

Effects of polypropylene mesh on the component separation technique in complex incisional hernia surgery

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Abstract

Aim: Giant or complex hernia repair is an important risk factor for poor outcome compared with results after repair for smaller hernias. Various operation techniques have been described for this hernia types. In this study, we aimed to present our outcomes of component separation technique (CST) repair in patients with giant incisional hernia and compare the results of CST with or without mesh.

Material and Methods: A comprehensive retrospective study was planned and performed on all patients who underwent the CST for complex incisional hernia between 2007 and 2013 at study institution. Patients were divided into two groups according to polypropylene mesh use. Follow-up appointments were typically done at 2 weeks, 4 weeks, 2 months, 3 months, 6 months, 1 year and 2 years. Hernia recurrence was diagnosed by physical examinations and ultrasonography if needed.

Results: A total of 91 patients were evaluated in this study, with 45 (49.4%) men and 46 (50.6%) women. The median age was 55 (23-83) years and hernia defect size was 314 cm² (62-940 cm²). Component separation group (CS) consisted of 13 women and 10 men with median age 56 years, whereas Component separation with mesh group (CS-M) comprised 35 women and 33 men with median age 55 years. A total of three patients (13%) had recurrence hernia in CS group vs. none of patients in CS-M group ($p=0.015$). Surgical site complication developed in 8 (34.7 %) patients in CS group, whereas in 28 (40.5%) patients in CS-M group ($p=0.66$). Statistical significant factors were associated with the development of complications including male gender ($p=0.032$), older than 60 years ($p=0.045$), and ASA score was 3 ($p=0.017$).

Conclusion: Component separation technique could be preferred by surgeons in complex ventral hernias. Contrary to common belief, onlay polypropylene mesh placement was not increase the surgical site complications. Also, recurrence rates were lower in mesh group statistically significantly.

Keywords: Component separation technique; complex incisional hernia; polypropylene mesh; herniography

INTRODUCTION

Incisional hernia is an undesirable but frequently seen complication after major abdominal surgery. The frequency of various studies has been reported to be 11-23% (1-3). Most patients with hernia have symptoms that require surgical treatment such as abdominal distention, back pain, and limitation of movement (4,5).

Treatment options for surgeons; open primary repair, open primary repair with mesh, laparoscopic repair or autologous tissue transfer (5). The choice of surgical technique is controversial and depends to surgeon preference due to lack of high-level evidence. However,

incisional hernia repair may result in a recurrent hernia and the risk of failure after the initial repair is higher (3,6). Nationwide Danish prospective hernia study have shown that incisional hernia defect size was less than 15 cm (median 7 cm) in 89 % of repair, while 11 % of repair was more than 15 cm in size (giant hernia) (7), which tends more frequently to failed surgical attempt.

Giant or complex hernia repair is an important risk factor for poor outcome compared with results after repair for smaller hernias and many surgeons jip at doing complex incisional hernia because of local and systemic issues that place him at risk for complications and recurrences, such as the presence of infection, previous

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mesh, an enterostomy, enterocutaneous fistulae, obesity, diabetes, cancer, and other comorbidities that complicate reconstructive planning (6,8).

On the other hand, the ultimate goals of incisional hernia repair is not to close the defect only, but also is restore functional integrity, provide support, protect the abdominal viscera, and minimize complications and recurrences. Incisional hernias may result in significant functional impairment as they enlarge, in addition to presenting obvious cosmetic concerns with the abdominal bulge (5). The objectives of abdominal wall reconstruction include restoring structural support, providing stable soft-tissue coverage, and optimizing esthetic appearance while minimizing morbidity and postoperative disability(5). In 1990, Ramirez et al. introduced a new repair technique named 'the components separation (CST)' to bridge the facial gap without the use of prosthetic material (9). The technique is based on the enlargement of the abdominal wall surface by separation and advancement of the muscular layers. By using this technique, up to 10 cm of unilateral advancement can be achieved, thus permitting a tension-free abdominal closure with medialization of the rectus abdominus muscle in large ventral hernias with improving abdominal wall functions (5,10,11).

The results of adding mesh with this technique are uncertain. In this study, we aimed to present our outcomes of CST repair in patients with giant incisional hernia and compare the results of CST with or without mesh.

MATERIAL and METHODS

A retrospective, non-controlled study was planned. Ethics committee approval was received for the present study from study institution. The all operations were performed by single surgeon (TC) at Mersin University Medical Faculty, Mersin, Turkey, between 2007 and 2013. Patients with preferred component separation technique to repair the midline hernia defect were included in this study. After the first 23 patients without mesh repair, all patients underwent mesh repair. 91 consecutive patients were included. Exclusion criteria included, repairs performed laparoscopically, or repairs performed in a "bridging" manner with mesh. The patients were divided to two groups according to using mesh (CS-M) or not (CS) after performing component separation.

Patient characteristics including sex, age, body mass index (BMI), medical comorbidities, ASA(American Society of Anesthesiologists) score, history of abdominal surgery, hernia defect size, operating time, post-operative complications and length of hospital stay were noted.

All operations were performed under general anesthesia with preoperative antibiotic administration (first generation cephalosporin), bladder catheterization, and nasogastric intubation if indicated by intraoperative findings. Standard perioperative anticoagulant protocols have been followed according to risk assessment for deep venous thrombosis.

Hernia repair with component separation technique was performed as described by Hood et al. (12).

The long and short axes of the defect were measured during surgery, and hernia defect was calculated with ellipse formula ($\pi \times \text{long axis} \times \text{short axis}/4$). In case of cribriform or multiple defects were existed, whole defects were used for calculation. The large polypropylene mesh placed in the onlay position overlapping the defect until lateral border of external oblique aponeurosis, if used. Skin was then closed with 2-0 Polypropylene mattress sutures. Drains were used routinely. When the amount of drainage decreased to 25-30 ml daily, drain was taken.

Pulmonary toilet and early ambulation with abdominal wall support was performed for perioperative care. Infections were defined as intraabdominal, prosthesis, or superficial wound infections requiring either antibiotics or opening of the wound. Follow-up of the patients was performed in 2-4 weeks, 2-3-6 months and 1-2 years. Follow-up data were obtained from hospital data archive. Hernia recurrence was diagnosed by physical examinations and ultrasonography if needed.

Statistical analysis: istatistical analysis was performed by using SPSS 17.0 (IBM, Armonk, NY). Differences between treatment groups were analyses with χ^2 tests and student t-tests. χ^2 tests were used for non-parametric variables and student t-tests for parametric variables. Probability values < 0.05 were accepted significant.

RESULTS

45 (49.4%) men and 46 (50.6%) women, total of 91 patients were commented in this study. The median age was 55 years [range, 23-83]. The mean BMI 26.1 [20-31.20], thirty-five (38.4%) patients had active smoker and forty-three (47.2%) patients had at least one comorbid condition. The median ASA score was 2 [1-4]. Four patients (4.4%) had one recurrence and two (2.2%) patients had two recurrence of hernia. The median hernia defect size was 314 cm² (62-940 cm²). The mean operating time was 122.75 ± 29.00 min. And the mean time to pull of the drain was 4.45 ± 2.78 days. At least one complication developed in thirty-six (39.5%) patients and the most frequent (26%) complication was surgical site infection. The mean hospital stay was 10.97 ± 8.86 days.

CS consisted of 13 women and 10 men with median age 56 years, whereas CS-M comprised 35 women and 33 men with median age 55 years. There were no significant differences between the two groups in terms of BMI (p=0.61), ASA score (p=0.55), and hernia defect size (p=0.10). Ten patients (43.4%) had at least one co-morbid condition (one co-morbidity in 5, two co-morbidities in 3 and three co-morbidities in 2 patients) in CS group, whereas 33 patients (48.5%) patients had at least one co-morbidity (one co-morbidity in 21 patients, two co-morbidities in 4 and three co-morbidities in 8 patients) in group CS-M (p=0.74). Smoker ratio was 34.7% (8/23) in CS group vs. 42.6% (29/68) in CS-M group (p=0.47). A total of

three patients (13%) had recurrence hernia in CS group vs. None of patients in CS-M group ($p=0.015$). Recurrences of these 3 patients were detected between 6-9 months. The demographics of the patients were summarized in Table 1-2.

Table 1. Overall patients characteristics and general outcomes	
Number of Patients (total)	91
Gender (male/female)	45/46
Age; median (range)	55 (23-83)
BMI (kg/m ²); median (range)	26.1 (20-31.2)
Defect size (cm ²); median (range)	314 (62-940)
Operating time (minute); mean \pm SD	122.75 \pm 29.00
Pull of the drain (day) ; mean \pm SD	4.45 \pm 2.78
Hospital stay (day); mean \pm SD	10.97 \pm 8.86
(BMI body mass index)	

The mean operating time was longer in CS group when compared with CS-M group (143.33 \pm 38.19 vs. 115.57 \pm 20.83, $p=0.001$). The reason for the shorter operation time in the mesh group may be due to the increasing experience of CST. However, the length of stay in hospital were similar when compare CS group (9.00 \pm 3.46) with CS-M group (11.53 \pm 9.99) ($p=0.29$).

At least one surgical site complication developed in 8 (34.7%) patients in CS group, whereas in 28 (40.5%) patients in CS-M group ($p=0.66$). Despite there were no significant differences between groups in terms of complications, different type of complications were seen within groups. Three superficial surgical site infections (SSI), three wound dehiscence and two wound necrosis were seen in CS group, while two superficial SSI and three wound dehiscence and three wound necrosis occurred in CS-M group. Statistical significant factors were associated with the development of complications including male gender ($p=0.032$), older than 60 years ($p=0.045$), and ASA score was 3 ($p=0.017$). On the other hand, obesity (BMI>30), hernia defect size, history of prior hernia repair, operating time, and active smoking history were not found to be statistical significant factors associated with complication development in this study.

The mean follow-up was 26.23 \pm 12.90 months. Recurrence developed in three patients in CS group, while none in CS-M group ($p=0.015$) during this time.

Table 2. Comparison between groups of component separation with and without mesh			
	CS	CS-M	p value
Gender (male/female)	10/13	33/35	0.63
Age; median (range)	56 (23-83)	55 (32-73)	0.94
BMI (kg/m ²); median (range)	27.7 (21.3-31.2)	25.5(20.0-31.2)	0.61
Defect size (cm ²); median (range)	314(235-706)	290(62-940)	0.10
Co-morbidities (%)	10 (43.4%)	33 (48.5%)	0.74
Smoker (%)	8 (34.7%)	29 (42.6%)	0.47
Operating time (min.); mean \pm SD	143.33 \pm 38.19	115.57 \pm 20.83	0.001
Hospital stay (day); mean \pm SD	9.00 \pm 3.46	11.53 \pm 9.99	0.29
Surgical side complication (%)	8 (34.7%)	28 (40.5%)	0.66
Recurrence (%)	3 (13%)	0	0.015
(CS component separation without mesh; CS-M component separation with mesh; BMI body mass index)			

DISCUSSION

Surgical repair in giant incisional hernia is a high-risk surgical procedure, which can cause significant morbidity and recurrence. There is no standard treatment for hernia size in surgical treatment planning. Incisional hernia repair is a process widely used in general surgery (3). Preoperative comorbidities, body mass index, preoperative infection and hernia size are important factors in etiology (13,14).

Recurrence rate in simple hernia repair decreased from 30-40% to 2-5% with increasing mesh usage (14-16). Furthermore, patients undergo a complex surgical procedure and are at risk of recurrence due to medical problems, poor care and comorbidities. Nowadays, a few studies have compared the CST only and CST with mesh placement (14,18). Furthermore, these studies mostly compare the laparoscopic technique with open surgery outcomes regarding complications, recurrence and comorbidities. Despite this study has limited number of patients, especially in the CS group, we believed the results of this study contribute the literature due to limited knowledge in this field (8).

As it is known, the purpose of mesh use in ventral hernia repair is to increase abdominal wall stabilization in the long term. In the case of giant ventral hernias and loss of abdominal domain, some form of reinforcement might have some advantages in order to provide supporting framework for the newly reconstructed abdominal wall (19). Still mesh using are a not simple and complete answered in these patients. Several type of mesh has been used in different positions placement with some advantages and disadvantages. The onlay mesh technique can be applied by a bridging technique or by augmentation technique. In this study, mesh was not used in the first 23 patients (CS group), but the operating time was longer than mesh used patients, because of increasing experience in the time would be shorten the operation time.

Ghazi et al reported complication rates were 2,6 % in no mesh group and 36,6 % in synthetic mesh group. Also infection rates higher in mesh group and recurrence rates are higher in no mesh group. In our study there were no statistical significant of complications rates between CS and CS-M group ($p=0.66$), also type of complications.

The preoperative risk factors such as obesity ($BMI>30$), hernia defect size, history of prior hernia repair, operating time, and active smoking history were not effective to development complications significantly. But these and other risk factors have been mentioned in previous studies (13,15,16). However, in this study, male gender, older than 60 years, and ASA score-3 were associated with the development of complications.

The length of hospital stays was similar in these groups. Despite long hospitalization in patients who had surgical complications was observed, the mean of hospital stay was 10.9 days and this is acceptable for these patients who had several co-morbidities and complex illness.

The incidence of incisional hernia after primary laparotomy is 11%. However, this rate increases to 54% in recurrent hernias (16,20-22).

The use of unstretched mesh has been reported to reduce recurrence (3,17,23). However, the use of synthetic mesh is not recommended in high-risk patients because of the risk of infection (22,24). Recurrence and infection are undesirable complications after incisional hernia repairs. Patients diagnosed with recurrent incisional hernia are also at risk of recurrence. Although onlay mesh placement is easier, the risk of mesh infection is higher than other mesh repair methods (25). In contrary to this report, in this study, surgical site infections were observed slightly higher in CS-M group, but these were not significant than CS only and recurrence rates were significantly less in CS-M group.

Comorbidities such as diabetes, smoking, cardiac and lung disease have been associated with hernia recurrence (8,15,16,22). However in this study, the only preoperative factor that had statistically significant association with recurrence was without mesh repair.

The first limitation of this study was its retrospective design and that it was a single center study. Although retrospective, some data were prospectively collected and the follow-up strategy did not change. The number of patients could be more, however, the number was limited as there were other repair options in complex ventral hernias.

CONCLUSION

Component separation technique could be preferred by surgeons in complex ventral hernias. Contrary to common belief, onlay polypropylene mesh placement was not increase the surgical site complications. Also, recurrence rates were lower in mesh group statistically significantly. The surgeons should make recommendations to patients as lose weight, stop smoking, controlling systemic diseases to reduce the risk of post-surgical complications. Appropriate precautions need to be taken, especially in these patients, to maintain safety and minimize morbidity.

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