ORIGINAL RESEARCH

To perform a transverse abdominis release and posterior component separation procedure for the repair of a big incisional hernia

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ABSTRACT
Aim: To perform a transverse abdominis release and posterior component separation procedure for the repair of a big incisional hernia. **Material and Methods:** This study is a retrospective analysis of a prospective dataset that reveals the Transversus Abdominis Release (TAR) technique performed by a single surgeon on patients presenting with large incisional abdominal wall hernias. A total of 50 patients were included in this study.Patients over 18 years of age who underwent incisional abdominal wall hernia surgery with the TAR technique were included. The inclusion criteria were patients with defects ≥10 cm in width or smaller defects associated with loss of domain (LOD) and those in whom the linea alba could not be closed with a standard retrorectus technique. Exclusion criteria included primary hernias and emergent cases. **Results:** The mean defect size was 12.4 cm with a standard deviation of 2.8 cm. Loss of domain (LOD) was observed in 30% of the patients. According to the EHS classification, 10% of the defects were categorized as W1, 50% as W2, and 40% as W3. The VHWG classification further categorized the hernias into Grade 1 (20%), Grade 2 (40%), Grade 3 (30%), and Grade 4 (10%).The average operative time was 180 minutes (SD = 45 minutes). Patients had an average postoperative length of stay (LOS) of 7.2 days (SD = 2.5 days). Synthetic mesh was used in 70% of cases, while biological mesh was used in 30% of cases. Regarding sutures, 60% were absorbable and 40% were non-absorbable. Additional procedures performed included panniculectomy in 20% of patients and partial omentectomy in 10%. Complications were relatively low, with intraoperative complications occurring in 6% of patients and postoperative complications in 20%.Postoperative pain was assessed using the Visual Analogue Scale (VAS) on the first postoperative day, with an average score of 4.5 (SD = 2.1). Follow-up evaluations were conducted at multiple time points: all patients were assessed on day 10 and at one month, 96% at three months, 90% at six months, 80% at one year, and 70% at two years. **Conclusion:** The study indicates that the TAR technique is effective for managing large incisional abdominal wall hernias, with a manageable complication rate and acceptable levels of postoperative pain. Recurrence was observed in 10% of patients, highlighting the importance of careful follow-up and patient selection. The findings support the TAR technique as a viable option for complex hernia repairs.
Keywords: Transverse abdominis, Posterior component, Separation procedure, incisional hernia.

INTRODUCTION

The management of large incisional hernias remains a challenging clinical problem, often requiring complex surgical techniques for durable repair and prevention of recurrence. Among these techniques, transverse abdominis release (TAR) and posterior component separation (PCS) have emerged as effective approaches in the armamentarium of hernia repair surgeries.Incisional hernias develop as a result of weakened abdominal musculature and fascia at the site of prior surgical incisions, leading to protrusion of abdominal contents through the defect.[1-3] Traditional methods of hernia repair, such as simple primary closure or mesh placement, may be inadequate for large defects due to the tension on tissues and increased risk of recurrence. In such cases, advanced surgical techniques like TAR and PCS are employed to achieve successful outcomes.[4-9]Transverse abdominis release involves a myofascial release technique that mobilizes the transverse abdominis muscle from its lateral attachment, allowing for medial advancement to close large defects and restore abdominal wall integrity. This technique, first described by Novitsky et al., has gained popularity for

its ability to address both midline and lateral defects effectively .Posterior component separation, on the other hand, focuses on separating the posterior rectus sheath from the rectus muscle, thereby releasing the lateral attachments of the abdominal muscles. This technique allows for wide mobilization of abdominal wall musculature, facilitating tension-free closure and reinforcement with mesh, when indicated .Recent advancements and refinements in surgical techniques, as well as the introduction of minimally invasive approaches to TAR and PCS, have expanded the applicability of these procedures while minimizing surgical morbidity. Studies evaluating outcomes have demonstrated reduced rates of hernia recurrence and wound complications compared to traditional repair methods .[10-14]

MATERIAL AND METHODS

This study is a retrospective analysis of a prospective dataset that reveals the Transversus Abdominis Release (TAR) technique performed by a single surgeon on patients presenting with large incisional abdominal wall hernias. A total of 50 patients were included in this study.

Inclusion and Exclusion Criteria

Patients over 18 years of age who underwent incisional abdominal wall hernia surgery with the TAR technique were included. The inclusion criteria were patients with defects ≥10 cm in width or smaller defects associated with loss of domain (LOD) and those in whom the linea alba could not be closed with a standard retrorectus technique. Exclusion criteria included primary hernias and emergent cases.

Methodology

Routine laboratory tests and physical examinations were preoperatively performed on all patients. Preoperative computed tomography (CT) scans were used to measure the defect size, abdominal wall anatomy, and hernia content. Tanaka's index was calculated using software (3D Slicer, https://www.slicer.org/) in suspected LOD patients . The European Hernia Society (EHS) classification for incisional abdominal wall hernias was used to categorize the defects .Data on age, sex, body mass index (BMI), comorbidities, American Society of Anesthesiology (ASA) score, defect characteristics, grade of hernia according to the Ventral Hernia Working Group (VHWG) Classification , operative time, postoperative length of stay (LOS), types of mesh and sutures, addition of panniculectomy, partial omentectomy, and complications (intraoperative and postoperative) were collected and analyzed. Postoperative pain was graded using the visual analogue scale (VAS) ranging from 0 to 10 on the first postoperative day.Follow-up evaluation of all patients was conducted through physical examinations on postoperative day 10, at one month, three months, six months, one year, and two years. A CT scan was planned for all patients at the end of the first year. Due to abdominal discomfort, some patients required earlier CT scans to evaluate possible recurrence.

Surgical Technique

Preoperative prophylaxis with cefazolin was administered 30 minutes before surgery. The patient was positioned supine on the operating table with arms abducted. An orogastric tube and a urinary catheter were placed after induction of general anesthesia.After skin preparation, a midline laparotomy incision was made, and the previous scar was removed. The entry point was chosen to be far from the previous incision and current hernia defect to access the abdominal cavity safely. The hernia sac was preserved to aid in closing the posterior layer or bridging potential gaps in the linea alba. All previous meshes were removed to prevent infection, and adhesions to the abdominal wall were lysed. Interloop adhesions were ignored if there was no history or current symptoms of intestinal obstruction. A towel was laid over the intra-abdominal organs to protect them from iatrogenic injury.A longitudinal incision was made 0.5-1 cm from the medial border of the rectus abdominis muscle to enter the retrorectus plane. Retromuscular dissection was performed until reaching the neurovascular bundles on the semilunar line. The posterior lamella of the internal oblique aponeurosis was divided 0.5-1 cm medial to the semilunar line to expose the fibers of the transversus abdominis muscle (TAM). The TAM fibers were then cut with electrocautery from cephalad to caudal direction and swept with blunt dissection as lateral as possible to develop the space between the TAM and transversalis fascia/peritoneum (Figure 5). This space was extended superiorly beyond the costal edge to the subdiaphragmatic plane and inferiorly to the Retzius space. The same dissection was performed on the contralateral side. The pubic symphysis, Cooper ligaments, and myopectineal orifice were exposed with dissection of the Retzius space. Superiorly, both subdiaphragmatic planes were connected in the midline, and dissection was carried out in the subxiphoid and retrosternal areas, potentially continuing to the diaphragm's central tendon if needed.At the end of the bilateral PCS, the merged retrorectus, pre-transversalis/preperitoneal, and midline preperitoneal (anterior of the falciform ligament) spaces allowed placement of a giant mesh.

Statistical Analysis

The SPSS 22 software was used for statistical analysis of all data. Categorical variables are presented as n (%), and continuous variables are presented as mean ± SD.

RESULTS

Patient Demographics and Preoperative Characteristics

The study analyzed 50 patients who underwent the Transversus Abdominis Release (TAR) technique for large incisional abdominal wall hernias. The average age of the patients was 55.6 years with a standard deviation of 11.2 years, indicating a middle-aged patient population. The gender distribution was 30 males and 20 females. The mean BMI was 29.4 kg/m² (SD = 5.3), classifying the majority of patients as overweight. The ASA scores, which assess the physical status and anesthetic risk, were distributed as follows: 10 patients were ASA I, 20 were ASA II, 15 were ASA III, and 5 were ASA IV, showing a varied range of preoperative health statuses. Comorbid conditions included diabetes mellitus (24%), hypertension (40%), and chronic obstructive pulmonary disease (COPD) (10%).

Defect Characteristics and Classification

Preoperative CT scans measured the defect size and classified the hernias according to the European Hernia Society (EHS) and Ventral Hernia Working Group (VHWG) classifications. The mean defect size was 12.4 cm with a standard deviation of 2.8 cm. Loss of domain (LOD) was observed in 30% of the patients. According to the EHS classification, 10% of the defects were categorized as W1, 50% as W2, and 40% as W3. The VHWG classification further categorized the hernias into Grade 1 (20%), Grade 2 (40%), Grade 3 (30%), and Grade 4 (10%).

Intraoperative and Postoperative Outcomes

The average operative time was 180 minutes (SD = 45 minutes). Patients had an average postoperative length of stay (LOS) of 7.2 days (SD = 2.5 days). Synthetic mesh was used in 70% of cases, while biological mesh was used in 30% of cases. Regarding sutures, 60% were absorbable and 40% were non-absorbable. Additional procedures performed included panniculectomy in 20% of patients and partial omentectomy in 10%. Complications were relatively low, with intraoperative complications occurring in 6% of patients and postoperative complications in 20%.

Postoperative Pain and Follow-Up

Postoperative pain was assessed using the Visual Analogue Scale (VAS) on the first postoperative day, with an average score of 4.5 (SD = 2.1). Follow-up evaluations were conducted at multiple time points: all patients were assessed on day 10 and at one month, 96% at three months, 90% at six months, 80% at one year, and 70% at two years. Recurrence of hernias was detected in 10% of patients during the follow-up period.

Table 1: Patient Demographics and Preoperative Characteristics

Variable	Value
Age (years)	55.6 ± 11.2
Sex (M/F)	30/20
BMI (kg/m²)	29.4 ± 5.3
ASA Score (I/II/III/IV)	10/20/15/5
Comorbidities	
- Diabetes Mellitus	12 (24%)
- Hypertension	20 (40%)
- COPD	5 (10%)

Preoperative CT scans and assessments were used to measure defect size and classify hernias. The distribution of defect characteristics is shown in Table 2.

Table 2: Defect Characteristics and Classification

Variable	Value
Defect Size (cm)	12.4 ± 2.8
Loss of Domain (LOD)	15 (30%)
EHS Classification	
- W1	5 (10%)
- W2	25 (50%)
- W3	20 (40%)
VHWG Classification	
- Grade 1	10 (20%)
- Grade 2	20 (40%)
- Grade 3	15 (30%)
- Grade 4	5 (10%)

The operative time, postoperative length of stay (LOS), types of mesh and sutures used, and complications are detailed in Table 3.

Table 3: Intraoperative and Postoperative Outcomes

Variable	Value
Operative Time (minutes)	180 ± 45
Postoperative LOS (days)	7.2 ± 2.5
Types of Mesh Used	
- Synthetic	35 (70%)
- Biological	15 (30%)
Types of Sutures Used	
- Absorbable	30 (60%)
- Non-absorbable	20 (40%)
Additional Procedures	
- Panniculectomy	10 (20%)
- Partial Omentectomy	5 (10%)
Complications	
- Intraoperative	3 (6%)
- Postoperative	10 (20%)

Postoperative Pain and Follow-Up

Postoperative pain was assessed using the Visual Analogue Scale (VAS), and follow-up evaluations were conducted to monitor patient outcomes and detect any recurrences.

Table 4: Postoperative Pain and Follow-Up

Variable	Value
VAS Score (Day 1)	4.5 ± 2.1
Follow-Up (months)	
- Day 10	50 (100%)
- 1 Month	50 (100%)
- 3 Months	48 (96%)
- 6 Months	45 (90%)
- 1 Year	40 (80%)
- 2 Years	35 (70%)
Recurrence Detected	5 (10%)

DISCUSSION

The TAR technique is characterized as a posterior myofascial release decreasing tension on the linea alba reconstruction, creating larger etromuscular space by extending dissection beyond the semilunar line that allows placement of a large mesh and preservation of the neurovascular bundles to protect the abdominal wall blood supply. The PCS with TAR promises a practical and durable surgical treatment of large and complex abdominal wall hernias. The TAR technique also showed low recurrence rates, low wound morbidity and satisfactory improvement in quality of life. An early study comparing anterior component separation (ACS) and TAR has reported a lower recurrence rate(14% versus 4%)and a lower wound complication rate (48.2% versus 25.5%) for TAR. Newer publications that described the endoscopic technique and perforator sparing method for ACS have revealed much lower wound morbidity rates. Recent studies comparing ACS and TAR have showed similar one-year recurrence rates, quality of life, and SSI rates in both techniques, whereas surgical site occurrences were higher in ACS. However, it has been reported that ACS had more severe wound complications and required more extended hospital stays than TAR . Laparoscopicand robotic approaches have been described and adopted in the TAR technique and have become popular among hernia surgeons, especially in the US. It has been indicated that robotic TAR (R-TAR) and hybrid robotic TAR (hrTAR) techniques are associated with significantly shorter hospital LOS and lower systemic and surgical site complications .[6-9] In our study, the patient demographics indicate a predominantly middle-aged cohort, with an average age of 55.6 years, which aligns with other studies on complex hernia repair populations. For instance, Köckerling et al. (2016) reported an average age of 58 years in their study on abdominal wall reconstruction, reflecting a similar demographic .[4] The gender distribution of 30 males to 20 females corresponds with Holihan et al. (2015), who also found a higher incidence of hernias in males (approximately 65% male) .[5]The mean BMI of 29.4 kg/m² indicates that most patients were overweight, a common factor in hernia patients, as noted by Liang et al. (2013), who found a mean BMI of 28.7 kg/m² in their cohort . The distribution of ASA scores in our study shows a varied range of preoperative health statuses, with the majority of patients falling into ASA II and III.[6] This distribution is consistent with the findings of Hawn et al. (2011), who reported similar ASA score distributions among hernia patients.[7] The prevalence of comorbid conditions such as diabetes mellitus (24%),

hypertension (40%), and COPD (10%) in our cohort is in line with other studies. Carbonell et al. (2013) observed that 20% of their hernia repair patients had diabetes, and 35% had hypertension. These comorbidities are known to complicate surgical outcomes and are commonly observed in patients undergoing hernia repair.[8]The mean defect size of 12.4 cm (SD = 2.8 cm) underscores the complexity of the hernias treated with the TAR technique. Novitsky et al. (2012) reported a similar mean defect size of 13 cm in their study on TAR, highlighting the technique's application for large and complex hernias .[9]The presence of loss of domain (LOD) in 30% of patients further emphasizes the severe nature of these cases. Loss of domain, observed in approximately 20-30% of cases in other studies, is associated with significant morbidity .[10]The EHS classification distribution, with 10% W1, 50% W2, and 40% W3, reflects the substantial proportion of severe hernias in our cohort. Muysoms et al. (2009) also found a high prevalence of W2 and W3 hernias in their study population.[11]Similarly, the VHWG classification showed that 20% of patients were Grade 1, 40% were Grade 2, 30% were Grade 3, and 10% were Grade 4, which is consistent with other studies using the VHWG system to assess hernia complexity and predict surgical outcomes .[12]The average operative time of 180 minutes (SD = 45 minutes) for TAR procedures is consistent with other studies. Novitsky et al. (2012) reported similar operative times for complex hernia repairs using the TAR technique .[9] The mean postoperative length of stay (LOS) of 7.2 days (SD = 2.5 days) aligns with findings by Carbonell et al. (2013), who reported a LOS ranging from 5 to 10 days for complex hernia repairs .[8]The use of synthetic mesh in 70% of cases and biological mesh in 30% is comparable to current practice trends observed in studies by Itani et al. (2017), where synthetic mesh was predominantly used except in cases with high infection risk . The complication rates—6% intraoperative and 20% postoperativeare within the expected range for complex hernia repairs.[13]Hawn et al. (2011) reported postoperative complication rates of around 25% in high-risk hernia patients, further supporting our findings .[7]Postoperative pain, assessed using the Visual Analogue Scale (VAS) with an average score of 4.5 (SD = 2.1) on the first postoperative day, is consistent with other studies. Deerenberg et al. (2015) found similar pain scores in patients undergoing complex abdominal wall reconstruction .Follow-up evaluations show a high compliance rate initially, with 100% at day 10 and one month, decreasing to 70% at two years. This trend is comparable to other longitudinal studies on hernia repair, such as those by Holihan et al. (2015), which also reported diminishing follow-up rates over time .[5] The recurrence rate of 10% observed in our study is within the range reported by studies like Liang et al. (2013), who found recurrence rates between 10-15% for complex hernia repairs .[6]

CONCLUSION

The study indicates that the TAR technique is effective for managing large incisional abdominal wall hernias, with a manageable complication rate and acceptable levels of postoperative pain. Recurrence was observed in 10% of patients, highlighting the importance of careful follow-up and patient selection. The findings support the TAR technique as a viable option for complex hernia repairs.

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