19 TAR Plus (TAR plus Peritoneal Flap Hernioplasty) for Large Midline Ventral Hernias

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19.1 Indications and Case Selection

19.1.1 Background

Transversus abdominis release has become a popular technique for large and complex ventral hernias. It has shown to be an effective technique in very difficult conditions like recurrent hernias [1], open abdomen [2], hernias after liver transplant [3], and kidney transplant [4]. A cadaveric study has shown that the TAR gives medial mobilization of up to around 5 cm on each side [5]. However, some hernias are so large and wide that component separation is not enough to reconstruct the midline. In these situations, certain bailout options are needed. When the posterior layer can not get approximated or is torn beyond repair, the omentum or vicryl mesh may be used to bridge the defect. And when the anterior rectus sheath (ARS) can not get approximated, the mesh is usually stitched to the anterior rectus sheath to the point where it comes without tension. The subcutaneous tissue and skin is closed over this bridging repair. The incidence of bridging repair ranges from 0% to 19% in cases where TAR is performed [6]. However, the bridged TAR has drawbacks. The muscles of the anterior abdominal wall are not approximated in the midline so they do not regain their strength and lack the dynamics of the normal abdominal musculature. A recent study with 96 patients of TAR with bridged repair for large complex ventral hernias observed a composite recurrence of 46% [7]. They reported 10% SSI, 2% mesh exposure, 5% partial mesh excision, and 16% surgical site occurrences requiring procedural intervention (SSOPI).

To overcome these disadvantages, we hypothesized that the TAR can be combined with the peritoneal flap technique (TAR plus) in these complex cases. Peritoneal flap (PF) hernioplasty was first reported by Malik et al. [8] and Petersson et al. [9]. In this technique, the hernial sac (peritoneal flap) is preserved. On one side it is kept in continuity with the anterior rectus sheath and on the other side with the posterior rectus sheath. The retrorectus space is created and the peritoneal flap is used to give a tension-free closure in the posterior rectus sheath as well as the anterior rectus sheath. Critiques have argued that the hernia sac may not be a robust repair. However, proponents of the technique claim that it has sufficient strength with no perceivable bulge (pseudorecurrence) on leg raising and head raising maneuvers on follow up. The peritoneal flap

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creates a "triple-layer neo linea alba" that increases the abdominal volume [10]. They also propose that "the abdominal wall function relies more on an intact circle or ring of abdominal muscle/fascia and that it does not matter if the gap between the muscles is several centimeters wide as long as it is firm and strong, providing a firm ridge of fibrous tissue against which the recti and lateral obliques can pull" [10]. We combined TAR with Peritoneal Flap (TAR Plus) in five complex cases with 3/5 having loss of domain and found satisfactory results on medium-term follow up. Ours was the first study of combined TAR plus PF (TAR plus) [6] which in our opinion is a useful addition to the armamentarium of procedures for large ventral hernias.

19.1.2 Indications

There are very large hernias, often with loss of domain, in which TAR cannot give tension-free closure of the midline and if done they will end in bridged repair or an abdominal compartment syndrome. These are the patients in which combining TAR with peritoneal flap gives a safer repair. The TAR achieves a wide overlap of mesh in retromuscular space which extend craniocaudally from diaphragm to space of Retzius and from psoas muscle of one side to the other. Practically whole of the anterior abdominal wall gets the mesh cover. The PF gives satisfactory anterior as well as posterior coverage to the mesh. The larger the hernia the larger the amount of peritoneal flap for usage, which is a significant advantage of the procedure especially in cases with loss of domain.

We advocate that whenever we perform TAR in a large hernia, we should preserve the hernia sac. At the end of the procedure, we should assess whether we need them or not. If required they can be used; otherwise, they can be excised and TAR alone may be sufficient.

There are only two publications on this technique both showing that this was employed in complex cases. In our series, the average defect width was 15.4 cm (range 12–20 cm), the average defect area was 240.5 cm^2 (range 141.4–314.2 cm^2), and the mean Tanaka's index was 30% [6]. In the series by Yeste & Riquelme-Gaona, the median transverse diameter of the hernia was 13.3 cm (range 10–17) [11]. We think, for defects more than 10 cm, a TAR Plus may be needed to avoid bridging.

19.2 Contraindications

In hernias after the open abdomen in which the skin is directly over the bowel due to healing by secondary intention or split-thickness split graft, TAR plus usually can not be done. This is because there is no hernia sac in these cases and the skin adheres to the bowel (Fig. 19.1).

Fig. 19.1 Open abdomen managed by split thickness skin graft over the bowel, is not suitable for TAR plus

19.3 Instruments and Energy Source

The routine open surgical instruments used in abdominal surgery are required. Electrocautery is used in most of these procedures. If there are extensive adhesions, adhesiolysis of omentum can be done with ultrasonic shears or bipolar cautery. This saves time and decrease blood loss. The choice of mesh is important. We use medium-weight macroporous polypropylene mesh as this resists infection better than microporous meshes and therfore, has more chances of salvage in case of mesh infection [12].

19.4 Team Setup, Anesthesia, and Position

The patient lies supine and the surgeon stands on the contralateral side for performing TAR / PF for convenience. An epidural catheter may be put in for prolonged postoperative analgesia. Antibiotic prophylaxis is needed for not more than 1 day if being done in a clean setting. Deep vein thrombosis prophylaxis is given for all patients.

19.5 Key Steps

- Skin overlying the hernia is excised with an elliptical incision. The hernia sac (PF) is preserved by shaving off the skin and subcutaneous tissue from it. The hernia sac is bisected.
- Opening the retrorectus space on one side just anterior to the hernia sac. This sac lies in continuity with the posterior rectus sheath.
- Opening the retrorectus space on the other side just posterior to the hernia sac. This sac lies in continuity with the anterior rectus sheath.
- Division of the posterior rectus sheath followed by transversus abdominis muscle 1.5 cm medial to the linea semilunaris protecting the neurovascular bundles.
- Creation of wide retromuscular space.
- The peritoneal flap in continuity with the posterior rectus sheath (PRS) is sutured with the PRS of the opposite side.
- The large size mesh is placed in the retromuscular space in a diamond configuration.
- The peritoneal flap in continuity with the anterior rectus sheath (ARS) is sutured with the ARS of the opposite side.

19.6 Surgical Techniques/ Variations

The extent of the hernial sac is assessed, its area is marked all around, and skin-deep incision is given (Fig. 19.2). The skin over the sac is shaved off from the sac by fine dissection with the scissor or electrocautery (Fig. 19.3). The plane of dissection is between the subcutaneous tissue and the sac. Care is taken to not make the sac/peritoneal flap too thin. This dissection continues from the medial border of one rectus muscle to the other.

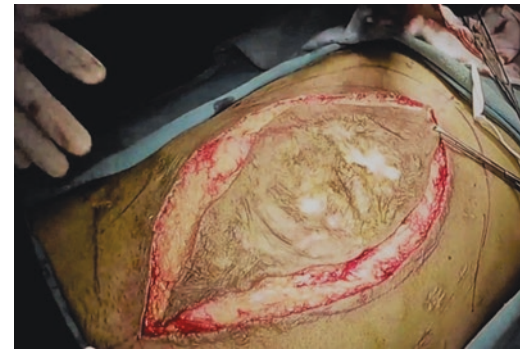

Fig. 19.2 The area of the hernial sac is marked (6)

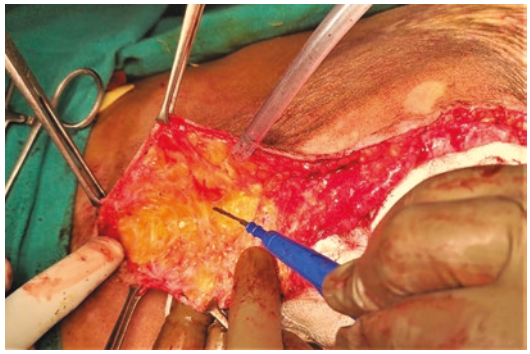

Fig. 19.3 Dissection of the skin from the hernial sac

Fig. 19.4 The hernial sac is opened. After this we have one peritoneal flap on each side

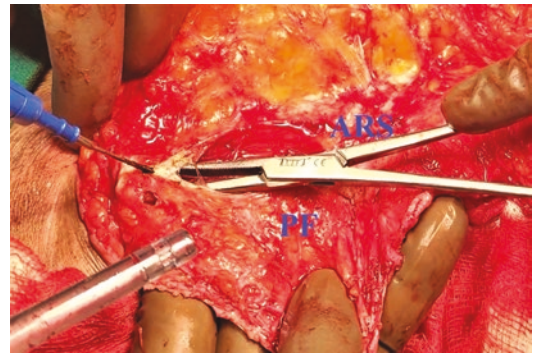

Fig. 19.5 Incision over the anterior rectus sheath for entering the retrorectus space. After this, the PF is in continuity with the posterior rectus sheath

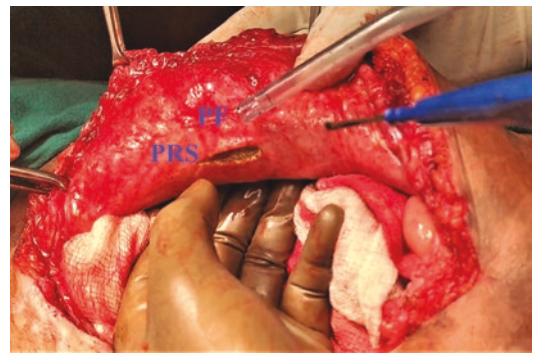

Fig. 19.6 Incision over the posterior rectus sheath

The hernia sac is opened in the midline taking care not to injure the underlying bowel (Fig. 19.4). The inside of the sac is separated from any adhering bowel loop or omentum. The abdominal towel is placed over the bowels so that they do not come into the dissection field.

The sac is divided in the midline throughout its whole length and this creates two peritoneal flaps (PF), one on each side. Next, we keep one peritoneal flap in continuity with the anterior rectus sheath (ARS) and another with the posterior rectus sheath (PRS). We expose the anterior rectus sheath on one side. A longitudinal incision is made on the anterior rectus sheath just adjacent to the PF (Fig. 19.5). This leads us to the retrorectus or Rives-Stoppa's space while keeping the peritoneal flap in continuity with the posterior rectus sheath. After this the retrorectus dissection is done up to the linea semilunaris preserving the neurovascular bundles.

On the other side, we expose the posterior rectus sheath adjacent to the PF. A longitudinal incision is made on the posterior rectus sheath just adjacent to the PF (Fig. 19.6). With this, we enter the retrorectus or Rives Stoppa space keeping the PF in continuity with the anterior rectus sheath (Fig. 19.7). Retrorectus dissection is done up to the linea semilunaris preserving the neurovascular bundle (Fig. 19.8).

Next, we start the steps for transversus abdominis release (TAR). We start this in the upper abdomen as transversus abdominis (TA) muscle is better visible there. We can often see the pinkish hue of the TA muscle lying behind the PRS (Fig. 19.9). Around 1.5 cm medial to linea semilunaris, posterior lamellar of internal oblique is divided longitudinally (Fig. 19.10). This is done in the whole of its length. This exposes the TA muscle. We start the TA muscle division by hook-

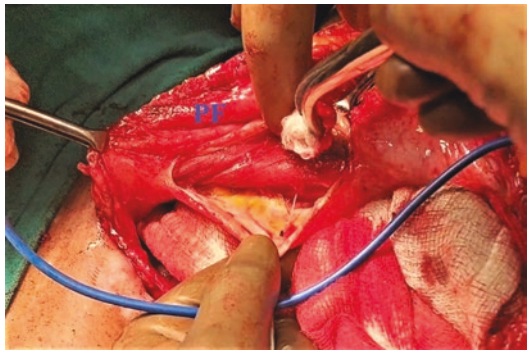

Fig. 19.7 After the incision over the PRS, we enter the retrorectus space. After this, the PF is in continuity with the anterior rectus sheath

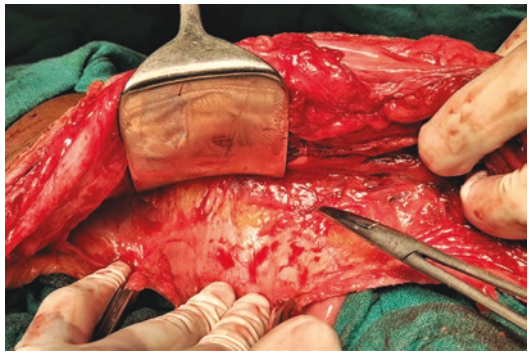

Fig. 19.8 The posterior rectus sheath is visible up to the linea semilunaris. Neurovascular bundles are identified and preserved

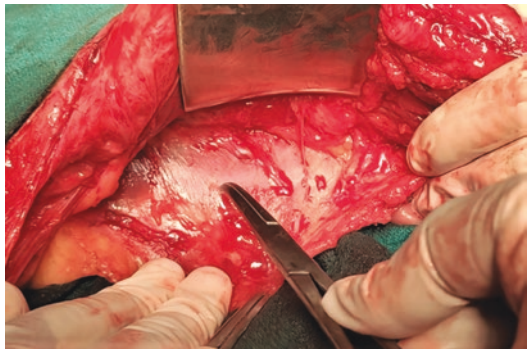

Fig. 19.9 The pinkish hue of the transversus abdominis muscle is visible through the posterior rectus sheath

ing it with the right-angle forceps and dividing with the electro-cautery (Fig. 19.11). It is done in small bits safeguarding the transversalis fascia and peritoneum behind the muscle. As we move

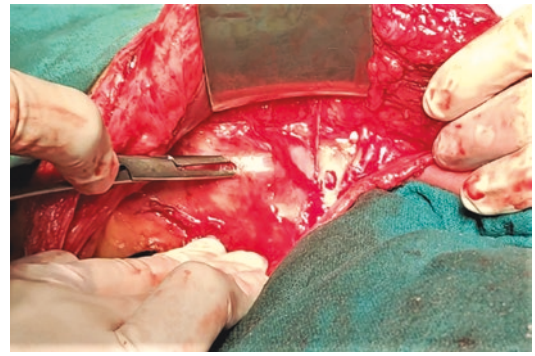

Fig. 19.10 The posterior lamella of internal oblique is divided exposing the transversus abdominis muscle

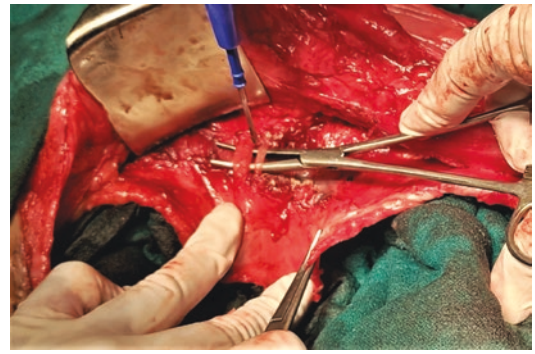

Fig. 19.11 The transversus abdominis muscle is divided

towards the lower abdomen the TA muscle becomes aponeurotic (TA aponeurosis). It is divided with care as it thins out in the lower abdomen. The upper extent of the TAR is till the diaphragm and the lower extent is till the space of Retzius. We enter the lateral retromuscular space by blunt or fine dissection. This is the space to which anteriorly lies the TA muscle and posteriorly the fascia transversalis along with the peritoneum. Care is taken not to tear the peritoneum. The lateral space is created up to the psoas muscle on both sides.

The PF which is with the PRS is sutured to the PRS of the other side (Fig. 19.12). This is by continuous suture with delayed absorbable suture (usually 2-0 polydiaxonane sutures). This forms the posterior layer for the placement of mesh. The hemostasis is checked and the retromuscular space is measured for the placement of mesh. A large piece of polypropylene mesh is placed in a

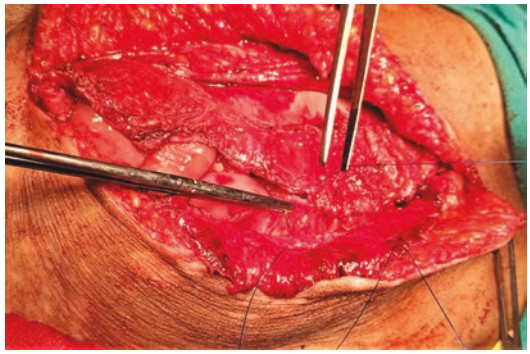

Fig. 19.12 The PF which is continuity with the PRS is sutured to the PRS of the other side

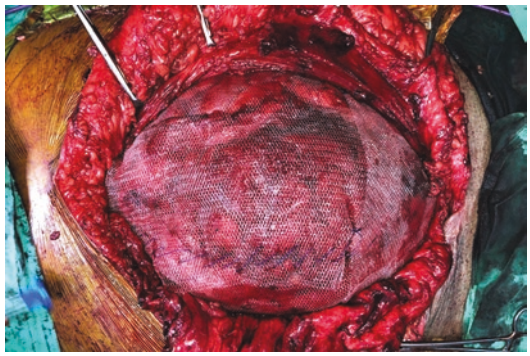

Fig. 19.13 Placement of large polypropylene mesh in the retromuscular space

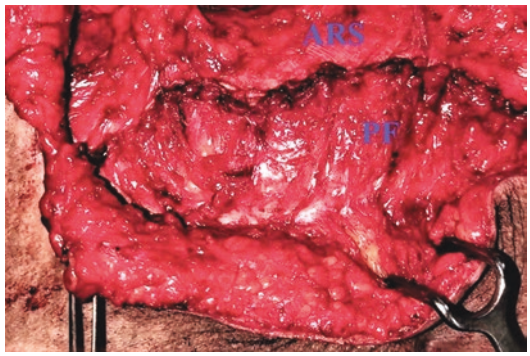

Fig. 19.14 PF which is in continuity with the ARS is sutured to the ARS of the other side

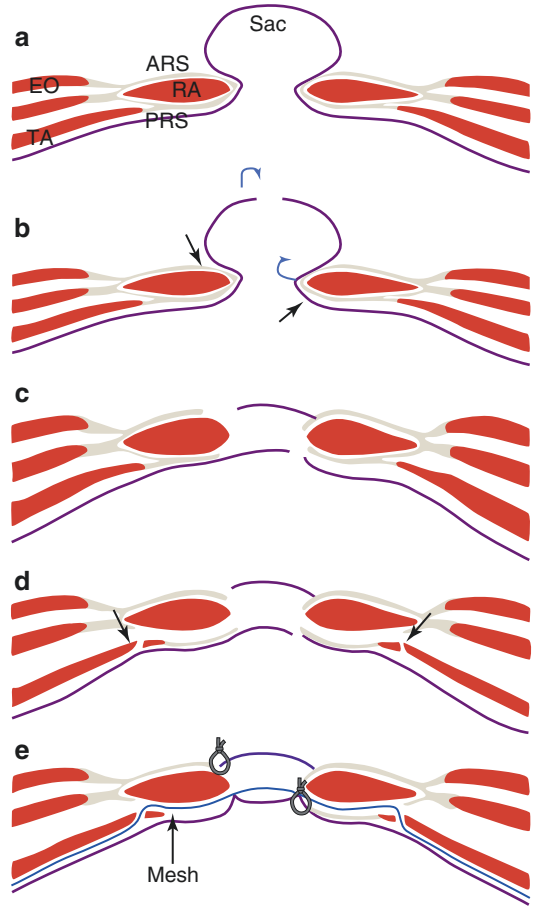

Fig. 19.15 Schematic diagram showing the steps of TAR plus (6). EO, external oblique; IO, internal oblique; TA, transversus abdominis; RA, rectus abdominis; ARS, anterior rectus sheath; PRS, posterior rectus sheath. (**a**) Large ventral hernia with muscles of the anterior abdominal wall. (**b**) The hernia sac with its bisection. Black arrows show the place of incision. Curved arrows show the direction of rotation of peritoneal faps. (**c**) The right-sided peritoneal flap in continuity with the ARS and the left-sided peritoneal fap in continuity with PRS. (**d**) The divided TA muscle is shown. (**e**) The completed procedure with retromuscular mesh (blue line) and suture closure of the right-sided peritoneal fap with ARS and the left-sided peritoneal flap with PRS

diamond configuration (Fig. 19.13). As there is no space for mesh migration, fixation of the mesh may not be required. The suction drain is placed in this space. Next, we suture the PF with the ARS to the ARS of the other side (Fig.19.14). This is by continuous suture with delayed absorbable or nonabsorbable sutures. This covers the mesh. While utilizing the peritoneal flaps it is to be seen that only that much of PF is kept which is required for the tension-free closure. Any excess PF is excised at the time of closure. Subcutaneous tissue and the skin are closed. A schematic line diagram of the steps of TAR plus is shown in Fig. 19.15.

Fig. 19.16 The leg raising test of the patient in the early postoperative period shows no bulge

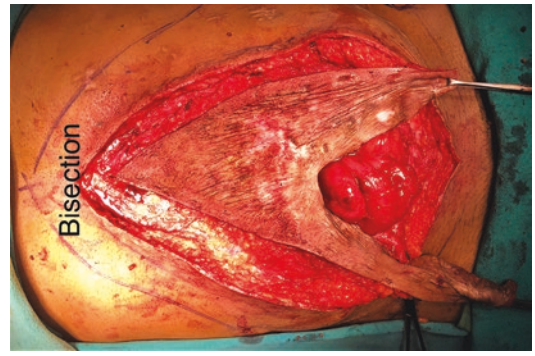

Fig. 19.17 Our modification of bisection of the skin and sac. The bisected skin is then shaved off preserving as much sac as possible

Postoperatively, these patients usually do not require elective ventilation since intra-abdominal hypertension is rare. This is because the abdominal circumference is increased and compliance decreased with this technique. Patients are usually discharged within 5–7 days once they tolerate solid food, and wound appears healthy. In the follow up, apart from checking for recurrence, SSO, and SSI, we regularly look for abdominal bulge/pseudorecurrence on leg rising test. We have not seen any bulge so far. This picture shows a patient with TAR plus in the early postoperative period showing no bulge in the leg raising maneuver (Fig. 19.16).

19.7 Tips and Tricks

- We advocate preserving the sac whenever we go for TAR in a large hernia. At the end of the procedure, they can be used as PF or excised.
- Care should be taken to not make the sac/peritoneal flap too thin. Generally, the sac is surprisingly tough. The sac at the center of the hernia may not be separable from the scarred skin and should be sacrificed.
- PF should be kept only as wide as required for a tension-free closure. Any excess PF should be excised at the time of closure.
- Our improvisations over the Original PF Technique: Sometimes we face problems in dissecting the skin from the hernial sac at the beginning of the surgery. This is especially in the midline where there is scarring from the previous surgery. To alleviate this, we enter the abdomen from one end in the midline and do adhesiolysis under the vision with the progressive bisection of the skin and sac. The bisected skin is then shaved off preserving as much sac as possible (Fig. 19.17).

19.8 Complications and Management

The potential complications of this procedure are seroma, hematoma, surgical site infection, wound dehiscence, post-operative pain, recurrence, and pseudorecurrence (bulge) as with all hernia procedures. In large hernias which usually need a bridging TAR the complication rate reported by Alkhatib et al. was 10% SSI, 2% mesh exposure, 5% partial mesh excision, 16% surgical site occurrences requiring procedural intervention (SSOPI), and 46% composite recurrence (recurrence + pseudorecurrence) [7]. The complication of TAR plus in our series of five patients was one superficial SSI, no seroma, readmission, recurrence, or mortality [6]. In another study of 17 patients, there were five (26%) surgical site occurrence (SSO) (two seroma, two SSI, and one cellulitis) [11]. In the median follow up of 11 (4–28) months there was one (5.8%) recurrence

and four (23.5%) bulge (pseudorecurrence). Although the data is small, the comparisons do show favorable outcomes with TAR plus.

19.9 Conclusion

The TAR plus procedure seems to be a useful addition to the armamentarium of procedures for large midline ventral hernias. It has the potential of reducing the recurrence, pseudorecurrence, SSO, and SSI seen in bridging TAR. It is also useful for cases with loss of domain. It has the potential to reduce postoperative ventilatory requirement and intra-abdominal hypertension.

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