

# Early Postoperative Outcome of Posterior Component Separation through Transversus Abdominus Release for the Treatment of Midline Incisional Hernia

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**Background:** Posterior Component Separation through Transversus abdominus Muscle Release (PCS-TAR) is considered as a better option for Abdominal Wall Reconstruction (AWR) during large ventral wall IH repair as it has advantage over both Rives-Stoppa (Retro muscular) repair and Anterior Component Separation (ACS) repair in avoiding injury of the nerve supply to rectus muscle, and in the ability to achieve more lateral dissection, providing better quality of life (QoL).

**Aim of work:** To evaluate 30-day post operative outcome of PCS-TAR regarding both; Visual Analogue Scale (VAS) and Surgical Site Occurrence (SSOs) classification provided by Ventral Hernia Working Group (VHWG) in 2010.

**Patients and methods:** This prospective observational study was conducted to 30 patients who have a midline incisional hernia with defect size  $\geq 10$  cm in widest diameter (W3) and underwent IH repair through (PSC-TAR) after routine laboratory investigations, abdominal ultrasonography, and CT. Informed consent was taken from all cases. Results were reviewed and evaluated.

**Results:** Out of 30 patients, 13 patients (43.3%) developed SSOs. 3 patients (10%) developed cellulitis. 3 patients (10% of patients) presented with superficial infection. Seroma occurred in 5 patients (16.7%) 3 of which (10%) developed complicated seroma that needed procedural intervention (SSOpi). Hematoma was observed in 2 patients (6.7%).

**Conclusion:** Retro muscular, Ravis Stoppa technique and ACS are comparable to PCS-TAR regarding patient reported outcomes (PROs). However, PCS-TAR still has resulted in a better quality of life (QoL). The outcome of PCS-TAR is still better even in the presence of comorbidities such as high BMI, DM, and COPD.

**Key words:** Posterior Component Separation through Transversus Abdominis Release, Incisional Hernia Repair, Surgical Site Occurrence.

## Introduction

Incisional hernia (IH) is defined as a defect in the abdominal wall with or without a protrusion at the site of previous surgical incision diagnosed by either physical examination or imaging.<sup>1</sup> It is considered a major iatrogenic complication following abdominal surgery with an incidence of around 18.5%.<sup>2</sup> The highest incidence of IH is found to be in the age ranges from 30-50 years old. It is more common in females with a history of gynecological operations in the infra umbilical region, with a female to male ratio of 6:1. About 50% of cases occur within the first 2 years from the operation time, and 74% occur within 3 years postoperatively.<sup>3</sup>

The most important goal of the repair of midline IH is to do tension-free hernioplasty in the abdominal wall muscles and avoid an increase in the intra-abdominal pressure.<sup>4</sup> However, IH repair can be technically challenging, and over years there have been numerous methods developed to deal with IH such as Rives-Stoppa, (Retro Muscular) and Rameris (Anterior Component Separation); also

known as Component Separation (CST) Repairs.<sup>5</sup> All these methods of IH repair carry their limitations and risks mainly the inability to deal with large hernia defects while preserving the functionality of the abdominal wall. Most of the published literatures about Techniques of repair and Anterior Wall Reconstruction (AWR) consist of case series and observational studies. These studies usually combine all data of various patient groups with primary ventral, incisional, and paraumbilical hernias.<sup>6</sup>

Recently, a new technique has been proposed by Novitsky et al., 2012 which is labeled as Posterior Component Separation through Transversus Abdominis Release (PCS-TAR). It entails a new concept of abdominal wall anatomy, which implies an extension of the transversus abdominis muscle beyond the limit of linea semilunaris medially and giving more chance for dealing with large midline IH.<sup>7</sup>

Our study aim is to evaluate the 30-day outcome of PCS- TAR, in the hernioplasty of large midline

IH (W3  $\geq$ 10 cm in the widest diameter) according to the width classification of IH by the European Hernia Society (EHS),<sup>8</sup> regarding Surgical Site Occurrence (SSO) classification introduced by the Ventral Hernia Working Group (VHWG) in 2010,<sup>9</sup> and post-operative pain guided by Visual Analogue Scale (VAS).<sup>10</sup>

## Patients and methods

Our study was carried out on a total of 30 patients from Departments of General Surgery in both, Ain Shams university hospitals in Cairo Governorate, and Menoufia Military Hospital in Menoufia Governorate, Egypt, from February 2019 to January 2021.

## Ethical approval

From Department of General Surgery Faculty of Medicine, Ain Shams University, Research Ethics Committee (REC), on 27 January 2019. IRB 00006379.

## Study population

**Inclusion Criteria:** Patients aged between 18 -60 years, both male & female who have a midline IH with defect size  $\geq$ 10 cm in widest diameter (W3). All the patients were subjected to routine laboratory investigations and abdominal ultrasonography, and CT. Informed consent was taken from all cases.

**Exclusion Criteria:** Decline to consent, uncontrolled diabetes mellitus (Hb A1c  $\geq$  6.5), Pregnancy in female cases, Morbid obesity (BMI  $\geq$  32), Smokers (at least 30 days abstinence), Mental incapacity, Patients who are very high risk for major surgery ASA IV. Hepatic patients, recurrent incisional hernia, and patients with restricted pulmonary function tests.

## Operative technique

Based on the technique proposed by Novitsky et al in 2012, all patients underwent general anesthesia, then through a midline incision we excised the old scar and subcutaneous tissue, and we opened the hernial sac, reduced the contents after complete dissection and adhesolysis.

To access the rectus sheath, we did a longitudinal incision in the posterior rectus sheath about 0.5–1 cm medial to the junction of the anterior and posterior rectus sheath, at the umbilicus level to avoid injury of the neurovascular bundles which visualized and preserved and mobilized the rectus abdominis muscles anteriorly. The plane was developed retro-muscular towards linea semilunaris, to expose the underlying transversus abdominis muscle which is separate by using electrocautery. The first step in the upper third of the abdomen identifies medial fibers of the transversus abdominis muscle and separates it from the underlying fascia.

Generally, this step allows entrance to the space between the transversalis fascia and the divided transversus abdominis muscle. This space is connecting with the retroperitoneum and extended to the psoas muscle laterally. The dissection plane of the retro-muscular area was extended from the costal margins and sternum up and created by sweeping the peritoneum/transversalis fascia of the diaphragm. Then the dissection was extended down till the anterior to the urinary bladder (space of Retzius) was entered to expose the symphysis pubis and both Cooper ligaments. Below the level of the arcuate line, only transversalis fascia and peritoneum were medialized. This dissection allows for significant medial expansion of the posterior rectus sheaths.

We followed the exact technique developed by Novitsky and others in their key paper published in 2012, where we used ULTRAPRO® Macroporous Partially Absorbable Lightweight Mesh, produced by ETHICON, part of JOHNSON & JOHNSON Family of companies. Once the release was performed bilaterally, the posterior rectus sheaths were sutured together with a continuous midline non-absorbable suture. Mesh was put in the retro-muscular space (Sublay) and fixed by non-absorbable sutures while the lower edge of the mesh is sutured to both Cooper ligaments bilaterally using interrupted sutures. Suction drains were inserted over the mesh.<sup>7</sup>

## Statistical analysis

Data was analyzed using IBM Statistical Package for Social Sciences software (SPSS), (IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp).

## Results

### I. Pre-operative demographic data of the studied patients:

Demographic Variables are shown as follows (Table 1).

### II. Hernia assessment and operative findings:

#### 1. Actual Length of Incision during Incisional Hernia Repair:

Regarding actual length of incision during incisional hernia repair, the length ranged from 7.0 cm to 28 cm with mean of  $16.20 \pm 5.37$ . (Table 2).

#### 2. Defect Width classification according to EHS:

All patients were classified as W3 ( $\geq$  10 cm). The width varied from 11 cm to 24 cm with mean of  $16.07 \pm 3.67$ ,8 (Table 3).

### III. Post-operative assessment after IH repair:

#### A. Post-operative pain assessment after incisional hernia repair using visual analogue scale for pain:

Regarding post-operative pain, 17 patients (56.7% of patients) had moderate level of pain on VAS scale,9 and only 2 patients (6.7% of patients) had severe pain (Table 4).

#### B. Post-Operative assessment of Incisional Hernia Repair regarding Surgical Site Occurrence (SSO):

AS We followed up patients regarding SSO, Patient Reported Outcomes (PROs) were assessed and recorded as follows: SSOs occurred in 13 out of 30 patients (43.3%), where 3 patients (10% of patients) were complicated with cellulitis. 3 patients (10% of patients) were complicated with superficial infection. Seroma occurred in 5 patients (16.7% of patients) 3 of which (10% of patients) developed complicated seroma that needed procedural intervention (SSOpi). Hematoma was observed in 2 patients (6.7% of patients). Fortunately, patients didn't develop neither deep infection nor entero cutaneous fistula and nor wound dehiscence (Table 5).

Table 1: Distribution of patients regarding demographic data

Demographic Variables	Studied patients (n = 30)	
	n.	%
<b>Age (years)</b>		
Minimum	39.0	
Maximum	60.0	
Mean± SD	50.57± 6.22	
Median (IQR)	49.5 (46.0- 56.0)	
<b>Gender</b>		
Male	19	63.3%
Female	11	36.7%
<b>BMI (Kg/m<sup>2</sup>)</b>		
Minimum	25.0	
Maximum	32.0	
Mean± SD	28.73± 2.29	
Median (IQR)	29.0 (27.0- 31.0)	

Table 2: Distribution of patients regarding actual length of incision during incisional hernia repair

Length of incision (cm)	Studied patients (n = 30)
Minimum	7.0
Maximum	28.0
Mean± SD	16.20± 5.37
Median (IQR)	18.0 (12.0- 19.0)

Table 3: Distribution of patients regarding defect width

Defect width (cm)	Studied patients (n = 30)
Minimum	11.0
Maximum	24.0
Mean± SD	16.07± 3.67
Median (IQR)	15.0 (13.0- 19.0)

**Table 4: Distribution of patients regarding post-operative pain assessment regarding VAS scale**

Post-operative pain	Studied patients (n = 30)	
	n.	%
Mild (1-4)	11	36.7%
Moderate (5 - 8)	17	56.7%
Severe (9 -10)	2	6.7%

**Table 5: Distribution of patients regarding post-operative assessment of Incisional Hernia Repair according to Surgical Site Occurrence**

Surgical Site Occurrence (SSOs)	Studied patients (n = 30)	
	n.	%
Cellulitis	3	10.0%
Superficial Infection	3	10.0%
Deep Infection	0	0.0%
Incidental Seroma (I, II)	2	6.7%
Complicated Seroma (III, IV)	3	10.0%
Hematoma	2	6.7%
Entero Cutaneous Fistula	0	0.0%
Wound Dehiscence	0	0.0%

## Discussion

Because of the limitations of both Rives-Stoppa repair and ACS, there was a need for a new technique capable to deal with large IH defects. Fortunately, this was achieved by Novotisky et al. new technique in 2012, known as Posterior Component Separation through Transversus Abdominis Release (PCS-TAR). It has succeeded to provide better option for Abdominal Wall Reconstruction (AWR) during large ventral wall IH repair as it has advantage over Rives-Stoppa repair in avoiding injury of the nerve supply to rectus muscle, and additionally ability to achieve more lateral dissection.

During conducting this study, the main aim was to evaluate 30-day outcome of this relatively new technique as it has been notices that there are few studies discussing this subject in detail.

Our study is a prospective one carried on 30 patients of 19 males (63.3% of patients) and 11 females (36.7% of patients) with a male to female ratio of 1.73:1; the age of which at time of operative intervention ranged from 39 to 60 years with mean age was  $50.57 \pm 6.22$  years. The mean BMI in our studied patients was  $28.73 \pm 2.29$  Kg/m<sup>2</sup> and ranged from 25 Kg/m<sup>2</sup> to 32 Kg/m<sup>2</sup>, and the actual length of incision during incisional hernia repair ranged from 7.0 cm to 28 cm with mean of  $16.20 \pm 5.37$ , while the width defect size  $\geq 10$  cm in widest diameter

were included in our study. The width varied from 11 cm to 24 cm with mean of  $16.07 \pm 3.67$ . Regarding length of defect zones during incisional hernia repair, it was observed that M3 supra umbilical (3 cm) was the commonest length involved (83.3%) with a M1-M3 type being the most frequent (36.7%).

In our study, SSOs occurred in 13 out of 30 patients (43.3% of patients); detailed as follows, 3 patients (10% of patients) were complicated with cellulitis. Superficial infection was observed in 3 patients (10% of patients). 5 patients (16.7% of patients) were found to have incidental seroma 3 patients of which (10% of patients) had complicated seroma. Hematoma was observed in 2 patients (6.7% of patients). Fortunately, none of our patients were complicated with deep infection, enterocutaneous fistula, or wound dehiscence. Regarding post-operative pain assessment, 17 patients (56.7% of patients) had moderate level of pain on VAS scale and only 2 patients (6.7% of patients) had severe pain, while the rest of patients developed mild tolerable pain.

In comparison to Novinsky et al. key paper published in 2012, which surgically managed 40 patients with massive ventral anterior wall incisional hernia, there were 32 women (76% of patients), with a mean age of 52.1 years. The average body mass index was  $39 \pm 13$  kg/m<sup>2</sup> (Range, 23–69 kg/m<sup>2</sup>). Postoperative wound complications occurred in 10 patients (24%

of patients), 7 patients of which (17% of patients) had minor superficial infections, while the remaining 3 patients (7% of patients) developed major wound infections.<sup>7</sup>

The lower incidence of SSO occurred with Novitsky and his colleagues compared to our study could be justified that it was only a reflection of complications which were detected during hospital stay and not covering a 30-day outcome. In subgroup analysis, they had a higher incidence of deep wound infection which could be explained by their higher patients BMI compared to our cohort study. ( $39 \pm 13 \text{ kg/m}^2$ ,  $28.73 \pm 2.29 \text{ Kg/m}^2$  respectively).

In 2016, Novitsky and others published another retrospective study was held between 2007 – 2014 on 77 patients underwent PCS-TAR technique for repair of ventral wall incisional hernia, with mean age of  $56 \pm 13$  years, mean BMI of  $34.8 \pm 9.6 \text{ kg/m}^2$ . The Mean hernia defect width was  $14.3 \pm 3.3$  cm. Regarding post operative complications, The SSOs were 33 patients (42.9 % of patients) out of 77 patients, in the form of Seroma 4 patients (5.2% of patients), Hematoma 4 patients (5.2% of patients), Wound dehiscence 4 patients (5.2% of patients), Wound cellulitis 2 patients (2.6% of patients), and Surgical site infections, 22 patients (28.6 % patients) in the form of Superficial infection 7 patients (9.1% of patients), Deep infection 14 patients (18.2% of patients) and Organ space infection 1 patient (1.3 % of patients).<sup>11</sup>

Although Novitsky has had higher incidence of SSO in the later mentioned paper due to long follow up period which extended for seven years, in addition to more variables in the inclusion criteria, yet he and his colleagues recommended the use of PCS – TAR technique as valuable option for dealing with large ventral wall hernia defects.

In USA a multicentric study was carried on 50 patients; 24 of which underwent PCS-TAR, 12 and their final PROs regarding SSOs were comparable our study which were 9 patient (37.5% of all patients). However, they had a significantly higher complications regarding deep space infection which was in 5 patients (20.8% of patients) and SSO requiring procedural intervention (SSOpi) was 3 patients (12.5% of patients), in the contrary of our study. This can be explained as they had higher age ( $56 \pm 13$  years) and slightly higher BMI (29.7). Most importantly, they also included patients with considerable comorbidities such as hypertension in 9 patients (37.5% of patients), Diabetes Mellitus in 4 patients (16.7% of patients), 3 smokers (12.5% of patients) and 1 patient complaining of COPD (4.2% of patients).

Finally, according to the literature, recurrence rate is less after AWR through PCS-TAR in comparison to

ACS. It was 3.6% for PCS-TAR versus 14.3% for ACS as reported by Krpata et al. in 2016. Additionally, Cobb et al. in 2015 reported that recurrence rate was 13.4% for PCS-TAR versus 19.5% for ACS. Finally in the study of Holihan et al. in 2016, recurrence rate was 20.8% for PCS-TAR versus 16.2% for ACS, respectively.<sup>13-15</sup> Moreover, PCS-TAR technique gives the best functional outcome for the abdominal after reconstruction.

## Conclusion

Retro muscular, Ravis Stoppa technique and ACS are comparable to PCS-TAR regarding PROs. However, PCS-TAR still has resulted in a better quality of life (QoL). The outcome of PCS-TAR is still better even in the presence of comorbidities such as high BMI, DM, and COPD.

## Recommendation

One of the main limitations of our study that it is not a comparative one, and patients with recurrent IH were not included. Additionally, patients who had permanent stoma or being immune compromised were excluded. Our tight inclusion criteria were based on the need to have a base line early post operative complications following these techniques, and another study could be carried out in the future to include such cohort patients.

We suggest a randomized controlled trial comparing PCS-TAR to both Retro Muscular and Ravis Stoppa (ACS) techniques in a larger scope comparative study.

**Conflict of interest:** There is no conflict of interest or financial support involved in this case report.

**Ethical approval:** From Department of General Surgery Faculty of Medicine, Ain Shams University, Research Ethics Committee (REC), on 27 January 2019. IRB 00006379.

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