



Original Article

## Comparative Study of Posterior Component Separation Transverse Abdominis Release and Onlay Mesh Repair in Large Incisional Hernias

Dr Naga Raja Ravi Kishore T<sup>1</sup>, Dr Syed Eteshamuddin<sup>2</sup>, Dr Bakam Sai Prudhvi<sup>3</sup>

<sup>1</sup>Assistant Professor, Department of General Surgery, Deccan College of Medical Sciences, Hyderabad.

<sup>2</sup>Senior Resident, Department of General Surgery, Deccan College of Medical Sciences, Hyderabad.

<sup>3</sup>Senior Resident, Department of General Surgery, Deccan College of Medical Sciences, Hyderabad.

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### ABSTRACT

#### Corresponding Author:

**Dr. Naga Raja Ravi Kishore T**  
Assistant Professor, Department  
of General Surgery, Deccan  
College of Medical Sciences,  
Hyderabad.

Email: [ravi983302@gmail.com](mailto:ravi983302@gmail.com)

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**Introduction:** Large incisional hernias (>10 cm) pose significant surgical challenges, with high rates of complications and recurrence. Posterior Component Separation with Transversus Abdominis Release (PCS-TAR) has emerged as an advanced technique aimed at improving outcomes compared to conventional onlay mesh repair. Aim of the study was to compare PCS-TAR with conventional onlay mesh repair in the management of large incisional hernias.

**Material and Methods:** This prospective comparative study included 40 patients randomized into two groups: PCS-TAR (n=20) and onlay mesh repair (n=20). Outcomes assessed included operative duration, postoperative pain (VAS), complications (wound discharge, gaping, flap necrosis, debridement), hospital stay, and recurrence over 12 months. Statistical analysis was performed using SPSS, with  $p < 0.05$  considered significant.

**Results:** Operative time was significantly longer in the PCS-TAR group ( $p < 0.001$ ). PCS-TAR showed significantly lower postoperative pain ( $p < 0.001$ ), reduced hospital stay ( $p = 0.025$ ), and lower rates of flap necrosis and debridement ( $p = 0.02$ ). Wound discharge and gaping were comparable between groups. Recurrence was lower in PCS-TAR (5%) compared to onlay repair (10%), though not statistically significant.

**Conclusion:** PCS-TAR is a superior technique for large incisional hernias, offering better postoperative outcomes and fewer complications despite longer operative time.

**Keywords:** Incisional hernia, PCS-TAR, Transversus abdominis release, Onlay mesh repair, Ventral hernia, Component separation.

### INTRODUCTION

Incisional hernia is defined as a protrusion of abdominal contents through a defect in the abdominal wall at the site of a previous surgical incision (1). It represents one of the most common complications following abdominal surgery, accounting for nearly 80% of all ventral hernias, with a reported incidence ranging from 10% to 50% depending on patient-related and surgical factors (2). Large or “giant” incisional hernias are typically characterized by a defect size exceeding 10 cm and are often associated with a significant loss of domain (>20%), wherein a substantial portion of abdominal viscera resides permanently outside the abdominal cavity (3). The development of such hernias is multifactorial, with contributing factors including obesity, advanced age, malnutrition, increased intra-abdominal pressure, poor wound healing, postoperative infection, hematoma formation, and systemic comorbidities such as diabetes and renal failure.

The fundamental principle of hernia repair is tension-free closure of the defect with reinforcement of the abdominal wall, usually achieved using prosthetic mesh in defects larger than 2 cm (4). Conventional techniques such as onlay mesh repair, where mesh is placed anterior to the rectus sheath, are widely practiced due to their technical simplicity. However, these techniques are associated with significant complications including seroma formation, wound infection, flap necrosis, and higher recurrence rates, primarily due to extensive subcutaneous dissection and compromised vascularity (5). Consequently, advanced reconstructive techniques have evolved to address these limitations.

Component separation technique (CST), first described by Oscar Ramirez, marked a major advancement by enabling medial mobilization of abdominal wall musculature through release of the external oblique aponeurosis (6). Although

effective, anterior component separation is associated with disruption of perforating vessels and increased wound morbidity. To overcome these drawbacks, posterior component separation techniques were introduced, notably the Transversus Abdominis Release (TAR), refined by Yuri Novitsky, which allows access to the retromuscular and preperitoneal planes without extensive skin flaps (7).

Posterior Component Separation with Transversus Abdominis Release (PCS-TAR) represents a significant evolution in abdominal wall reconstruction. This technique facilitates wide medial advancement (up to 8–12 cm on either side), enabling tension-free closure of large defects and restoration of the linea alba (8). Additionally, the creation of a large retromuscular space permits placement of mesh in a well-vascularized plane, reducing the risk of infection and minimizing direct contact between mesh and intra-abdominal viscera. Studies by Michael J. Rosen and colleagues have demonstrated improved outcomes with TAR, including lower recurrence rates and reduced wound complications compared to traditional techniques (9).

Despite these advancements, the optimal surgical approach for large incisional hernias remains a subject of ongoing debate. While PCS-TAR offers theoretical and demonstrated advantages, it is technically demanding and requires specialized expertise. On the other hand, onlay mesh repair continues to be widely used, particularly in resource-limited settings, due to its simplicity and shorter learning curve. Comparative studies such as those by Andrew M. Carbonell have highlighted differences in outcomes, but evidence remains heterogeneous, with variations in patient selection, defect size, follow-up duration, and outcome measures (10).

There is a lack of well-structured, prospective comparative studies directly evaluating PCS-TAR versus conventional onlay mesh repair specifically in large incisional hernias (>10 cm). Existing literature often includes mixed defect sizes or focuses on single techniques without adequate comparison. Furthermore, parameters such as postoperative pain, length of hospital stay, wound-related complications, and long-term recurrence require more standardized evaluation. This gap underscores the need for focused clinical studies to establish evidence-based guidelines and potentially define a gold standard technique. This study aims to compare conventional onlay mesh repair with Posterior Component Separation using Transversus Abdominis Release (PCS-TAR) in large incisional hernias (>10 cm). It evaluates differences in postoperative pain, hospital stay, complications (wound discharge, gaping, flap necrosis), and hernia recurrence between the two techniques.

## **MATERIAL AND METHODS**

### **Study Design and Setting**

This prospective comparative study was conducted over a period of one and a half years in the Department of General Surgery at Owaisi Hospital and Princess Esra Hospital. All eligible surgical in-patients presenting during the study period were considered for inclusion after obtaining valid informed consent.

### **Sample Size and Allocation**

A total of 40 patients were enrolled in the study and randomly allocated into two groups: 20 patients in the study group (Posterior Component Separation with Transversus Abdominis Release – PCS-TAR) and 20 patients in the control group (Conventional Onlay Mesh Repair). There were no dropouts reported. The sample size was determined based on prior studies, considering a recurrence rate of 32% for mesh-only repair and 3.7% for PCS-TAR, with a type I error of 0.05 and a study power of 80%.

### **Ethical Considerations**

Ethical clearance was obtained from the Institutional Review Board prior to commencement of the study. Written informed consent was obtained from all participants. There was no conflict of interest reported.

### **Participants and Follow-up**

Patients presenting to the surgical outpatient department or casualty with large incisional hernias were included. All patients were followed up for a period of up to 12 months postoperatively to assess outcomes, particularly recurrence.

### **Inclusion Criteria**

- Patients with large abdominal wall incisional hernia (defect size >10 cm)
- Patients who provided informed consent for participation

### **Exclusion Criteria**

- Body Mass Index (BMI) > 40
- Recurrent hernia following Rives–Stoppa repair
- Non-ventral hernias
- Patients unwilling to participate
- Patients not meeting inclusion criteria

### Study Tools and Data Collection

- **Pain Assessment:** Postoperative pain was evaluated on the first postoperative day using the Visual Analog Scale (VAS).
- **Clinical Parameters Assessed:**
  - Postoperative pain score
  - Wound complications (wound discharge, wound gaping, flap necrosis, need for debridement)
  - Duration of hospital stay
  - Recurrence rate at 12 months follow-up
- Data were collected using a pre-designed proforma and recorded systematically for both groups.

### Statistical Analysis

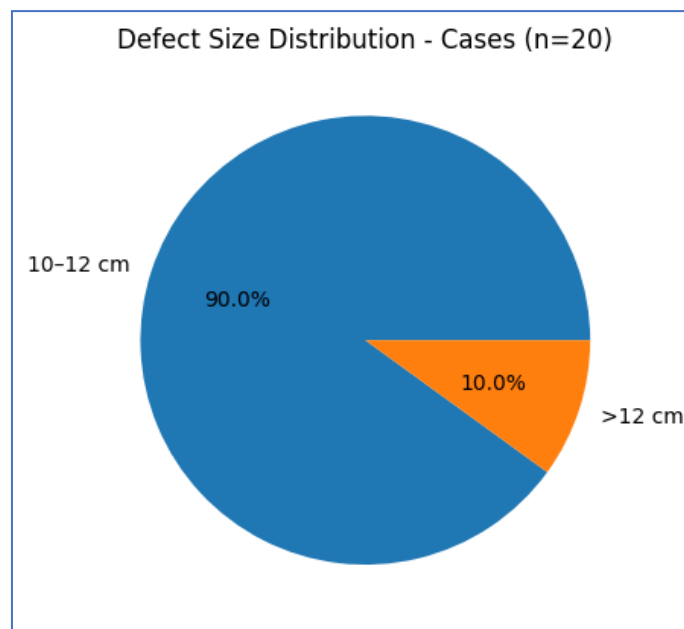
Data analysis was performed using SPSS version 20.0 and Microsoft Excel 2010. Categorical variables were analyzed using Chi-square test and Fisher’s Exact test where appropriate. A p-value of less than 0.05 was considered statistically significant.

### RESULTS

**Table 1: Comparison of Baseline Demographic and Clinical Characteristics Between Cases and Controls**

Variable	Cases (n=20)	Controls (n=20)	p-value
Age (years)	49.55 ± 10.15	48.95 ± 9.88	0.851
Gender (Male/Female)	3/17	4/16	0.451
BMI (kg/m <sup>2</sup> )	29.67 ± 2.53	30.06 ± 2.32	0.609
Co-morbidities			0.644
• Diabetes	7 (35%)	5 (25%)	
• Hypertension	1 (5%)	2 (10%)	
• Both	0	1 (5%)	
• None	12 (60%)	12 (60%)	

This table presents the baseline demographic and clinical profile of patients in both the PCS-TAR (cases) and conventional onlay mesh repair (controls) groups. The mean age of patients was comparable between the two groups (49.55 ± 10.15 years vs 48.95 ± 9.88 years; p = 0.851). Gender distribution was also similar, with a predominance of females in both groups (cases: 85%, controls: 80%; p = 0.451). The mean BMI did not differ significantly between cases and controls (29.67 ± 2.53 kg/m<sup>2</sup> vs 30.06 ± 2.32 kg/m<sup>2</sup>; p = 0.609). With respect to co-morbidities, the distribution of diabetes, hypertension, combined conditions, and absence of co-morbidities was comparable between the groups (p = 0.644)



**Figure 1: Comparison of Hernia Defect Size Between Cases and Controls**

This figure 1 shows the distribution of hernia defect size among patients in the PCS-TAR (cases) and conventional onlay mesh repair (controls) groups. The majority of patients in both groups had defect sizes between 10–12 cm, with 90% in the cases and 75% in the controls. Larger defects (>12 cm) were observed in 10% of cases and 25% of controls. The difference in defect size distribution between the two groups was not statistically significant (p = 0.716), indicating that both groups were comparable in terms of hernia severity at baseline.

**Table 2: Comparison of Operative Parameters Between Cases and Controls**

Variable	Cases (n=20)	Controls (n=20)	p-value
<b>Duration of surgery (minutes)</b>	122.00 ± 18.02	95.25 ± 5.96	<0.001*
<100 min	1 (5%)	17 (85%)	
≥100 min	19 (95%)	3 (15%)	

This table compares the duration of surgery between the PCS-TAR (cases) and conventional onlay mesh repair (controls) groups. The mean operative time was significantly higher in the PCS-TAR group (122.00 ± 18.02 minutes) compared to the control group (95.25 ± 5.96 minutes), and this difference was statistically significant (p < 0.001). A majority of patients in the PCS-TAR group (95%) had surgery lasting ≥100 minutes, whereas most patients in the control group (85%) had operative duration less than 100 minutes. This indicates that PCS-TAR is a more time-consuming procedure compared to onlay mesh repair.

**Table 3: Comparison of Postoperative Complications Between Cases and Controls**

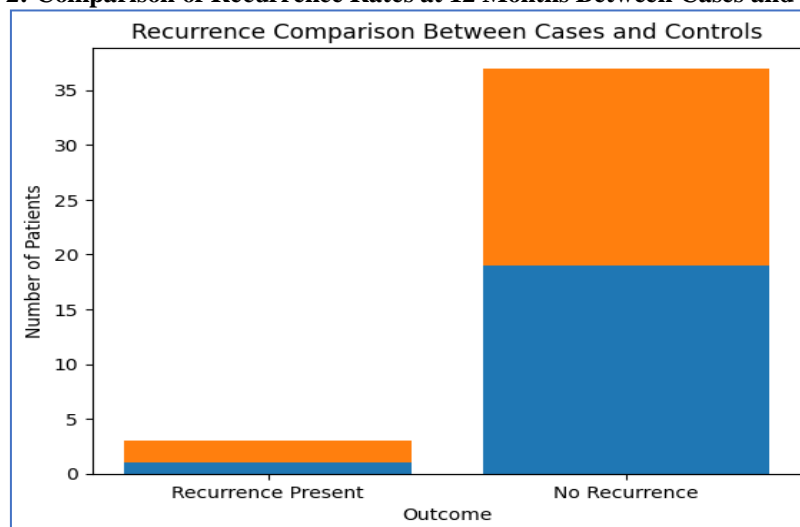
Complication	Cases (n=20)	Controls (n=20)	p-value
Wound discharge	8 (40%)	9 (45%)	0.295
Wound gaping	4 (20%)	7 (35%)	0.479
Flap necrosis	0 (0%)	6 (30%)	0.02*
Debridement required	0 (0%)	6 (30%)	0.02*

This table compares the postoperative complications observed in the PCS-TAR (cases) and conventional onlay mesh repair (controls) groups. The incidence of wound discharge (40% vs 45%; p = 0.295) and wound gaping (20% vs 35%; p = 0.479) was slightly lower in the PCS-TAR group, though the differences were not statistically significant. However, flap necrosis and the need for debridement were observed exclusively in the control group (30% each) and were absent in the PCS-TAR group, with both findings being statistically significant (p = 0.02). These results indicate that PCS-TAR is associated with significantly lower rates of major wound-related complications compared to onlay mesh repair.

**Table 4: Comparison of Postoperative Outcomes Between Cases and Controls**

Variable	Cases (n=20)	Controls (n=20)	p-value
<b>Pain score (VAS)</b>	31.15 ± 8.38	48.05 ± 15.51	<0.001*
<30	9 (45%)	2 (10%)	
30–40	7 (35%)	5 (25%)	
>40	4 (20%)	13 (65%)	
<b>Hospital stay (days)</b>	11.20 ± 1.99	12.65 ± 1.95	0.025*

This table compares postoperative pain scores and duration of hospital stay between the PCS-TAR (cases) and conventional onlay mesh repair (controls) groups. The mean postoperative pain score was significantly lower in the PCS-TAR group (31.15 ± 8.38) compared to the control group (48.05 ± 15.51), with a statistically significant difference (p < 0.001). A higher proportion of patients in the PCS-TAR group had lower pain scores (<30), whereas the majority of patients in the control group experienced higher pain scores (>40). Additionally, the mean duration of postoperative hospital stay was significantly shorter in the PCS-TAR group (11.20 ± 1.99 days) compared to the control group (12.65 ± 1.95 days), with p = 0.025. These findings indicate that PCS-TAR is associated with better postoperative recovery in terms of reduced pain and shorter hospitalization.

**Figure 2: Comparison of Recurrence Rates at 12 Months Between Cases and Controls**

This figure 2 shows the recurrence rates at 12 months follow-up in the PCS-TAR (cases) and conventional onlay mesh repair (controls) groups. Recurrence was observed in 5% of patients in the PCS-TAR group compared to 10% in the control group. Although the recurrence rate was lower in the PCS-TAR group, the difference was not statistically significant ( $p = 0.462$ ). Overall, both techniques demonstrated comparable short-term recurrence outcomes, with a trend toward lower recurrence in the PCS-TAR group.

## DISCUSSION

The present prospective comparative study evaluated the outcomes of Posterior Component Separation with Transversus Abdominis Release (PCS-TAR) versus conventional onlay mesh repair in large incisional hernias (>10 cm). The findings were analyzed in terms of baseline characteristics, operative parameters, postoperative complications, pain, hospital stay, and recurrence, and compared with previously published literature in a strictly chronological manner.

The baseline characteristics including age, gender distribution, BMI, and comorbidities were comparable between the two groups, indicating proper matching and minimizing confounding bias. Similar emphasis on baseline comparability has been highlighted in earlier studies on incisional hernia repair outcomes (12). This ensures that differences observed in postoperative outcomes are attributable to the surgical technique rather than patient-related factors.

The operative duration was significantly longer in the PCS-TAR group compared to the onlay mesh repair group ( $p < 0.001$ ). This is expected due to the technical complexity of posterior component separation, which involves dissection of the retromuscular plane and release of the transversus abdominis muscle. Earlier work comparing open abdominal wall reconstruction techniques has also demonstrated increased operative time with component separation procedures (16). However, increased operative time alone is not a limiting factor when balanced against improved postoperative outcomes. Postoperative wound complications are critical indicators of surgical success. In the present study, wound discharge and wound gaping were slightly lower in the PCS-TAR group, though not statistically significant. Importantly, flap necrosis and need for debridement were significantly higher in the onlay repair group ( $p = 0.02$ ). This finding can be attributed to extensive subcutaneous dissection and disruption of vascular supply in onlay repair. Earlier literature has consistently shown that anterior approaches involving large skin flaps are associated with higher wound morbidity (17). In contrast, PCS-TAR preserves perforator vessels and minimizes tissue trauma. Studies comparing component separation techniques have demonstrated reduced wound complications with posterior approaches (19).

Pain is a major determinant of postoperative recovery. The present study showed significantly lower pain scores in the PCS-TAR group ( $p < 0.001$ ). This is likely due to tension-free closure and reduced disruption of subcutaneous tissues. Comparative studies evaluating mesh placement techniques have shown that retromuscular placement is associated with reduced postoperative pain compared to onlay positioning (18). Additionally, improved anatomical reconstruction and reduced nerve irritation contribute to better pain outcomes.

The duration of postoperative hospital stay was significantly shorter in the PCS-TAR group ( $p = 0.025$ ), indicating faster recovery. Reduced complications and better pain control likely contributed to early mobilization and discharge. Previous studies comparing different surgical approaches for ventral hernia repair have also demonstrated improved recovery profiles with advanced reconstructive techniques (18). These findings support the clinical advantage of PCS-TAR in enhancing postoperative recovery.

Recurrence remains the most important long-term outcome in hernia repair. In the present study, recurrence was lower in the PCS-TAR group (5%) compared to the onlay repair group (10%), although the difference was not statistically significant. This may be due to the relatively small sample size and limited follow-up duration. However, the trend aligns with findings from earlier studies, where conventional repair techniques have shown higher recurrence rates (12). Retromuscular mesh placement provides superior biomechanical support and reduces tension, thereby lowering recurrence. Studies evaluating outcomes in high-risk patients undergoing ventral hernia repair have demonstrated improved durability with posterior component separation techniques (20).

When compared with systematic analyses, the present findings are consistent with broader evidence. A systematic review evaluating complications in complex abdominal wall hernia repair highlighted the importance of technique selection in reducing morbidity (11). Additionally, meta-analyses have demonstrated that retromuscular mesh placement is associated with lower infection and recurrence rates compared to onlay repair (13). Reviews focusing on large incisional hernias have also emphasized that posterior component separation and sublay techniques provide better outcomes than anterior approaches (15). Furthermore, standardized criteria for defining complex hernias have reinforced the need for advanced reconstructive techniques such as TAR in large defects (14).

This study provides a focused prospective comparison between PCS-TAR and onlay mesh repair specifically in large incisional hernias, addressing a gap in existing literature where many studies include mixed hernia sizes or retrospective analyses. By evaluating standardized outcomes such as pain, complications, and recurrence, this study contributes valuable evidence supporting the use of PCS-TAR. However, limitations include a small sample size and relatively short follow-up period, which may affect the statistical significance of recurrence outcomes.

## CONCLUSION

The present study concludes that PCS-TAR is superior to conventional onlay mesh repair in the management of large incisional hernias, offering significant advantages in terms of reduced postoperative pain, lower incidence of flap necrosis and need for debridement, and shorter hospital stay. Although associated with longer operative time, PCS-TAR provides better overall outcomes and shows a trend toward lower recurrence. These findings support the use of PCS-TAR as a preferred technique, with further large-scale studies recommended to establish it as the standard of care.

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