disability') is added to the respective grade of complication. This label indicates the need for a follow-up to fully evaluate the complication

CNS, central nervous system.

$$\begin{aligned}\text{MELD} = {} & 3.78\times\ln\left[\text{serum bilirubin}\left(\text{mg}/\text{dl}\right)\right]+\\ & 11.2\times\ln\left[\text{INR}\right]+9.57\times\ln\\ & \left[\text{serum creatinine}\left(\text{mg}/\text{dl}\right)\right]\\ & +6.43\times\text{aetiology}\\ & \left(0:\text{cholestatic or alcoholic},1:\text{otherwise}\right)\end{aligned}$$

In interpreting the MELD score in hospitalized patients, the 3-month mortality is determined as follows:

(1) 40 or more, 71.3% mortality
(2) 30–39, 52.6% mortality
(3) 20–29, 19.6% mortality
(4) 10–19, 6.0% mortality
(5) <9, 1.9% mortality.

The surgical technique

Inguinal hernia repairs were performed with primary musculofascial closure and completed with the use of an on-lay prosthetic material (Prolene mesh) in elective cases after sac invagination in an intact pattern whenever possible, to avoid any loss of ascitic fluid during or after the procedure or transfixion and excision of the sac after reduction of the contents. An emergency procedure was defined as a surgical hernia repair that occurred up to 12 h after the diagnosis of ascites leakage due to ruptured hernia, irreducibility

or incarceration with refractory pain, obstruction, and strangulation. Both general and local anesthesia was used in this study. Local anesthesia in the form of ilioinguial/iliohypogastric nerve block anesthesia were used in patients whenever general anesthesia is risky or life threatening (e.g. American Society of Anesthesiologists III and IV patients). Spinal anesthesia was used in few number of cases and was avoided in patients with prolonged prothrombin time to avoid hematoma in the spinal canal.

In suspected incarcerated emergency cases, we were obliged to open the sac to check for the viability of the contents with good care to minimize ascitic fluid loss from the hernia site; however, in elective cases, we attempted complete invagination without opening the sac (Figs 1–3). If an advert opening of the sac occurred, patient position was temporarily adjusted to Trendlenburg position, tilting the table to the contralateral side of the hernia to avoid ascitic fluid loss from the torn sac. Thereafter, the contents were reduced, the sac was rolled, followed by transfixion ligation at the neck, and then the sac was excised. Patients were observed by a hepatologist at least once daily until hospital discharge.

Results

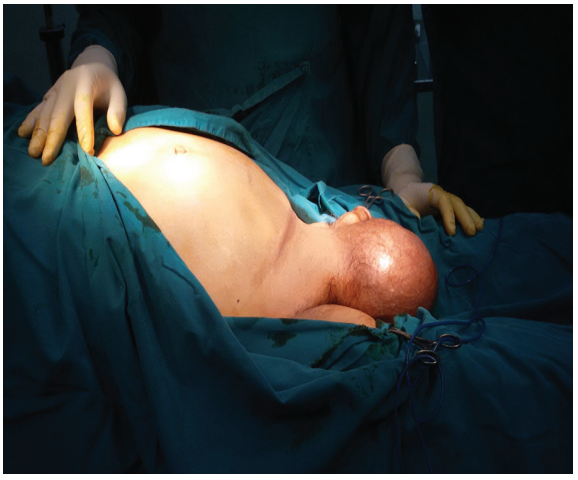
A total of 56 patients were included in the study. In terms of hernia repair urgency, 28 repairs were performed electively (group 1) and 28 repairs were considered emergency procedures (group 2).

All patients had a minimal follow-up of 12 months after surgery. The mean follow-up for patients included in this study either in the surgical outpatient clinic or the hepatology outpatient clinic was 13 ± 2.3 months (range 1–28 months).

Surgery was performed as an emergency because of irreducibility (n = 16), incarceration (n = 6) and obstruction of intestine (n = 3), and strangulation (n = 3). A polypropylene mesh was used in all elective cases and in irreducible cases of the emergency group.

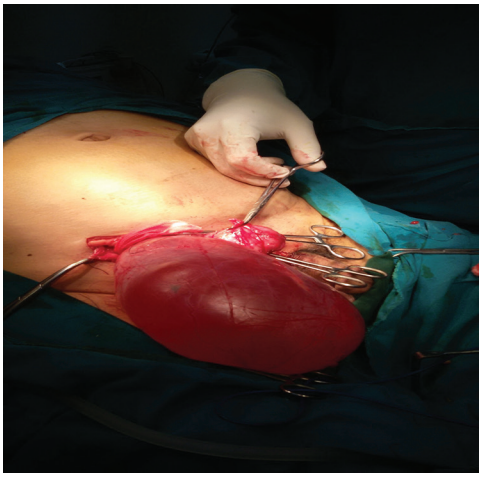
A total of eight (28.5%) patients died within 30 days after emergency surgical repair of their hernia. Unfortunately, CTP class A patients were not encountered in our study, despite it not being an exclusion criteria in the study. Seven (25%) patients died in the emergency group, and one patient (3.5%) died after elective repair; all of them were CTP class C patients. Six patients had local complications, including leaking ascites and wound infection. In contrast to

Figure 1



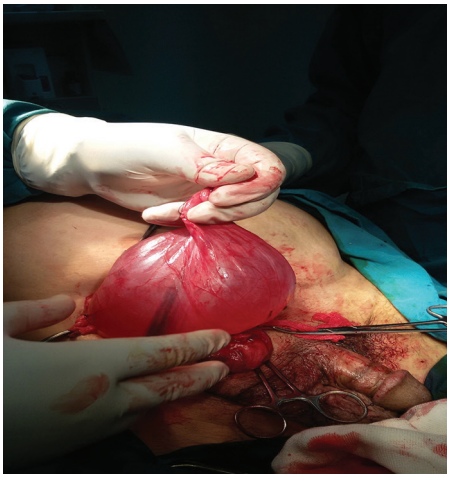
Hepatic cirrhotic patient with inguinal hernia.

Figure 2



Inguinal hernia sac containing ascitic fluid.

Figure 3



Attempts of sac invagination without its opening.

the emergency surgery group, only one mortality was recorded in the first 30 days postoperatively in the elective group.

Emergency patients also presented with a markedly higher number of perioperative class III–V complications according to the Clavien–Dindo classification (60% in the emergency group vs. 7% in the elective group).

Postoperative complications

Complications occurred in 19 (68%) patients of the emergency intervention group and in four cases (14%) of the elective group. Notably, the complication rate for the emergency group was significantly higher than that for the elective group ($P < 0.001$).

Postoperative mortality

Despite careful management in the hepatology ICU, seven patients of CTP class C and one patient of CTP class B died in the postoperative period in the emergency group. However, in the elective group, only one patient died. These patients were more affected by progression of the underlying decompensated liver disease in addition to the comorbidity added by emergency operation in unfit patient. There was a high statistically significant difference between the two groups in mortality ($P < 0.001$).

Quality of life

The SF-36 questionnaire [11] was administered the day before and 12 months after surgery. Global analyses of the eight domains of SF-36 were performed. On analysis of these results, it was clearly evident that QOL was improved in the elective group than in the emergency group.

Discussion

The number of patients with cirrhosis who require surgery is on the rise. At the same time, the types of medications and treatments aimed at increasing survival among patients with cirrhosis have been increasing. Therefore, it can be expected that a growing number of patients with liver disease, both known and as yet undiagnosed and asymptomatic, will undergo surgical intervention. In contrast to umbilical hernia [12], the incidence of inguinal hernia is not markedly influenced by ascites, and, in fact, severe complications of inguinal hernia, such as strangulation, are uncommon in cirrhotic patients [13]. However, surgical repair in patients with refractory ascites has been reported to be associated with high mortality and morbidity [14].

Although inguinal herniorrhaphy has been reported in patients with cirrhosis, relatively few studies had been conducted on this topic or on optimal management. Pere *et al* [15]. described three patients with stable cirrhosis and controlled ascites whose condition severely deteriorated after elective operation.

Furthermore, a Danish nationwide database study of postoperative death in LC patients who have undergone inguinal hernia repair showed an adjusted odds ratio for 30-day mortality of 4.4 [16].

It also became evident that the major component of success of this surgical procedure, especially when performed in an emergency situation, relates to the perioperative management of both ascites and renal insufficiency.

Advanced cirrhotic patients with major abdominal wall hernias should therefore be preferentially referred to specialized centers that also offer a hepatology intensive care, and hence an elective surgery could be performed at ease.

The difference in ascites leak was highly significant between the two groups ($P < 0.001$). Sac invagination was recently proved equally effective and safer compared with ligation [17]. Therefore, we made strong attempts to not open the sac during elective repair of inguinal hernia. We used the technique of invagination of the intact dissected sac rather than opening it whenever possible. Opening the sac was unavoidable whenever strangulation was doubtful, to check the viability of the contents and proper dealing with the it.

We identified emergency surgery as a factor of higher morbidity, postoperative mortality, uncontrolled ascites, or high MELD score, and we recommend elective repair. Therefore, we propose that patients with refractory ascites may be eligible for elective hernia repair in selected cases, such as patients with symptomatic hernias, thin skin, or skin ulceration.

Other studies on patients with decompensated cirrhosis have suggested that hernias may be safely repaired without increased surgical risk or any undue increase in recurrence [18]. Although the numbers of patients included were small and the follow-up durations were short in these series, recent studies clearly demonstrate that the presence of ascites does not contraindicate surgical repair, and that morbidity and recurrence rates are not clearly affected in elective hernia repair in cirrhotic patients. In addition, we were able to compare elective and emergency intervention for inguinal hernia repair in cirrhotic ascitic patients with respect to complication and recurrence rates. The inguinal

nerve block provided a good chance to operate on patients who had very bad general condition and were not good candidates for the general anesthesia. The use of local anesthesia definitely widened the spectrum of operability for patients who were not a candidate for general anesthesia, but its impact on mortality could not be assessed because its use was limited to severely morbid patients. The overall recurrence rate after inguinal hernia repair in our series was 7% for both the elective and emergency groups (4/56). Our recurrence rate is within the acceptable range of recurrence rate (0–14.3%) reported for nonmesh open repair of inguinal hernia [19]. In this study, elective repair gave us a better preoperative chance to improve some important parameters described in MELD score. To achieve good results, we corrected serum electrolytes, impaired renal functions, prolonged prothrombin time, anemia, and low serum albumin. The correction of the above vital parameters need a considerable time; thus, the proper correction of these parameters was difficult in cases of emergency situations. Moreover, the high mortalities in the emergency group [eight patients (28.5%)] were actually a reflection of the concomitant disturbed vital parameters, which were described above. As regards the MELD score, patients with low MELD score showed good postoperative results and low morbidity and mortality. Given these results, we recommend that the laboratory MELD score to be considered a useful and objective tool to further refine the therapeutic algorithm of abdominal wall hernia repair in cirrhotic patients (Table 2), and we also recommend downgrading the management of the MELD score preoperatively whenever possible.

As regards the CTP class, patients who were of class C showed high mortality (25%) in the emergency group but it was 3% in the elective group. Unfortunately, we did not encounter patients with CTP class A to evaluate the timing of hernia repair; however, as the liver disease is usually progressive, the concept of clinical observation in patients with inguinal hernia should be discouraged.

Our results indicate that elective inguinal hernia repair in patients with LC can be performed with an acceptable incidence of postoperative complications, as well as less hospital stay, reduced mortality, and lower recurrence rate regardless of CTP class, and that cirrhotic conditions do not increase operative risk, recurrence rate, or contralateral inguinal hernia development and patients showed improved QOL (Table 2).

This supports the contention that elective surgical repair of abdominal wall hernia should be electively performed, to prevent the development of life-threatening complications.

Conclusion

Elective inguinal hernia repair for cirrhotic patients with ascites is a relatively safe procedure. The

Table 2 Comparison between the demographic characteristics and postoperative course in both groups

	Elective group 1 (*N*=28)	Emergency group 2 (*N*=28)	*P* value
Age (mean (range)) (years)	41.6±12.4 (44-62)	40.2±14.7 (45-60)	>0.05
CTP class			
A	Not encountered	Not encountered	
B	18	13	>0.05
C	10	15	>0.05
Mean preoperative MELD	13 (8-23)	18 (9-25)	>0.05
Ascites leak	0/28 (0)	19/28 (68)	<0.001
Hospital stay (mean (range)) (days)	5±2 (3-11)	13±4 (7-27)	<0.05
ICU stay (mean (range)) (days)	1.6±0.86 (1-2.5)	6.8±3 (3.5-8.5)	<0.001
Morbidity (*n* (%))	4 (14)	19 (68)	<0.001
Mortality (*n* (%))			
A			<0.001
B		1 (3.5)	
C	1 (3.5)	6 (21.4)	
Clavien–Dindo classification			
I	5	4	>0.05
II	6	7	>0.05
III	4	3	>0.05
IV	5	5	>0.05
V	8	9	>0.05
Mean postoperative MELD (range)	15 (8-18)	24 (15-36)	<0.05
Hernia recurrence	0	4	

CTP, Child–Turcotte–Pugh; MELD, model for end-stage liver disease.

improvement in QOL represents a clear indication for elective hernia repair.

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Conflicts of interest

There are no conflicts of interest.

References

1. Andraus W, Pinheiro RS, Lai Q, Haddad LB, Nacif LS, D'Albuquerque LA, Lerut J Abdominal wall hernia in cirrhotic patients: emergency surgery results in higher morbidity and mortality. BMC Surg 2015:15:65.
2. Ecker BL, Bartlett EK, Hoffman RL, Karakousis GC, Roses RE, Morris JB, Kelz RR. Hernia repair in the presence of ascites. J Surg Res 2014;190 (2):471–477.
3. Carbonell AM, Wolfe LG, DeMaria EJ. Poor outcomes in cirrhosis-associated hernia repair: a nationwide cohort study of 32 033 patients. Hernia 2005;9:353–357.
4. EK Choe, KJ Park, H-K Oh, H Kim, S Ryoo. Inguinal hernia repair in patients with cirrhosis is not associated with increased risk of complications and recurrence. World J Surg 2011;35:1229–1233.
5. Shlomovitz E, Quan D, Etemad-Rezai R, McAlister VC. Association of recanalization of the left umbilical vein with umbilical hernia in patients with liver disease. Liver Transpl 2005;11 (10):1298–1299.
6. Horn TW, Harris JA, Martindale R, Gadacz T. When a hernia is not a hernia: the evaluation of inguinal hernias in the cirrhotic patient. Am Surg 2001;67 (11):1093–1095.
7. Arroyo A, García P, Pérez F, Andreu J, Candela F, Calpena R. Randomized clinical trial comparing suture and mesh repair of umbilical hernia in adults. Br J Surg 2001;88:1321–1323.
8. Gray SH, Vick CC, Graham LA, Finan KR, Neumayer LA, Hawn MT. Umbilical herniorrhaphy in cirrhosis: improved outcomes with elective repair. J Gastrointest Surg 2008;12:675–681.
9. Dindo, D. TheClavien–Dindo classification of surgical complications. In: Cuesta, Miguel A, Bonjer, Jaap H, eds. Treatment of postoperative complications after digestive surgery. London, UK: Springer; 2014:13–17.
10. Han YS, Kim BH, Baek IY Lee DK Kim KJ Dong SH *et al.* The change of the etiology, complications and cause of death of the liver cirrhosis in 1990s. Korean J Hepatol 2000;6:328–339.
11. Brazier JE, Harper R, Jones NM, O'Cathain A, Thomas KJ, Usherwood T, Westlake L. Validating the SF-36 health survey questionnaire: new outcome measure for primary care. BMJ 1992; 305 (6846):160–164.
12. Paik SW. Optimal timing and evaluation of liver transplantation. Korean J Hepatol 2004;10 (3):177–184.
13. Mansour A, Watson W, Shayani V, Pickleman J Abdominal operations in patients with cirrhosis: still a major surgical challenge. Surgery 1997;122 (4):730–735 discussion 735–736.
14. Leonetti JP, Aranha GV, Wilkinson WA, Stanley M, Greenlee HB. Umbilical herniorrhaphy in cirrhotic patients. Arch Surg 1984;119 (4):442–445.
15. Pere P, Höckerstedt K, Lindgren L. Life-threatening liver failure after inguinal herniorrhaphy in patients with cirrhosis. Eur J Surg 1999;165 (10):1000–1002.
16. Hansen JB, Thulstrup AM, Vilstup H, Sørensen HT Danish nationwide cohort study of postoperative death in patients with liver cirrhosis undergoing hernia repair. Br J Surg 2002;89 (6):805–806.
17. Othman, I, Hady, HA. Hernia sac of indirect inguinal hernia: invagination, excision, or ligation?. Hernia 2014; 18:199–204.
18. Ozden I, Emre A, Bilge O, Tekant Y, Acarli K, Alper A, Aryogul O Elective repair of abdominal wall hernias in decompensated cirrhosis. Hepatogastroenterology 1998;45 (23):1516–1518.
19. Amato B, Moja L, Panico S Persico G Rispoli C Rocco N Moschetti I Shouldice technique versus other open techniques for inguinal hernia repair. World J Surg 2011; 35:1229–1233.

Hanging the appendix to the abdominal wall using ties during laparoscopic appendectomy: a technique report and preliminary results

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Introduction
Laparoscopic appendectomy is an effective and safe procedure for acute appendicitis. The cost of laparoscopic appendectomy is higher in both simple and complex cases. In this study, we aim to present a new technique to be used during laparoscopic appendectomy with the aim of reducing the cost. We also present the preliminary results.

Patients and methods
The technique entails hanging the appendix to the abdominal wall using ties applied through the abdominal wall to inside the peritoneum and back to outside the abdomen. The technique was used on 50 patients during laparoscopic appendectomy.

Results
The mean operative time was 51.8 min. In three cases, the tie caused a tear in the mesoappendix of the distal appendix. In one case, minimal trauma to the small intestines occurred. In a fifth case the very short and inflamed mesoappendix necessitated the use of a harmonic blade to secure it.

Conclusion
Within the limitation of this study, we can conclude that laparoscopic appendectomy with hanging of the appendix to the abdominal wall using ties is a technically safe, feasible, and cheap method that can be adopted when facilities and funds are limited.

Keywords:
cheap method, mesoappendix, tying

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1110-1121

Introduction

Approximately 6% of the population develops appendicitis in their lifetime, with a peak incidence between the ages of 10 and 30 years, thus making appendectomy the most frequently performed abdominal operation [1].

Despite the longer operative time, laparoscopic appendectomy results in less postoperative pain, faster postoperative rehabilitation, a shorter hospital stay, and fewer postoperative complications than open appendectomy. Therefore, laparoscopic appendectomy is recommended as an effective and safe procedure for acute appendicitis [2–4].

The cost of laparoscopic appendectomy is higher in both simple and complex cases. The decision analysis demonstrated an economic advantage to the hospital with open appendectomy. In contrast, laparoscopic appendectomy represents a better economic choice for the patient [5–7].

In this study, we aim to present a new technique to be used during laparoscopic appendectomy, which entails hanging the appendix to the abdominal wall using ties, with the aim of reducing the costs of laparoscopic appendectomy. The preliminary results are also discussed.

Patients and methods

This study was conducted in Menoufia University Hospital, Shebin El-Kom, Egypt, between January 2013 and June 2015. It was conducted on 50 patients diagnosed with acute appendicitis. The study was approved by the ethical committee of the hospital. Informed consent was obtained from each patient. We excluded from this study patients who were below 18 years and patients with frank peritonitis.

Description of the technique

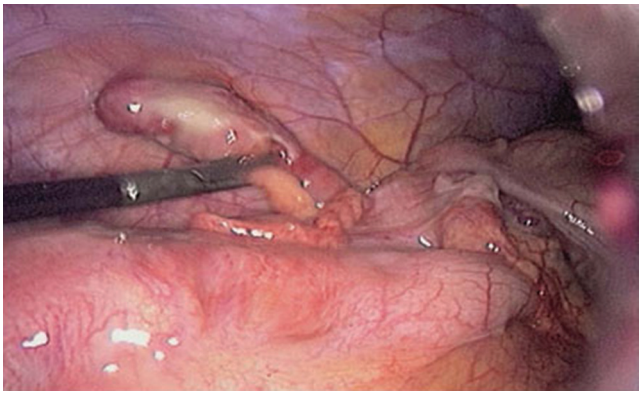
To our knowledge, we are the inventors of this technique. The technique requires the insertion of three ports, one for the camera at the umbilicus, one

5 mm in the suprapubic region, and one 5 mm in the left iliac fossa.

After routine exploration using the two graspers inserted through the two 5-mm ports, we start the procedure by finding the ileocecal junction where the appendix is lying. After mobilization of the appendix, a needle with 2/0 vicryl suture material is inserted into the right iliac fossa through the abdominal wall. A curved needle is routinely used, unless the abdominal wall is judged to be thick, in which case we use a straight needle. Once in the peritoneal cavity, the needle is grasped with a needle holder and passed through the mesoappendix of the lateral third of the appendix, close to the wall of the appendix. Then the needle is passed again to the outside through the abdominal wall, thus creating a loop around, and hanging the appendix to the abdominal wall. The two edges of the vicryl loop are secured on an artery outside the abdomen, which is used to adjust the degree of tension needed to hang the appendix and display its base. On occasion, more than one loop may be needed. The precise point of passing through the abdominal wall varies according to the position of the appendix and other factors such as the length of the appendix and the bulk of the mesoappendix. One should keep in mind the anatomy of the inferior epigastric artery and avoid it. The surgeon places the loop in the abdominal wall so as to encircle the appendix and avoid tearing the mesoappendix from the appendix.

Once the appendix is elevated, a window is made at the mesoappendix near the base of the appendix through which we pass a 2/0 vicryl tie to secure the mesoappendix using the intracorporal tying technique. Another similar tie is taken for security. The surgeon tries to slide the ties as low on the mesoappendix as possible so as to place the tie on the narrow base of the mesoappendix rather than just below the appendix (Figs. 1–5). Sometimes more than one window is needed to secure the whole mesoappendix.

Figure 1



Hanging of the appendix.

Once the mesoappendix is secured, similar intracorporal tying is used to secure the base of the appendix, which is subsequently amputated and retrieved in a retrieval bag through the suprapubic port. Irrigation and drain insertion are applied as needed.

The following data were collected:
(1) Demographic data including age, sex, and BMI.
(2) Intraoperative data including operative time (from skin incision to wound closure), technical difficulties encountered, costs, and conversion to open appendectomy.
(3) Postoperative data including wound infection, intraperitoneal collection, visual analogue pain score (12 h postoperative), time of starting oral fluids, and length of hospital stay.

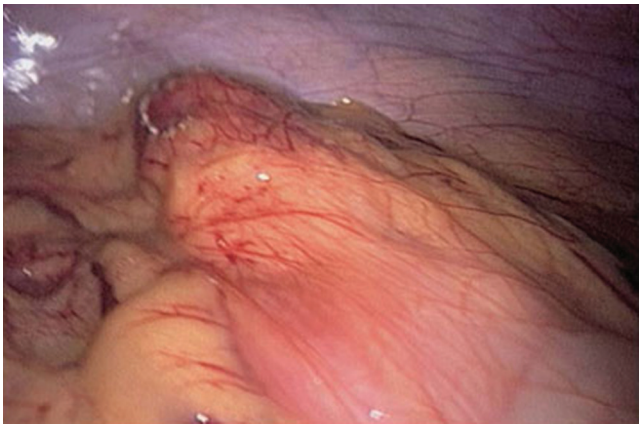
Results

The mean age of the patients in this study was 22.58 ± 14.83 years (range 18–61 years). Thirty patients were male (60%) and 20 were female. The mean BMI was 26.41 ± 7.62 (range 21–43). Table 1 shows the operative time.

The technical difficulties encountered included the following: in three cases (6%) the loop we passed cut through the mesoappendix so as to separate the distal end of the appendix from its mesoappendix. This was noted to occur if the loop is passed too distal on the mesoappendix and if the surgeon passed the loop too medial in the abdominal wall, so that the stretch on the loop was not on the body of the appendix. We dealt with this by passing the loop twice around the bare appendix.

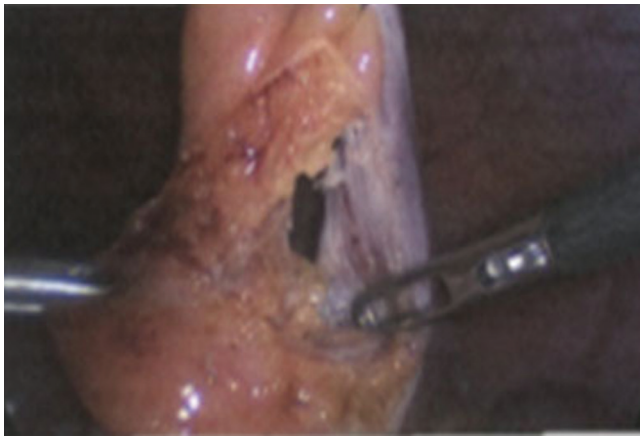
Another mishap was puncturing the small intestines, which occurred in one case (2%). Given the very small size of the puncture, no further management was needed.

Figure 2



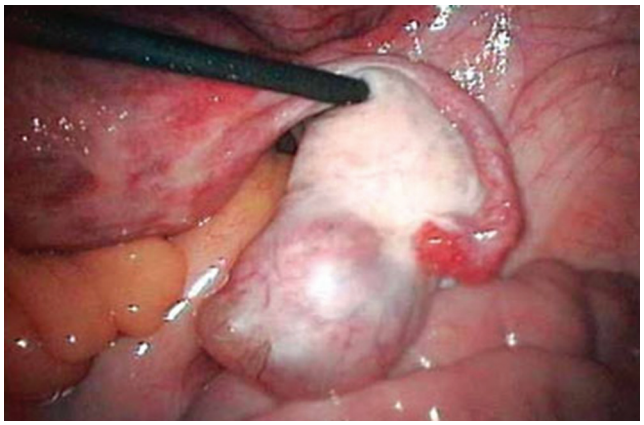
Laparoscopic exploration of the peritoneal cavity.

Figure 3



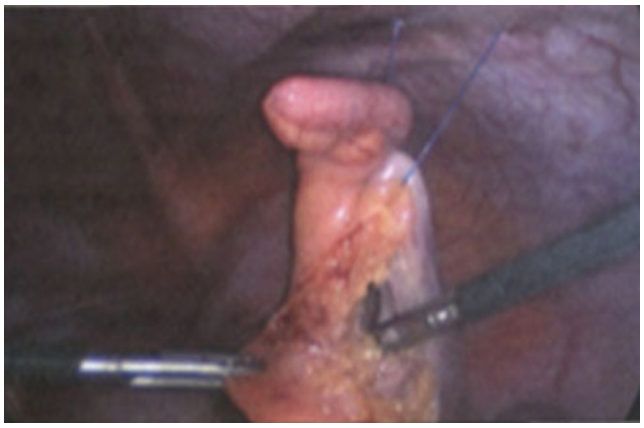
Laparoscopic appendiceal dissection.

Figure 4



Right ovarian cyst detected by a laparoscope.

Figure 5



Tying of the appendix hung to the abdominal wall.

In a fifth case we employed the harmonic sealing device because of a very short and inflamed mesoappendix, both of which made tying very difficult.

The costs were very low. In most of the cases we used two vicryl ampoules, which cost less than 10 USD. We understand that there are indirect costs (e.g. that of anaesthesia, instrument wear and tear, etc.), but these were difficult to estimate.

We converted to open appendectomy in three cases (6%), but all the conversions were due to findings not related to the technique. In one case it was the associated pathology (ruptured ectopic pregnancy). In two cases, the conversion was because the appendixes were subserous and retrocaecal, and the caeca were oedematous and fixed.

Regarding the wound infection rate, two cases (4%) were noted. Both cases were mild and were treated on outpatient basis with oral antibiotics. No case of postoperative intra-abdominal complication was noted. The average time of starting oral fluids was 22.51 ± 11.55 h.

The length of hospital stay is shown in Table 2.

The results of visual analogue pain score 12 h after surgery is shown in Table 3.

Discussion

Laparoscopic appendectomy is a safe and effective method of appendectomy [2–4]. It inherently carries all the advantages of laparoscopic surgery. However, the issue of high cost is still an obstacle for its routine use, at least in developing countries [6]. In this study, we present this technique to be used during laparoscopic appendectomy with the aim of reducing the costs without compromising the safety of the procedure.

The advantages of the technique are:

(1) Avoiding the use of clips, staplers, endoloops, and expensive thermal coagulation devices (e.g. harmonic blade) for securing the mesoappendix or the base of the appendix.
(2) Typically, intracorporal tying will need four ports: one for the camera, two for the needle holders used for tying, and a fourth port for a grasper to hang the appendix. Employing our technique will avoid the insertion of a fourth port, thus causing fewer traumas and saving the costs of the port and the grasper.

This will maximize the usage of the already established laparoscopy units and simultaneously will minimize the ongoing costs of staplers or endoloops. The ongoing cost will be that of vicryl sutures. One disadvantage of the technique is the relatively long operative time (51.8 min) (Table 1). The crucial step in the technique (i.e. passing the ties to create loops) did not consume time. Intracorporal tying consumed most of the time, especially when multiple windows were created to secure bulky mesoappendices. Injury to the intestines (or

Table 1 Operative time

Study group	Mean	SD	Median	Minimum	Maximum
50 patients	51.8202	10.85044	54.3000	41.00	82.00

Table 2 Length of hospital stay

Parameter	Mean	SD	Minimum	Maximum	Median
Hospital stay (days)	1.2000	1.05259	0.75	4.00	1.5500

Table 3 Visual analogue pain score 12 h after surgery

Parameter	Mean	SD	Minimum	Maximum	Median
Visual analogue pain score (12 h after surgery)	4.4724	2.84741	3	7	4.2

to other intra-abdominal structures) by the passing of the needle occurred once. Care must be taken, especially if the needle is a straight one. Tearing of the mesoappendix from the distal appendix occurred in 6% of cases. This can be avoided by making sure that the loop is made around the appendix rather than around the mesoappendix. The wound infection rate (4%), visual analogue pain score, time to start oral fluids, and hospital stay (Tables 2 and 3) are comparable to data from other studies. Katkhouda *et al.* [8] reported operative time between 60 and 105 min (average 80 min), time to liquids 23.5 h, and length of stay 2–4 days (average 2 days). Comparable results were reported by Long *et al.* [9].

Conclusion

Within the limitations of this study, we can conclude that laparoscopic appendectomy with hanging of the appendix to the abdominal wall using ties is a technically safe, feasible, and cheap method that can be adopted when facilities and fund are limited.

Level of evidence

Level IV, therapeutic case series.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Kumar B, Samad A, Khanzada TW, Laghari MH, Shaikh AR. Superiority of laparoscopic appendectomy over open appendectomy: the Hyderabad experience. RMJ 2008; 33:165–168.

2 Wei B, Qi CL, Chen TF, Zheng ZH, Huang JL, Hu BG, Wei HB. Laparoscopic versus open appendectomy for acute appendicitis: a metaanalysis. Surg Endosc 2011; 25(4): 1199–1208.

3 Golub R, Siddiqui F, Pohl D. Laparoscopic versus open appendectomy: a metaanalysis. J Am Coll Surg 1998; 186 (5): 545–553.

4 Ortega AE, Hunter JG, Peters JH, Swanstrom LL, Schirmer B and Laparoscopic Appendectomy Study Group. A prospective, randomized comparison of laparoscopic appendectomy with open appendectomy. Am J Surg 1995; 169:208–213.

5 Moore DE, Speroff T, Grogan E, Poulose B, Holzman MD. Cost perspectives of laparoscopic and open appendectomy. Surg Endosc 2005; 19(3): 374–378.

6 Ali R, Khan MR, Pishori T, Tayeb M. Laparoscopic appendectomy for acute appendicitis: is this a feasible option for developing countries?. Saudi J Gastroenterol 2010; 16(1): 25-29.

7 McGrath B, Buckius MT, Grim R, Bell T, Ahuja V. Economics of appendicitis: cost trend analysis of laparoscopic versus open appendectomy from 1998 to 2008. J Surg Res 2011; 171(2): e161–e168.

8 Katkhouda N, Mason RJ, Towfigh S, Gevorgyan A, Essani R. Laparoscopic versus open appendectomy: a prospective randomized double-blind study. Ann Surg 2005; 242(3): 439-448.

9 Long KH, Bannon MP, Zietlow SP, Helgeson ER, Harmsen WS, Smith CD, *et al.* Laparoscopic Appendectomy Interest Group A prospective randomized comparison of laparoscopic appendectomy with open appendectomy: clinical and economic analyses. Surgery 2001; 129(4): 390–400.

Diverticulitis of the appendix: is it clinically significant?

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We represent here, a case of male patient aged 32 years coming complaining of diffuse periumbilical pain since 2 days that shifted to the right iliac fossa and suprapubic areas within 6 h from onset. The condition was accompanied by vomiting (once), constipation, and fever. Abdominal examination revealed tender Mc-Burney point with rebound tenderness in the right iliac fossa; he had a pulse of 97 beats/min, temperature of 38.1°C, and total leukocytic count of 9000 c/m. Ultrasonography revealed minimal free fluid with noncompressible tubular blind structures, indicating acute appendicitis (Fig. 1). The patient was prepared for appendectomy in the usual manner through Lan's incision. On operation, two bulges were found arising from the antimesenteric border of the distal half of the appendix (Fig. 2) as diverticulae with impending rupture of one of them (Fig. 3). Both the appendix and diverticulae are seats of inflammation (Fig. 4). Appendectomy was performed and the specimen was sent for histopathologic examination, revealing diverticulitis of an inflamed appendix (type 2 diverticulosis of the appendix). We reviewed the literature to study cases on such a clinical entity and determine whether appendectomy was sufficient in all cases and whether there was actual increased risk for another diverticulae elsewhere.

Keywords:
appendiceal diverticulitis, colonic diverticulae, rare diverticular disease

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1110-1121

Discussion

Although acute appendicitis is one of the most common acute abdominal conditions [1], diverticulosis of the appendix is an uncommon entity [2] (Figs. 1–4). It was first described by Kelynack [3] in 1893 as a greatly distended appendix, totally shut off from the cecum, having two distinct diverticular processes directed between the folds of the mesentery [4]. Over the years several cases have been reported [5]. The incidence of diverticulae found in appendectomy specimens ranges from 0.004 to 2.1% and that from routine autopsies from 0.20 to 0.6% [6]. Some believe that the incidence may be greater than that generally appreciated and may be dismissed by surgeons and pathologists as a variant of true appendicitis [7]. However, appendiceal diverticulitis is a discrete clinical process that must be considered in the appropriate setting [6].

Two types of appendiceal diverticulae have been identified: congenital and acquired [8]. The acquired type, which is the most prevalent, is a false diverticulum. It represents a herniation of the mucosa through a muscular defect of the appendix (mainly on the mesenteric border) [2]. Some believe that nearly all appendiceal diverticulae are acquired [8]. The exact pathogenesis is still unknown, but several explanations have been postulated [4]. The inflammatory theory is one of these explanations: it postulates that an attack of appendicitis occurs with a postappendicitis weakness of the wall, followed by ulceration and regenerated epithelium over the injured area [9]. Alternatively, Stout [10] suggested a combination of luminal obstruction (coupled with the 1–2 ml of appendiceal secretions that are produced daily) in the presence of active muscular contraction, which leads to development of high intraluminal pressure with subsequent formation of a diverticulum on the mesenteric border of the appendix, often at the site of entry of the artery. Others suggested a multifactorial origin [9].

Incidental reports of congenital diverticulae have been reported [5]. The congenital type is a true diverticulum characterized by the presence of all layers of the bowel wall. This type is extremely rare, with ~50 cases reported in the literature [7]. There may be a chromosomal basis for this lesion with possible linkage to a group D chromosomal trisomy 13–15 (trisomy D13–D15 syndrome) [7]. Some have suggested embryonic deformities such as appendiceal duplication with local sacculations formed during appendiceal recanalization, or epithelial inclusion in the appendiceal wall or traction [10].

Progression from diverticulosis to diverticulitis follows a partial or complete obstruction of the lumen [11]. This may be due to swelling of the mucosa, inflammation, fecaliths, fibrous strictures, or torsion [5].

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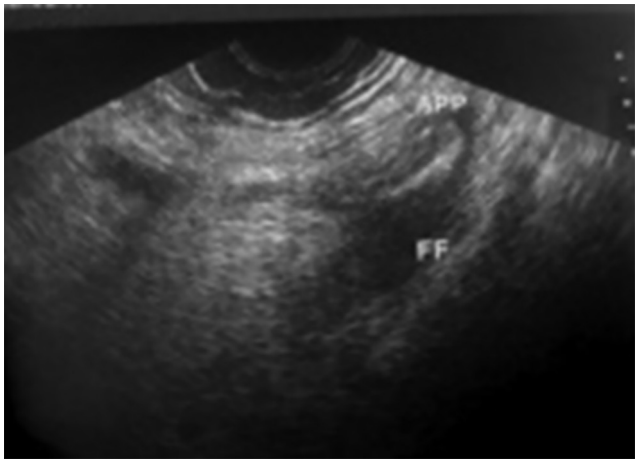
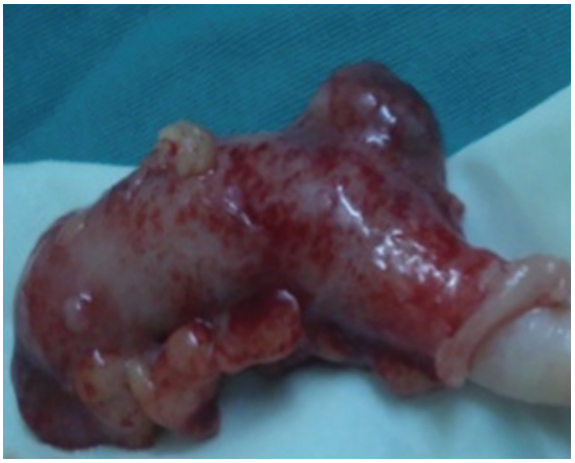
Figure 1



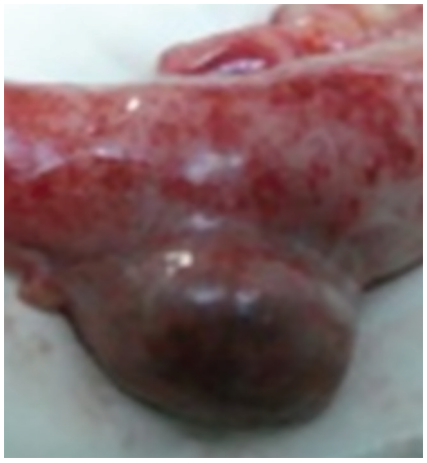
Ultrasound demonstrated a noncompressible blind tube with minimal free fluid. There is difference in the usual presentation of appendicular diverticulitis and appendicitis.

Figure 2



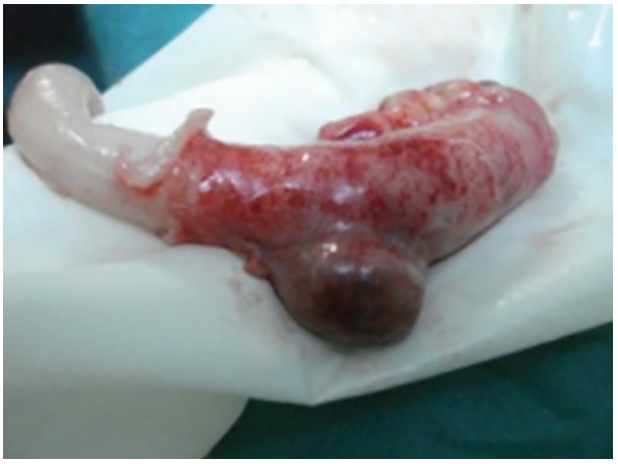
Two bulges on the antimesenteric border of the appendix.

Figure 3



Impending rupture of the diverticulum.

Figure 4



Type 2 diverticulosis of the appendix — that s, diverticulitis with appendicitis.

Classically, there is a diverticulum with a cylindrical appearance in the distal third of the appendix in nearly 60% of cases [12]. The acquired lesions occur on the mesenteric border of the appendix, often in association with an arteriolar blood vessel and thinning of the muscularis propria, and macroscopically it may be associated with periappendicitis [12]. Microscopic examination of the appendiceal specimen often reveals a small lumen with increased thickness of the submucosa and muscular wall, as well as atrophy of the mucosal lymphoid tissue [12] (Fig. 5).

These findings are likely physiological responses to a chronically elevated luminal pressure [9]. Appendiceal diverticula occurs in the absence of colonic diverticulosis [7].

Four subtypes of appendiceal diverticulitis have been reported. Type 1 is defined as a normal-appearing appendix with an acutely inflamed diverticulum. Type 2 involves an acutely inflamed diverticulum with surrounding appendicitis, as seen in this case. Type 3 is conventional appendicitis with an incidental uninvolved diverticulum. Type 4 is an incidental appendiceal diverticulum with no evidence of appendicitis or diverticulitis [6].

The clinical presentation varies greatly from the asymptomatic group to the seriously complicated group with 30-fold increased mortality compared with simple appendicitis [4].

Patients with diverticulosis may be asymptomatic or may just complain of persistent lower abdominal pain [13]. When acute diverticulitis develops, the patient presents with acute appendicitis. Some cases of acute appendicitis may present difficulties in diagnosis [14]. The confusion is greater in cases of

diverticulitis of the appendix [13]. On comparison with appendicitis, pain is often described as insidious in nature, intermittent, and extended over a long period. Anorexia, nausea, and vomiting, which are cardinal features in classic appendicitis [15], are usually absent [13]. Signs may be few [16]. Most of the patients would have had one or more admissions before the operative admission [16]. Appendiceal diverticulitis occurs more often in the male population [11] and in patients with cystic fibrosis [7]. Appendicitis classically manifests in patients before the third decade of life, whereas appendiceal diverticulitis usually appears after the third decade of life [17] (Table 1). Occasionally, these two conditions can be distinguished with a thorough history and physical examination. With detailed questioning, some patients will report prior episodes of right lower-quadrant pain (i.e. chronic appendicitis). Patients seek medical treatment much later than those with classic appendicitis, and if there is a delay in establishing the correct diagnosis perforation within the mesentery is found at the time of operation [17].

Perforation of the appendiceal diverticulitis is four-fold that of simple appendicitis, and there is a 30-fold increase in mortality rate. However, generalized peritonitis is unusual as the inflammatory process is contained within the mesoappendix by surrounding adhesions [18]. This 'mass-like' effect is often mistakenly identified as carcinoma [18]. Hemorrhage from the appendiceal diverticulae may also occur that sometimes requires several units of blood transfusion [12]. In addition, several cases of pseudomyxoma peritonei have been reported from appendiceal diverticuli [19]. Pseudomyxoma peritonei is a potential risk [15]. This may make removal of an appendix with diverticuli appropriate when found incidentally during surgery or upon barium enema [6]. Some suggested possible associations with locoregional neoplasms. However, most of the studies in the literature have not shown any association of it with appendiceal neoplasm or locoregional neoplasm and advised the pathologists to ensure they do not overdiagnose any reactive atypia or ruptured diverticulum as low-grade mucinous neoplasm [2]. Chronic diverticulitis sometimes presents with chronic intermittent lower abdominal pain and a mass-like effect on imaging study [18].

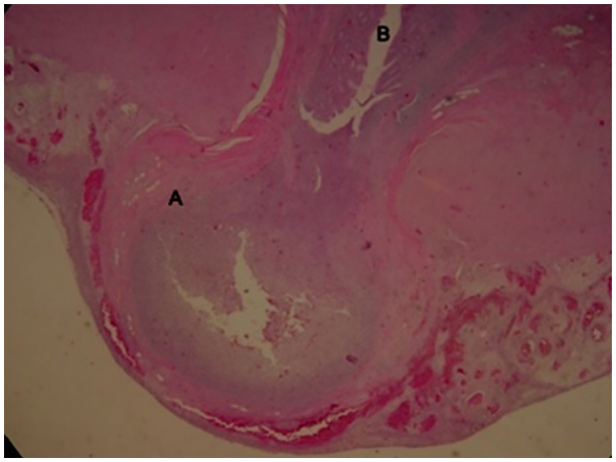
No current diagnostic radiographic evaluations are available for appendiceal diverticulosis [6]. Because of the likelihood of complications, diverticulosis of the appendix is a finding that radiologists stress upon. Ultrasonography has been used to identify peridiverticulitis, but its role in detecting appendiceal diverticulitis remains to be established [20].

Computed tomography is a very useful diagnostic tool (Fig. 6) especially in cases of persistent nonspecific right lower-quadrant abdominal pain. CT can identify the appendicecal diverticulum with the pericecal fat usually shows increased density. Also, a large pericecal phlegmon with or without evidence of abscess formation may be present [11]. The literature shows that computed tomography is the best imaging modality for diagnosis of appendiceal diverticular diseases [11].

Table 1 Comparison of usual presentation of appendiceal diverticulitis[4]

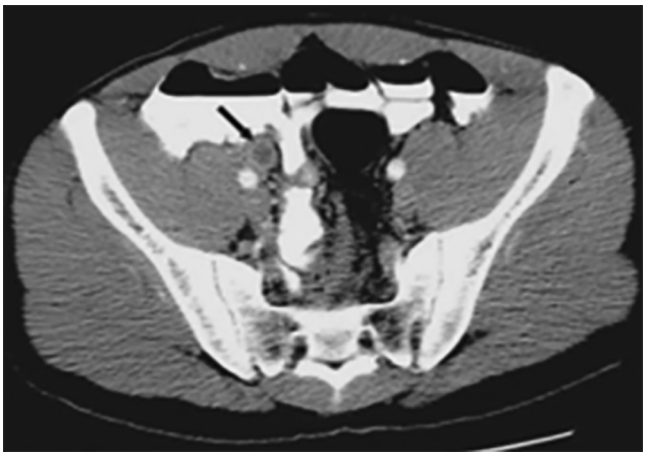
Symptom	Onset	Characteristic
Right lower-quadrant abdominal pain	2–13 days	Insidious, intermittent, originates in the right lower quadrant
Nausea, anorexia, emesis	Variable	Often absent
Fever	Variable	Temperature 38.4°C or more

Figure 5



Microscopic picture of a false diverticulum.

Figure 6



Computed tomography (CT) of diverticulitis of the appendix.

Treatment options vary from appendectomy, cecectomy, to right hemicolectomy, depending on the extent of indurations and intraoperative findings [21].

Once the diagnosis of appendiceal diverticular disease has been established, resection is recommended. Laparoscopic or conventional resection of the incidentally discovered appendix with diverticulosis is indicated because two-third of patients will experience an episode of acute inflammation [21]. However, some investigators doubt the potential benefit of a prophylactic appendectomy [7].

Conclusion

Although diverticulitis of the appendix is an uncommon clinical entity, it should be considered because of its possible clinical significances. Its insidious onset and initial minimal signs make late presentation common. Risk for perforation is four times more than that in simple appendicitis with 30-fold increase in mortality rate. Pseudomyxoma peritonei and significant hemorrhage may also occur. Sometimes the presentation of a mass-like effect is often mistakenly identified as carcinoma. It may also be the cause of chronic lower abdominal pain. No current diagnostic radiographic evaluations are available for appendiceal diverticulosis. However, computed tomography is very useful in patients with complications.[22] Appendectomy is usually sufficient, but sometimes extended resection until right hemicolectomy may be needed. Prophylactic appendectomy is recommended because of the serious sequelae that may occur.

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Conflicts of interest

There are no conflicts of interest.

References

1 Brunicardi FC, *et al.* The Appendix. Schwartz's principles of surgery. Liang MK, Andersson RE, Jaffe BM, BergerMcGraw-Hill DH Education. 10th ed. 2015; 30:1241–1245

2 Al-Brahim N, Al-Kandari I, Munahai M, Sharma P. Clinicopathological study of 25 cases of diverticular disease of the appendix: experience from Farwaniya Hospital. Pathol Res Int 2013; 2013:404308.

3 Kelynack TN. *A contribution to the pathology of the vermiform appendix*. London, England: HK Lewis; 1893.

4 Halder SK, Khan I. An Indian female presenting with appendicular diverticulitis: a case report and review of the literature. Case J 2009; 2:8074.

5 Phillips BJ, Perry CW. Appendiceal diverticulitis. Mayo Clin Proc 1999; 74:890–892.

6 Friedlich M, Malik N, Lecompte M, Ayroud Y. Diverticulitis of the appendix. Can J Surg 2004; 47:146–147.

7 Kabiri H. Appendiceal diverticulitis. Internet J Surg 2004; 7:7023–7025.

8 Place RJ, Simmang CL, Huber PJ. Appendiceal diverticulitis. South Med J 2000; 93:76–79.

9 Lock JH, Wheeler WE. Diverticular disease of the appendix. South Med J 1990; 83:350.

10 Stout AP. A study of diverticular formation in the appendix. Arch Surg 1923; 6:793–829.

11 Mahmood RD. Appendiceal diverticulosis. BMJ Case Rep 2010; 07:2085–2089. doi:10.1136/bcr.07.2009.2090.

12 Majeski J. Diverticulum of the vermiform appendix is associated with chronic abdominal pain. Am J Surg 2003; 186:129–131.

13 Satoshi H, Ryutaro M, Koichiro M, Seiji H, Kajuya E, Akira N. Clinical study of diverticulum of appendix. J Japan Surg Assoc 2004; 65:1592–1595.

14 Sandell E, Berg M, Sanblom G, Sundman J, Franneby U. Surgical decision-making in acute appendicitis. BMC Surg 2015; 15:69.

15 Stefan R, Brendan M. Pseudomyxoma peritonei. Recent advances insurgery, Irving Taylor & Colin D Johnson, The Royal Society of Medicine Press Limited. 36; 2014;8:109–19.

16 Friedlich M, Malik N, Lecompte M, Ayroud Y. Diverticulitis of appendix. J Can Chir 2004; 47:146–147.

17 Chang Gung Med J 2000, 23:711–714. Journal of Japan Surgical Association 2004, 65:1592–1595

18 Lin CH, Chen TC. Diverticulosis of the appendix with diverticulitis — case report. Chang Gung Med J 2000; 23:711–714.

19 Konen O, Edelstein E, Osadchi A, *et al.* Sonographic appearance of an appendiceal diverticulum. J Clin Ultrasound 2002; 30:45–47.

20 Delikaris P, Stubbe Teglebjaerj P, Fisker-Sorensen P, Balslev I. Diverticula of the vermiform appendix: alternatives of clinical presentation and significance. Dis Colon Rectum 1983; 26:374–376.

21 Bradley JP, Charles WP. Appendiceal diverticulitis. Mayo Clin Proc 1999; 74:890–894.

22 Subramanian M, Chawla A, Chokkappan K, Liu H. Diverticulitis of the appendix, a distinctive entity: preoperative diagnosis by computed tomography. Emerg Radiol 2015; 22(5):609–12.