Early postoperative outcome of posterior component separation through transversus abdominis release for the treatment of large midline incisional hernia

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Background

Posterior component separation through transversus abdominis muscle release (PCS-TAR) is considered a better option for abdominal wall reconstruction during large ventral wall incisional hernia (IH) repair as it has advantage over both Rives-Stoppa (retromuscular) repair and anterior component separation 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.

Aim

To evaluate 30-day postoperative outcome of PCS-TAR regarding both visual analog scale and surgical site occurrence (SSOs) classification provided by Ventral Hernia Working Group (VHWG) in 2010.

Patients and methods

This prospective observational study was conducted on 30 patients who had a midline IH with defect size more than or equal to 10 cm in the widest diameter (W3) and underwent IH repair through PSC-TAR after routine laboratory investigations, abdominal ultrasonography, and computed tomography. Informed consent was taken from all cases. Results were reviewed and evaluated.

Results

Of 30 patients, 13 (43.3%) patients developed SSOs: three (10%) patients developed cellulitis; three (10%) patients presented with superficial infection; seroma occurred in five (16.7%) patients, comprising three (10%) patients who developed complicated seroma that needed procedural intervention (SSOpi); and hematoma was observed in two (6.7%) patients.

Conclusion

Retromuscular Rives-Stoppa technique and anterior component separation are comparable to PCS-TAR regarding patient-reported outcomes. However, PCS-TAR still has resulted in a better quality of life. The outcome of PCS-TAR is still better even in the presence of comorbidities such as high BMI, diabetes mellitus, and chronic obstructive pulmonary disease.

Keywords:
incisional hernia repair, posterior component separation through transversus abdominis release, surgical site occurrence

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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 [1]. It is considered a major iatrogenic complication following abdominal surgery with an incidence of ~18.5% [2]. The highest incidence of IH is found to be in the age range from 30 to 50 years. It is more common in females with a history of gynecological operations in the infraumbilical region, with a female to male ratio of 6: 1. Approximately 50% of cases occur within the first 2 years from the operation time and 74% occur within 3 years postoperatively [3].

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 [4]. However, IH repair can be technically challenging, and over years, there have been numerous methods developed to deal with IH such as Rives-Stoppa (retromuscular) and Ramirez [anterior component separation (ACS)], also known as component separation repairs [5]. All these methods of IH repair carry limitations and risks, mainly the inability to deal with large hernia defects while preserving the functionality of the abdominal wall. Most of the published literature studies 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 [6].

Recently, a new technique has been proposed by Novitsky and colleagues, 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 [7].

Our study aim was to evaluate the 30-day outcome of PCS-TAR in the hernioplasty of large midline IH (W3 ≥10 cm in the widest diameter) according to the width classification of IH by the European Hernia Society [8], surgical site occurrence (SSO) classification introduced by the Ventral Hernia Working Group (VHWG) in 2010 [9], and postoperative pain guided by visual analog scale (VAS) [10].

Patients and methods

Our study was carried out on 30 patients from the 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

It was obtained from the Research Ethics Committee (REC) of Department of General Surgery, Faculty of Medicine, Ain Shams University, on January 27, 2019, with IRB 00006379.

Study population

Inclusion criteria

Patients aged between 18 and 60 years of both sexes who had a midline IH with defect size more than or equal to 10 cm in the widest diameter (W3) were included. All of the patients were subjected to routine laboratory investigations, abdominal ultrasonography, and computed tomography. Informed consent was taken from all cases.

Exclusion criteria

Patients who declined to provide consent, patients with uncontrolled diabetes mellitus (hemoglobin A1c≥6.5), pregnancy in female cases, morbid obesity (BMI ≥32), smokers (at least 30 days of abstinence), mental incapacity, patients who are very high risk for major surgery ASA IV, hepatic patients, patients with recurrent IH, and patients with restricted pulmonary function tests were the exclusion criteria.

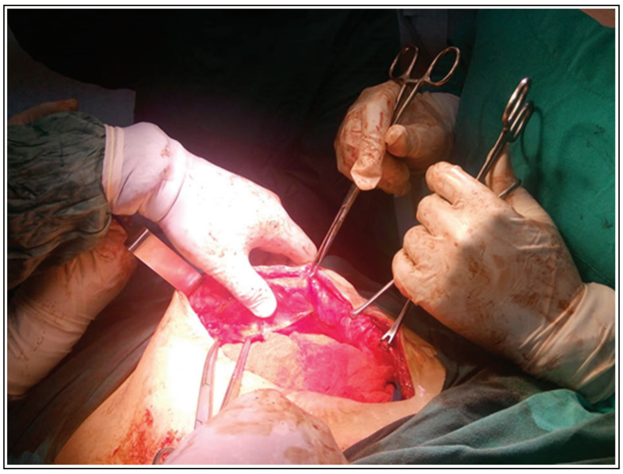
Operative technique

Based on the technique proposed by Novitsky and colleagues, all patients underwent general anesthesia. Then, through a midline incision, we excised the old scar and subcutaneous tissue. We opened the hernial sac and 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 were visualized and preserved, and then, we mobilized the rectus abdominis muscles anteriorly (Fig. 1).

The plane was developed retromuscular toward linea semilunaris, to expose the underlying transversus abdominis muscle, which is separate using electrocautery (Fig. 2). The first step in the upper third of the abdomen is to identify medial fibers of the transversus abdominis muscle and separate them from the underlying fascia.

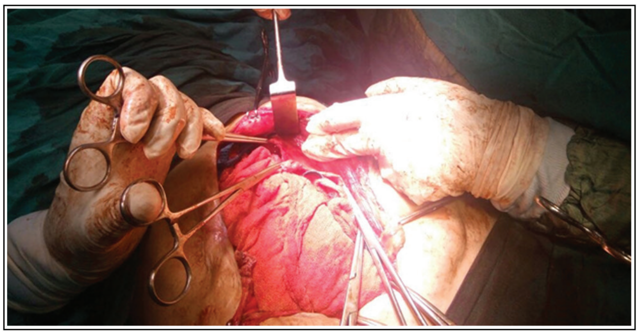
Generally, this step allows entrance to the space between the transversalis fascia and the divided

Figure 1



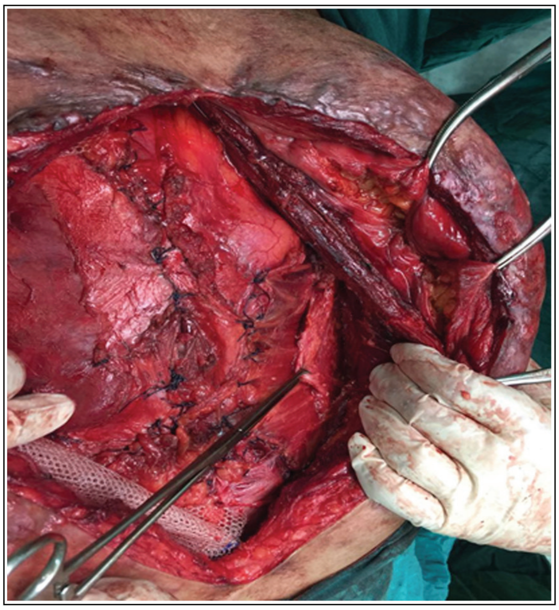
Creation of retromuscular plane.

Figure 2



Cutting through tendon of TAM.

Figure 3



Access to transversalis fascia.

transversus abdominis muscle. This space connects with the retroperitoneum and is extended to the psoas muscle laterally (Fig. 3).

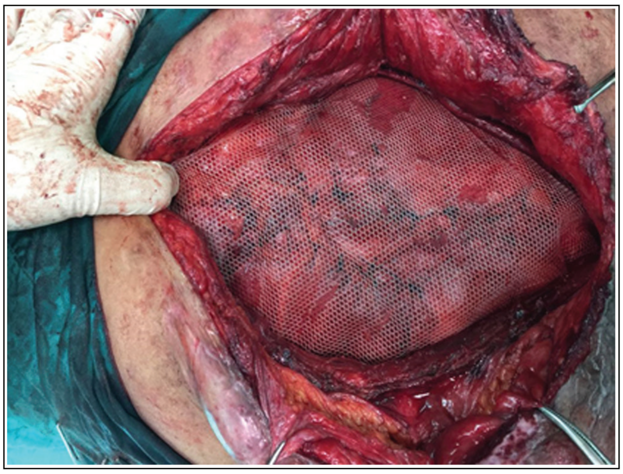
The dissection plane of the retromuscular area was extended from the costal margins and sternum up and created by sweeping the peritoneum/transversalis fascia of the diaphragm. Then the dissection was extended down till the anterior to the urinary bladder (space of Retzius) was entered to expose the 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, 507, Mount Wellington Hwy, Penrose, New Jersey 1060, NZ, USA). Once the release was performed bilaterally, the posterior rectus sheaths were sutured together with a continuous midline nonabsorbable suture. Mesh was put in the retromuscular space (sublay) and fixed by nonabsorbable sutures while the lower edge of the mesh is sutured to both Cooper ligaments bilaterally using interrupted sutures (Fig. 4). Suction drains were inserted over the mesh [7].

Statistical analysis

Data were analyzed using IBM Statistical Package for the Social Sciences software (SPSS), (IBM SPSS Statistics for Windows, Version 26.0.; IBM Corp., Armonk, New York, USA).

Figure 4



Fixing mesh bilaterally in prefascial plane after closure of peritoneum.

Table 1 Distribution of patients according to demographic data

Demographic variables	Studied patients (N=30) [n (%)]
Age (years)	
Minimum	39.0
Maximum	60.0
Mean±SD	50.57±6.22
Median (IQR)	49.5 (46.0–56.0)
Sex	
Male	19 (63.3)
Female	11 (36.7)
BMI (kg/m^2)	
Minimum	25.0
Maximum	32.0
Mean±SD	28.73±2.29
Median (IQR)	29.0 (27.0–31.0)

IQR, interquartile range.

Results

Preoperative demographic data of the studied patients

Demographic variables are shown in Table 1 and Figs 5–7.

Hernia assessment and operative findings

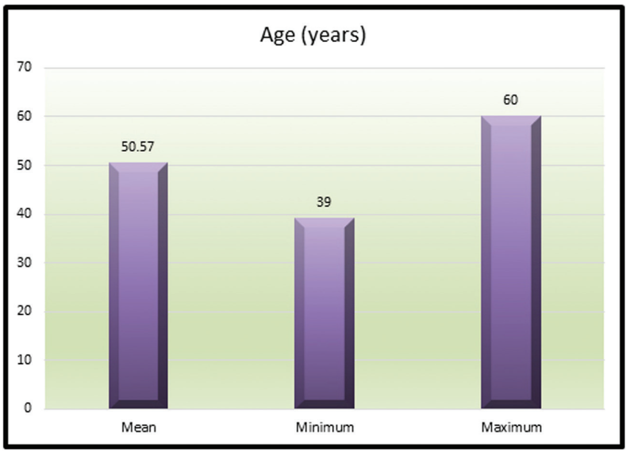
Actual length of incision during incisional hernia repair

Regarding actual length of incision during IH repair, the length ranged from 7.0 to 28 cm, with mean of 16.20±5.37 (Table 2 and Fig. 8).

Defect width classification according to European Hernia Society

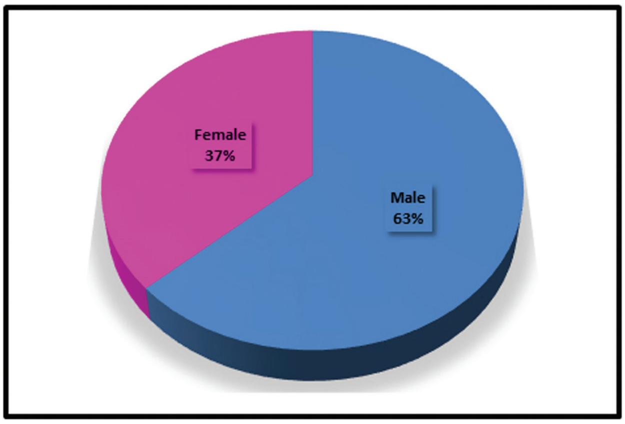
All patients were classified as W3 (≥10 cm). The width varied from 11 to 24 cm with mean of 16.07±3.67 [8] (Table 3 and Fig. 9).

Figure 5



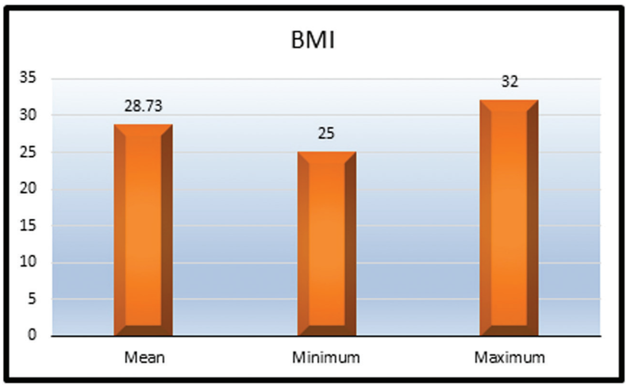
Mean and range of age in the studied patients.

Figure 6



Distribution of patients according to sex.

Figure 7



Mean and range of BMI in the studied patients.

Defect zone length distribution during incisional hernia repair

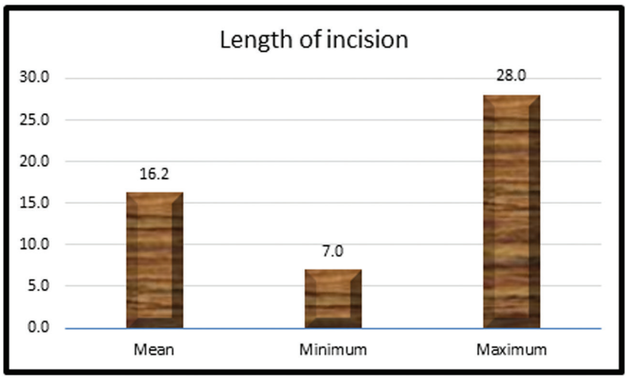
Both Table 4 and Figs 10 and 11 show distribution of patients regarding length of defect zones during IH repair. It was observed that M3 supraumbilical (3 cm) was the commonest length involved (83.3%) with a M1–M3 type being the most frequent (36.7%).

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)

IQR, interquartile range.

Figure 8



Mean and range of length of incision during incisional hernia repair in the studied patients.

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)

IQR, interquartile range.

Figure 9

Mean and range of defect width in the studied patients.

Postoperative assessment after incisional hernia repair

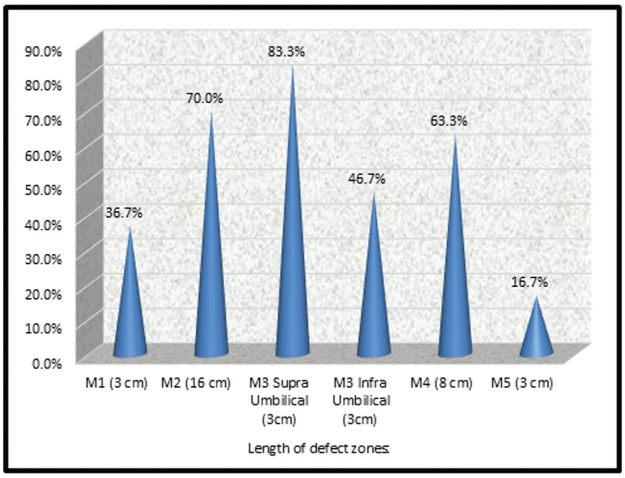
Postoperative pain assessment after incisional hernia repair using visual analog scale for pain

Regarding postoperative pain, 17 (56.7% of patients) patients had moderate level of pain on VAS [9] and only two (6.7% of patients) patients had severe pain (Table 5 and Fig. 12).

Table 4 Distribution of patients regarding length of defect zones during incisional hernia repair

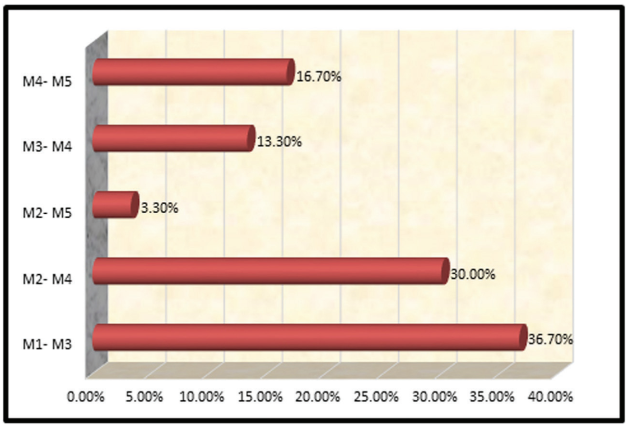
	Studied patients (N=30) [n (%)]
Length of defect zones	
M1 (3 cm)	11 (36.7)
M2 (16 cm)	21 (70.0)
M3 supraumbilical (3 cm)	25 (83.3)
M3 infraumbilical (3 cm)	14 (46.7)
M4 (8 cm)	19 (63.3)
M5 (3 cm)	5 (16.7)
Range of length (cm)	
M1–M3	11 (36.7)
M2–M4	9 (30.0)
M2–M5	1 (3.3)
M3–M4	4 (13.3)
M4–M5	5 (16.7)

Figure 10



Distribution of patients according to length of defect zones.

Figure 11



Distribution of patients according to length range of defect zones.

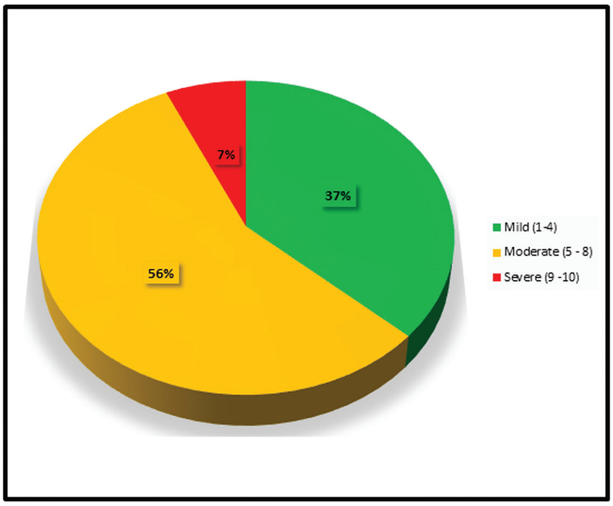
Postoperative assessment of incisional hernia repair regarding surgical site occurrence

As we followed up patients regarding SSO, patient-reported outcomes (PROs) were assessed and recorded as follows: SSOs occurred in 13 (43.3%) of 30 patients, where three (10% of patients) patients were complicated with cellulitis; three (10% of patients) patients were complicated with superficial infection; seroma occurred in five (16.7% of patients) patients, comprising three (10%) patients who developed complicated seroma that needed procedural intervention (SSOpi); and hematoma was observed in two (6.7% of patients) patients. Fortunately, patients did not develop either deep infection, enterocutaneous fistula, or wound dehiscence (Table 6 and Fig. 13).

Table 5 Distribution of patients regarding postoperative pain assessment regarding visual analog scale

Postoperative pain	Studied patients (N=30) [n (%)]
Mild (1–4)	11 (36.7)
Moderate (5–8)	17 (56.7)
Severe (9–10)	2 (6.7)

Figure 12



Distribution of patients according to postoperative pain.

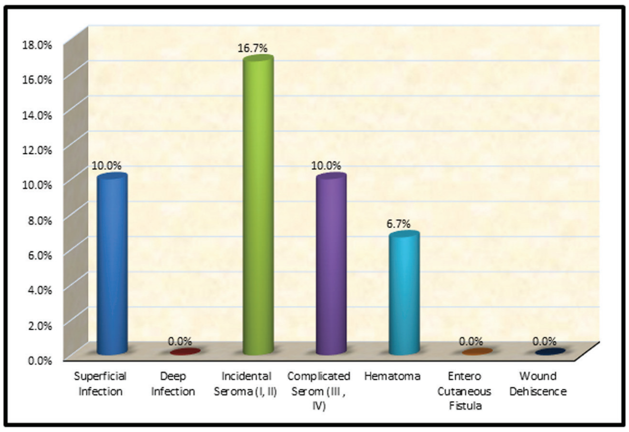
Table 6 Distribution of patients regarding postoperative assessment of incisional hernia repair according to surgical site occurrence

Surgical site occurrence	Studied patients (M=30) [n (%)]
Cellulitis	3 (10.0)
Superficial infection	3 (10.0)
Deep infection	0
Incidental seroma (I and II)	2 (6.7)
Complicated seroma (III and IV)	3 (10.0)
Hematoma	2 (6.7)
Enterocutaneous fistula	0
Wound dehiscence	0

Discussion

Because of the limitations of both Rives-Stoppa retromuscular repair and ACS, there was a need for a

Figure 13



Distribution of patients according to postoperative assessment of incisional hernia repair according to surgical site occurrence.

new technique capable of dealing with large IH defects. Fortunately, this was achieved by a new technique by Novitsky and colleagues in 2012, known as PCS-TAR. It has succeeded in providing a better option for AWR during large ventral wall IH repair as it has advantages over Rives-Stoppa repair in avoiding injury of the nerve supply to rectus muscle and additionally ability to achieve more lateral dissection.

While performing this study, the main aim was to evaluate the 30-day outcome of this relatively new technique, as it has been noticed that few studies exist discussing this subject in detail.

Our study was a prospective one carried out on 30 patients, comprising 19 (63.3% of patients) males and 11 (36.7% of patients) females, with a male to female ratio of 1.73 : 1. The age of patients at the time of operative intervention ranged from 39 to 60 years, with a mean age was 50.57 ± 6.22 years. The mean BMI in our studied patients was 28.73 ± 2.29 kg/m^2 and ranged from 25 to 32 kg/m^2. The actual length of incision during IH repair ranged from 7.0 to 28 cm, with a mean of 16.20 ± 5.37, whereas the width defect size was more than or equal to 10 cm in the widest diameter. The width varied from 11 to 24 cm, with a mean of 16.07 ± 3.67. Regarding the length of defect zones during IH repair, it was observed that M3 supraumbilical (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 (43.3% of patients) of 30 patients: three (10% of patients) patients were complicated with cellulitis; superficial infection was observed in three (10% of patients) patients; five (16.7% of patients) patients were found to have incidental seroma, comprising three (10% of patients) patients who had complicated seroma; and hematoma was observed in two (6.7% of patients) patients. Fortunately, none of our patients were complicated with deep infection, enterocutaneous fistula, or wound dehiscence. Regarding postoperative pain assessment, 17 (56.7% of patients) patients had moderate level of pain on VAS and only two (6.7% of patients) patients had severe pain, whereas the rest of patients developed mild tolerable pain.

In comparison, a key paper by Novitsky aand colleagues published in 2012, which surgically managed 40 patients with massive ventral anterior wall IH, reported that there were 32 (76% of patients) women, with a mean age of 52.1 years. The average BMI was 39 ± 13 kg/m^2 (range, 23–69 kg/m^2). Postoperative wound complications occurred in 10 (24% of patients) patients, where seven (17% of patients) patients had minor superficial infections, whereas the remaining three (7% of patients) patients developed major wound infections [7].

The lower incidence of SSO found in the study by Novitsky and colleagues compared with our study could be justified by that it was only a reflection of complications that were detected during hospital stay and did not cover a 30-day outcome. In subgroup analysis, they had a higher incidence of deep wound infection which could be explained by their patients' higher BMI compared with our cohort study (39 ± 13 and 28.73 ± 2.29 kg/m^2, respectively).

In 2016, Novitsky and others published another retrospective study that was held between 2007 and 2014 on 77 patients who underwent PCS-TAR technique for repair of ventral wall IH, with mean age of 56 ± 13 years and mean BMI of 34.8 ± 9.6 kg/m^2. The mean hernia defect width was 14.3 ± 3.3 cm. Regarding postoperative complications, the SSOs were seen in 33 (42.9% of patients) patients of 77 patients, in the form of seroma in four (5.2% of patients) patients; hematoma in four (5.2% of patients) patients; wound dehiscence in four (5.2% of patients) patients; wound cellulitis in two (2.6% of patients) patients; and surgical site infections in 22 (28.6% patients) patients in the form of superficial infection in seven (9.1% of patients) patients, deep infection in 14 (18.2% of patients) patients, and organ space infection in one (1.3% of patients) patient [11].

Although Novitsky and colleagues had a higher incidence of SSO in the later mentioned paper owing to long follow-up period which extended for 7 years, in addition to more variables in the inclusion criteria, yet they recommended the use of PCS-TAR technique as a valuable option for dealing with large ventral wall hernia defects.

In USA, a multicentric study was carried on 50 patients, including 24 patients who underwent PCS-TAR [12]. Their final PROs regarding SSOs were comparable our study, which represented nine (37.5% of all patients) patients. However, they had significantly higher complications regarding deep space infection, as seen in five (20.8% of patients) patients, and SSO requiring procedural intervention (SSOpi), as seen in three (12.5% of patients) patients, which was in contrary to our study. This can be explained by that they had a higher age (56 ± 13 years) and slightly higher BMI (29.7) among their patients. Most importantly, they also included patients with considerable comorbidities such as hypertension in nine (37.5% of patients) patients, diabetes mellitus in four (16.7% of patients) patients, three (12.5% of patients) smokers, and one (4.2% of patients) patient complaining of chronic obstructive pulmonary disease.

In comparison with other techniques, Christopher and colleagues conducted a valuable comparative study between retromuscular repair and PCS-TAR regarding SSO. A total of 50 patients met the inclusion criteria, where 26 patients underwent retromuscular repair in ventral hernia repair and 24 underwent bilateral TAR at the time of ventral hernia repair. PRO showed comparable rates of SSOs [RR: four (15.4%) patients out of 26 patients vs. TAR: nine (37.5%) patients out of 24 patients] and are detailed as follows: SSI in RR occurred in five (19.2%) patients out of 26 patients versus five (20.8%) patients out of 24 patients in PCS-TAR. Seroma in RR was one (3.9%) patient versus three (12.5%) patients in PCS-TAR. Hematoma was 0 in RR versus one (4.2%) patient. Although more extensive abdominal wall dissection during reconstruction, TAR PROs were comparable to that of RR, and when the preoperative quality of life scores were re-evaluated postoperatively, patients who underwent TAR had significantly lower baseline scores of Abdominal Hernia Questionnaires through patient-reported outcome measures regarding pain, sleep, daily routine, independence, physical activities, and appearance than those undergoing RR repair [12]. According to the literature, until 2018, a total of 363 studies were published on PCS-TAR. A systematic review of 19 studies was published aiming to evaluate patients with PCS-TAR, 10 of which were prospective and retrospective studies comparing PCS-TAR with other techniques. Only three studies met the systematic review inclusion criteria and were published in 2011, 2014, and 2015, respectively. The first study in 2011 reported SSO of PCS-TAR of 8.2% in comparison with 25.5% of ACS. A later study in 2015 reported SSO of PCS-TAR of 29.2% in comparison with 32% of open ACS [13]. Risk incidence of SSO in PCS-TAR versus ACS was 25 versus 48% according to Krpata *et al*. [14], and was 29.2 versus 32% according to Holihan *et al*. [15].

Finally, recurrence rate is less after AWR through PCS-TAR in comparison with ACS. It was 3.6% for PCS-TAR versus 14.3% for ACS as reported by Krpata *et al.* [14]. Additionally, Cobb *et al.* [16] reported that recurrence rate was 13.4% for PCS-TAR versus 19.5% for ACS. In the study of Holihan *et al*. [15], recurrence rate was 20.8% for PCS-TAR versus 16.2% for ACS, respectively. Moreover, PCS-TAR technique gives the best functional outcome for the abdominal after reconstruction.

Conclusion

Retromuscular Rives-Stoppa technique and ACS are comparable to PCS-TAR regarding PROs. However, PCS-TAR still has resulted in a better quality of life. It is even better in the presence of comorbidities such as high BMI, diabetes mellitus, and chronic obstructive pulmonary disease.

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 baseline early postoperative 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 with both retromuscular and Rives-Stoppa (ACS) techniques in a larger scope comparative study.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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