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Study Of Transverse Abdominis Release (Tar) In Repair Of Complex Incisional Hernia

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Abstract

Background: *Incisional hernia is a common postoperative complication, particularly challenging when large, recurrent, or associated with comorbidities. The Transverse Abdominis Release (TAR) technique represents a major advancement in abdominal wall reconstruction, offering tension-free closure, reduced recurrence, and lower complicationrates*

Aim: *To evaluate the efficacy, intraoperative challenges, and postoperative outcomes of TAR in the management of complex incisional hernias.*

Methods: *This prospective observational study included patients undergoing TAR at a tertiary care center. Data were collected on patient demographics, comorbidities, previous surgeries, intraoperative findings, complications, and hernia recurrence at one-year follow-up*

Results: *TAR demonstrated excellent outcomes in terms of reduced recurrence and manageable complications. A 1-year recurrence rate was significantly lower than with traditional methods, even in high-risk patients.*

Conclusion: *TAR is a reliable and effective technique for managing complex incisional hernias, especially in patients with multiple risk factors or failed prior repairs.*

Keywords: *Transverse Abdominis Release, Incisional Hernia, Mesh Repair, Abdominal Wall Reconstruction, TAR, Component Separation.*

INTRODUCTION

Incisional hernias, defined as herniation at the site of a previous surgical incision, are one of the most common complications after abdominal surgery, with incidence ranging from 10% to 20%. Incisional hernia refers to abdominal wall hernia at the site of a previous surgical incision. It is a type of ventral hernia. Midline incisional hernias are more common than other sites. It can be a definite hernia with all the hernia components of the defect, sac, and content. Or, it can be a weakness of the wall with shallow sac and occasional bulge of content. It is a common surgical problem. Surgeons are often asked to evaluate patients with incisional hernias as they can often be symptomatic to patients. The classical presentation is a bulge with a positive cough impulse at the site of the incision. Patients with incisional hernias are also at risk for incarceration, obstruction (if the content is bowel), or strangulation. Traditional repair methods—including primary suture closure and mesh-based techniques—have variable success, particularly in large, complex hernias. The Transverse Abdominis Release (TAR) technique, introduced by Novitsky in 2012, allows for effective posterior component separation, facilitating wide medial mobilization, mesh placement in a retro muscular plane, and reduced wound morbidity.

The evolution of TAR can be traced through several key innovations:

- Posterior Component Separation: Instead of releasing the external oblique aponeurosis (anterior component separation), TAR involves a posterior approach 42 where the transverse abdominis muscle is released from its lateral attachments. This manoeuvre creates a wide, retro muscular plane that facilitates extensive medial advancement of the abdominal wall musculature.
- Preservation of Neurovascular Structures: One of the significant advantages of TAR is the ability to preserve the neurovascular bundles that run along the lateral abdominal wall. Traditional anterior component separation often resulted in devascularization or denervation, potentially compromising the

functional and structural integrity of the abdominal wall. TAR, by contrast, minimizes such injury by working in a plane that safeguards these critical structures.

• Enhanced Mesh Placement: The creation of an extensive retro muscular space through TAR provides an ideal environment for the placement of a prosthetic mesh. The mesh, positioned in this well-vascularized and relatively avascular plane, benefits from a broad overlap that dissipates intra-abdominal forces. This results in improved incorporation of the mesh into the native tissue and a decreased risk of recurrence [61].

AIM:

Study Of Transverse Abdominis Release (Tar) In Repair of Complex Incisional Hernia

OBJECTIVES:

• To Assess Transverse Abdominis Release and Its Efficacy in Repair of Complex Incisional Hernia
• To Evaluate Difficulties While Performing Tar
• To Look for Post Operative Complications (Such As Recurrence, Surgical Site Infection (Ssi), Seroma, Hematoma, And Re Intervention)

MATERIALS AND METHODS

Study Site**:** Department of General Surgery, K.I.M.S. KVV, KARAD
Study Design**:** Prospective study
Study Duration**:** March 2023 To December 2024
Source Of Data- Patients getting admitted to surgery department in Krishna Hospital with appendicitis during the period of MARCH 2023 TO DECEMBER 2024 will be taken for study, considering the inclusion and exclusion criteria.

Method Of Collection of Data:

The randomization will be achieved by the closed envelope method.
Patients admitted to surgery department in Krishna hospital with complex incisional hernia in period of march 2023 to December 2024 will be taken for study, considering inclusion and exclusion criteria. A written consent will be signed by the patients for the surgical technique after taking detailed history. Routine investigations, XRAY, USG, CECT Abdo + pelvis will be done preoperatively. Surgical management of pathology will be done. The above data be tabulated in accordance with parameters including age, sex, comorbidities, nutritional status, occupation and personal habits such smoking. Observations were made with regard to duration and ease of operation, wound complications, mesh infections, hospital stay, morbidity and recurrence. All the patients will be assessed preoperatively, intra-operatively and post-operatively, and the findings will be recorded in a pre-structured proforma. Patients were evaluated in terms of age, gender, and Body Mass Index (BMI), mean operation time, length of hospital stay, pre-operative investigations, surgical technique, and post-operative complications. Patients were followed up to 1 year to see whether recurrence occurs or not.

Inclusion Criteria

1. Diagnosed cases of complex incisional hernia, defined as a defect larger than 8 cm in width, recurrent hernias, or hernias requiring myofascial release.
2. Patients who provided written informed consent to participate in the study.
3. Patients who were fit for elective surgery as per preoperative anaesthesia evaluation.

Exclusion Criteria

1. Patients with small incisional hernias (defects that could be closed easily without myofascial release).
2. Pregnant women with incisional hernias following previous lower segment caesarean section (LSCS).
3. Patients with significant medical comorbidities (such as advanced cardiac disease, uncontrolled diabetes, or renal failure) making them unfit for major abdominal surgery.
4. Patients having liver disease and ascites
5. Patients with active infections or contaminated surgical fields at the time of surgery.
6. Patients not willing to provide consent or those who refused follow-up visits.

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Study Sample Size
Total no of patients included were 36

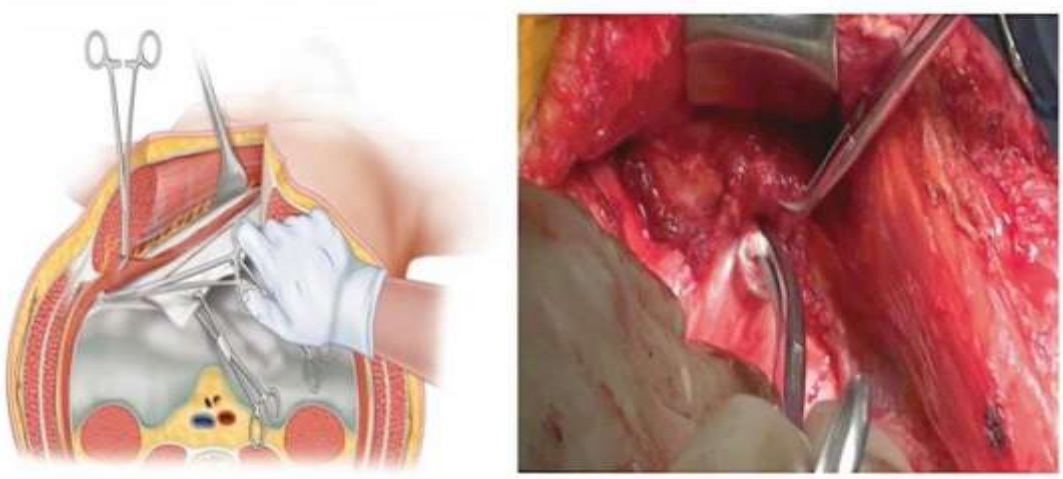

Figure 1: Development of retro muscular plane

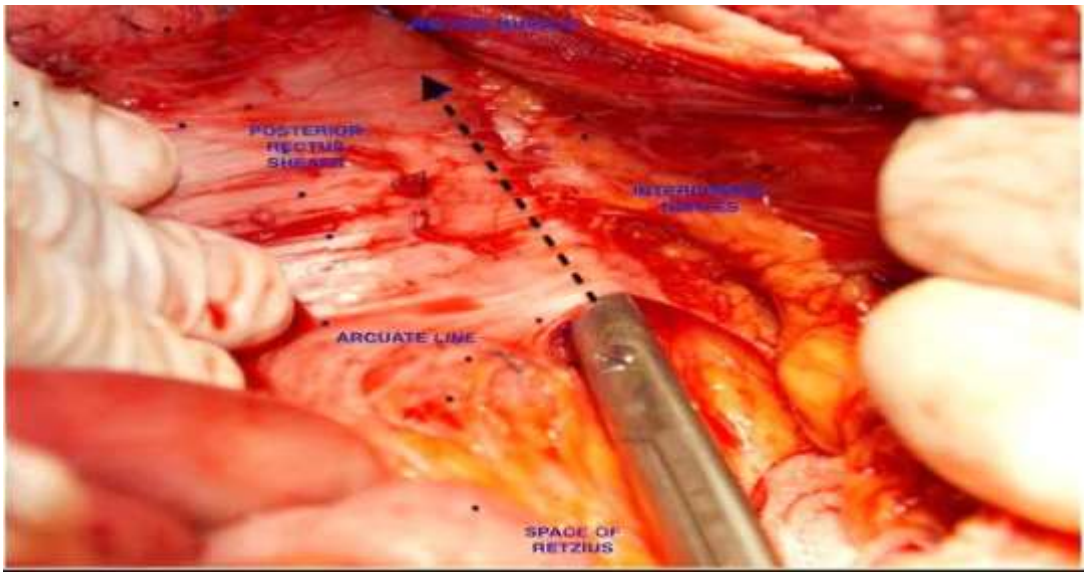

Figure 2: Creation of retro muscular plane

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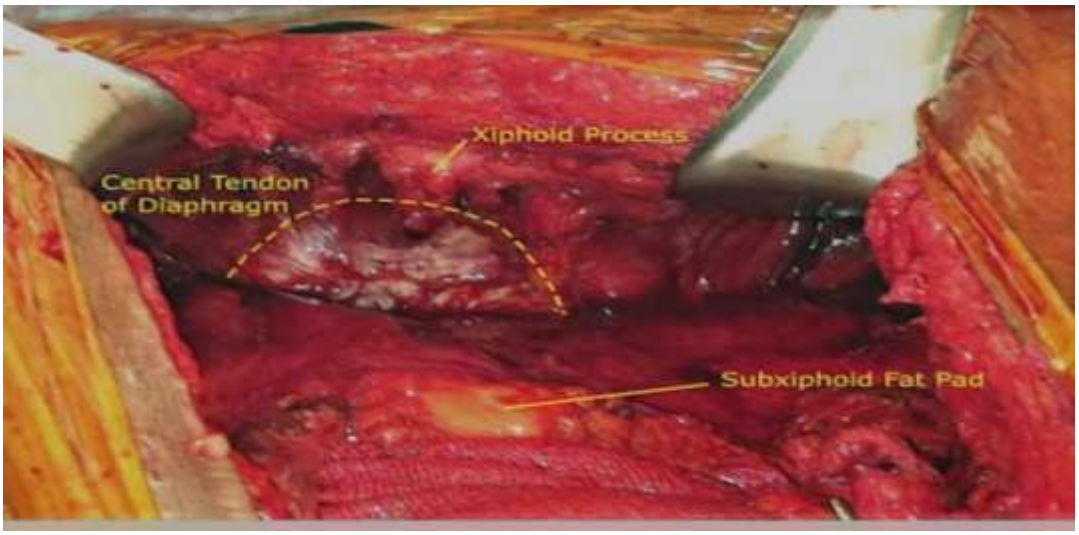

Figure 3: Extent of TAR dissection

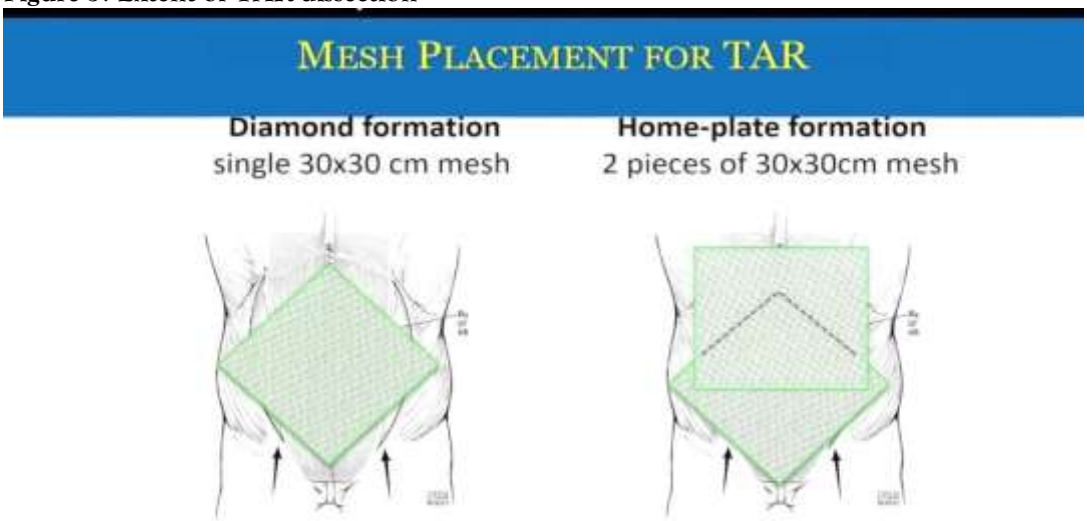

Figure 4: Mesh placement

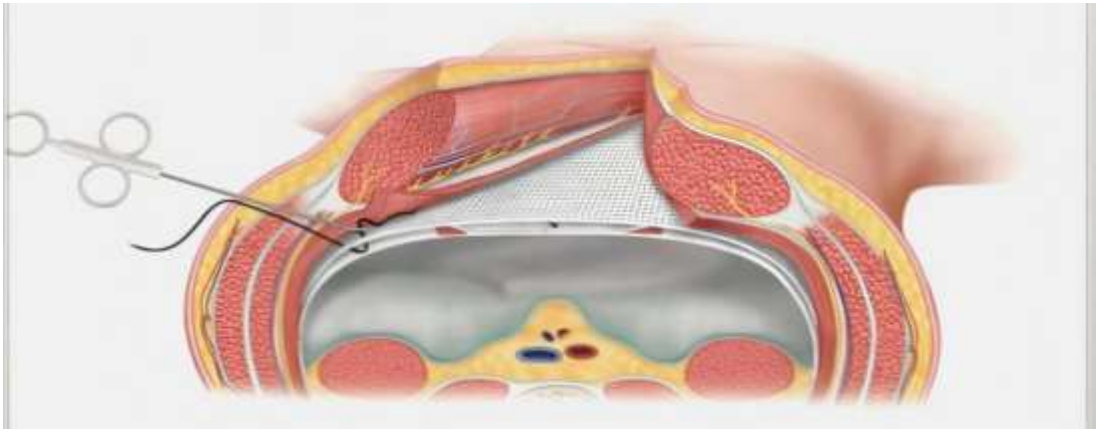

Figure 5: Animation showing mesh placement

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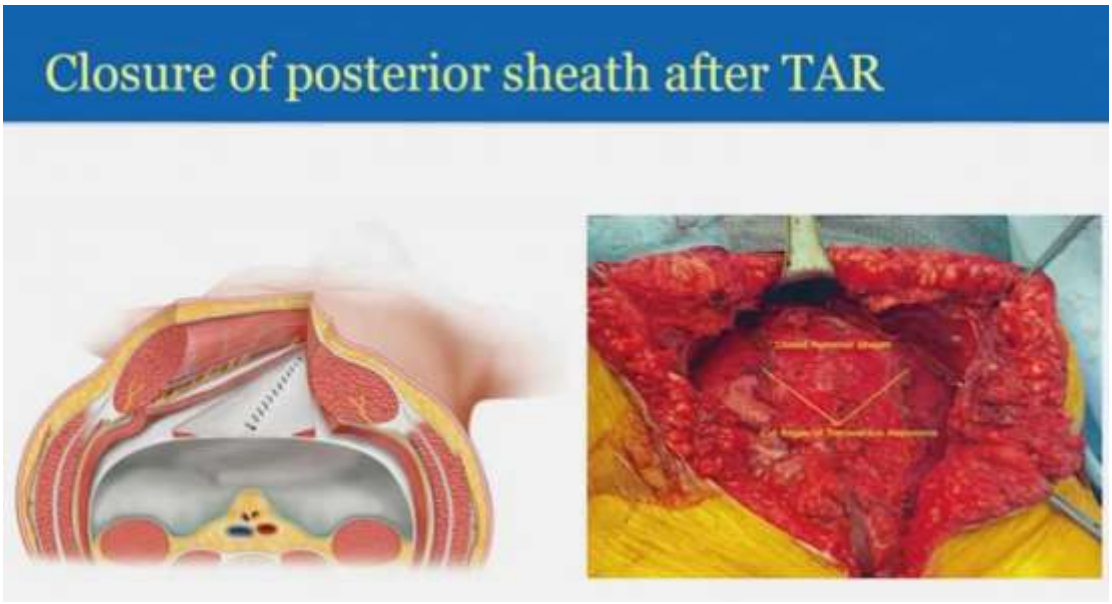

Figure 6: Closure of posterior rectus sheath

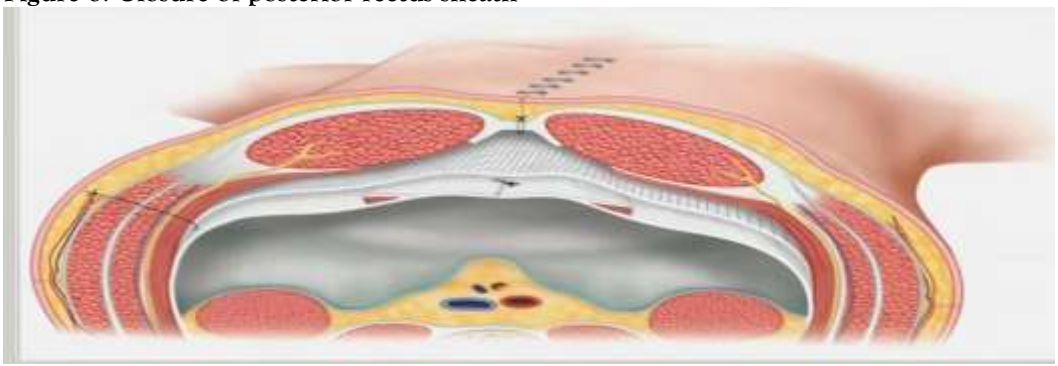

Figure 7: Animation post TAR with mesh

OBSERVATION AND RESULTS

1.Gender Distribution of the Study Population

The study cohort exhibited a female predominance, with 58.3% of patients being women and 41.7% men. This distribution may reflect a higher incidence of prior abdominal surgeries such as caesarean sections or gynaecological operations among women, which are recognized risk factors for incisional hernias. The gender distribution is important in understanding the surgical demographics and may also have implications for postoperative recovery, pain perception, and cosmetic expectations, which can differ between sexes. Recognizing such trends aids in tailoring patient education and perioperative care.

Table 1: Gender Distribution of the Study Population

Gender	Frequency	Percentage (%)
Female	21	58.30
Male	15	41.70

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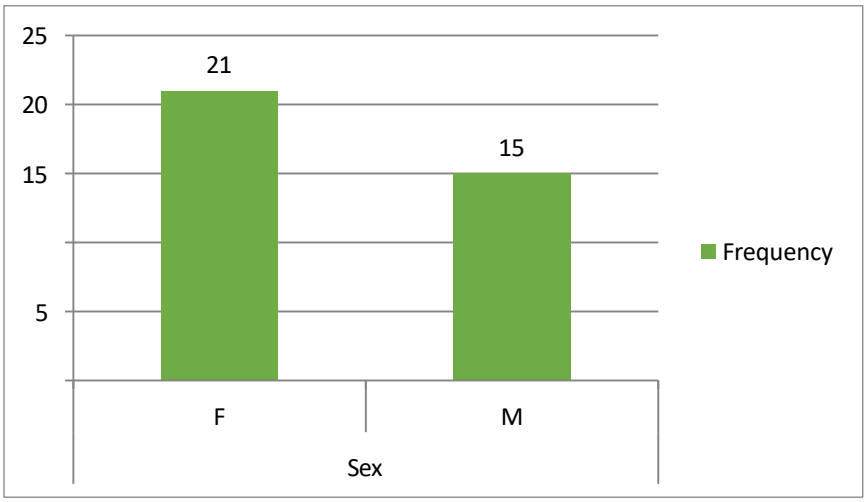
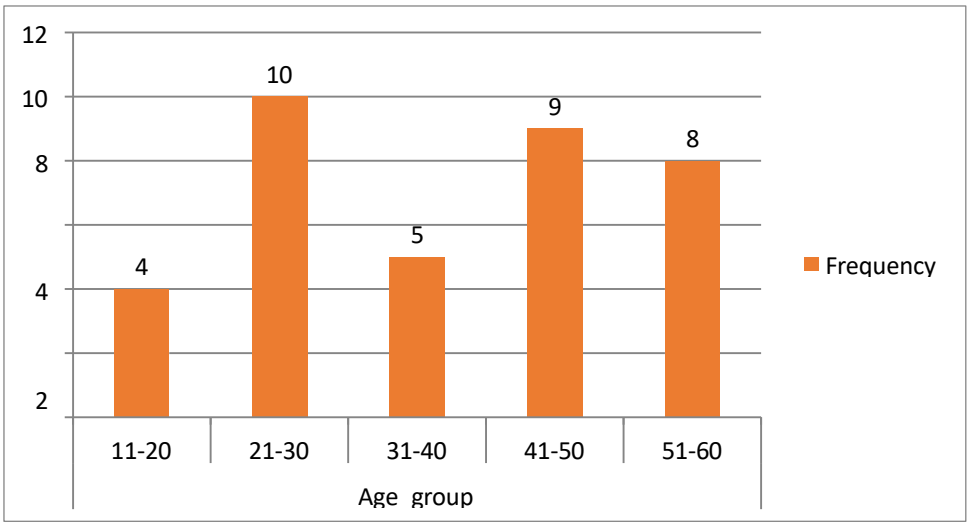


2.Age Distribution of the Study Population

The age distribution revealed that the majority of patients undergoing TAR were in the 21–30 (27.8%) and 41–50 (25%) age groups, indicating that complex incisional hernias affect both younger and middle-aged adults. The presence of cases in the 11– 20 age group (11.1%) suggests early surgical exposure or congenital weakness in some individuals. With nearly 60% of patients under 40, the data underscores the importance of effective, durable hernia repair techniques like TAR to minimize long- term morbidity and recurrence in a relatively younger demographic.

Table 2: Age-wise Distribution of Patients Undergoing TAR

Age Group (years)	Frequency	Percentage (%)
11–20	4	11.1
21–30	10	27.8
31–40	5	13.9
41–50	9	25.0
51–60	8	22.2
Total	**36**	**100.0**

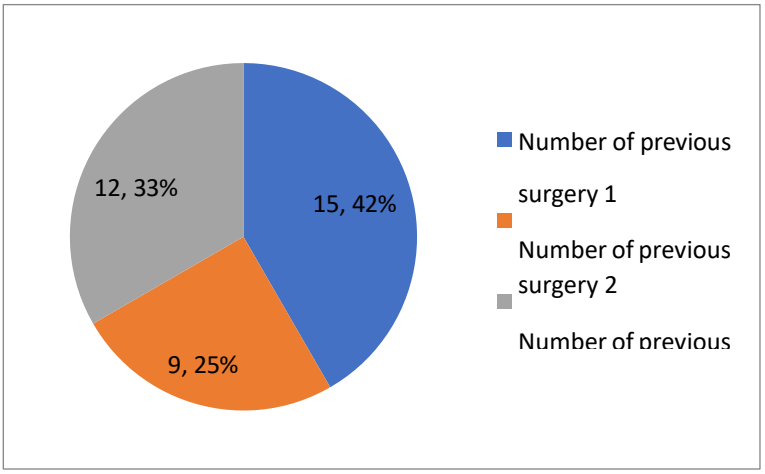


3.Number of Previous Surgeries Among the Study Population

A notable proportion of patients (58.33%) had undergone two or more prior abdominal surgeries, with one-third (33.33%) having a history of three surgeries. These findings emphasize the complexity of cases included in the study, many of which represent recurrent or previously inadequately treated hernias. The surgical history suggests that TAR was often considered after failed conventional repairs, highlighting its role as a salvage or definitive technique for difficult and recurrent hernias.

Table 3: Number of Prior Abdominal Surgeries in Patients Undergoing TAR

Number of Surgeries	Frequency	Percentage (%)
1	15	41.67
2	9	25.00
3	12	33.33



Graph 3: Distribution of patients by number of previous abdominal surgeries

4.Type of Previous Abdominal Incision

The most frequent incision types observed among patients were midline (30.6%) and lower midline (33.3%), which are commonly associated with a higher incidence of incisional hernias due to weaker anatomical support and greater exposure to intra- abdominal pressure. Right paramedian incisions accounted for 25% of cases. These findings support existing literature that midline incisions are more prone to herniation, emphasizing the need for durable repair techniques like TAR in such cases. Understanding the incision type also aids in surgical planning and mesh placement strategies.

Table 4: Distribution of Patients Based on Previous Abdominal Incision Type

Type of Incision	Frequency	Percentage (%)
Left Paramedian	2	5.60
Lower Midline Incision	10	33.30
Midline	13	30.60
Right Paramedian	9	25.00
Upper Midline	2	5.60

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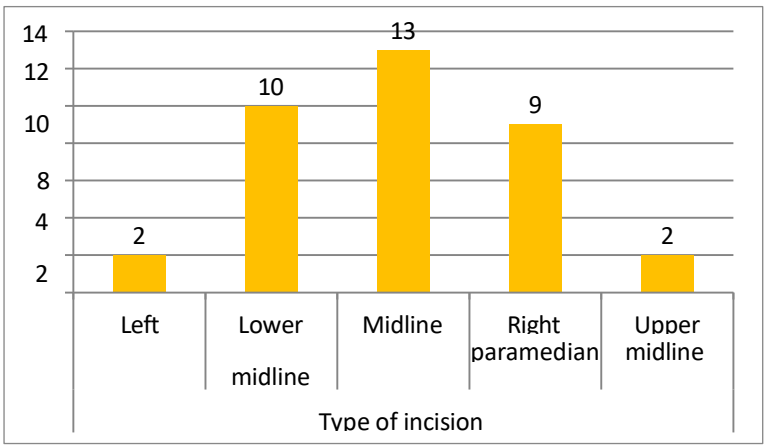


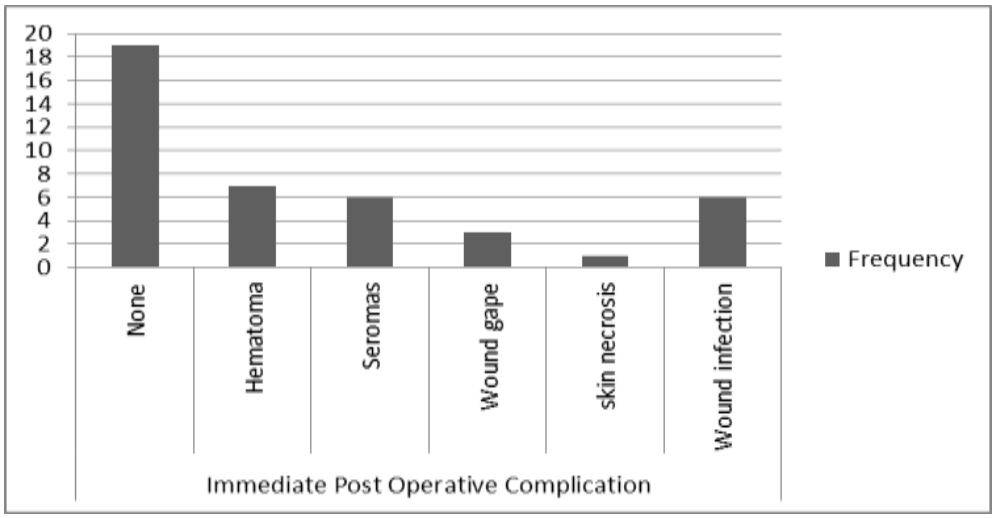
Graph 4: Distribution of previous abdominal incision types among patients undergoing TAR

5.Postoperative Complications

In the immediate postoperative period, 55.6% of patients experienced one or more complications following TAR. Hematoma formation was the most common (19.7%), followed by seroma and wound infection (both 16.7%). Wound gape occurred in 8.3% of patients, while skin necrosis was rare (2.8%). Notably, 44.4% of patients had no complications, suggesting a relatively safe profile of TAR when performed in a controlled surgical setting. These results highlight the importance of meticulous technique and postoperative wound care to mitigate complications in complex incisional hernia repair.

Table 5: Distribution of Immediate Postoperative Complications Following TAR Procedure

Immediate Postoperative Complication	Frequency	Percentage
None	19	44.4%
Hematoma	7	19.7%
Seroma	6	16.7%
Wound infection	6	16.7%
Wound gape	3	8.3%
Skin necrosis	1	2.8%



Graph 5: Incidence of various immediate postoperative complications in patients undergoing TAR for complex incisional hernia.

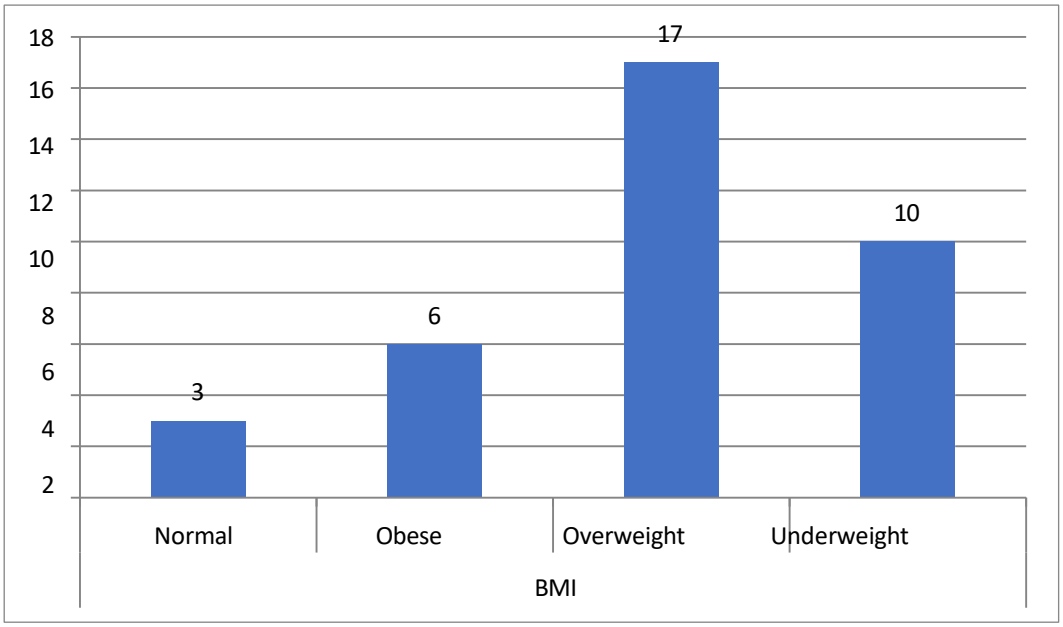
6.BMI Distribution of the Study Population

Most patients were either overweight (47.2%) or underweight (27.8%), highlighting a trend of nutritional imbalance within the study cohort. Obesity was identified in 16.7% of patients, while only 8.3% had a normal BMI. Both undernutrition and excess weight are recognized risk factors for poor wound healing, increased complication rates, and hernia recurrence. These findings underscore the importance of preoperative nutritional counselling and optimization in patients undergoing TAR, as BMI is a modifiable factor that can significantly influence surgical outcomes.

Table 6: Body Mass Index (BMI) Distribution of Patients Undergoing TAR

BMI Category	Frequency	Percentage (%)
Normal	3	8.30
Obese	6	16.70
Overweight	17	47.20
Underweight	10	27.80

Graph 6: Distribution of BMI categories among patients undergoing TAR



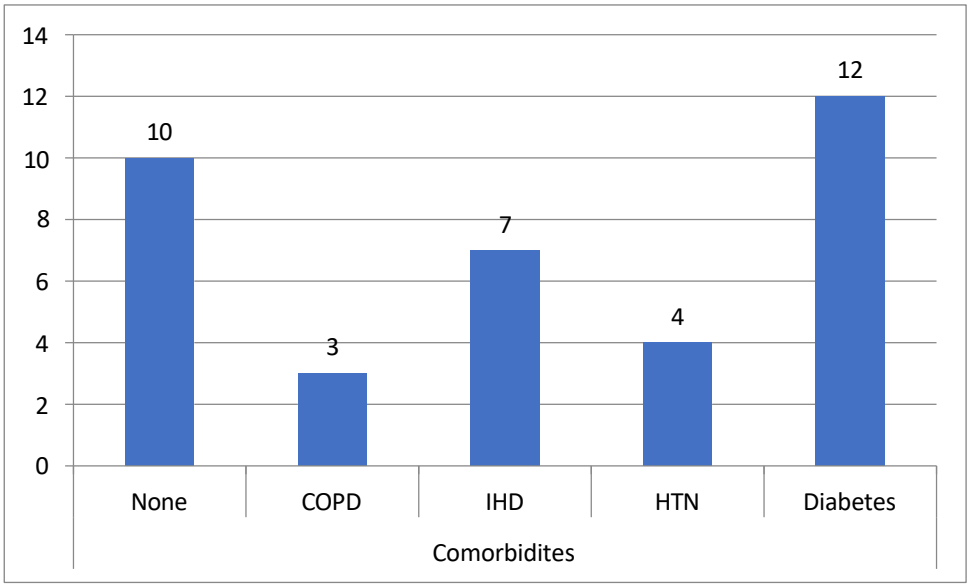
7.Comorbidity Profile

A significant proportion of patients undergoing TAR presented with comorbidities, with diabetes being the most prevalent (33.3%). Ischemic heart disease (19.4%) and hypertension (11.1%) were also notable. Chronic obstructive pulmonary disease (COPD) was observed in 8.3% of cases. Only 27.8% of patients had no identifiable comorbid condition. These results highlight the burden of systemic illness among patients with complex incisional hernias, emphasizing the importance of thorough preoperative assessment and multidisciplinary optimization to mitigate perioperative risk and improve surgical outcomes.

Table 7: Comorbid Conditions in Patients Undergoing TAR

Comorbidity	Frequency	Percentage
None	10	27.8%
Diabetes	12	33.3%

Ischemic Heart Disease (IHD)	7	19.4%
Hypertension (HTN)	4	11.1%
Chronic Obstructive Pulmonary Disease (COPD)	3	8.3%



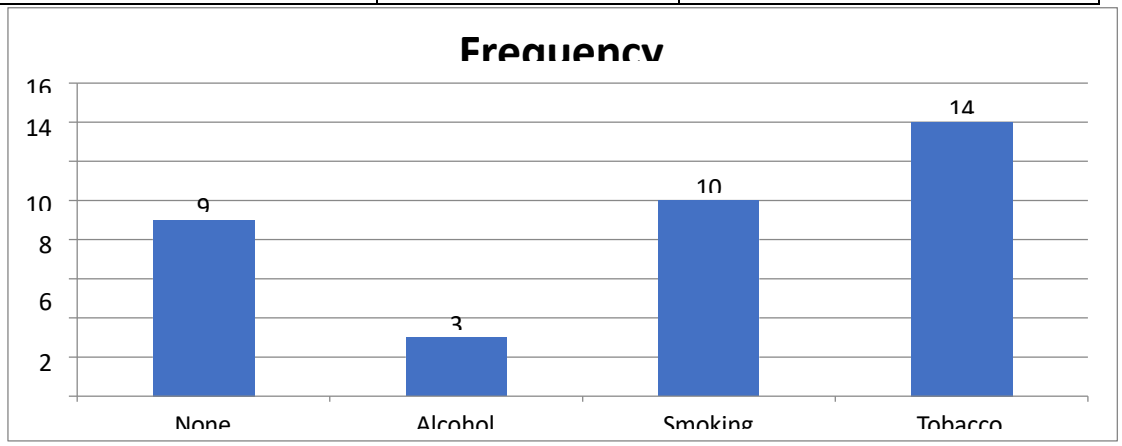
Graph 7: Prevalence of comorbid conditions among TAR patients

8.Addiction Profile of the Study Population

Tobacco use (38.6%) and smoking (27.8%) were the most common addictions among the patients studied. Only 25% reported no addictions, and 8.3% consumed alcohol. Addictive habits are known to impair tissue oxygenation, reduce immune function, and delay wound healing, thereby increasing the risk of postoperative complications. These findings highlight the critical need for preoperative counselling and cessation programs as part of holistic patient preparation for TAR procedures.

Table 8:Addictive Habits in Patients Undergoing TAR

Addiction Type	Frequency	Percentage (%)
None	9	25.00
Alcohol	3	8.30
Smoking	10	27.80



Tobacco	14	38.60

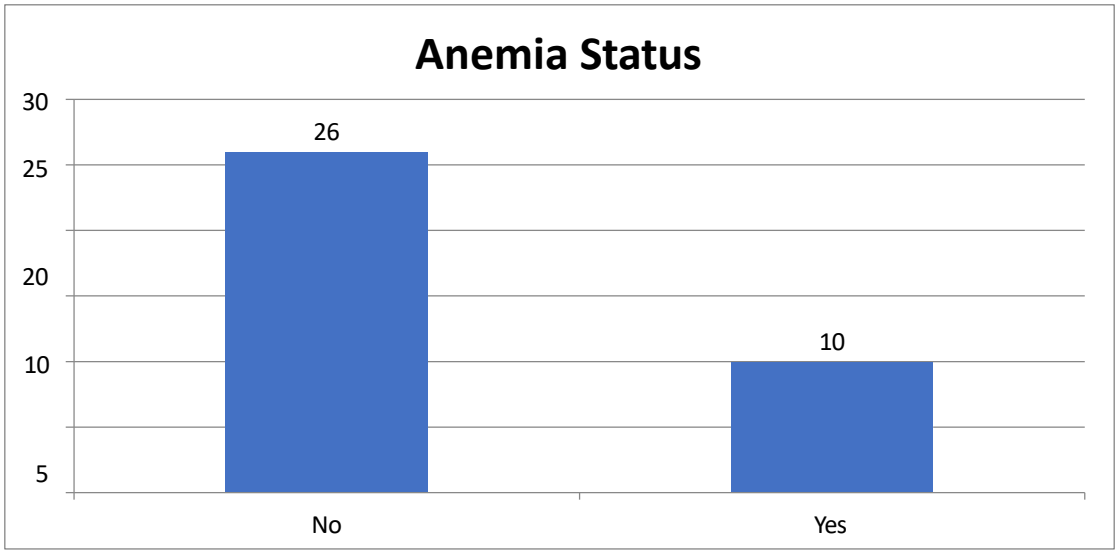
Graph 8: Distribution of addictive habits among patients undergoing TAR

9.Prevalence of Anaemia

Among patients undergoing TAR, 27.8% were found to have preoperative anaemia, while the majority (72.2%) had normal haemoglobin levels. The presence of anaemia in nearly one-third of the cohort is clinically relevant, as it may contribute to impaired wound healing and increased susceptibility to postoperative complications. These findings support the need for routine preoperative screening and management of anaemia to optimize surgical outcomes in complex hernia repair.

Table 9: Preoperative Anaemia Status in Patients Undergoing TAR

Anaemia Status	Frequency	Percentage
No	26	72.2%
Yes	10	27.8%



Graph 9: Proportion of TAR patients with and without preoperative anemia.

Summary Statistics of Patient Demographics and Clinical Parameters

The mean age of patients undergoing TAR was 38.64 years, indicating that complex incisional hernias affect relatively younger adults. The average hospital stay post- surgery was 4.69 days, suggesting a relatively efficient postoperative recovery period. The mean defect size was 10.86 cm, confirming the inclusion of large and challenging hernia cases, which justifies the use of advanced techniques such as TAR. These baseline characteristics provide a quantitative overview of the study population and frame the clinical context for evaluating outcomes.

Table 10: Summary of Demographic and Clinical Characteristics of Patients Undergoing TAR

Parameter	Mean	Standard Deviation
Age (years)	38.64	13.93
Hospital Stay (days)	4.69	1.12
Defect Size (cm)	10.86	2.65

1.Recurrence of Hernia at One-Year Follow-Up by Age Group

This table presents the distribution of hernia recurrence after one year of follow-up across different age groups. Recurrences were observed exclusively in the older age brackets, particularly among patients aged 41–60 years. Notably, patients aged 51–60 accounted for 3 out of the 4 total recurrence cases. Younger

patients (≤40 years) demonstrated no recurrence. The difference in recurrence rates across age groups was statistically significant (p = 0.0036), indicating that age may be a significant factor influencing long-term outcomes following TAR. This suggests a potential need for closer monitoring and tailored post-op care in older patients.

Table 11: One-Year Hernia Recurrence Stratified by Age Group

Age Group (years)	No Recurrence	Recurrence
11–20	6	0
21–30	7	0
31–40	8	0
41–50	6	1
51–60	5	3

P value: 0.0036

2.Sex-wise Recurrence after One Year

Among the 36 patients who underwent TAR, recurrence was observed in 2 females and 2 males after one year. The recurrence rate was slightly higher among males (13.3%) compared to females (9.5%), but the difference was not statistically significant (p = 0.72). These findings indicate that sex does not appear to be a major determinant of recurrence in patients treated with TAR for complex incisional hernia, though continued monitoring in larger cohorts is necessary to confirm this trend.

Table 12: Sex-wise Distribution of Recurrence One Year Post-TAR

Sex	No Recurrence	Recurrence	p-value
Female	19	2	
Male	13	2	0.72

3.Recurrence in Relation to Comorbidities

This table illustrates the impact of pre-existing comorbid conditions on hernia recurrence at one year following TAR. No recurrence was observed among patients without comorbidities (n=20), whereas recurrence occurred in patients with COPD (1 case), hypertension (2 cases), and diabetes (1 case). Interestingly, ischemic heart disease (IHD) showed no recurrence in the single affected patient. The findings were statistically significant (p = 0.035), reinforcing the role of systemic health— particularly cardiopulmonary and metabolic conditions—in influencing postoperative healing and recurrence risk. Comprehensive preoperative management of comorbidities may enhance surgical outcomes.

Table 15: One-Year Recurrence Rates Based on Comorbidity Status

Comorbidity	No Recurrence	Recurrence
None	20	0
COPD	2	1
Ischemic Heart Disease (IHD)	1	0
Hypertension (HTN)	5	2
Diabetes Mellitus	4	1

P value: 0.035

4.Recurrence in Relation to Addiction History

Among patients undergoing TAR, recurrence was more frequently observed in those with a history of substance use. Recurrences occurred in patients with alcohol (33.3%), smoking (20%), and tobacco use (7.1%), while no recurrences were observed in patients without addictions. Although this pattern suggests an association between substance use—particularly smoking and alcohol—and higher recurrence, the findings were not statistically significant (p = 0.405). Nonetheless, these trends support the need for perioperative counselling and intervention targeting modifiable risk factors such as addiction.

Table 16: One-Year Recurrence Based on Addiction History

Addiction Type	No Recurrence	Recurrence	p-value
None	9	0	
Alcohol	2	1	
Smoking	8	2	
Tobacco	13	1	0.405

5.Association Between Immediate Postoperative Complications and One-Year Hernia Recurrence

This table examines the link between early postoperative complications and the incidence of hernia recurrence at one year post-TAR. Patients without any immediate complications showed no recurrence (n=24). In contrast, recurrence was observed in patients who developed hematoma, seroma, skin necrosis, or wound gape. Each of these complications contributed to one recurrence case, suggesting that compromised early wound healing can negatively impact long-term surgical outcomes. The association was statistically significant (p = 0.048), underlining the importance of meticulous intraoperative technique and vigilant postoperative care to minimize early complications and improve durability of repair.

Table 17: One-Year Recurrence in Relation to Immediate Postoperative Complications

Immediate Postoperative Complication	No Recurrence	Recurrence
None	24	0
Hematoma	2	1
Seroma	3	1
Skin Necrosis	2	1
Wound Gape	1	1

P value: 0.048

6.Influence of Number of Previous Surgeries on One-Year Hernia Recurrence

This table highlights the relationship between the number of prior abdominal surgeries and the likelihood of hernia recurrence one year following TAR. Patients with only one previous surgery experienced no recurrence, whereas recurrence rates increased with the number of prior surgeries—2 cases each in those with two and three previous surgeries. The trend was statistically significant (p = 0.035), indicating that a history of multiple abdominal interventions may weaken the abdominal wall or compromise tissue integrity, thereby increasing the risk of postoperative recurrence. Surgical planning should account for such cumulative operative trauma in high-risk patients.

Table 18: One-Year Hernia Recurrence Based on Number of Previous Surgeries

Number of Previous Surgeries	No Recurrence	Recurrence
1	22	0
2	6	2
3	4	2

P value: 0.035

DISCUSSION

TAR offers several advantages over traditional open and laparoscopic approaches:
- Tension-free closure of large fascial defects.
- Reduced risk of mesh infection due to sublay placement in a well-vascularized plane.
- Effective component separation without compromising overlying skin or neurovascular supply.

The technique was particularly effective in obese and diabetic patients, and in those with multiple previous operations. Challenges included learning curve, bleeding control during dissection, and need for meticulous anatomical knowledge

Traditional methods like suture repair and mesh placement often fail in complex cases. TAR, introduced as a refined surgical approach, allows for posterior component separation by releasing the transverse abdominis muscle, enabling tension-free closure and wide mesh placement. Through a systematic approach involving patient assessment, operative techniques, and follow-up over one year, the study found TAR to be beneficial in reducing recurrence and enhancing patient outcomes. The technique demands anatomical expertise but offers improved reinforcement of the abdominal wall with fewer complications. This work supports the broader adoption of TAR for complex hernias and contributes valuable clinical insight into its practical application.

CONCLUSION

TAR is a highly effective surgical approach for complex incisional hernia repair. It enables durable midline closure, decreases recurrence, and is associated with acceptable complication rates even in high-risk populations. As surgical expertise with TAR increases, it may become the standard approach for complex ventral hernias. Conclusion Summary:

The study concludes that Transversus Abdominis Release (TAR) is a highly effective, safe, and feasible technique for the repair of complex incisional hernias. It significantly reduces recurrence rates, especially in high-risk patients who previously experienced failure with traditional methods. TAR enables stable fascial closure even in anatomically challenging cases, offering a robust tension-free repair by allowing medial advancement of the abdominal wall muscles.

The procedure demonstrated no hernia recurrence in the early follow-up period among the studied cohort, validating its clinical effectiveness. However, recurrence was more likely in patients with multiple prior surgeries, poor glycemic control (diabetes), or extreme BMI values. Comorbidities like hypertension and addiction habits also influenced postoperative outcomes, highlighting the importance of patient optimization.

Technically demanding, TAR requires precise anatomical knowledge and surgical expertise. Despite these challenges, its anatomical advantages—such as preserving neurovascular structures and enabling wide mesh placement—contribute to better long-term outcomes. In conclusion, TAR represents a superior surgical option for complex hernia repairs when applied with appropriate patient selection and meticulous execution.

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