Case report

Transversus Abdominis Release as an Effective Technique for Large Ventral Hernias: A Report of 13 Cases

ABSTRACT

Chronic complex abdominal defects leading to large ventral abdominal hernias have exhibited an escalating trend in recent years. To date, an ideal surgical technique for repairing these types of hernias has not been delineated. At present, no surgical approach has been proven to be the optimal method for repairing these specific types of hernias. Mesh repair, which is a common procedure employed for most hernias, has proven ineffective in these instances due to substantial loss of domain associated with large hernia. In practical terms, component separation technique (CST) is now utilized as a potential technique for optimal repair. Transversus abdominis release (TAR) is a posterior approach within CST. Herein, we present a series of thirteen case reports involving large ventral hernias that were successfully treated with TAR, as there was a significant loss of domain in all cases, necessitating substantial reconstruction to compensate accordingly. Here, we report thirteen cases of patients with large ventral hernias who were effectively treated with TAR. Each case involved a significant loss of domain, necessitating extensive reconstruction.

KEYWORDS

Large ventral hernia, transversus abdominis release, incisional hernia, abdominal wall reconstruction, complex hernia repair

INTRODUCTION

A hernia is defined as an aberrant protrusion of a viscus from one compartment to another. Ventral hernia can broadly be classified as congenital or acquired. Most hernias seen today are due to acquired causes, such as a history of surgery, trauma, and repetitive stress on the natural weak points of the abdominal wall. As the most common complication after laparotomy, incisional hernias are typically the inciting factor in the development of these complex defects leading to large ventral hernias [1]. Preoperative risk management includes patient optimization measures such as smoking cessation, controlling blood glucose in patients with diabetes, and weight reduction in obese patients to reduce complications [2]. Smoking cessation, along with the regulation of blood glucose and blood pressure, is advised to mitigate post-procedure risks and improve patient outcomes. The surgical repair varies according to the size of the hernia defect. Initial mesh repair techniques were associated with an increased incidence of recurrence. Evidence has shown that TAR is far superior in repairing large defects, with improved postoperative outcomes for patients. Here, we report a series of thirteen cases of ventral abdominal hernia treated with TAR rather than the traditional mesh repair, achieving successful outcomes that support our statement.

METHODS

Inclusion Criteria

- Patients diagnosed with large ventral hernias with significant loss of domain, with a defect size exceeding 10 cm in width.
- Cases where traditional mesh repair technique failed to provide adequate closure.
- Both male and female with complex abdominal defects, regardless of smoking or co-morbidities, such as diabetes or hypertension, as long as they were controlled or managed.

Exclusion Criteria

- Patients with hernia where the loss of domain was minimal and could be repaired with traditional mesh repair techniques.
- Cases where the patient had a significant infection.
- Patients with underlying conditions that contraindicated major surgery, such as severe pulmonary disease or uncontrolled diabetes.

Tanaka Index

Tanaka index was used to calculate the loss of domain using preoperative CT imaging, which measures the ratio of herniated abdominal contents to the total abdominal cavity. A value above 0.25 was generally considered significant loss of domain, which is given in detail in the discussion.

CASE PRESENTATION

A series of cases was conducted at Rajiv Gandhi Government General Hospital from 2020 to 2023, documenting thirteen cases of large ventral hernia—seven males and six females. Common clinical symptoms among these patients included abdominal pain, vomiting, and small bowel obstruction. The preferred diagnostic tool was a CT scan of the abdomen and pelvis. Due to the inability to reduce the contents of the hernial sac and create a recto-rectus plane, traditional mesh repair techniques failed. Consequently, transversus abdominis muscle release was performed. Of the patients, five underwent unilateral release, seven underwent bilateral release, and one required peritoneal flap bridging (table 1).

Key points:

- Male to female ratio: 7:6

- Out of 13 patients, 7 underwent bilateral muscle release, 5 underwent unilateral release, and 1 underwent peritoneal flap bridging.

Case 1: Here we report a case of a 39-year-old male who presented with an incisional hernia at the paraumbilical site. He reported abdominal swelling on the right side of his abdomen, had no known comorbidities, and displayed unfavorable social tendencies. Physical examination revealed a distended abdomen with tenderness and a palpable mass in the right paraumbilical region. A subsequent CT scan showed a 9.3 cm defect with herniated small bowel loops and omentum. Routine blood and biochemical tests were normal. The Tanaka index was calculated to be 0.40, indicating a significant loss of domain in the hernia. Closure could not be achieved intraoperatively, necessitating the release of both sides of the transversus abdominis muscle.

Case 2: A 36-year-old man presented with swelling at an abdominal scar site, persisting for six months. His surgical history included a laparotomy two years prior for a duodenal perforation, followed by the development of an incisional hernia managed with onlay mesh repair. The hernia recurred and was managed accordingly, but the patient experienced a secondary recurrence. He had a 15-year smoking history and no known comorbidities. Blood test results were normal. Physical examination revealed a distended abdomen with tenderness and a palpable mass in the umbilical region. A CT scan showed a 10 cm defect with herniated small bowel loops and omentum. The Tanaka index was 0.37, indicating a loss of domain in the hernia. Intraoperative procedures failed to achieve closure, so one side of the transversus abdominis muscle was released.

Case 5: A 39-year-old woman presented with ventral abdominal swelling persisting for two years. She had no significant past surgical history but had type II diabetes controlled with medications. The patient had no unfavorable social habits, and all pertinent blood tests were normal. Examination revealed a large anterior abdominal swelling (14 x 15 cm) covering the left lower, right upper, and lower quadrants of the abdomen. A CT scan showed a 15 cm defect with herniated small bowel loops and omentum. The Tanaka index was 0.40, indicating a loss of domain in the hernia. After a significant weight loss of 6 kg on a weight-loss plan, bilateral transversus abdominis release surgery was performed. Additional space was required, so a peritoneal flap was resected and used as a bridge to achieve closure.

Table 1: Patient Demographics and Surgical Details for Ventral Hernia Repair

Case	Age/Sex	Presentation	Past Surgical History	Smoking History	Chronic medical conditions	Findings in Imaging	Tanaka Index	Surgical Procedure
1	39/M	Right sided abdominal distention for 7 months	Paraumbilical hernia surgery repair 7 years back	Non-Smoker	-	9.3cm defect with herniated small bowel loops and omentum	0.40	B/L (bilateral) transversus abdominis release
2	36/M	3rd recurrence of abdominal scar site swelling for 6 months	H/O of laparotomy for duodenal perforation 2 years ago. H/O incisional hernia with onlay mesh repair. H/O of repair of the incisional hernia after 2nd occurrence	H/O smoking for 15 years and current	-	10 cm defect with herniated small bowel loops and omentum	0.37	U/L (unilateral) transversus abdominis release
3	29/M	Abdominal scar site swelling for 8 months	H/O laparotomy for significant small intestinal perforation 3 years ago, followed by mesh repair of the incisional hernia that grew over it.	Non-smoker	-	12 cm defect with herniated small bowel loops and omentum	0.39	U/L transversus abdominis release
4	40/M	Abdominal swelling in the scar site for 1.5 years	H/O open mesh repair for paraumbilical hernia 6 years ago. H/O mesh repair of the incisional hernia on the surgical site.	H/O smoking for 20 years and current	Hypertension for 20 years – controlled with medications	13.2 cm defect with herniated small bowel loops and omentum	0.40	B/L Transversus abdominis release

5	39/F	Abdominal swelling for 2 years	No significant history	-	-	15 cm defect with herniated small bowel loops and omentum	0.40	Peritoneal flap was used as a bridge to bring closure as transversus abdominis release didn't achieve closure
Note: This case differs from others in the series as the posterior rectus sheath could not be approximated even after TAR, necessitating the use of a peritoneal flap.								
6	53/M	Abdominal swelling for 6 years	H/O laparotomy for duodenal perforation 16 years ago. H/o open mesh repair for the incisional hernia developed on the scar.	Known smoker and alcoholic	Uncontrolled DM (Diabetes Mellitus) – non compliant with the medications	8 cm defect with small bowel loops and omentum herniation accompanied by right inguinal hernia	0.26	U/L transversus abdominis release. Stoppa's repair was done in the same setting for inguinal hernia Wound dehiscence post-procedure, complicated by infection, was managed with VAC (Vacuum-Assisted Closure) dressing, and the

								mesh was preserved. secondary suturing was done after infection control.
7	50/F	Abdominal swelling for 7 years	H/O C-section 30 years ago. H/O open lay mesh repair on the scar	-	DM – controlled with medications	10 cm defect with herniated small bowel loops and omentum	0.22	U/L transversus abdominis release
8	53/F	Abdominal swelling for the past 1 year	H/O staging laparotomy for ? cancer H/O open mesh repair on the surgical site. (P/O wound gaping, mesh infection □ required additional mesh exploration and suturing	-	DM – controlled with medications	11 cm defect with herniated small bowel loops and omentum	0.32	B/L Transversus abdominis release
9	60/F	Abdominal swelling for 2 years	H/O B/L TAH BSO 8 years ago	Tobacco chewer	Uncontrolled DM – non compliant with the medications	12 cm defect with herniated small bowel loops and omentum	0.34	B/L Transversus abdominis release
10	40/M	Abdominal swelling for 4 years	H/O laparotomy for traumatic jejunal transection 7 years ago	-	-	12 cm with herniated small bowel loops and omentum	0.47	B/L Transversus abdominis release

11	34/F	Abdominal swelling for 10 years	H/O 2 LSCS 15 and 13 years ago.	-	-	13 cm defect with herniated small bowel loops and omentum	0.33	U/L transversus abdominis release
12	40/M	Abdominal swelling for 12 years	H/O appendicectomy 22 years ago. H/O laparotomy with resection and anastomosis for extensive mesenteric tear with intestinal gangrene 14 years ago.	-	-	14 cm defect with herniated small bowel loops and omentum	0.38	B/L Transversus abdominis release
13	56/F	Abdominal swelling for 5 years	H/O puerperal sterilization 30 years ago. H/O staging laparotomy for a complicated ovarian cyst 8 years ago.	Known smoker	Uncontrolled DM – non compliant with the medications	11.5 cm with herniated small bowel loops and omentum	0.34	B/L Transversus abdominis release

Management:

Transversus abdominal release surgical technique was used in the above cases to accommodate the contents of the hernia and improve patient outcomes. Obese patients were placed on a weight-loss regimen for at least a month to mitigate the risk of post-operative wound infections. Pulmonary Function Tests (PFTs) were performed on patients deemed at higher risk for respiratory complications based on clinical assessment, but not all patients underwent PFTs. Additionally, all patients scheduled for repairs were advised to adhere to an incentive spirometry program (at least five times per day) to improve their pulmonary status. Patients with a smoking history were required to abstain for at least 14 days.

Intra-abdominal pressure was monitored perioperatively. Traditional surgical techniques did not achieve appropriate closure, so transversus abdominis muscle release was performed to create adequate space for the hernia contents. Despite the disadvantage of persistent diffuse abdominal swelling, the benefits of creating sufficient space for the hernia contents and avoiding life- threatening complications outweighed the drawback. As the outcomes for

initial cases were excellent, the same surgical method and drain placements were used for all thirteen cases. The surgical steps are outlined below (Figure 1):

1. Midline laparotomy incision

2. Adhesiolysis, sac dissection, and reduction of hernia contents

3. Posterior rectus sheath incised 0.5 cm from the Linea alba on either side

4. Retro rectus plane developed to the Linea semilunaris, with the neurovascular bundle visualized and preserved on either side.

5. 0.5 cm medial to the neurovascular bundle, the posterior rectus sheath is incised to visualize the transversus abdominis muscle (on one side for unilateral release and both sides for bilateral release)

6. Muscle is divided along its entire medial edge and released.

7. Released transversus abdominis muscle is pushed away to enter the space between the transversus abdominis muscle and transversalis fascia (which can be extended up to the psoas muscle if needed)

8. Inferiorly, the space of Retzius is entered and Cooper's ligament visualized.

9. Superiorly, the retro muscular plane can be extended cephalad to the xiphoid and diaphragm if needed.

10. This muscle release aids in medialization of the posterior rectus sheath (below the arcuate line, medialization of the transversalis fascia and peritoneum) and the anterior rectus sheath, and also creates a large plane for mesh placement

11. After closure of the medialized ends, a 30×30 cm mesh is placed in the created plane and anchored with 2-0 Prolene sutures to Cooper’s ligament

12. Drain tube is placed over the mesh in the retro rectus plane

13. Anterior rectus sheath is closed to recreate the Linea alba

14. Peritoneal flap closure is done if closure is not achieved with the steps above.

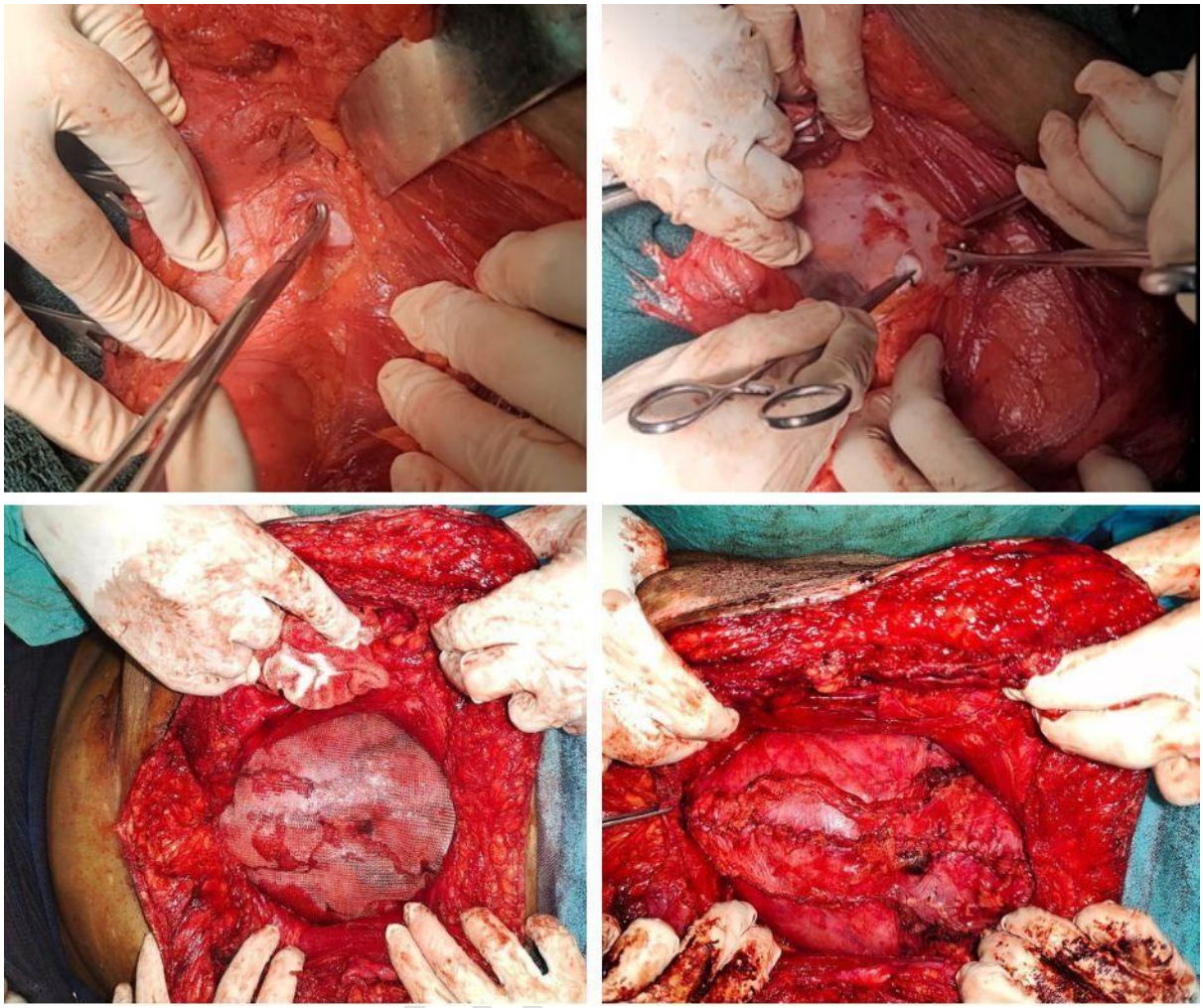
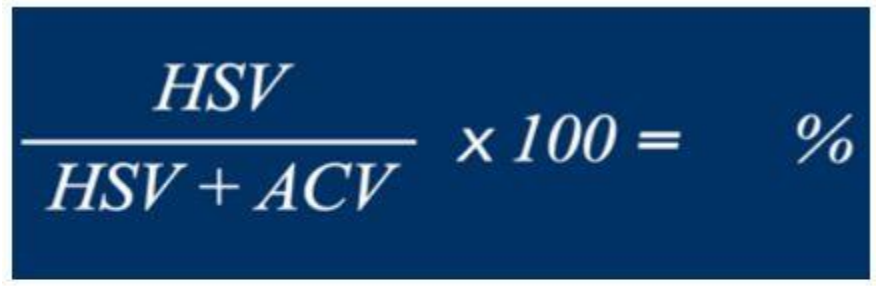


Figure 1: A series of intraoperative images demonstrating key steps in the Transversus Abdominis Release (TAR) procedure. (Top left) shows the release of the Transversus Abdominis muscle. (Top right) illustrates the Transversus Abdominis muscle retracted to access the plane between the muscle and the transversalis fascia. (Bottom left) depicts the placement of a 30×30 cm mesh within the created recto muscular plane. (Bottom right) demonstrates the final closure of the anterior rectus sheath.

DISCUSSION

Large ventral hernias are quite common these days in patients with significant past surgical histories. Majority of the individuals do not present with intestinal obstruction, as the defect size is large; thus, patients usually present with non-emergent symptoms, leading to a late presentation. A hernia is simply defined as an outpouching of the contents present inside the compartment via a defect in the same compartment. The severity of the hernia depends on the type of content that is herniated and the defect size. The severity is calculated with a ratio called Loss of domain (also known as Tanaka index) as shown in figure 2 below. This ratio estimates the percentage of peritoneal content outside the abdominal compartment. This ratio guides us to use the appropriate treatment method and also predicts the risk of perioperative complications [3]. The occurrence of hernia depends on various factors influencing the strength of the covering and the pressure inside it. Post abdominal surgery leads to the weakening of the abdominal muscle wall; thus, the same existing abdominal pressure present inside is not tolerated by the abdominal musculature, leading to splaying of the muscle, which in turn leads to hernia development at the surgical site [4].



HSV (Hernia sac volume)

ACV (Abdominal cavity volume)

TPV (Total peritoneal volume) = HSV+ACV

Figure 2: Loss of domain = signifies the severity of the hernia

The occurrence of abdominal wall defects in surgical practice is rising rapidly, and they are regarded as a complicated pathology. Herniation is possible in patients who have laparotomies 22–55% of the time [5]. When planning on surgical treatment, in order to prevent recurrence, we typically proceed with anterior rectus sheath closure for primary ventral and incisional hernias after reducing the contents of the hernial sac. The primary drawbacks of these mesh repair techniques include seroma development, skin flap necrosis, and wound gaping. However, more recently, we have shifted towards retro rectus repair described by Rives-Stoppa, in which the mesh is positioned over a closed posterior rectus sheath [6][7]. The benefits of retro rectus repair include less seroma formation, less skin necrosis, a lower recurrence rate, and less mesh migration. However, retro rectus repair is limited in cases of severe ventral hernia with large defects, generally defined as those exceeding 10 cm in size, particularly near the Linea semilunaris [8].

To combat this, a groundbreaking technique of releasing the transversus abdominis muscle and extrapolating the retro rectus space was developed. This technique has several significant advantages, including significant medial mobilization of the posterior rectus sheath up to 10 cm on each side, along with mobilization of the anterior rectus sheath, a reduction in the incidence of intra-abdominal hypertension and abdominal compartment syndrome, medialization of the anterior component of rectus muscles, and large mesh placement in the retro rectus plane [9].

Prior to transversus abdominis muscle release, preoperative optimization may also be performed using progressive preoperative pneumoperitoneum with or without Botox injection to the lateral abdominal wall [10]. Only two patients in this case series experienced complications: hematoma development, which was treated conservatively, and wound gaping, which was treated with VAC. Thirteen patients had successful midline closure, while one patient needed peritoneal flap bridging. Except grade 1 intra-abdominal hypertension reported in a few patients, abdominal compartment syndrome did not occur, which was supported according to intra-abdominal pressure monitoring by uroflowmetry. Although transversus abdominis release (TAR) has increased operative duration and predicted blood loss, and the Hodgkinson meta-analysis recurrence rate was 5.7%, it still appears to be the best approach for difficult ventral hernias [11][12][13].

CONCLUSION

Transversus abdominis muscle release (TAR), a modification of the Rives-Stoppa technique, is a safe and effective method for treating giant primary and recurrent hernias with loss of domain. This technique offers the advantages of retro rectus mesh placement while overcoming the limitations associated with the closed nature of the retro rectus plane. TAR achieves the primary goals of ventral hernia repair, including new midline creation, tension-free midline, and adequate myofascial cover for mesh placement. Wound complication rates were low, and the risk of developing abdominal compartment syndrome was almost negligible. In a low-resource setting, TAR is a vital technique that should be included in the armamentarium of all abdominal wall reconstruction (AWR) surgeons. This study provides valuable insights into the use of TAR as a promising alternative to traditional mesh repairs, demonstrating its effectiveness in managing patients with significant loss of domain and improving outcomes in complex abdominal wall reconstructions.

DECLARATION

Consent

Written informed authorized consent was obtained from the patient for the use of their personal protected information, in accordance with university standards.

Ethical Approval:

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

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