Primary ventral hernia repair: mini-component separation technique versus onlay mesh repair

Hussein Elgohary, Ehab Oraby, Mostafa B. Abdelwahab

Department of General Surgery, Faculty of Medicine, Benha University, Benha, Egypt

Correspondence to Mostafa B. Abdulwahab, MD, Department of General Surgery, Faculty of Medicine, Benha University, Benha, 13518, Egypt; Tel: 01000059987; e-mail: mostbiomy@gmail.com

Received 12 December 2016
Accepted 26 December 2016

The Egyptian Journal of Surgery
2017, 36:174–180

Introduction
Although with the increased frequency of ventral herniorrhaphy use, it is somewhat surprising that the question of optimal choice of repair is not yet settled. The published data of numerous studies revealed results with major differences.
Objectives
The aim of this study to compare the results of mini-component separation technique (mini-CST) repair of primary ventral hernia cases with onlay mesh repair.
Patients and methods
This prospective randomized controlled study was carried out on 64 consecutive adult patients with primary ventral hernia. Patients were divided randomly into two groups. Group A was treated using mini-component separation technique. Group B was treated using suture repair reinforced with onlay polypropylene mesh.
Results
Group A repair demonstrated 9.4% seroma rate and 6.3% surgical site infection rate (SSI), no wound dehiscence, and 3.1% recurrence rate. Group B repair demonstrated 15.6% seroma rate, 25% SSI, 3.1% wound dehiscence, and no recurrence. For seroma rate, infection, wound dehiscence, and recurrence, *P* values were 0.44, 0.038, 0.31, and 0.31, respectively, between both the group. These results indicate that mesh repair has a small reduction in recurrence rate compared with mini-CST for primary ventral hernias, but an increased risk of SSO (seroma, SSI, and wound dehiscence).
Conclusion
The repair of primary ventral hernia cases can be made simple without foreign body implantation by holding the concept of CST to allow for tension-free midline fascial closure. We prefer to retain the mesh repair for big defects or complex cases that need either mesh reinforcement or even bridging of the defect.

Keywords:
mini-component separation, nonsignificant increase in recurrence rate, significant reduction of surgical site occurrence, ventral hernia repair

Egyptian J Surgery 36:174–180

1110-1121

Introduction

Ventral hernia is defined as a protrusion through a defect in anterior abdominal wall with the exception of the hernia through inguinofemoral region. Ventral hernia is classified according to its cause into primary and secondary types. Primary ventral hernia occurs because of primary defect in abdominal wall fascia, which can cause umbilical hernia, paraumbilical hernia, epigastric hernia, or spigelian hernia. Secondary ventral hernia 'incisional hernia' occurs because of herniation through a weak abdominal scar, such as scar of previous operation [1].

More than 350 000 ventral hernias are being repaired in the USA annually, of which 75% are primary ventral hernias [2].

Assessment of hernia cases should involve hernia grading system and analysis of abdominal wall defect. A three-level hernia grading system would significantly improve the accuracy of predicting surgical site occurrence (SSO) after open ventral hernia repair. Grade 1 includes healthy patients with no comorbidity or wound contamination. Grade 2 includes those with comorbidities and/or history of previous wound infections. Grade 3 includes patients with contaminated wounds and should be stratified according to Centers for Disease Control and prevention definitions of wound contamination [3]. Also, abdominal wall defect should be analyzed and evaluated according to site, size, and quality of surrounding tissues (muscles and overlying skin) regarding its quality, vascularity, mobility, tissue loss, and fibrosis [4].

Ventral hernia repair notoriously has technical difficulties, high morbidity, and relatively high recurrence rate especially with big defects which,

 DOI: 10.4103/1110-1121.204533

because of lack of sufficient tissues, require defect bridging either by mesh implantation or autologous tissue reconstruction [5].

Going through the existing literature, we have found that mesh repair is considered to be superior to primary suture repair even for small hernias in which abdominal wall defects are less than 3 cm [6]. However, in a large retrospective review of all elective cases of primary ventral hernia repairs at a single institution from 2000 to 2010, the authors concluded that there was a nonsignificant reduction in recurrence rate after mesh repair versus suture repair [7].

Mesh reconstructions are not preferred to be performed in the presence of contamination or infection. Also, if meshes are used in non-contaminated cases, certain precautions shall be taken to avoid subsequent major complications. At least the greater omentum or peritoneum must be interpolated between the bowels and the mesh to prevent adhesions and intestinal erosions [8]. Also, there is a need for full-thickness skin coverage to prevent mesh exposure, which may lead to scar contraction, mesh wrinkling, mechanical irritation, secondary infection, sinus formation, and finally mesh loss. So, wound infection is considered a major complication in cases with prosthetic mesh repair as it leads to a major consequence – mesh loss. On the contrary, wound infection with suture repair cases is considered just a minor problem [5,8].

The major question in ventral hernia repair is how to close the hernia defect in a tension-free manner by using local tissues instead of foreign body implantation. In 1990, Ramirez and colleagues introduced the concept of 'component separation' for closure of abdominal wall defects. This concept was on the basis of true anatomical facts. Their idea was to increase the surface of abdominal wall by translation of muscular layers through a release incision which was done in external oblique aponeurosis 1–2 cm lateral to the rectus sheath. A clear plane of dissection is created away from neurovascular plane of abdominal wall. This procedure allowed for creation of bipedicled innervated fasciomuscular flap which could be mobilized medially to bridge a large defect up to 20 cm width at the waistline [4,8].

Component separation technique (CST) achieved relatively good results in large complex hernias and contaminated cases. So, CST seems to be valuable under these conditions as there are no reasonable alternatives [8].

The rationale of this study is to apply the principles of component separation in primary ventral hernia cases. This technique allows us to achieve tension-free suture repair of hernia defects by using local tissues instead of foreign body implantation.

Patients and methods

This prospective randomized controlled study was conducted at General Surgery Department, Benha University Hospital, Benha, Egypt, and Al-Adwani General Hospital, Taif, KSA, after obtaining approval from the local ethical committee and after a fully informed written consent signed by patients. This study was carried out on 64 consecutive adult patients with primary ventral hernia from February 2012 to May 2016 to allow a minimum follow-up period of at least 12 months for the last case operated upon.

Preoperative patient assessments regarding age, sex, patient comorbidity, BMI, subtype of ventral hernia, divarication of recti, and status of surrounding muscles were recorded.

All patients had primary ventral hernias. All operations were clean wounds, with no operative contamination.

Exclusion criteria included complicated or recurrent hernia cases, chronic liver disease, immune deficiency disease, or known use of immunosuppressive treatment and pregnant cases.

Patients were divided randomly into two groups. Group A included 32 patients who were treated with mini-CST (tension-free suture repair). Group B included 32 patients who were treated with suture repair reinforced with onlay polypropylene mesh.

Methods of randomization

Simple random allocation method was used, where 64 cards (32 were signed as group A and other 32 were signed as group B) were prepared and were put in closed envelops and mixed together. Each patient chose an envelope after he had approved for participation.

Blinding

Double-blind technique was applied where patients and care providers were blind about to which group the patients were allocated.

Technique

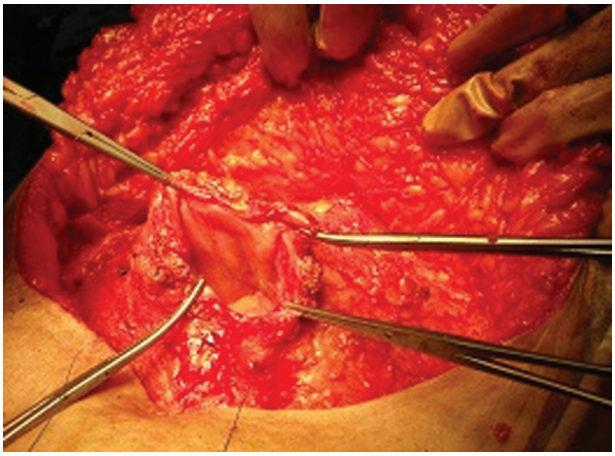
All patients had preoperative antibiotic injection. All patients underwent the following steps. Patients

positioned in supine position. Surgery was performed under general anesthesia. Design of incision was performed according to the status of skin redundancy. Direct transverse incision was done with no skin redundancy. Obese patients with redundant abdomen required abdominoplasty incisions. Subcutaneous dissection was carried out to expose the hernia sac and its neck. The dissection was extended laterally to 2 cm lateral to rectus sheath in all cases. Dissection was extended upward till xiphisternum in cases with divaricated recti. Herniotomy was done, and the abdominal wall defect was measured (Fig. 1).

Mini-component separation technique

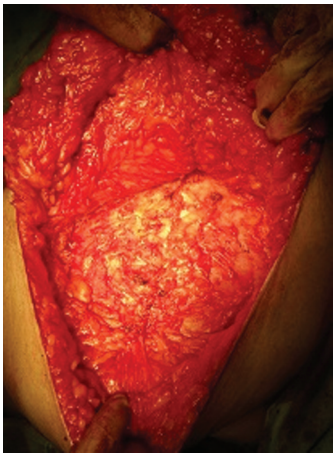
In the mini-CST group, midline closure was done by continuous polypropylene 1 suture and second layer of interrupted inverting layer by polydioxanone sutures 0 sutures (Fig. 2). The tension created after midline closure was eliminated through multiple release incisions. These multiple small release incisions were sited just 1–2 cm lateral to the rectus sheath. These incisions involved only external oblique aponeurosis, and care was taken not to cut through deeper layers. The first release incision in each side (Fig. 3) was done just wide enough to allow passage of surgeon index finger for blunt dissection and used as a guide for citation of another release incision (Fig. 4). The idea of creating multiple small incisions instead of one big release incision is to avoid postoperative abdominal wall bulge. These release incisions were extended vertically just beyond the limits of abdominal wall defect (mini-component separation). In cases with divaricated recti, the release incisions were extended upward to cross over the costal margin. Blunt finger dissection was done to open the plane between external and internal oblique muscles laterally to the extent that bring the abdominal wall flap easily to the midline. Insertion of two subcutaneous tube drains was done along with skin closure.

Figure 1



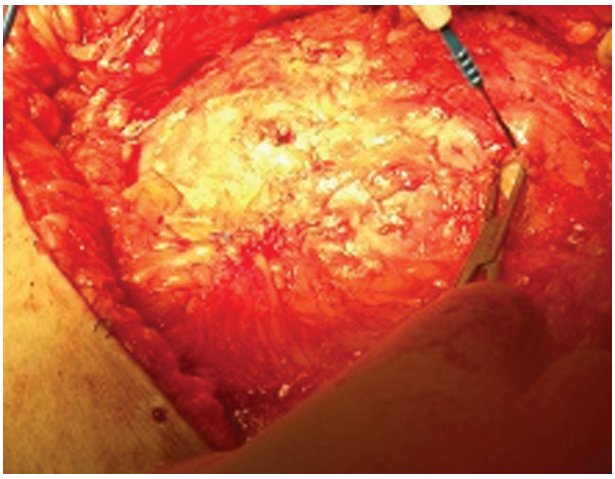
Hernia defect after herniotomy.

Figure 2



Defect repair – midline facial closure.

Figure 3



Starting release incision after repairing the defect.

Figure 4

Creation of another release incision.

Prosthetic mesh group

In the prosthetic mesh group, the defect was closed by anatomical midline repair with continuous layer of polypropylene 1 suture and second layer of interrupted vicryl 0 layer. Abdominal wall reinforcement was with onlay polypropylene mesh that overlapped the fascia around the defect for at least 5 cm. In two cases with large defect that could not be closed primarily, peritoneal closure was done, and bridging the defect was done by onlay mesh with two circles of interrupted sutures at the edge of the defect. Insertion of two subcutaneous tube drains was done along with skin closure.

Postoperative course

The patients were discharged 24 h after the operation. Instructions on discharge included avoidance of straining or carrying heavy objects for the following 3 months. Follow-up visits were scheduled on fifth, seventh, and 14th days for assessment of wound complications such as seroma, hematoma, infection, wound dehiscence, and drain output. Drain removal was done after minimal output serous discharge (20 ml/day). Further follow-up visits were scheduled at 3 months, 1 year, and annually for assessment of hernia recurrence.

Statistical analysis

The obtained data were presented as mean±SD, ranges if continuous, and numbers and percentages if categorical. The collected data were tabulated and analyzed using Student's *t*-test, *Z*-test for proportions, and χ^2-test. Statistical analysis was conducted using the SPSS (version 16) for Windows statistical package (SPSS Inc., Chicago, Illinois, USA) and Microstat W software (CNET Download.com, India; City of Lancaster case study). Values of *P* less than 0.05 were considered significant.

Results

Overall, 64 patients with primary ventral hernia were randomly divided into two groups. Group A included 32 patients who were treated with mini-CST. Group B included 32 patients who were treated with onlay prolene mesh hernioplasty. All patients were selected to have primary noncomplicated hernias and categorized as clean wounds. Mean age at presentation was 47.9±4.3 years (33–61 years); there were 21 men and 43 women. There was a nonsignificant ($P>0.05$) difference between studied patients regarding age and sex (Table 1). A total of 12 patients had comorbidities: six cases had diabetes mellitus, two cases were on steroids, one case had bronchial asthma, one had rheumatoid arthritis, and 12 cases had chronic obstructive pulmonary disease. Moreover, two female patients had a history of previous postoperative wound infection.

Table 2 shows patient comorbidities in the studied groups, which help in the grading of hernia. This grading system was helpful in predicting postoperative SSO. In total, 49 cases were evaluated as grade 1 whereas 15 cases as grade 2 according to the modified hernia grading system. All cases were reconstructed under clean conditions, and no cases were evaluated as grade 3 (Table 3). Obesity was a real problem especially in female patients. The BMI was measured for all patients in both groups as shown in Table 4.

All patients had primary ventral hernias: 57 cases with paraumbilical hernia (16 cases with divarication of recti and 41 cases without divarication) and seven cases with epigastric hernia (Table 5).

Table 1 Demographic data

	Group A (*n*=32)	Group B (*n*=32)	Test of significance	*P*
Sex [*n* (%)]				
Male	10 (31.2)	11 (34.4)	χ^2=0.07	0.79 (NS)
Female	22 (68.8)	21 (65.6)		
Age (years)				
Mean±SD (range)	45.5±5.6 (33–58)	46.3±4.1 (35–61)	Student's *t*=0.65	0.52 (NS)

Table 2 Patient comorbidities

Comorbidities	Group A		Group B		Total
	Male	Female	Male	Female	
DM	0	3	1	2	6
Steroid therapy	1	0	0	1	2
COPD	2	0	1	1	4
History of wound infection	0	1	0	1	2

COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus.

Intraoperative measuring of hernia defects was a constant step. Table 6 shows the average size of hernia defects and the length of operations in both groups.

There was a nonsignificant ($P>0.05$) difference between both groups regarding patient comorbidity, grading of hernia, BMI, subtypes of hernia, and defect size.

The duration of surgery was significantly ($P<0.05$) longer in the mesh repair group than in the mini-component separation group.

All cases showed smooth postoperative recovery, and all were discharged after 24 h. Early outpatient visits on days 5, 7, and 14 were scheduled for wound care and detection of early complications.

Table 3 Hernia grading

	n (%)		
	Group A	Group B	Total
Grade 1	24 (75)	25 (78.1)	49 (76.6)
Grade 2	8 (25)	7 (21.9)	15 (23.4)
Grade 3	0 (0.0)	0 (0.0)	0 (0.0)

Table 4 BMI of patients (original)

BMI	*n* (%)		
	Group A	Group B	Total
18.5–25			
Normal	11 (34.4)	10 (31.3)	21 (32.8)
25–30			
Over weight	8 (25)	9 (28.1)	17 (26.6)
30–35			
Mild obesity	10 (31.3)	9 (28.1)	19 (29.7)
>35			
Morbid obesity	3 (9.4)	4 (12.5)	7 (10.9)
Total	32	32	64

χ^2=0.3. P=0.95 (NS).

A total of eight cases of seroma were found in both groups: three cases in group A and five cases in group B. Seroma was treated by drainage through aspiration or removal of one or more stitches. In group B cases, more amount of seroma persisted for longer periods. Moreover, three cases of seroma in group B were complicated by secondary infection. Regarding wound infection, group A had two cases. Both cases were superficial infection, which resolved after good drainage and appropriate antibiotics. On the contrary, group B involved eight cases of wound infection, including the complicated cases of seroma. Among them, six cases were mild infection in the form of skin erythema and wound edema. The other two cases showed purulent discharge, which was progressive in one case that developed to complete wound dehiscence. Both cases of aggressive wound infection were diabetics, and one of them was markedly obese and on steroid therapy for bronchial asthma. Both cases were readmitted for tight control of diabetes mellitus and wound care for 2 weeks. Remission of acute infection was achieved but with no complete resolution even after prolonged courses of antibiotics. One case developed a sinus with intermittent purulent discharge. The other case showed intermittent abdominal wall cellulitis and fever. Both cases were scheduled for reoperation and mesh removal.

Drain output was significantly more in group B cases, which persisted for 9–13 days. One case in group A showed a recurrent bulge at the upper angle of wound. This bulge appeared after 7 months of hernia repair. This case was evaluated as grade 2 hernia because of chronic obstructive pulmonary disease comorbidity. Reoperation was done using tension-free repair reinforced with onlay prolene mesh implantation (Table 7).

Table 5 Subtypes of primary ventral hernia (original)

Hernia subtype	Group A		Group B		Total
	Male	Female	Male	Female	
Paraumbilical hernia					
No divarication	6	14	9	12	41
divarication	3	5	1	7	16
Epigastric hernia	1	3	1	2	7
Total	10	22	11	21	64

Table 6 Operative data

	Group A	Group B	Student's *t*-test	*P*
Defect size (mm)	35±5 (23–47)	36±8 (25–57)	0.599	0.55 (NS)
Operation time (min)	54±9	79±12	9.4	<0.001 (HS)

HS, highly significant.

Discussion

Although with the increased frequency of ventral herniorrhaphy use, it is somewhat surprising that the question of optimal choice of repair is not yet settled [9].

Mayo described his technique of hernia repair. It was recognized as the classical method for the repair of umbilical hernia [10]. From that time, many advanced techniques have been developed for ventral hernia repair, with not enough evidence still to support a single technique.

The published data of numerous studies revealed results with wide differences. The problem lies in that some studies did not separate the results of primary hernia repair from the results of recurrent cases repair. Others did not link their results with patient comorbidity [9].

Luijendijk *et al.* [11] reported that mesh repair is superior to suture repair regarding the recurrence of hernia, regardless of the size of the hernia.

In the current study, group A repair demonstrated 9.4% seroma rate, 6.3% surgical site infection rate (SSI), no wound dehiscence, and 3.1% recurrence rate. Group B repair demonstrated 15.6% seroma rate, 25% SSI, 3.1% wound dehiscence, and no recurrence.

These results indicate that mesh repair has a small reduction in recurrence rates compared with mini-CST for primary ventral hernias, but an increased risk of SSO (seroma, SSI, and wound dehiscence).

Nguyen *et al.* [2] showed significant reduction in recurrence rate in mesh repair cases with nonsignificant increase of incidence of wound infection. Mesh repairs demonstrated 2.7% recurrence rate, 7.7% seroma rate, and 7.3% SSI rate. The suture repairs demonstrated 8.2% recurrence rate, 3.8% seroma rate, and 6.6% SSI rate.

Berger *et al.* [7] reported that mesh repair was associated with more SSI and seroma, but without statistically significant decrease in recurrence rate. Mesh repairs demonstrated 5.6% recurrence rate, 14.3% seroma rate, and 19.8% SSI rate. The suture repairs demonstrated 7.5% recurrence rate, 4.1% seroma rate, and 7.9% SSI rate. In the previous two large retrospective studies, the results were not linked to associated comorbidities.

In this study, postoperative complications were linked to hernia grade (comorbidity and previous wound infection) (Table 8). These details showed a large difference between both approaches of data extraction. In grade 2 hernia cases, results showed significant increase in complication rates than in grade 1 hernia cases in both groups. These data are in line with that reported by Finan *et al.* [12] in their realization that even a single comorbidity may increase the risk of SSO as much as four-folds. However, the relative contribution of different comorbidities to complication risk remains unknown. In our study, there was a significant reduction in mean operative time and SSO in cases with mini-CST. There was small nonsignificant increase in recurrence rate which required reoperation. On the contrary, mesh repair cases

Table 7 Postoperative complications (*n*=32)

	n (%)		*Z*-test	*P*
	Group A	Group B		
Seroma	3 (9.4)	5 (15.6)	0.75	0.44 (NS)
Infection	2 (6.3)	8 (25)	2.07	0.038 (S)
Wound dehiscence	0 (0.0)	1 (3.1)	1.0	0.31 (NS)
Drain output (days)	6.4±1.18 (5–8)	10.4±1.26 (9–13)	13.0	<0.001 (HS)
Readmission	0 (0.0)	2 (6.3)	1.44	0.15 (NS)
Recurrence	1 (3.1)	0 (0)	1.0	0.31 (NS)
Reoperation	1 (recurrence) (3.1)	2 (mesh removal) (6.3)	0.59	0.54 (NS)

HS, highly significant; S, significant.

Table 8 Postoperative complications linked to hernia grade (comorbidity and previous wound infection)

	Group A		Group B		*Z*	*P*
	Total	Complications [*n* (%)]	Total	Complications [*n* (%)]		
Grade 1 hernia patients	24	2 (8.3)	25	4 (16)	0.82	0.4 (NS)
Grade 2 hernia patients	8	4 (50)	7	6 (85.7)	1.46	0.14 (NS)
Overall results	32	6 (18.8)	32	10 (31.3)	1.16	0.25 (NS)

although had a less recurrence rate, still there was higher incidence for reoperation for removal of infected meshes especially with patients comorbidities.

Wound infection and recurrence are not equally significant complications. It is more burdensome for a patient to deal with wound infection that is associated with fever, increased pain, swelling, and drainage of pus from the wound. Also, wound infection has been identified as a consistent risk factor for recurrence after ventral hernia repair. Luijendijk *et al.* [11] reported in their study that wound infection occurred in 3.7% of the patients, and these patients with wound infection were associated with a greater than 80% risk of recurrence.

Conclusion

It could be concluded that the repair of primary ventral hernia cases can be made simple without foreign body implantation by holding the concept of CST to allow for tension-free midline fascial closure. We suggest that min-CST is an option for repair of primary ventral hernia, and further studies are needed to conclude that mesh repair should be reserved for large defects or complex cases.

Acknowledgements

All authors contributed to the submission. The surgeons (H.E., E.O., and M.B.) contributed in the operations and follow-up of patients in addition to writing the article.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Sriram BM. Hernia (chapter 18). In: Ajanta offset and pachagings Ltd. SRBS manual of surgery. 4th ed. New Delhi: Jaypee; 2013. p. 824.

2 Nguyen MT, Berger RL, Hicks SC, Davila JA, Li LT, Kao LS, Liang MK. Comparison of outcomes of synthetic mesh vs suture repair of elective primary ventral herniorrhaphy: a systematic review and meta-analysis. JAMA Surgery 2014; 149:415–421.

3 Kanters AE, Krpata DM, Blatnik JA, Novitsky YM, Rosen MJ. Modified hernia grading scale to stratify surgical site occurrence after open ventral hernia repairs. New York, NY: American Hernia Society; 2012.

4 Shestak KC, Edington HJD, Johnson RR. The separation of anatomic components technique for the reconstruction of massive midline abdominal wall defects: anatomy, surgical technique, applications, and limitations revisited. Plast Reconstr Surg 2000; 105:732–738.

5 de Vries Reilingh TS, van Goor H, Charbon JA, Rosman C, Hesselink EJ, van der Wilt GJ, Bleichrodt RP. Repair of giant midline abdominal wall hernias: 'components separation technique' versus prosthetic repair. World J Surg 2007; 31:756–763.

6 Bell RL, Seymour NE. Schwart's Principles of Surgery (Chapter 34). In: Brunicardi FC, editor. Abdominal wall, omentum, mesentry, and retroperitoneum. 8th ed. United States of America: McGraw-Hill Medical Publishing; 2005. p. 1321.

7 Berger RL, Li LT, Hicks SC, Liang MK. Suture versus preperitoneal polypropylene mesh for elective umbilical hernia repairs. J Surg Res 2014; 192:426–431.

8 de Vries Reilingh TS, van Goor H, Rosman C, Bemelmans MH, de Jong D, van Nieuwenhoven EJ, *et al.* Components separation technique for the repair of large abdominal wall hernias. J Am Coll Surg 2003; 196:32–37.

9 Lauri Barcloy L. Mesh repair is linked to less hernia recurrence, more risks. JAMA Surg 2014; http://www.medscape.com/viewarticle/820940.

10 Lau H, Patil NG. Umbilical hernia in adults laparoscopic vs open repair. Surg Endosc 2003; 17:2016–2020.

11 Luijendijk RW, Hop WC, van den Tol MP, de Lange DC, Braaksma MM, IJzermans JN, *et al.* A comparison of suture repair with mesh repair for incisional hernia. N Engl J Med 2000; 343:392–398.

12 Finan KR, Vick CC, Kiefe CI, Neumayer L, Hawn MT. Predictors of wound infection in ventral hernia repair. Am J Surg 2005; 190:676–681.