Combined Open Components Separation with Mesh Repair Versus Mesh Bridged Repair in Complicated Large Ventral Hernias

Original Article

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ABSTRACT

Background: Although Managing a major ventral hernia is a surgical struggle, which becomes increasingly more difficult if it is complicated. Not every patient will benefit from the same ventral hernia repair strategy. So, using combined components separation with mesh reinforcement or mesh bridged repair is important to provide tensionless repair and avoid further complications.

Aim: Comparing combined open components separation with mesh repair versus mesh bridged repair in complicated large ventral hernia with regard to surgical site occurrences and hernia recurrence.

Patients and Methods: This retrospective analysis was undertaken at the Department of General Surgery, Tanta University, including 36 patients who presented with complicated large ventral hernia underwent surgical repair between June 2018 and December 2022.

Results: The analysis included 27 women and nine men, who were followed for a median of 40 months, with a mean age of 51.22±4.35 years. The mean preoperative BMI was 30.87±4.42kg/m^2. The mean operative time was significantly shorter in the mesh bridged group than the component separation group (102.35±27.58 vs. 145.35±12.54min). The mean hospital stay was less in the mesh bridged group (5±0.8 vs. 7±1.2 days). Postoperative complications were encountered in 11 cases. Recurrence occurred in two (14.2%) patients.

Conclusion: Mesh bridged repair may be the safest choice in an emergency, depending on patient stability, volume status and degree of contamination, while the combined components separation technique with only mesh reinforcement has superior outcomes compared with mesh bridged repair in complicated large ventral hernia as regards surgical site occurrences, hernia recurrence and achieving functional, tensionless, strong fascial closure.

Key Words: Components separation, Mesh bridged, Ventral hernia.

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INTRODUCTION

Ventral hernias are classified as challenging when specific criteria are met, such as a hernia defect larger than 10 cm, loss of domain exceeding 20%, a hernia over a bony prominence, and several hernial defects. Hernia complexity raises the risks, complications, and perioperative measures[1].

Repairing a big, complicated ventral hernia is a difficult surgical task. Due to lateral rectus migration, decreased oblique musculature compliance and need for enterolysis[2].

Even though abdominal wall surgery has advanced over the past 20 years, there is still no widely accepted technique for fixing big ventral hernias. Numerous management strategies and component separation methods have been detailed, each with unique benefits and drawbacks[3].

Surgeons use anterior components separation techniques to provide ideal hernia repair, which should be tension-free and provide dynamic muscle support[4]. While posterior components separation shows significantly low surgical site occurrences and low recurrence rate when compared with anterior components separation[5].

Mesh reinforcement modification to component separation shows lower hernia recurrence, as reported by Buenafe and Lee-Ong[6].

In an emergency, mesh bridged repair may be the safest choice depending on patient stability, volume status, and degree of contamination, due to its affordability and lack of significant systemic or mesh-related problems[7,8].

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The surgeon's preference, surgical tradition, or even the hospital's financial position typically impacts the procedure chosen[9].

Despite plenty of research establishing the usefulness and safety of prosthetic mesh treatment for ventral hernias, surgeons are nevertheless hesitant to employ prostheses in these instances[10].

PATIENTS AND METHODS:

This retrospective study was carried out at the General Surgery Department, Tanta University, including 36 patients more than 18 years old who presented with complicated large ventral hernia and underwent surgical repair between June 2018 and Dec 2022. Group A included 22 patients who underwent combined component separation with mesh repair, and group B included 14 patients who underwent mesh bridged repair. The work received permission code (36264PR1004/12/24) from Tanta University's Faculty of Medicine's Quality Assurance Unit and Research Ethics Committee.

Every operated patient's data was regularly gathered from the registered information showing measurements, radiological, and laboratory investigations (Figure 1).

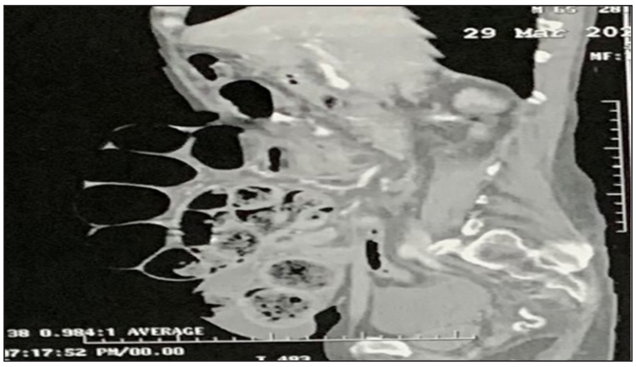

Figure 1: CT abdomen show large ventral hernia with incarcerated bowel; CT: Computed Tomography.

Surgical steps

All cases were done under general anesthesia, using the open technique. Prophylactic antibiotic and LMWH was given for high-risk cases to be continued 14 days postoperatively. Peak airway pressure was measured by an anesthesiologist before incision, during and after reduction of hernia content with (fascial closure in group A and mesh bridging in group B).

The incision was planned according to previous scars and the hernia site. Hernial sac dissection was done, then opened with reduction of the contents if viable in irreducible or obstructed hernia, while resection of nonviable omentum or resection anastomosis when a gangrenous loop was detected in a strangulated one. Defect width was measured. In group A, dissection was done 2–5cm lateral to the linea semilunaris on both sides, cranially to the costal margins and caudally to the inguinal region. Anterior components separation was performed by a vertical incision 1 cm lateral and parallel to the linea semilunaris from the costal margin down to the symphysis pubis to develop a plane between the external oblique fascia and the internal oblique fascia to avoid damage to the neurovascular structures supplying the muscles. Posterior components separation was added to create tensionless fascial closure on both sides if needed. Midline closure using continuous Prolene 1, with onlay polypropylene mesh fixed to the lateral edge of the external oblique aponeurosis using continuous Prolene 1 and was positioned underneath and beyond the lateral edge of the external oblique aponeurosis for 5 cm to minimize extensive flap mobilization (Figures 2 and 3).

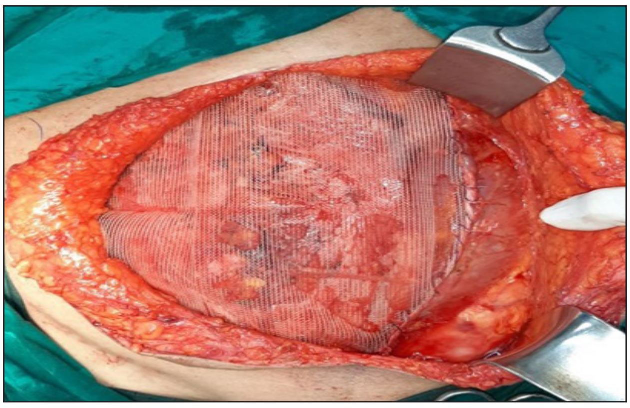

Figure 2: Mesh was positioned underneath and beyond the external oblique aponeurosis in group A.

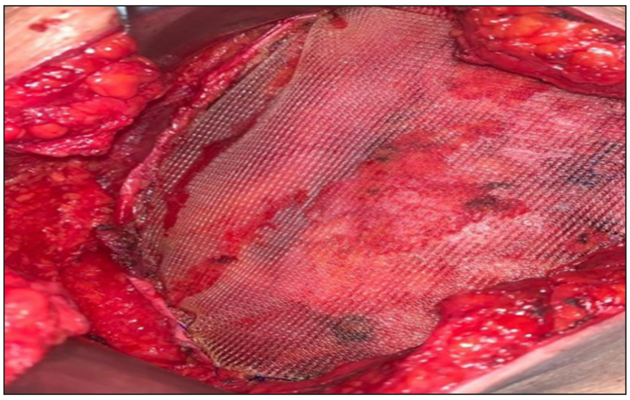

Figure 3: Mesh was positioned underneath and beyond the external oblique aponeurosis in group A.

While in group B after reduction of hernial contents, omentum or peritoneum/or hernial sac was sutured all around the defect to cover intestine using continuous Vicryl 1 (Figure 4) followed by closure the defect by polypropylene mesh bridge using continuous Prolene 1 then the mesh was extended beyond the defect for 5cm then it was fixed using continuous or interrupted Prolene 1 all around (onlay mesh) (Figures 5 and 6). Tube drains were inserted on both sides and were eliminated after 2 days in a row when their daily output was less than 50ml per 24h. Early ambulation and chest exercise were done, and an abdominal binder was used in the early postoperative period.

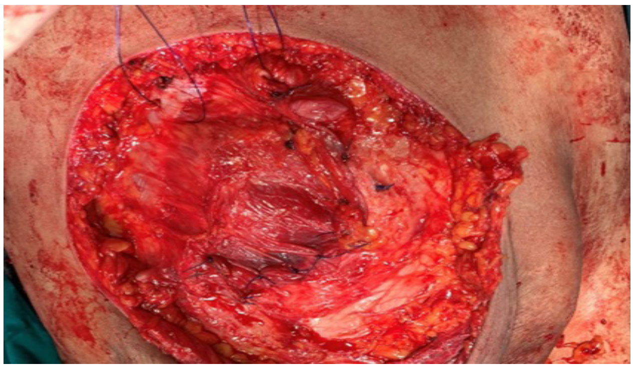

Figure 4: Covering intestine by peritoneum/or hernial sac.

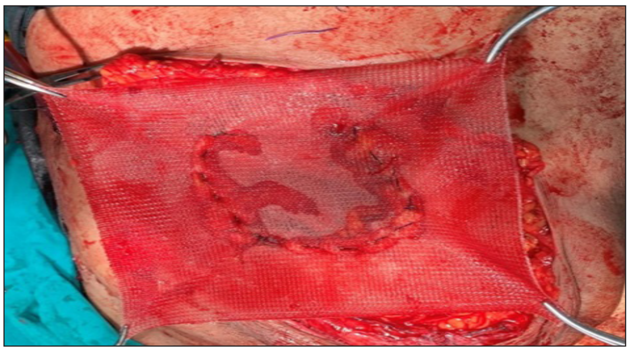

Figure 5: Mesh bridged repair group B.

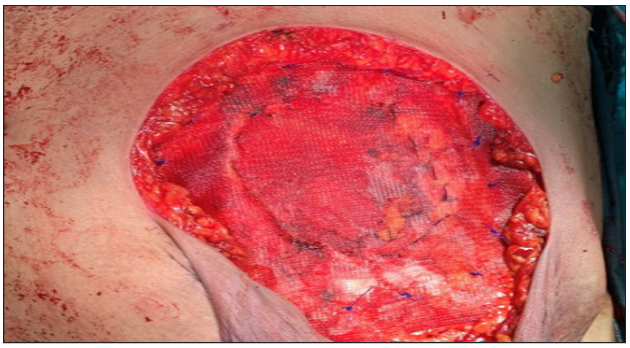

Figure 6: Mesh bridged repair group B.

Postoperative data, including postoperative course, ICU stay, duration of hospitalization, any issues, readmission, treatment, and recurrence.

Clinical follow-up was carried out weekly in the first month, then monthly in first year, and then yearly intervals. Phone calls were made to patients who were unable to attend the follow-up, and their information was updated. When a clinical examination revealed a possibility of a recurrence, a computed tomography scan was conducted.

Outcomes

Recurrence of hernias was our primary outcome measure. The length of operation, time to remove drains, pain scores, length of hospital stay, seroma, hematoma, infection, flap necrosis, and death were the secondary outcome measures.

Statistical analysis

The collected data were organized, tabulated, and statistically analyzed using the software program of the Statistical Package of Social Science, version 20 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics were performed for quantitative variables as mean±SD and range. While categorical data were expressed as numbers and percent. Metric data were expressed as range, mean, and SD. Comparison of variables between the two groups was conducted using the χ^2 test, and when it was inappropriate, the Monte-Carlo exact test was used instead. The level of significance was adopted at P value less than 0.05.

RESULTS:

All of our patients underwent an open emergency surgery; patients in group A underwent combined component separation and mesh repair, while patients in group B underwent mesh bridged repair. The patient characteristics and a comparison of the two groups are displayed in Table (1). Seventy-five percent of the cohort were female. The average age was 51.22±4.35 years. The majority of patients had related comorbidities, particularly obesity, which was present in almost 64% of them. The mean BMI was 30.87±4.42kg/m^2.

Operative records

The mean operative time was significantly shorter in the mesh bridged group (102.35±27.58 vs. 145.35±12.54min) as shown in Table (2). The mean blood loss was also significantly decreased in group B than in group A (151.42 vs. 304.68ml), which was estimated by adding blood collected in the suction apparatus to the blood sucked by the gauze. In group A, the anterior components separation technique was done alone in 18/22(81.8%) patients with defect width 9–12cm, while the posterior components separation technique was added to the anterior components separation technique in four (18.2%) patients with defect width 13–17cm to obtain tensionless midline fascial closure. The mesh was positioned underneath and over the lateral edge of the external oblique aponeurosis in all cases to minimize extensive flap mobilization. In group B, omentum was used in 7/14(50%) patients, while peritoneum/or hernial sac was used in 7/14(50%) patients to be sutured all around the defect to cover the intestine with a defect width of 10–16cm. Resection anastomosis of gangrenous small bowel was done in two cases in each group.

Postoperative results

The mean postoperative hospital stay was significantly shorter in the component separation group (5±0.8 vs. 7±1.2 days). Two (5.5%) patients required ICU admission immediately after surgery, where they underwent close cardiovascular and ventilatory monitoring, and they were released 3 days later. Also, there is a significant difference between both groups as regards daily drain discharge (154.23 vs. 168.47ml), but not for timing of drain removal (14.6 vs. 15.4 days). Postoperative complications were encountered in 11(30.6%) patients and were comparable between both groups five (22.7%) patients in group A vs. six (42.9%) patients in group B) as shown in Table (3). Three (8.3%) patients developed subcutaneous hematoma, which was managed conservatively under the cover of antibiotics, and three (8.3%) patients developed seroma after drain removal, which was managed by ultrasound (US)-guided aspiration under complete aseptic conditions. On follow-up, one patient in group B requires US-guided drain insertion after frequent aspiration and was removed thereafter. Two (5.5%) patients developed wound dehiscence, one in each group, and were managed by secondary suturing for a smooth outcome. Three (21.4%) patients in group B had superficial surgical site infection, and one (4.6%) in group A, and were managed conservatively.

We did not record any incidences of deep vein thrombosis in the leg or pneumonia, which are major systemic complications. None of the patients had any recorded deaths.

Follow-up and recurrence

The duration of the follow-up was between 24 and 72 months, with a median of 40 months. Recurrence of hernia after surgical repair occurred in two (14.2%) patients in group B, 6 and 8 months postoperatively, and both were managed later by the component separation technique with mesh reinforcement, with a smooth outcome thereafter.

All patients were satisfied postoperatively; although four (11.11%) patients reported abnormal sensation over the mesh site, two in each group. Recurrence had occurred in two (14.2%) patients in group B and was attributed to surgical site infections.

Four instances experienced minor chronic pain that did not interfere with daily activities at follow-up; there was no statistically significant variance between the two groups. Lately, there has been no persistent abdominal wall accumulation, sticky intestinal blockage, or enterocutaneous fistula.

Table 1: Preoperative data of the studied patients (*N*= 36):

Preoperative data	Total, *N*= 36	Group A, *N*= 22	Group B, *N*= 14	Test of significance *P* value
Sex [n(%)]				
Female	27(75)	18(81.8)	9(64.3)	χ^2= 1.4
Male	9(25)	4(18.2)	5(35.7)	2.3
Age				
Minimum–maximum	41–56	45–56	41–55	*t*= 1.4
Mean	51.22±4.35	52.36±3.47	49.697.4±	0.15
BMI				
Minimum–maximum	26–35	26–33	28–35	*t*= 0.4
Mean	30.87±4.42	29.78±2.3	30.2±3.4	0.6
[(%) Associated risk factors [n				
Obesity	23(63.9)	13(59.1)	10(71.4)	χ^2= 0.9
Multiparity	21(58.3)	12(54.6)	9(64.3)	0.9
Type 2 DM	13(36.1)	6(27.3)	7(50)	
Chronic chest disease	12(33.3)	7(31.8)	5(35.7)	
Smoking	7(19.4)	3(13.6)	4(28.6)	
Types of hernia [*n*(%)]				
Incisional hernia	21(58.3)	14(63.6)	7(50)	χ^2= 1.28
Recurrent ventral hernia	12(33.3)	7(31.8)	5(35.7)	0.52
De novo ventral hernia	3(8.4)	1(4.6)	2(14.3)	
Defect width (cm)				
Minimum–maximum	9–17	9–17	10–16	*t*= 1.1
Mean	13.7±2.5	12.6±5.3	14.3±3	0.2

More than one risk factor was found in the same patient; DM: Diabetes Mellitus.

Table 2: Operative data of the studied patients (*N*= 36):

Operative data	Total	Group A, N=22	Group B, N=14	Test of significance P value
Operative time				
Minimum–maximum	75–160	130–160	75–120	*t*= 6.3
Mean	124.5±22.6	145.35±12.54	102.35±27.58	0.0001*
The blood loss (ml)				
Minimum–maximum	120–420	250–420	120–180	*t*= 53.26
Mean	179.6±22.8	304.68±23.7	151.42±19.5	<0.0001*
Daily drain discharge (ml)				
Minimum–maximum	125–195	125–170	135–195	*t*= 14.24
Mean	162.8±19.7	154.23±20	168.47±18.4	0.03*
Subcutaneous drains removal (days)				
Minimum–maximum	9–19	9–17	12–19	*t*= 0.8
Mean	13.2±3	14.6±1.5	15.4±2.7	0.2
Hospital stays (days)				
Minimum–maximum	4–10	4–7	5–10	*t*= 2
Mean	5.7±1.3	5±0.8	7±1.2	<0.0001*

Table 3: Postoperative complications of the studied patients (*N*= 36):

Postoperative complications	Total	Group A, *N*= 22	Group B, *N*= 14	Test of significance *P* value
Yes [*n*(%)]	11(30.6)	5(22.7)	6(42.9)	χ^2= 2.8
No [*n*(%)]	25(69.4)	17(77.3)	8(57.1)	0.09
ICU admission	2	1	1	
Hematoma	3	2	1	
Seroma	3	2	1	
Wound dehiscence	2	1	1	
Wound infection	4	1	3	
Recurrence	2	0	2	

There is more than one complication that occurred in the same patient.

DISCUSSION

For both the surgeon and the patient, ventral hernia surgery is a challenging and complex matter. Finding the optimal procedure for a difficult provided formula (patient, anatomy, hernia) that requires a full reconstruction enhanced by a large and appropriately positioned mesh with low early and late morbidity is the primary issue for this surgery. Herniology provides a wealth of information about different types of mesh and surgical techniques, but standardization is constrained by biases and heterogeneity[11].

The introduction of sophisticated surgical techniques like the TAR technique facilitates midline closure while creating room for the placement of large mesh. Techniques for correcting ventral hernias have advanced significantly over time, extending from simple anatomical repair to component separation[12]. Restoring abdominal wall function, minimizing wound morbidity, and achieving a satisfactory esthetic appearance are the main objectives of any major ventral hernia repair[13].

Our study aimed to compare combined open components separation with mesh repair (group A) versus mesh bridged repair (group B) in complicated large ventral hernia with regard to surgical site occurrences and hernia recurrence. This study included 36 cases between June 2018 and December 2022.

Twenty-one (58.3%) of our patients had incisional hernias, and 12(33.3%) had recurrent ventral hernias, which were caused by several risk factors, such as obesity, multiparity, smoking, chronic chest diseases, and diabetes mellitus, which are also associated with increased complications after hernia repair[14].

The bulk of the patients in our study were female, 27 36(75%). This sex value is reported by Daware *et al*.,[15], which explained that multiparity, about 22(61.1%) cases in our study, is a risk factor in females causing hernia.

Furthermore, a higher BMI is linked to more adipose tissue, which may lengthen the duration of surgery or necessitate concurrent subcutaneous advancement flaps[16]. In our investigation, no BMI exclusion criteria were used.

Twenty-three (63.8%) patients are obese with mean of BMI 30.87±4.42kg/m^2 which is matched with that reported by Tastaldi *et al*.,[17] with a mean BMI of 31.3kg/m^2, and a study with Talpai *et al.,*[18] with a mean BMI of 30.4kg/m^2, as increased BMI more than or equal to 30kg/m^2 is associated with surgical site occurrences and hernia recurrence[19].

Smokers had a higher risk of recurrent and incisional hernia independent of other factors[20]. In our study, seven (19.4%) are smokers as smoking is a risk factor for recurrent and incisional hernia since rigorous quitting smoking for a month before surgery lowers the risk of issues[21]. In addition, 13(36.1%) patients suffered from diabetes mellitus, which increases the risk of recurrence and infection[22].

Prehabilitation is a novel technique that prepares patients for hernia repair, enabling people to prepare their bodies for the strain of surgery. This program, which consists of pulmonary rehabilitation, physical activity, weight reduction, stress reduction and nutritional optimization, showed lower hospital charges and improved physiological activity postoperatively. Despite data showing a rise in prehabilitation patients' attrition and emergency repair percentages, which increases the challenge for complicated ventral hernia repair as occurred in the current study[23,24]. Bariatric surgery should be strongly considered to reduce weight and to avoid surgical delays that may occur with nonsurgical weight loss[25].

The patients appeared to tolerate the anterior component separation procedure well. In high-risk patients, the method itself can repair large ventral hernias. However, the most recent changes, which include retromuscle mesh implantation and maintaining perforator vessels, must be added to the original procedure in order to reduce wound issues and the relatively high recurrence rate[26].

The mean operative time was significantly shorter in the mesh bridged group than the component separation group (102.35±27.58 vs. 145.35±12.54min). These results could be attributed to the additional dissection that is required to perform the component separation. The mean blood loss was also significantly decreased in group B than group A (151.42 vs. 304.68ml), as mesh bridged repair requires the least dissection, which matches a study done by Omarov *et al.,*[27]. So, in an emergency, mesh bridged repair may be the safest choice depending on patient stability, volume status, and degree of contamination[28]. Although this approach leaves the mesh without the fascial layer's protection and makes it more liable to complications[29].

Numerous studies have demonstrated that the size of the hernia defect plays a critical role in determining the likelihood of problems following surgery[30]. In the current study, in group A, the anterior components separation technique was done alone in 18/22(81.8%) patients with defect width 9–12cm, while the posterior components separation technique was added to the anterior components separation technique in four (18.2%) patients with defect width 13–17cm to obtain tensionless midline fascial closure. While the donor sites are prone to bulging or herniation[29,31], mesh reinforcement decreases hernia recurrence or formation as reported by Buenafe and Lee-Ong[6].

While in group B omentum was used in 7/14(50%) patients, and peritoneum/or hernial sac 7/14(50%) patients to be sutured all around the defect interposed between viscera and mesh with defect width 10–16cm followed by closure the defect by onlay polypropylene mesh bridge without tension then the mesh was extended and fixed beyond the defect for 5cm which matched with that reported by Sorour[8] with acceptable cost-effective technique, low recurrence rates, and wound complications.

Placement of onlay polypropylene mesh necessitated adequate omentum or peritoneum. On the other hand, the use of composite mesh was effective and safe in lowering operative time, with a trend of low surgical site occurrences and recurrence rates and useful in overcoming the small size of the abdominal cavity. However, their primary downsides are their exorbitant price, poor handling, and inadequate tissue integration[32]. Therefore, funding for the provision of composite mesh in emergency rooms should be prioritized[33]. Regretfully, there is not an ideal mesh at the moment; therefore, surgeons must select the "best" mesh for a given clinical situation[34].

The defined composite outcome, called surgical site occurrences, includes seroma development, hematoma, wound breakdown, skin necrosis, enterocutaneous fistula development, and infection of the surgical area[35].

ICU admission was encountered in two (5.5%) patients, one in each group, where close ventilatory and cardiovascular monitoring with no need for intubation or ventilator therapy, and they were discharged 3 days later, which was matched with that reported by Kassem and El-Haddad[33].

Safety is a crucial factor when comparing various surgical techniques. Holihan *et al.,*[36] found that greater surgical site occurrences were linked to mesh bridging repair. Than components separation with mesh repair, including hematoma, seroma, surgical site infection, and wound dehiscence[37,38].

Which were encountered in our study in 11(30.6%) patients and were comparable between both groups: five (22.7%) patients in group A vs. six (42.9%) patients in group B, which matches the series conducted by De Luca *et al.,*[39], which shows a complications rate of 38% of the patients. Because of the substantial subcutaneous dissection, wound problems and seromas are more likely in CST patients than in mesh bridged individuals. A certain literature[40] showed that 42.9% of wound complications occurred following CST. In our study, wound complications developed in 11(30.6%) patients, which was consistent with the literature[27].

Three (8.3%) patients developed small subcutaneous hematoma, two in group A and one in group B, which were managed conservatively under the cover of antibiotics. Three (8.3%) patients developed seroma after drain removal, two in group A and one in group B, which were managed by US-guided aspiration under complete aseptic conditions. On follow-up, one patient in group B requires US-guided drain insertion after frequent aspiration and was removed thereafter. Two (5.5%) patients developed wound dehiscence, one in each group, and were managed by secondary suturing for a smooth outcome, and three (21.4%) patients in group B, and one (4.6%) in group A, had superficial wound infection, and were managed conservatively.

Following hernia treatment, wound complications might double the chance of hernia recurrence and raise overall expenditures by over 300% in the short term[41]. According to Jolissaint (2020)[42], operative site occurrences were the most important risk factor for recurrence adhering to ventral hernia repair.

Major complications occurred as compartmental syndrome in several studies, while they did not occur in our study due to the peak airway pressure being measured by an anesthesiologist before incision, during and after reduction of hernia content with fascial closure in group A and mesh bridging in group B[43,44].

There is no mortality in our study, while in study conducted by Habeeb *et al*.,[45] where the mortality rate was 2.5%, another series occurred in one of two cases of compartmental syndrome 5 days postoperatively a multiorgan failure of component separation in Torregrosa[43], and one case of mesh bridged 10 days postoperatively by massive pulmonary embolism in Sorour[8], which was avoided in our study by prophylactic LMWH which was provided to patients at high risk, to be continued 14 days postoperatively.

The follow-up time had a median of 40 months and varied from 24 to 72 months. When comparing various surgical techniques for hernia repair, recurrence is an important outcome that may indicate how effective the procedure is. The recurrence of hernias was confirmed clinically and radiologically in two (5.5%) individuals in group B, 6 and 8 months postoperatively, and both were managed later by the component separation technique with mesh reinforcement, with a smooth outcome thereafter.

As bridged repair has a number of flaws, such as surgical site occurrences and a higher rate of recurrence. The mesh acts like a sail in the wind[46]. For this, most surgeons reapproximate fascia to recreate a functional abdomen rather than bridged repair[29].

Recurrence occurred in different studies, as Robin-Lersundi[47] reported 4.3% presented incisional hernia recurrence due to surgical site occurrences, which was reported in Slater *et al*.,[32] that patients are three times more likely to experience a recurrence with surgical site occurrences.

Component separation techniques increase the risk of surgical site occurrences like hematoma, seroma, and infection due to skin and subcutaneous tissue mobilization, which creates a large surface area but does not increase the hernia recurrence rate. Also, it affects the blood supply of flaps, leading to wound dehiscence[40]. So in our study, the mesh was positioned underneath and over the lateral edge of the external oblique aponeurosis in all cases to minimize extensive flap mobilization. While minimally invasive techniques, such as endoscopic component separation and perforator vessel sparing components separation, allow for abdominal wall advancement with minimizing wound complications[36,47,48].

LIMITATIONS

There are a few study limitations to take into account. Even though our surgical center is the prospective source of our database, this is a retrospective study; the number of cases is not very large, but it accounts for 25% of all patients with ventral hernias admitted to our hospital. A more thorough and nuanced assessment of the study's findings will result from acknowledging and resolving these shortcomings. To validate these findings, more high-level research is needed, such as prospective randomized studies assessing the long-term outcomes on a large number of participants.

CONCLUSION

Mesh bridged repair may be the safest choice in an emergency, depending on patient stability, volume status and degree of contamination, while the combined components separation technique with onlay mesh reinforcement has superior outcomes compared with mesh bridged repair in complicated large ventral hernia as regards surgical site occurrences, hernia recurrence and achieving functional, tensionless, strong fascial closure. Sufficient training and a comprehensive understanding of the anatomy of the abdominal wall are essential for success

CONFLICT OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Slater NJ., Montgomery A., Berrevoet F., Carbonell AM., Chang A., Franklin M., *et al.* (2014). Criteria for definition of a complex abdominal wall hernia. Hernia; 18:7–17.

2. Zolper EG., Black CK., Devulapalli C., *et al.* (2020). Long term outcomes of abdominal wall reconstruction using open component separation and biologic mesh in the liver, kidney, and small bowel transplant population. Hernia; 24:469–479.

3. Serafio-Gómez JL., Aragón-Quintana C., Bustillos-Ponce M., Varela-Barraza O., Silva B. (2023). Effective management of giant ventral hernias: a comprehensive approach combining preoperative botulinum toxin application, modified ramírez's component separation, and Rives-Stoppa hernioplasty. Cureus; 15:11.

4. Shyanie K., Wesley ER., Callie DC., Wayne YW., Robert K., Scott RJ. (2018). Anterior versus posterior component separation: which is better?. Plastic Reconstr Surg; 142:47S–53S.

5. El-Halby AH., Elmahdy TM., El-Samongy A-D., Elkhadrawy OH. (2024). Posterior components separation with transversus abdominis release and sublay mesh reinforcement in large ventral hernia repair. Surg Pract; 28(4), 181-189.

6. Buenafe AA., Lee-Ong A. (2019). Lateral release in the repair of large ventral hernia. Ann Laparosc Endosc Surg; 4:24.

7. Berger RL., Li LT., Hicks SC., Davila JA., Kao LS., Liang MK. (2013). Development and validation of a risk-stratification score for surgical site occurrence and surgical site infection after open ventral hernia repair. J Am Coll Surg; 217:974–982.

8. Sorour MA. (2014). Interposition of the omentum and/or the peritoneum in the emergency repair of large ventral hernias with polypropylene mesh. Int J Surg; 12:578–586.

9. Mahmoud Uslu HY., Erkek AB., Cakmak A., Sozener U., Soylu L., Turkcapar AG., *et al.* (2006). Incisional hernia treatment with polypropylene graft: results of 10 years. Hernia; 10:380–384.

10. Nieuwenhuizen J., van Ramshorst GH., ten Brinke JG., de Wit T., van der Harst E., Hop WC., *et al*. (2011). The use of mesh in acute hernia: frequency and outcome in 99 cases. Hernia; 15:297–300.

11. Blatnick JA., Brunt ML. (2019). Controversies and techniques in the repair of abdominal wall hernias. J Gastrointest Surg; 23:837–845.

12. Gandhi JA., Gajjar AP., Shinde PH., Chaudhari S. (2024). Posterior component separation technique-original transversus abdominis release (TAR) technique. J Abdom Wall Surg; 3:12542.

13. Haidar MGM., Sharaf NAH., Haidar FM., Sukaina M. (2023). Impact of combined component separation technique and shoelace repair on big medline abdominal wall defect. Asian J Surg; 46:4363–4370.

14. Ferguson HD., Smith CG., Olufajo OA., Zeineddin A., Williams M. (2021). Risk factors associated with adverse outcomes after ventral hernia repair with component separation. J Surg Res; 258:299–306.

15. Daware A., Akhtar M., Zaki BM. (2019). Incisional hernia: predictive factors, clinical presentation and management. Int Surg J; 6:1618–1621.

16. Owei L., Swendiman RA., Kelz RR., Dempsey DT., Dumon KR. (2017). Impact of body mass index on open ventral hernia repair: a retrospective review. Surgery.; 162:1320–1329.

17. Tastaldi L., Krpata DM., Prabhu AS., Petro CC., Rosenblatt S., Haskins IN., *et al.* (2019). The effect of increasing body mass index on wound complications in open ventral hernia repair with mesh. Am J Surg; 218:560–566.

18. Talpai T., Râmboiu DS., Pîrvu CA., Pantea S., Şelaru M., Cârțu D., *et al.* (2024). A comparison of open ventral hernia repair risk stratification systems: a call for consensus. J Clin Med; 13:6692.

19. Liang MK., Holihan JL., Itani K., Alawadi ZM., Gonzalez JR., Askenasy EP., *et al.* (2017). Ventral hernia management: expert consensus guided by systematic review. Ann Surg.; 265:80–89.

20. Lindmark M., Strigård K., Löwenmark T., Dahlstrand U., Gunnarsson U. (2018). Risk factors for surgical complications in ventral hernia repair. World J Surg; 42:3528–3536.

21. Augenstein VA., Colavita PD., Wormer BA., Walters A., Bradley AU., Joel AU., *et al.* (2015). CeDAR: Carolinas equation for determining associated risks. J Am Coll Surg; 221:134.

22. Liang MK., Bernardi K., Holihan JL., Cherla DV., Escamilla R., Lew DF., *et al*. (2018). Modifying risks in ventral hernia patients with prehabilitation: a randomized controlled trial. Ann Surg; 268:674–680.

23. Howard R., Thompson M., Fan Z. (2019). Costs associated with modifiable risk factors in ventral and incisional hernia repair. JAMA Netw Open. 2019 Nov 1;2(11):e1916330.; 2:1–14.

24. Otero J., Cox TC., Huntington CR., Prasad MA., Davis BR., Kasten KR., *et al*. (2018). The development of the Carolinas equation for determining associated risks application and its effects on patient outcomes and potential financial savings in open ventral hernia repair. Am Coll Surg; 227:S98.

25. Pernar LIM., Pernar CH., Dieffenbach BV., Brooks DC., Smink DS., Ali Tavakkoli A. (2016). What is the BMI threshold for open ventral hernia repair?. Surg Endosc; Mar;31(3): 1311-1317.

26. Kesicioglu T., Yildirim K., Yuruker S., Karabicak I., Koc Z., Erzurumlu K., *et al.* (2022). Three-year outcome after anterior component separation repair of giant ventral hernias: a retrospective analysis of the original technique without mesh. Asian J Surg; 45:1117–1121.

27. Omarov N., Uymaz DS., Kaya M. (2024). The outcomes of component separation technique versus no component separation technique in the repair of large ventral hernias and impact on quality of life: a multicenter retrospective cohort study. Ann Surg Treat Res; 107:178–185.

28. Harth KM. Repair of ventral abdominal wall hernias. In: Ashley S, Cance W, Chen H, *et al.* (eds). (2014). ACS Surgery: Principles and Practice. 7th ed. Hamilton, ON, Canada: Decker Intellectual Properties; .

29. Lisiecki J., Kozlow JH., Agarwal S., Ranganathan K., Terjimanian MN., Rinkinen J., *et al.* (2015). Abdominal wall dynamics after component separation hernia repair. J Surg Res; 193:497–503.

30. Clarke JM. (2010). Incisional hernia repair by fascial component separation: results in 128 cases and evolution of technique. Am J Surg; 200:2–8.

31. Halm JA., de Wall LL., Steyerberg EW., Jeekel J., Lange JF. (2007). Intraperitoneal polypropylene mesh hernia repair complicates subsequent abdominal surgery. World J Surg; 31:423–429.

32. Slater NJ., van Goor H., Bleichrodt RP. (2015). Large and complex ventral hernia repair using ‘components separation technique’ without mesh results in a high recurrence rate. Am J Surg; 209:170–179.

33. Kassem MI., El-Haddad HM. (2016). Polypropylene-based composite mesh versus standard polypropylene mesh in the reconstruction of complicated large abdominal wall hernias: a prospective randomized study. Hernia; 20:691–700.

34. Rastegarpour A., Cheung M., Vardhan M., Ibrahim MM., Butler CE,, Levinson H. (2016). Surgical mesh for ventral incisional hernia repairs: Understanding mesh design. Plast Surg; 24:41–50.

35. DeBord J., Novitsky Y., Fitzgibbons R., Miserez M., Montgomery A. (2018). SSI, SSO, SSE, SSOPI: the elusive language of complications in hernia surgery. Hernia; 22:737–738.

36. Holihan JL., Askenasy EP., Greenberg JA., Keith JN., Martindale RG., Roth JS., *et al*. (2015). Component separation vs. bridged repair for large ventral hernias: a multi-institutional risk-adjusted comparison, systematic review, and meta-analysis. Surg Infect; 17:17.

37. Haskins IN., Horne CM., Krpata DM., Prabhu AS., Tastaldi L., Perez AJ., *et al*. (2018). A call for standardization of wound events reporting following ventral hernia repair. Hernia; 22:729–736.

38. Plymale MA., Ragulojan R., Davenport DL., Roth JS. (2017). Ventral and incisional hernia: the cost of comorbidities and complications. Surg Endo; 31:341–351.

39. De Luca M., Medina Pedrique M., Morejon Ruiz S., Munoz-Rodriguez JM., Robin Valle de Lersundi A., Lopez-Monclus J., *et al.* (2024). The Madrid posterior component separation: an anatomical approach for effective reconstruction of complex midline hernias. J Abdom Wall Surg; 3:12928.

40. Maloney SR., Schlosser KA., Prasad T., Colavita PD., Kercher KW., Augenstein VA., *et al*. (2019). The impact of component separation technique versus no component separation technique on complications and quality of life in the repair of large ventral hernias. Surg Endosc; 34:981–987.

41. Breuing K., Butler CE. (2010). Ventral Hernia Working Group. Incisional ventral hernias: review of the literature and recommendations regarding the grading and technique of repair. Surgery; 148:544–558.

42. Torregrosa AG., Muriel JS., Bueno-Lledo, Pastor PG., Iserte-Hernandez, Bonafe-Diana S. (2017). Modified components separation technique: experience treating large, complex ventral hernias at a University Hospital. Hernia; 9:1–8.

43. Singh DP., Zahiri HR., Gastman B., Holton LH., Stromberg JA., Chopra K. (2014). A modified approach to component separation using biologic graft as a load-sharing onlay reinforcement for the repair of complex ventral hernia. Surg Innov; 21:137–140.

44. Habeeb TAAM., Hussain A., Shelat V., Chiaretti M., Bueno-Lledó J., García Fadrique A., *et al*. (2023). A prospective multicentre study evaluating the outcomes of the abdominal wall dehiscence repair using posterior component separation with transversus abdominis muscle release reinforced by a retro-muscular mesh: filling a step. World J Emerg Surg.; 18:15.

45. Nguyen DH., Nguyen MT., Askenasy EP., Kao LS., Liang MK. (2014). Primary fascial closure with laparoscopic ventral hernia repair: systematic review. World J Surg.; 38:3097–3104.

46. Robin-Lersundi A., Hernando LB., López-Monclús J. (2018). How we do it: down to up posterior components separation. Langenbeck's Arch Surg.; 403:539–546.

47. Loh CYY., Nizamoglu M., Shanmugakrishnan RR., Tan A., Brassett C., Lovett B., *et al.* (2018). Comparing transversus abdominus release and anterior component separation techniques in reconstructing midline hernias: a cadaveric study. J Plast Reconstr Aesthetic Surg.; 71:1507–1517.

48. Stigall K., Roth JS. (2017). Anterior Component Separation Techniques. Cham: Textbook of Hernia Springer; 233–242.