

Comparison of Different Component Separation Techniques for Repair of Large and Complex Ventral Hernia

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ABSTRACT

Background: Ventral hernia is a common surgical problem following any laparotomy. Small hernia is easily manageable in different ways, but large incisional hernia is difficult to manage. Component separation technique is the light at the end of tunnel. Aim of the study was to compare outcome of different component separation techniques in terms of complication and outcome.

Materials and methods: This prospective study was conducted in the Department of Surgery, Rangamati Medical College Hospital and in a Private Hospital of Chattogram from January 2017 to December 2019. Patients with large ventral hernia >8cm in width were included in this study. Total 23 cases were included. Sampling technique was purposive. Recurrent hernia and hernia with other complications i.e. presence of stoma, partial loss of abdominal wall, lumbar and para-stomal hernia etc were included in this study. Presence of active infection and infected mesh were excluded from this study. All 23 cases were treated by different types of component separation technique and later each technique was evaluated by its outcome.

Results: Out of 23 cases 5 were treated by anterior component separation technique, 15 were treated by posterior separation technique and 3 were treated by posterior component separation technique plus transversus abdominis release. Post-operative complications were more in anterior component separation (80%) and least in posterior separation technique (20%) and in combined surgical technique (33.3%). Incidence of different complications also did not differ significantly with surgical technique.

Conclusion: We have no conclusive evidence that any of the compared surgical repair method was superior to other method.

Key words: Ventral hernia; Operative procedure; Comparative study.

INTRODUCTION

Approximately 0.5 to 1 % of population has been suffering from different types of ventral hernia¹. Incisional hernia complicating 11-23% of patients who undergone laparotomy^{2,3,4}. Risks of hernia in infected laparotomies are up to 60%⁴.

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Different methods of ventral hernia repair have been evolved. But none of them reduces the incidence of recurrence. Since the advent of mesh for repair of large ventral hernia, different ways are being tried to incorporate the mesh in the abdominal wall. But only mesh could not reduce the incidence of recurrence of ventral hernia. So for last 20-25 years surgeons are trying to use abdominal muscles, mid-line closures of abdominal wall, proper positioning of mesh to combat recurrence of ventral hernia. Initially anterior component separation technique was introduced, later posterior component separation technique and transversus abdominis release technique were adopted for reduction of recurrence following ventral hernia repair.

Abdominal wall is a dynamic structure. It protects and support the abdominal organs and helps in physiology of different systems. Integrity of the abdominal wall requires for effective respiration, urination, defecation, parturition, coughing, sneezing etc. It also helps in posture & gait of the patients and maintains the contour of the body. Any breach in

the abdominal wall fails to work properly. Simple apposition of the margins of incisional hernia by absorbable or nonabsorbable suture materials produces more than 40% recurrence^{5,6}. At the advent of artificial mesh in 1959, incisional hernia was initially repaired by simple bridging the gap and it was sutured at the margins of hernia. The mesh remains unprotected both its anterior and posterior aspect. So repair and position of mesh in this way did not reduce the rate of recurrence and mesh would not be able to a part of dynamic abdominal wall. From then, surgeons were tried to develop newer methods of repairing ventral hernia, where abdominal wall became more resilient and proper placement mesh gave increase strength of abdominal wall thus reducing the recurrence rate. In 1990, Ramirez and colleagues developed a technique for reconstruction of abdominal wall defects without prosthetic material⁷. This was Anterior Compartment Separation (ACS) technique (Figure 1). Component separation technique is based on the concept of re-establishing a functional abdominal wall with autologous tissue repair in the mid line⁸. ACS was associated with high recurrence as well as local complications i.e skin necrosis, haematoma and seroma formation. To overcome these problems Posterior Component Separation (PCS) technique was evolved. Carbonell et al proposed a modification of the retro-rectus hernia repair originally described by Rives and Stoppa, which he termed PCS⁹ (Figure 2). Its aim was to expand the retro-rectus space by incising the posterior rectus sheath and dissecting into the space between the transversus abdominis and the internal oblique muscle, consequently permits the deployment of a larger prostheses to repair large hernia defects with diameter greater than 15 cm. To obtain much length in large hernia Novitsky et al described another novel technique of Transversus Abdominis Release (TAR) associated with PCS¹⁰ (Figure 3).

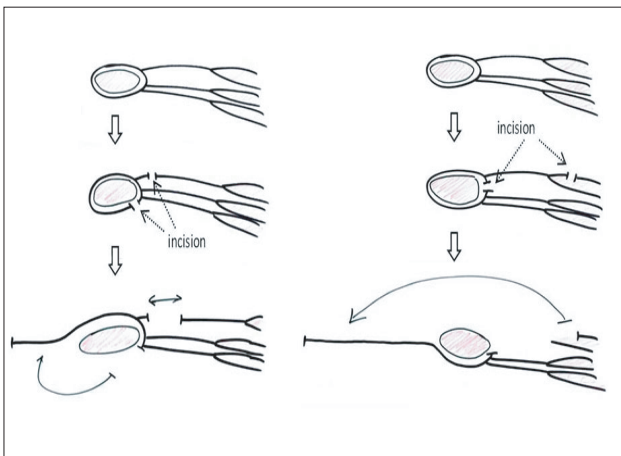


Figure 1 : Anterior component separation¹¹.

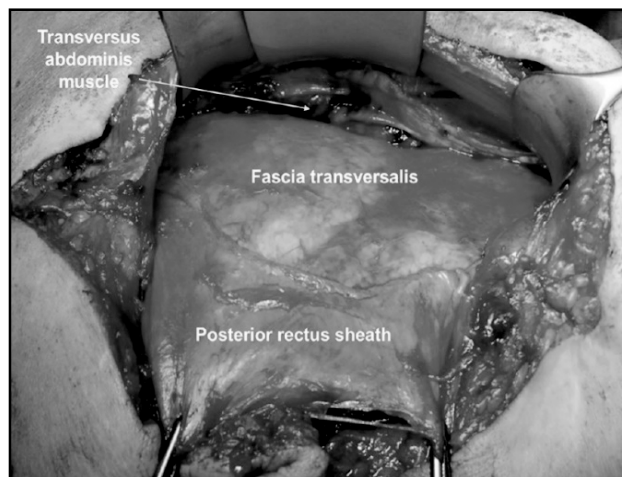


Figure 2 : Posterior component separation¹².

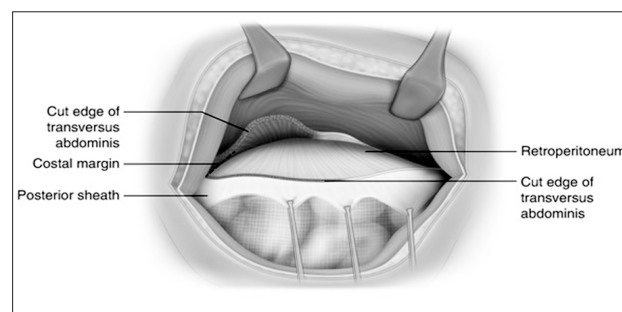


Figure 3 : Posterior component separation + Transversus abdominis release¹³.

In this study we repaired 23 cases of large ventral hernia by three different techniques namely ACS, PCS and PCS plus TAR respectively. Operation related complications and recurrence were assessed postoperatively.

Aim of this study was to compare these three techniques in terms of occurrence of post-operative complications i.e surgical site infection, seroma formation, haematoma formation, skin necrosis and recurrence.

MATERIALS AND METHODS

It was a prospective study carried out from January 2017 to December 2019 in Rangamati Medical College Hospital and in a Private Hospital of Chattogram. Total 23 patients with large incisional hernia (Width > 8cm) were included in this patient. Sampling technique was purposive. Patient with a defect of 8- 10.5 cm were assigned for ACS, 10.5 – 15 cm for PCS and 15- 17.5 cm for PCS plus TAR. Emergency operations were excluded. All the patients were examined postoperatively to assess the outcome of each operation technique. The operations were done under general anaesthesia and followed up at least six months to observe any complications and recurrence of hernia.

Numerical data like age of the patients, body mass index were expressed in mean \pm SD. Categorical data like gender, socioeconomic class and different operative complications were expressed as percentage. Differences between groups were evaluated with Fischer's exact test. Level of significance was set as $p < 0.05$ at 95% confidence interval. Statistical analysis was performed with SPSS version 21.0.

RESULTS

Sociodemographic characteristics of the patients are given in Table I. Among the twenty three patients, 56.5% ($n = 13$) were male and 43.5% ($n = 10$) were female. Mean body mass index was 22 ± 2.1 . Males from upper economic class with obesity showed the highest incidence of development of incisional hernia. Comorbidities included diabetes in four (17.4%), chronic obstructive pulmonary disease in three (13.1%), chronic kidney disease in one (4.34%) and previous malignancy in three (13.1%) patients.

In this series 15 (65.2%) patients underwent PCS technique, five (21.7%) received ACS and remaining three (13.1%) patients received PCS plus TAR. Post operative complications occurred in 8 (34.78%) patients. For individual operative techniques complication rate was 80% for ACS ($n = 4$) 20% for PCS ($n = 3$) and 33.33% for PCS plus TAR ($n = 1$). These difference was not statistically significant ($p = 0.77$) Table II. Difference in frequency of specific complications after repair of ventral hernia by three operative techniques also had no statistical significance (Table III).

Table I : Sociodemographic variables of the patients.

Variables	Characteristics
Age	
Mean age	35.67 \pm 8.5 years
Range	20 to 75 years
Gender	
Male	13 (56.52%)
Female	10 (43.48%)
Socioeconomic status	
Upper class	8 (34.73%)
Middle class	12 (52.17%)
Lower class	3 (13.10%)

Table II : Comparison of frequency of complications with different operative procedure.

Complications	ACS		Operative procedure				p
	(n = 5)		PCS		PCS + TAR		
	n	%	n	%	n	%	
Complicated	4	80	3	20	1	33.3	0.77
Uncomplicated	1	20	12	80	2	66.6	

Table III : Comparison of complications after repair of ventral hernia with different operative method.

Complications	Operative procedure						p
	ACS		PCS		PCS + TAR		
	(n = 5)		(n =15)		(n =3)		
	n	%	n	%	n	%	
Surgical site infection	1	20	2	13.3	-	-	1.00
Seroma	2	40	1	6.66	1	33.3	0.138
Recurrence of hernia	1	20	-	-	-	-	0.348

DISCUSSION

Abdominal wall consists of two compartments, anterior and posterior compartment. The anterior compartment includes the anterior rectus sheath and rectus abdominis muscle. The posterior compartment comprises the posterior rectus sheath, the transversalis fascia, and peritoneum. Midline abdominal wall closure with autologous tissues are the prime concern of component separation technique¹⁴. Linea alba in the midline of abdominal wall acts as an anchoring structure of the abdominal musculature. Separation of linea alba from the mid line causes contraction of oblique muscles of the abdomen laterally and gap becomes wider. Restoration of the linea alba will improve functional outcomes following hernia repair, resulting in improved the quality of life¹⁵.

In this study, male patients are more (>50%) than the female patients. Diabetes, COPD and history of operation for malignant disorders are most common associated comorbid illnesses. In one study, the incidence of diabetes was 16-19.9%¹⁶. It is almost similar to our study (17.4%) but the incidence of COPD in our study is much higher than other studies (13% vs 4-7%)¹⁶.

The size of the defect was measured in its width. In this study, we found hernial gap (Width) ranges from 8- 17.5 cm. Danish ventral hernia database showed that 89% of patients had <15 cm defects and 11% had >15 cm defects¹⁷. Large hernias pose a significant problem in repair and outcome than smaller hernias¹⁷. In another study, it varied from 6 to 15 cm (Average 9.72 cm)¹⁸. Suture repairs of ventral hernia are associated with high failure rate of up to 50% due to excessive tension, poor vascularity and poor tissue quality^{5,19}. So component separation technique is best way to overcome these problems. The introduction of the Intraperitoneal Onlay Mesh (IPOM) repair offered a tension-free repair and significantly decreased recurrence; however, being a bridging repair results to an adynamic abdominal wall repair without restoring abdominal wall function, that is prone to developing mesh eventration or pseudo-hernia, and ultimately to poor patient satisfaction. Fascial approximation restores natural abdominal musculature, improves strength and stability and normalizes abdominal pressures²⁰.

In this study we successfully closed all the abdominal defect by component separation technique. We encountered maximum defect 17.5 cm (Width) and total area of defect was 286.6 cm². Franklin et al. reviewed pre-operative CT scans of 54 patients who underwent CS (48 successful fascial closure and 6 bridged repair); the CS with bridged repair group had significantly higher mean transverse defect size (19.8 vs. 10 cm) mean defect area (420 vs. 184.2 cm²)¹⁹. Poruk et al in their retrospective study on the effect of hernia size on repair and outcome after an open repair, suggested that those with hernia defect area 200–300 cm² were amenable to CS repair²¹. This study is comparable to present study.

Present series shows total 8(34.78%) patients developed complications. Complications were more in ACS technique. Out of 5 cases of ACS, 4 developed complications. Borud LJ et al and de Vries Reilingh TS et al. showed that the complications of ACS were high (>60%)^{22,23}. Saulis & Dumanian, proposed that preservation of perforator vessels to decrease the incidence of post-operative wound complications in ACS²⁴.

Carbonell et al in 2008 proposed a modification of the retro-muscular hernia repair described by Rives and Stoppa, which he termed PCS⁹. It aimed to manage larger hernia, width more than 15 cm. We managed 15 patients by PCS.

Novitsky et al proposed an alternative PCS technique, which differs from that of Carbonell by the dissection of the divided transversus abdominis muscle off the underlying transversalis fascia and peritoneum^{9,10}. In this study 3 patients were managed by PCS+TAR method. In one study it had shown that the wound related complications in PCS and PCS+TAR vs. ACS (25.5% vs. 48.2%) and recurrence rate (3.6% vs. 14.3%) are much lower in PCS and PCS+TAR group than the ACS group²⁵. In this study one patient with ACS developed recurrence after 18 months of its repair.

LIMITATION

Very small sample size limits generalization of the observed results.

CONCLUSION

Component separation techniques are the ideal methods of reconstruction of repair of large ventral hernia. Different authors have been suggested that the PCS alone or PCS + TAR are superior to ACS. But in this study we have no conclusive evidence that any of the compared surgical repair method was superior to other method.

DISCLOSURE

The author declared no competing interest.

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