Section: Surgery

Original Research Article

A COMPARISON OF OUTCOMES OF THE COMPONENT SEPARATION TECHNIQUES IN LARGE INCISIONAL HERNIAS: MESH VS. NO MESH

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Received : 22/10/2023
Received in revised form : 29/11/2023
Accepted : 15/12/2023

Keywords:
Component separation, incisional hernia, mesh, recurrence.

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DOI: 10.47009/jamp.2023.5.6.189

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2023; 5 (6); 921-925

Abstract

Background: Incisional hernia remains a frequent complication of abdominal surgery. Results of surgical repair are disappointing with recurrence rates of suture repair being in the range of 5%–63% depending on the type of repair used, with better results using mesh implantation. For the management of such large hernias, interest has been generated in the Component Separation Technique. This technique relaxes abdominal wall by translation of muscular layers without severing the innervation and blood supply, with or without the mesh augmentation. This can accommodate for defects up to 25–30 cm in the waistline. The aim of this study is to compare the results of different surgical methods used in giant midline incision hernias. **Materials & Methods:** The records of 90 patients operated on for a midline abdominal incisional hernia were reviewed retrospectively. The patients were divided into three groups based on the surgical method used primary prosthetic repair (PPR), component separation with mesh (CSM) and component separation without mesh (CS). Two-year follow-up results were compared. **Results:** A statistically significant difference was noted between the groups in the transverse diameter measurement of the defect ($p = 0.003$). Subgroup analyses revealed that the median transverse diameter was higher in the CSM group than in the CS group ($p = 0.003$). There was also a statistically significant difference in the duration of surgery ($p < 0.001$), with a subgroup analysis revealing that the duration of surgery was longer in the CSM group than in the PPR and CS groups (PPR-CSM; $p = 0.008$, CSM-CS; $p < 0.001$). Recurrent incisional hernia, smoking and postoperative morbidity development were found to be statistically and significantly associated with recurrence ($p = 0.005$, $p = 0.002$, $p < 0.001$; respectively). **Conclusion:** The use of the CSM method for the repair of giant incisional hernias may reduce recurrence. Component Separation Technique is a safe, easy, and quick option for patients with large hernias.

INTRODUCTION

Incisional hernias are one of the most common complications after abdominal surgery with an estimated incidence as high as 10-50% following midline laparotomy.[1,2] Hence it's not surprising that extensive research has been conducted in the prevention and management of this complication.

A major improvement in hernia incidence was the development of the laparoscopic surgery where hernia incidence is on average 4.3% based on a meta-analysis of 3490 patients.[2] A challenging group of patients are those who have had multiple abdominal operations or recurrent wound herniation, maximizing the stress on their abdominal wall and making sub sequent repairs more difficult.

The 5-year re-operative rate in 10,822 Washington state patients who underwent incisional hernia repair was 23.8% after the first reoperation, 35.3% after the second, and 38.7% after the third.[3]

These patients are at increased risk for hernia repair with loss of domain, hence not being able to achieve primary closure with standard procedures. Conventional methods such as primary open suture repair of ventral hernias with simple fascial

ISSN (O): 2687-5365; ISSN (P): 2753-6556

approximation results in recurrence rates in excess of 60% in long term follow-up,[4,5] with the addition of mesh still resulting in longterm recurrence rates as high as 32%.[5] Hernias are thus not to be overlooked and are still a burden in all surgical disciplines.

To address these issues, alternative surgical approaches have been developed.

Patients undergoing abdominal surgery are likely to develop incisional hernias at a rate of 9-20%.[6] The primary treatment approach to incisional hernias is surgery, with an increased likelihood of morbidity and mortality due to hernia complications in untreated patients.[7-8] The reconstruction approach in the presence of giant midline abdominal wall incisional hernias is challenging in terms of the selection and implementation of the optimum method, and the high morbidity and relatively high recurrence rates in the postoperative period.[9]

One of the most common surgical approaches to incisional hernias is reconstruction with prosthetic materials.[10] The component separation technique was first described as "tension relieving" in epigastric hernias, and is today used to repair incisional hernias.[11-12] The component separation technique has been reported to result in a lower tension at the repair site,and lower postoperative morbidity and recurrence rates.[13-14]

The present study aimed to compare the outcomes of the primary prosthetic repair (PPR), component separation with mesh (CSM) and component separation without mesh (CS) techniques in giant midline incisional hernias.

increasingly and modifications trying to tackle the main issues of the technique have been made. Described limitations of this technique are complications involving the skin and subcutaneous tissue, most likely caused by surgical interruption of perforating vessels during exposure of the
oblique muscle.

To date, the more common variations on the component separation theme are the open anterior approach (OAA), the transversus abdominis release (TAR), the laparoscopic anterior approach (LAA) and the open anterior perforator preserving approach (PPA) with their original description in the noted references.

This systematic review analyzes the current literature involving component separation, its most common modifications and compares these techniques to evaluate if there are important differences in reported outcomes, adding evidence for best clinical practice.

The incidence of incisional hernia, as a complication of abdominal surgery, has been reported in 2%–20%,[15,17] of operated cases. Nearly 4% of the patients undergoing laparotomy will go through additional surgery for repair of incisional hernia.[18]

Out of all the patients undergoing incisional hernia repair, strangulation or incarceration is the indication for repair in 17% of such patients.[19] The cause is difficult to determine, but obesity, wound healing defects, multiple prior procedures, prior incisional hernias, and technical errors during repair may all be contributory.

Despite significant improvement in surgical techniques, recurrence rates following repair vary from 2% to 36%.[20,21] Mesh implantation, though frequently used, is associated with several complications like infection, seroma or hematoma formation, the incidence being almost twice as high compared to suture repair.[22]

In some cases, the size of incisional hernia can be so large that it could not be repaired even with a mesh. In such difficult cases of loss of abdominal domain, a simple reduction of hernial contents can cause abdominal compartment syndrome, resulting in decrease in cardiac output, and fall in renal, pulmonary, and also cerebral function. Component separation technique has been introduced based on enlargement of abdominal wall surface by translation of muscular layers without severing the innervations and blood supply of the muscles. This was further developed by separation of the posterior rectus sheath from the rectus abdominis muscle and later by augmentation with mesh between rectus abdominis muscle and the posterior rectus sheath.[23-25]

With this technique, defects up to 25–30 cm in the waistline can be bridged. However, wound complications are frequent 26– hematoma, seroma and infections are reported to be in up to half of the patients.

MATERIALS AND METHODS

In the present study, the data of 90 patients operated on for a midline abdominal incisional hernia, in the surgery department of GSVM medical college Kanpur between July 2023 and November 2023, were reviewed retrospectively. The patients were divided into three groups based on the surgical method used (PPR, CSM and CS), with each group including 30 patients. Prior to surgery, detailed information of the surgical method was provided to the patients, and their written informed consent was obtained.

The study included patients over the age of 18 that completed two years of follow up. Patients operated on using different methods, those with a hernia with a transverse diameter < 6 cm, those undergoing emergency surgery and those with a stoma were excluded from the study.

Demographic information, Body Mass Index (BMI), American Society of Anesthesiologists (ASA) scores, transverse diameter of hernia defect, status of being primary or recurrent hernia, duration of surgery, morbidity, length of stay in hospital and recurrence rates after two-year follow up of all patients were recorded and compared. Patients that had undergone previous incisional hernia surgery were assessed as "recurrent incisional hernia".

Operative Technique

Primary Prosthetic Repair (PPR) Technique: After intraabdominal adhesions were removed and

ISSN (O): 2687-5365; ISSN (P): 2753-6556

the intact fascia rims were exposed, the abdomen was closed using absorbable continuous sutures. The skin and subcutaneous tissue were mobilized laterally through the anterior rectus sheath to create space for the mesh placement. A non-absorbable polypropylene synthetic mesh (Prolene mesh, Ethicon) was then placed into this space.

Component Separation with Mesh [CSM] or without Mesh [CS] Technique: After intraabdominal adhesions were removed and intact fascia rims were exposed, the skin and subcutaneous adipose tissue were dissected bilaterally around 3-4 cm lateral to the linea semilunaris. The aponeurosis of the external oblique muscle was exposed around 1-2 cm laterally from the end of the rectus sheath (Figure1).

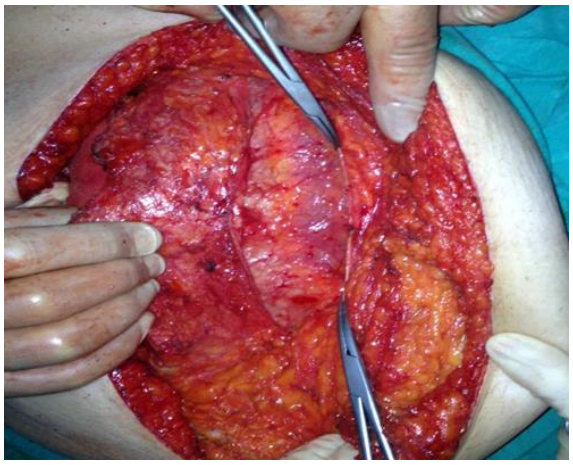

Figure 1: Unilateral component sepration

The myoaponeurosis of the external oblique muscle was transected longitudinally as far as the costa at the superior and the inguinal ligament at the inferior. The avascular area between the external oblique muscle and the internal oblique muscle was dissected. In this technique, the abdominal wall was unilaterally advanced to the midline by about 3-5 cm at the upper edge of the rectus muscle, 7-10 cm at the waistline and 1-3 cm at lower abdomen (Figure 2).

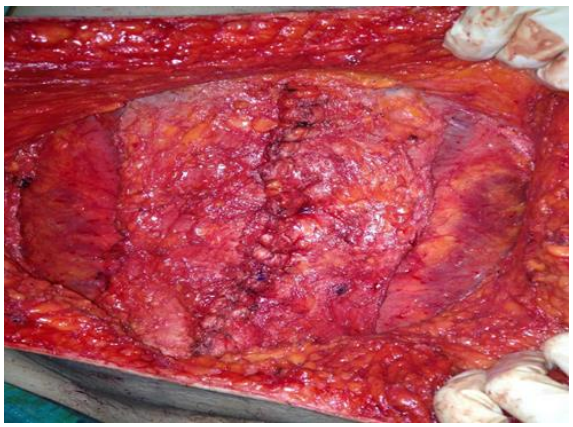

Figure 2: Final component separation

In the CSM group, a prolene mesh was placed on this area after closing the abdomen, while in the CS group, no mesh was used.

Perioperative Care

All surgeries were performed under general anesthesia. A urinary catheter was inserted into each patient and removed at the postoperative 2nd hour. Anti-embolism stockings were applied to every patient, and enoxaparin (Clexane, Sanofi Aventis) was administered to those with a BMI > 30 for embolism prophylaxis. All patients received prophylactic antibiotherapy prior to surgery. Wounds were monitored daily for hematoma, seroma and skin necrosis. Patients with wound site infections were administered antibiotic treatment based on culture results. Two aspirative drains were placed subcutaneously into the patients from all groups as routine. When the drainage amount decreased below 50 cc, the drains were removed. Patients were called for controls at 3, 6, 12 and 24 months, and checked with a physical examination. Cases suspected of recurrence during the physical examination were examined further with ultrasonography or computerized
tomography.

Statistical Analysis

A Shapiro-Wilk test was used to assess whether the variables followed a normal distribution. Variables were reported as mean ± standard deviation or median (minimum: maximum). Based on the results of the normality test, ANOVA or Kruskal Wallis tests were used for the comparison of the groups. A Dunn test was also performed after the Kruskal Wallis test for a pairwise comparison. Categorical variables were compared with Chi-square, Fisher's exact or Fisher-Freeman-Halton tests. To determine the independent risk factors affecting recurrence development, a binary logistic regression analysis was performed. SPSS (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) software was used for the statistical analyses. A p - value of ≤ 0.05 was considered statistically significant.

RESULTS

Demographic data of the patients from all groups were evaluated (Table 1). There was no difference in age, gender, weight and BMI between the groups. There was a statistically significant difference in transverse diameter of the defect between the groups ($p = 0.003$). Subgroup analyses revealed that the median transverse diameter was higher in CSM group compared to CS group ($p = 0.003$). No statistically significant difference was found in ASA score, smoking status and primary or recurrent nature of hernia between the groups ($p > 0.005$).

For the patients in all groups, the duration of surgery, postoperative morbidity, need for reoperation after morbidity, and recurrence rates on the day of hospitalization and during the two-year follow-up

ISSN (O): 2687-5365; ISSN (P): 2753-6556

period were evaluated. Other than wound site complications, no morbidities were detected in the patients. A statistical difference was noted in the duration of surgery ($p < 0.001$), with a subgroup analysis revealing that the duration of surgery was longer in the CSM group than in the PPR and CS groups (PPRCSM; $p = 0.008$, CSM-CS; $p < 0.001$). There was no statistical difference in morbidity, length of hospital stays or recurrence in the two-year follow up between the groups. Yet, the recurrence rate was 20% in the CS group and 10% in CSM group (Figure 3).

A logistic regression analysis was used to examine such potential risk factors as duration of surgery, BMI, transverse diameter of the hernia, wound complications, smoking status, ASA scoring, primary or recurrent nature of the hernia, age, gender and length of hospital stay, which were likely to affect recurrence development.

Recurrent incisional hernia, smoking and postoperative morbidity development were found to be statistically associated with recurrence ($p = 0.005$, $p = 0.002$, $p < 0.001$; respectively).

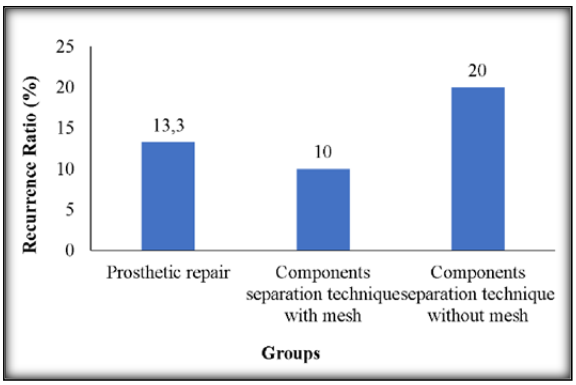

Figure 3: Recurrence rates between groups during follow-up

Table 1: Table I: Distribution of Lesion According to Age and Sex

	PPR (n=30)	CSM (n=30)	CS (n=30)	p-value	Pairwise comparisons		
					P_{1-2}	P_{1-3}	P_{2-3}
Age(year)	55.73±12.06	57±11.58	54.80±12.20	0.775[a]	-	-	-
Gender(F/M)	17/13	16/14	17/13	0.956[b]	-	-	-
Weight (kg)	74.83±8.22	75.63±10.47	74.93±12.73	0.951[a]	-	-	-
BMI	26.47±2.46	26.34±2.62	26.88±2.82	0.712[a]	-	-	-
Defect (cm) (transverse diameter)	10 (7:17)	11.50 (7:24)	8 (7:23)	**0.003[c]**	0.942[e] **0.003[e]**	0.063[e]	
ASA, n(%)							
I	7(23.30)	9(30)	12(40)	0.355[d]	-	-	-
II	12(40)	11(36.70)	14(46.70)				
III	10(33.30)	9(30)	3(10)				
IV	1(3.30)	1(3.30)	1(3.30)				
Smoking,n(%)	6(20)	5(16.70)	7(23.30)	0.812[b]	-	-	-
Recurrence/Primary, n(%)							
Recurrence	4(13.30)	5(16.70)	8(26.70)	0.390[b]	-	-	-
Primary	26(86.70)	25(83.30)	22(73.30)				

Data are shown as mean ± standard deviation or n (%) or median (minimum: maximum). PPR = Prosthetic repair, CSM = Component separation technique with mesh, CS = Component separation technique without mesh aANOVA test, bChi-square test, cKruskal Wallis Test, dFisher-Freeman-Halton Test, eDunn Test

DISCUSSION

The use of tension-free techniques with prosthetic materials for incisional hernia repairs has decreased recurrence rates from 50% to 24%.[11]

The risk factors for recurrence following incisional hernia reconstruction have been identified as hernia diameter (> 10 cm), BMI (> 30 kg/m2), history of previous repair, chronic obstructive pulmonary disease and diabetes, smoking and postoperative wound site complications (surgical site infection, hematoma and seroma).[12,13] The present study also found that a history of previous repair, smoking and surgical site infection were statistically associated with recurrence development.

The use of mesh is recommended as standard in incisional hernia reconstructions.[14] Repairs with mesh have been reported to significantly reduce recurrence rates in CS, as in the standard open ventral hernia repair technique.[15,16] The goal of tension-free and anatomic repair is to create a neo-linea alba by approximating the rectus muscles again to the midline,[17] which enables a tension-free closure of the fascia and its reinforcement with mesh, minimizing the risk of recurrence.[18,19]

In the present study, the recurrence rate during the postoperative two-year followup was 13.3% in PPR, 20% in CS and 10% in CSM, meaning no statistical difference in recurrence development between the surgical methods. That said, the recurrence rate was lower in patients with mesh, and lowest in the CSM group.

We believe that the failure to identify a statistical difference was due to the low volume of patients, and that a statistical difference may be established in future studies with a larger patient groups.

Wound site complications (hematoma, seroma, skin necrosis and surgical site infection) following the repair of giant incisional hernias may occur in 12-67 % and 12-27 % of patients treated with CS and PPR, respectively.[20,21]

ISSN (O): 2687-5365; ISSN (P): 2753-6556

It is believed that wound complications increase with wide dissections, prolonged durations of surgery and ligation of the epigastric perforating arteries at the dissection site.[20]

After ligating the epigastric perforating arteries, the supply of skin can only be provided through intercostal arteries and the branches of the pudental artery, leading to wound site perfusion and supply disorders.

Although attention was paid to preserving the perforating arteries in the present study, the wound site complication rates were 20%, 23.7% and 20% in the PPR, CSM and CS groups, respectively. A direct association has been identified between wound complications and recurrence risk.[12,13]

The present study also identified a more frequent development of recurrence in patients with wound complications. We believe that termination of smoking, especially in the preoperative period, and taking care to preserve the perforating arteries in patients with recurrent incisional hernia may be helpful.

This study is the first in literature to compare three surgical methods (CS with mesh and without mesh, and primary prosthetic repair) in incisional hernias. Our study is limited by the relatively low number of cases included in the groups and the single-center design.

In addition, a statistically significant difference was found in the transverse diameter of the hernia defect between the groups (groups 2 and 3, $p = 0.003$). Accordingly, the CSM procedure was applied to hernias with larger diameters, which may be attributed to the non-randomized design of the study. Prospective randomized controlled studies with a larger number of patients are needed for the acquisition of better data.

CONCLUSION

In conclusion, in giant midline incisional hernias, the CS technique is an effective and safe method involving careful dissection and the preservation of perforating vascular structures as far as possible. Nevertheless, we believe that such procedures should be reinforced with a mesh in order to minimize the recurrence rates as the defect size increases. We also believe that there is a need for randomized studies involving larger numbers of patients and evaluating short-term and long-term outcomes in order to determine the place of CS in incisional hernia reconstructions.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556