



Perforator Preserving Anterior Component Separation Technique Combined with Peritoneal Flap Hernioplasty in Patients of Complex Ventral Hernia

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Received: 24 March 2024 / Accepted: 13 August 2024
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Abstract

Complex ventral hernia which is large with wide defect requires multiple strategies to expand the abdominal wall. We have combined open perforator preserving anterior component separation technique with peritoneal flap hernioplasty in patients with large incisional hernias. We have described the indication, technique, and intraoperative and postoperative outcomes of this combined technique. To the best of our knowledge, this is the first report of this combined procedure. The surgeries were performed between May 2022 and January 2024. The patient had large midline hernias with more than 10-cm defect width. The patients were evaluated for operative time, postoperative pain, surgical site infection, seroma, hematoma, skin necrosis, recurrence, pseudo-recurrence (bulge), 90-day readmission, chronic pain, and Clavien-Dindo score. We operated six patients with this technique. All were women, and the mean age was 35 years (range 15–50). The mean BMI was 24 kg/m² (range 21–28). All were midline incisional hernias, and one had twice recurrence. The mean defect width was 14 cm (range 11–18), and the mean operative time was 147 min (range 130–160). There was one superficial surgical site infection (Clavien-Dindo 3a). In the postoperative period, none of the patients had seroma, hematoma, skin necrosis, recurrence, pseudo-recurrence, or chronic pain. The patients were followed for 8 months mean (range 3–22). In patients with large midline ventral hernia, perforator preserving anterior component separation technique can be combined with peritoneal flap hernioplasty to achieve tension-free fascial closure. However, more studies with large sample size and long follow-up period are needed on this.

Keywords Complex ventral hernia · Anterior component separation technique · Peritoneal flap hernioplasty · Loss of domain hernia · Transversus abdominis release

Introduction

A complex ventral hernia, which is large with a wide defect, requires strategies to expand the anterior abdominal wall. The anterior component separation technique (ACST) was the first surgical technique for it which was reported by Ramirez et al. in 1990 [1]. In ACST, we divide the external oblique muscle lateral to the linea semilunaris. Initially, the ACST was done without mesh and had a high recurrence rate [2]. Later, the mesh was routinely used in ACST. Skin necrosis was another problem as wide skin flaps were raised. This led to the start of periumbilical perforator vessel preserving

ACST to maintain skin vascularity [3, 4]. The deep epigastric collateral arteries perforating through the rectus muscles are preserved. They have the greatest density, approximately 2 cm above to 5 cm below the umbilicus [5, 6]. Many studies have evaluated the ACST, and it has been compared with other component separation techniques. A systematic review comparing perforator preserving ACST with transversus abdominis release (TAR) has found comparable results in terms of wound morbidity and recurrence [7]. Recently, a comparative study has found that perforator-sparing ACST and TAR are comparable in terms of wound-related complications, and ACST can be used with low overall wound morbidity [8].

Peritoneal flap hernioplasty (PF) is the technique in which we use the hernia sac for the repair of large hernia [9]. The hernia sac is divided into two parts, one is kept in continuity with the anterior rectus sheath and the other with the posterior rectus sheath. The retrorectus mesh is sandwiched

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between the two hernia sacs. The PF technique has shown good long-term results and low recurrence [10]. This technique has also been found useful in complex transverse incision hernias [11, 12]. In very large hernia, the PF can also be combined with TAR to give a tension-free closure [13].

The hernia which is large with wide defect requires multiple strategies to achieve a successful repair. We have combined open perforator preserving ACST with peritoneal flap hernioplasty in patients with large incisional hernias. We have described the indication, technique, and intraoperative and postoperative outcomes of this combined technique. To the best of our knowledge, this is the first report of it.

Patients and Methods

The surgeries were performed between May 2022 and January 2024. Institutional ethical clearance was taken before the start of the series. Informed consent was obtained from the patients. The patients included had large midline incisional hernias with more than 10-cm defect width. The patients less than 15 years were excluded. They all were evaluated with a CT scan for assessing the hernia and the abdominal musculature. The patients were evaluated for operative time, postoperative pain, surgical site infection, seroma, hematoma, skin necrosis, recurrence, pseudo-recurrence (bulge), 90-day readmission, chronic pain, and Clavien-Dindo score.

Surgical Technique

The procedure was done under general anesthesia, and prophylactic antibiotic was given. DVT prophylaxis was used. A midline incision was given. The hernia content was reduced and covered with drapes. The hernial sac (PF) was dissected from the subcutaneous tissue on both sides. On one side, a longitudinal incision was made on the anterior rectus sheath near its medial end and retrorectus space was created. With this, the PF comes to lie in continuity with the posterior rectus sheath (PRS). On the other side, a longitudinal incision was made on the posterior rectus sheath (PRS) near its medial end, and retrorectus space was entered. With this, the PF lies in continuity with the ARS. After this assessment was done, if we were able to approximate the anterior and posterior layers comfortably using the PF. If it was not possible without tension, we decided to go for perforator preserving ACST. Steps of the surgery are shown in Figs. 1, 2, 3, 4, 5, 6, 7, and 8.

We created a lateral subcutaneous tunnel in the lower abdomen till the external oblique muscle (EO) was visualized. A small incision was given in EO around 2 cm lateral to the linea semilunaris. The external oblique muscle was longitudinally divided. Another similar lateral tunnel was created in the upper abdomen, and the EO was incised.

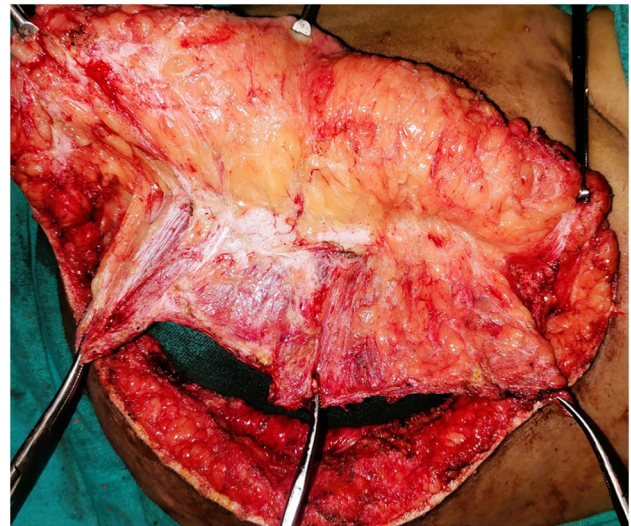


Fig. 1 The peritoneal flap is separated from the subcutaneous tissue by fine dissection on both the sides

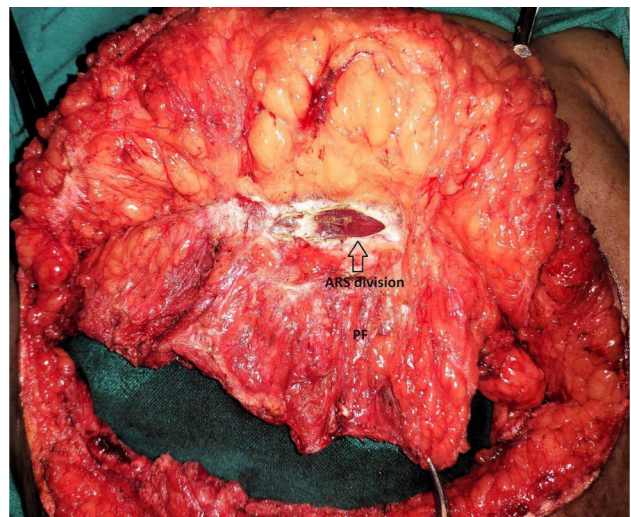


Fig. 2 The anterior rectus sheath is divided. The rectus muscle is visible and we enter the retrorectus space. This will keep the peritoneal flap in continuity with the posterior rectus sheath

No dissection was done in the periumbilical region to preserve the periumbilical perforators. The EO is divided from the lowercostal region above to the inguinal ligament below. The EO is separated from the internal oblique muscle below it, and ACST is completed. This was done on one side, and we again assessed for the anterior and posterior fascial layer approximation. If we needed more medialization of the layers after unilateral ACST, we did the ACST on the other side also.

The posterior layer was created by suturing PRS-PF to the other PRS. A large pore heavyweight polypropylene mesh

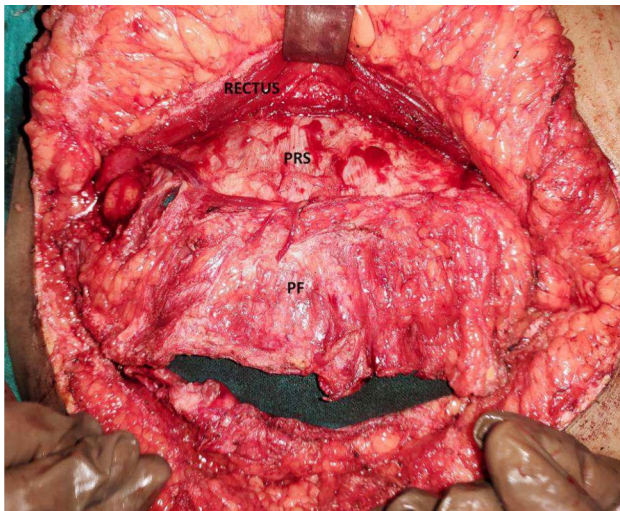


Fig. 3 The peritoneal flap is in continuity with the posterior rectus sheath on this side

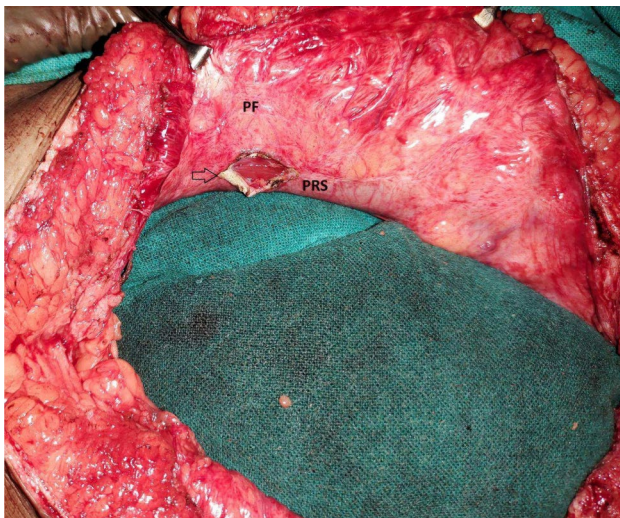


Fig. 4 The incision is given on the posterior rectus sheath. The retrorectus space will be created. The peritoneal flap on this side will lie in continuity with the anterior rectus sheath

was placed in the retrorectus space, covering the posterior layer (breadth = PRS-PF-PRS). Its length extended from the top to the bottom of the incision. A drain was placed over the mesh. The anterior layer closure was done, which was ARS-PF with the opposite ARS. During the closure, we assessed the tension by any significant rise in plateau pressure on the ventilatory setting (6 cm H₂O or more) [14]. We also assessed it subjectively by looking for undue tension in the abdominal wall during the closure [15]. Then the subcutaneous tissue and skin were closed. We gave triple analgesics in the perioperative period (paracetamol, diclofenac sodium, and tramadol), which we use in all major surgeries.

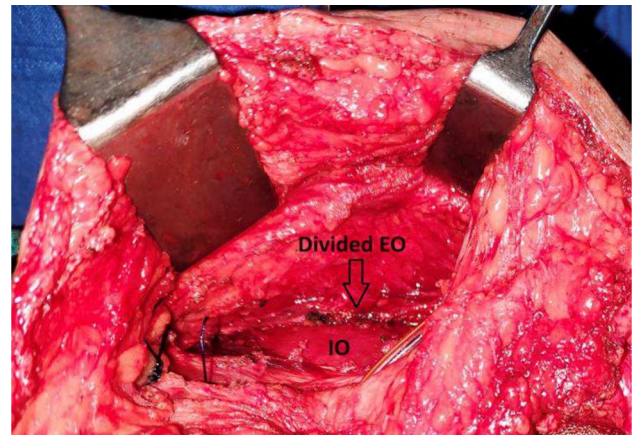


Fig. 5 The external oblique muscle is divided and separated from the internal oblique muscle (Perforator preserving ACST)

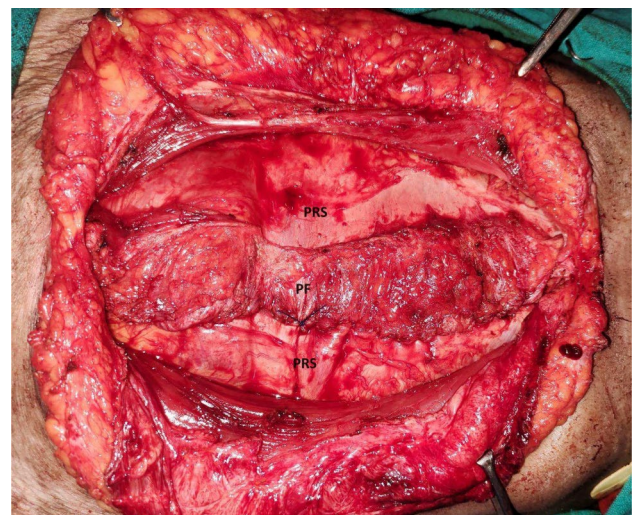


Fig. 6 The posterior layer is closed. The peritoneal flap in continuity with the posterior rectus sheath is sutured to the posterior rectus sheath of the other side. Below the arcuate line, the peritoneum will be there in place of posterior rectus sheath

The patients were allowed orally the next morning and mobilized. Our follow-up protocol was to call the patients for physical examination 3 months, 6 months, 1 year, and 2 years after the surgery. If required, we reviewed them telephonically in between for any complaints.

Results

We operated six patients with this technique. All were women, and the mean age was 35 years (range 15–50). The mean BMI was 24 kg/m² (range 21–28). One patient had hypertension, while there was no diabetes or smoking

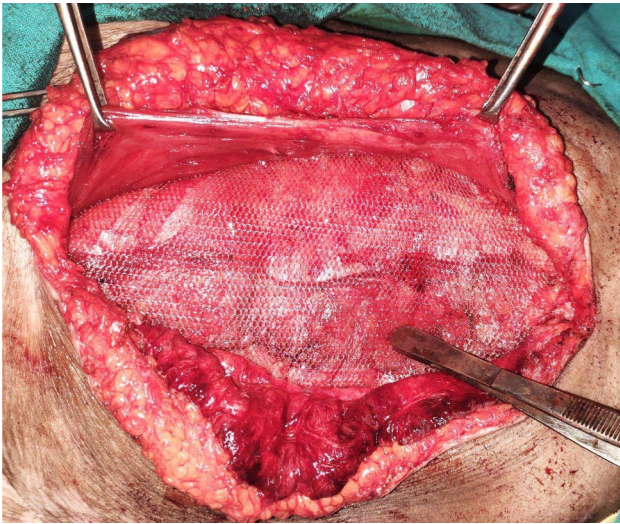


Fig. 7 The mesh is placed in the retrorectus space

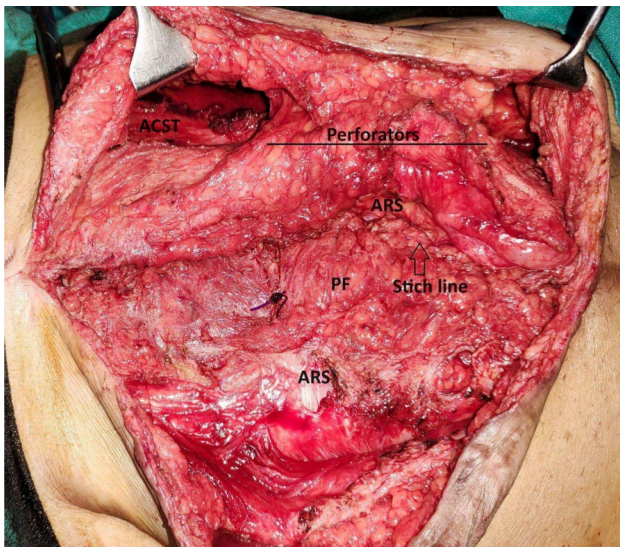


Fig. 8 The anterior layer is closed: The peritoneal flap in continuity with the anterior rectus sheath is sutured with the anterior rectus sheath of the other side. The external oblique release is seen along with the region of preserved periumbilical perforators

history. All were midline incisional hernias, and one had recurrence twice. The mean defect width was 14 cm (range 11–18), and the mean defect length was 13 cm (range 10–17). The European hernia society classification (EHS) was W3-all, M2-1, M3-3, and M4-2, and the Ventral Hernia Working Group grade (VHWG) was Grade 1–5, Grade 2–1, Grade 3–0.

The mean operative time was 147 min (range 130–160). The intraoperative blood loss was minimal in all of them. The plateau pressure in the ventilatory setting did

not increase more than 3 cm H₂O in any patient, and the abdominal muscles felt lax during the closure. The mean time required for adding ACST after completing the PF was 20 min (range 18–22). The mesh size was 22 cm mean length (range 20–25) and 18 cm mean breadth (range 15–20). In one patient, we could achieve tension-free closure with unilateral ACST only, so we did not go for the other side. The mean pain score on the postoperative day 1 was 2/10 (range 1–3). The time to mesh drain removal was 4 days mean (range 3–5), and the hospital stay was mean 5 days (range 3–7).

In the postoperative period, none of the patients had seroma, hematoma, skin necrosis, chronic pain, or recurrence. One patient had a superficial surgical site infection. She came back on the 15th postoperative day with a copious pus discharge from the incision site. Upon evaluation, it was found to be in the subcutaneous plane just below the skin incision. She was managed by the opening of the wound under local anesthesia, regular dressings, and culture-based antibiotic therapy. None of the patients developed chronic pain or postoperative bulge (pseudo-recurrence). The patients were followed for a mean 8 months (range 3–22). Table 1 shows the intraoperative details and postoperative outcomes.

Discussion

We operated on six patients of large midline incisional hernia with perforator preserving anterior component separation technique combined with peritoneal flap hernioplasty. The duration of surgery was mean 147 min and the time required for doing ACST was only 20 min mean. One patient had superficial SSI, and there was no other complication. There was no postoperative bulge (pseudo-recurrence), and

Table 1 Intraoperative details and postoperative outcomes of patients of perforator preserving ACST with peritoneal flap hernioplasty

Operative time	147 min mean (range 130–160)
Time required to do ACST	20 min mean (range 18–22)
Mesh size	22 cm mean length (range 20–25) 18 cm mean breadth (range 15–20)
POD 1 pain score	2 mean (range 1–3)
Time to mesh drain removal	4 days mean (range 3–5)
Seroma	0
Surgical site infection	1 superficial SSI
Hematoma	0
Clavien-Dindo score	Grade 1-1, Grade 2-1, Grade 3a-1
Hospital stay	5 days mean (range 3–7)
90-day readmission	1
Recurrence	0
Follow-up period	8 months mean (range 3–22)

the heavyweight polypropylene mesh could be the reason for it. We believe that the stiffer mesh is more suitable for the PF technique.

Recently, ACST with perforator preservation has been evaluated by many comparative studies and reviews [16]. A systemic review analyzed 5 cohort studies of perforator preserving ACST having 241 patients and 8 cohort studies of TAR having 761 patients [17]. The surgical site occurrence in ACST was 16.0% (39/242), and in TAR was 20.3% (39/193). The annual incidence rates of recurrence were 3.4% (4 studies) in ACST vs 3.8% (8 studies) in TAR. The difference between them was not statistically significant. A meta-analysis identified six studies with 285 cases of perforator preserving ACST and seven studies with 281 cases of TAR [7]. The analysis showed a hernia recurrence rate of 9.5% in ACST and 5.7% in TAR, which was not significant ($p=0.23$). The wound infection rates of ACST and TAR were superficial SSI 21.6% versus 10.9 ($p=0.15$) and deep SSI 12.7% versus 9.5 versus ($p=0.53$).

A recent prospective study compared wound complications between perforator preserving anterior component separation and transversus abdominis release [8]. The overall wound complication rate was comparable between the ACST and TAR groups (23.1% vs 36.1%, $p=0.129$). The rates of cellulitis were 8.1% vs. 7.0%, $p=0.824$; deep wound infection 2.7% vs. 5.5%, $p=0.490$; superficial wound dehiscence 2.7% vs. 7.8%, $p=0.347$; seroma 10.8% vs. 16.4%, $p=0.403$; and mesh infection 0.0% vs 1.6%, $p=0.438$, which were also all comparable. Most studies have found ACST a useful technique with complication and recurrence rates comparable to TAR.

Peritoneal flap hernioplasty has become another valuable tool for patients with complex ventral hernia. Nielsen et al. published long-term results of the PF technique [10]. They performed PF in 251 patients with large incisional hernia and were followed for a mean of 75 months. Post-operative complications were present in 21.1% of them. They were 1.2% superficial skin necrosis, 10.8% superficial wound infection, 4.8% symptomatic seroma, 4.4% hematoma requiring surgical intervention, and 2.8% recurrence. Other studies on PF have also found similarly low rates of complications and recurrence [9, 11, 12, 18, 19]. One common query about the hernia sac is that it is not a robust tissue, and the repair using it should be weak. The theoretical explanation given by the innovators of this repair is that the PF-mesh-PF triple layer behaves like a neo linea alba with sufficient strength [10]. This is proven by the low recurrence rate seen in the patients after long-term follow-up.

The component separation alone may not achieve fascial closure in large hernias with wide defects. We may need preoperative techniques like Botox therapy [20] and progressive preoperative pneumoperitoneum (PPP) before the surgery [21]. Recently, we described PF combined with transversus

abdominis release (TAR) in patients with large incisional hernias [13, 22]. When we performed TAR, the peritoneal flap was preserved. At the time of posterior and anterior fascial closure, we used the peritoneal flap if we felt the layers were not approximating. If the peritoneal flap was not required, we excised it at the end. With combined TAR and PF procedure, we achieved tension-free fascial closure without requiring preoperative PPP or Botox therapy.

In the PF technique, the hernia sac has limited availability, unlike what it seems. At the previous skin incision site, the hernia sac is usually thin with tight adhesion and needs to be excised. In other places, the sac may also be thin and need an excision. The remaining sac will be divided into two parts. Around half of the hernia sac will be kept with the posterior layer and the other half with the anterior layer. Therefore, the hernia sac available for use is not always large and wide. In patients with a large hernia, if the PF alone does not give fascial closure, we add ACST with perforator preservation. Together, they work with success in large hernias.

The indications of TAR with PF and ACST with PF are different. When we have done TAR in a large hernia and think that the fascial closure is still not possible, we add PF to the TAR. TAR is the primary procedure, and PF is added to it in case of difficulty. Now, some surgeons primarily do PF in large hernias. After the PF, if they feel that fascial approximation is not possible, then the ACST with perforator preservation is added. PF is the main procedure, and ACST is the additional procedure. Now, some surgeons primarily perform perforator preserving ACST. They should also preserve the PF till the end. If required, use the PF; if not, then excise it.

Limitations

The limitation of this study was that it is a small case series, and the follow-up period is short.

Conclusion

In patients with large midline incisional hernia, perforator preserving anterior component separation technique can be combined with peritoneal flap hernioplasty to achieve tension-free fascial closure. However, more studies with large sample size and long follow-up period are needed on this.

Declarations

Ethics Approval Institutional ethical clearance taken.

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Conflict of Interest The author declares no competing interests.

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