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TRANSVERSUS ABDOMINIS RELEASE(TAR)-WHEN HOPE MEETS EXPECTATIONS

Surgery

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ABSTRACT

Large/complex ventral hernia repair are becoming more frequent and challenging these days. Reconstructive techniques are numerous but most of them are unable to achieve the goals of hernioplasty.Abdominal wall reconstruction has added new horizons..Posterior component separation with transverses abdominis release (TAR) is a novel approach that offers a solution for complex ventral hernias specially for loss of domain hernia.The posterior rectus sheath is incised and the retrorectus plane is developed. In a modification of the Rives-Stoppa technique, the transversus abdominis is released medial to the linea semilunaris to expose a broad plane that extends from the central tendon of the diaphragm superiorly, to the space of Retzius inferiorly, and laterally to the retro-peritoneum. This preserves the neurovascular bundles innervating the medial abdominal wall. Mesh is placed in a sublay fashion above. Prior BOTOX injection to rectus helps in anatomical fashioning of linea alba ,creating a functional abdominal wall with wide mesh reinforcement.TAR seems to be the "ideal" approach for complex hernias with good immediate outcomes.

KEYWORDS

large incisional hernia,;Loss of domain hernia; Posterior component separation,;Botox ; Transversus abdominis release (TAR).

INTRODUCTION

Abdominal wall hernia repair[1,2] is often culmination of complex decision-making process by the surgeon. Defect size, location, patient comorbidities,the presence of contamination, acuity of the patient's presentation, necessity for an ostomy,and history of prior repairs with or without a prosthetic all weigh into the ultimate repair approach[3]. The stockpile of operations available does nothing to simplify the matter. There are innumerable surgical techniques, prosthetic choices, met with a judgment regarding the location of its placement relative to the abdominal wall. Underlay, onlay, inlay, and sublay reinforcement are all viable options that typically compliment the approach. Finally,dimesions of success can be equally ambiguous. Definitions for wound morbidity have only recently been defined. Most of the reconstructive techniques are unable to achieve the goals of hernioplasty.

In patients with LOD hernias[3,4], the abdominal cavity is unable to fully accommodate the abdominal contents within its fascial boundaries.There is no standard definition for loss of domain, generally speaking it refers to the clinical situation when more of the viscera is outside the abdominal cavity than inside. Whether this should be defined when the patient is straining or lying flat for a CT scan is unclear. Closure of the fascia is either impossible, or can lead to high intra-abdominal pressures, fascial dehiscence, or abdominal compartment syndrome.

Rives – Stoppa repair[5] evolved as an effective repair with favorable outcomes and low morbidity. The posterior rectus sheath dissection provides release of the rectus muscle and a well vascularised "box" for mesh placement. But the procedure is not appropriate for large defects due to its frequent inability of anterior fascial closure which leads to large surfaces of mesh under the skin . The immediate result is an increased rate of surgical site events (SSE) and surgical site infections (SSI) . The approach of anterior component separation (ACS) as described by Ramirez[6], despite its wide fascial advancement and improved functional outcomes is encumbered by a significant wound morbidity at rates as high as 50% even in the presence of peri-umbilical perforators sparing[7] . Minimally invasive surgery modifications reduced SSE but could not improve the recurrence rate which is still up to 30% .

As the number of large and complex abdominal wall defects[1] is increasing it is obvious that the procedure is not adequate for such pathology. Some modifications of the technique were reported but the limited advancement of the rectus abdominis muscle (RA) make them inappropriate . In 2012 Novitsky et al[8,9,10] reported a novel approach to posterior component separation by transversus abdominis muscle release (TAR) . This is a lateral extension of Rives – Stoppa repair[5] with the creation of a wide space between the transversus abdominis muscle (TA) and fascia transversalis-peritoneum complex. The promising results of this initial report determined us to implement the procedure as a daily practice.The goal of the paper is to present operative technical details of the procedure and our short-term results.

Botulinum toxin A (BTA) is a neurotoxic protein produced by *Clostridium botulinum*. BTA binds to glycoprotein's in the cholinergic nerve terminal, blocking signal transmission temporarily in both motoric and autonomic innervations. The toxin has an advantageous safety profile when applied in small doses to local tissue remote from vital muscles and organs. The paralyzing effect reaches a maximum 2 weeks after topical administration and declines gradually after 2.5 months.

Studies have shown that preoperative paralysis of the lateral abdominal muscles from intramuscular administration of BTA reduces the intraabdominal pressure, allowing closure of a hernia defect under less muscular tension[11,12,13,14]. Ideally, temporary paralysis of the abdominal wall muscles with BTA prior to hernia repair may allow primary fascial closure .
Under ultrasound control, 4-6 weeks prior to surgery, 50 units of BTA was injected into the external oblique, internal oblique and transversus abdominis muscles at three sites on each side of the lateral abdominal wall (total dose 300 units). Pre- and post-BTA abdominal computed tomography measured changes in abdominal wall muscle thickness and length.

Step by step procedure for a midline incisonal hernia[15,16,17,18,19,20,21]

1.Mid-line large laparotomy with complete excision of the scar if the skin is thin and poorly vascularized . The umbilicus is usually excised. Dissection of the sac in the classic fashion.

2.Adhesiolysis: completely free all the bowel/omentum adhesions from the undersurface of the abdominal wall(AW) to allow medialization of this layer and to prevent bowel injuries at the reconstruction time. Minimize interloop dissection only to grossly adhesions in order to prevent postoperative obstruction. Protect the viscera with a wide wet soft towel.

3.Creation of the retrorectus space is initiated at the level of the umbilicus. An incision is made on the posterior sheath 0.5 – 1 cm. apart of its medial edge .

Identify the RA not to enter pre-peritoneal plane !! If the plane is correctly approached the incision is extended cranially and caudally on the entire length of the RA sheath and the retro-rectus space[3] is developed by blunt or sharp dissection. Laterally the dissection is

extended to the semilunar line. Care must be taken to prevent damages of the epigastric vessels and of the neurovascular branches of the RA which perforate the posterior sheath just medial to Spiegel (perforators) line .The retro-rectus plane is continued by cranial dissection to the retro-xiphoyd plane and caudal in the pre-peritoneal space of Retzius with identification of both Cooper's ligaments and pubic symphisis.

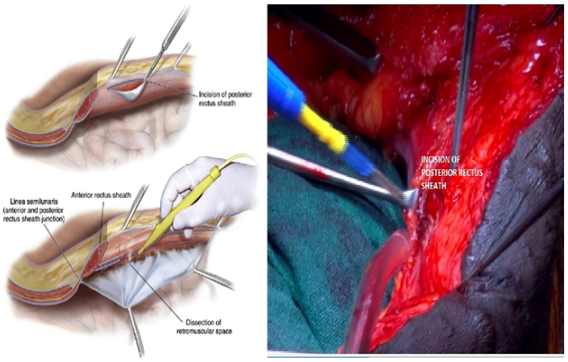

Figure 1

4.Incision of the posterior rectus sheath in the upper third of the abdomen, 0,5 cm medial to the perforating neurovascular bundles of the thoraco – abdominal nerves the posterior rectus fascia is sharply incised to expose the underlying TA muscle .Once the muscle is exposed the fibers are then divided along its entire medial edge. The separation from the preperitoneal plane is easily with an "L" curved dissector .In the upper third the muscle is well developed and easy to identify; its volume regress in the distal 2 thirds where there is no muscle but only tendinous component.

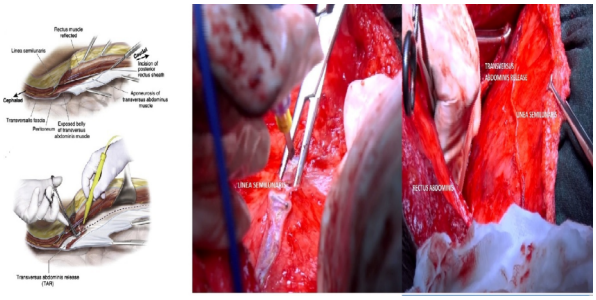

Figure 2.

5.Creation of the pre-peritoneal plane between the edges of the transected TA a new pre-peritoneal plane is created. Two Allis clamps on the lateral edge of the TA are elevated together with the muscle by the assistant surgeon. Left hand of the surgeon pushes inferiorly the medial edge of the TA so a dihedral angle is created between the muscle and the peritoneum. With a mounted swab the undersurface of the lateral border of the TA is freed from the peritoneum. In 20% or more frequent at the first procedures peritoneal tears are encountered .All of them must be carefully closed with an absorbable suture (3-0 Vicryl usually) to avoid protrusions of the small bowel under the mesh. In rare instances (2%) large peritoneal tears cannot be closed and must be buttressed with omentum, local fat or even an absorbable mesh.

Laterally the dissection is extended as far as the psoas muscle; it's lateral border can be used as a landmark but usually the posterior axillary line is the main anatomic landmark for the lateral dissection .The cranial extend of the dissection depends on the extend of the defect; in upper hernias the space is advanced cranially through the costal margins to view the diaphragm.

Inferior the pre-peritoneal plane is contiguous with the space of Retzius in the median line and with the space of Bogros on its lateral part. Trans-section of the medial attachments of the arcuate line of Douglas to the linea alba allow the access to the pre-peritoneal plane. Parietalization of the cord or resection of the round ligament extend the dissection in the space of Bogros and both miopectineal triangles.

6.Closing of the posterior rectus sheath with a 2-0 slowly absorbable suture (Polydyoxanone) recreates the visceral sac excluding the bowel

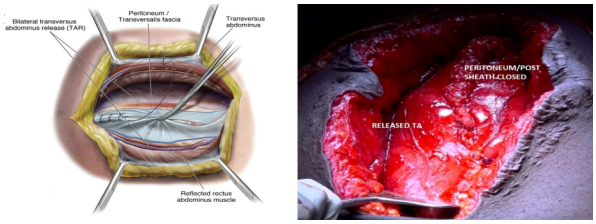

Figure 3.

7.Placing the mesh this wide pre-peritoneal space is measured in length and width for an appropriate mesh adjustment. Usually a mesh larger than 30/30 cm is necessary. A low or mid weight large pores monofilament polypropylene mesh is used (40 to 60 g/m2). For lateral defects or very large defects a heavyweight mesh could be necessary. The mesh must overlap the defect minimally to the anterior axillary line, subxiphoid space and 2-4 cm below the symphisis.

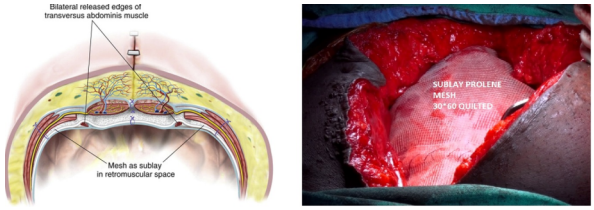

Figure 4.

8.Anchoring the mesh first step is to suture the mesh to both Cooper's ligaments and to symphysis with no 1 slowly absorbable suture/non absorbable suture. Inferior fixation is essential for the protection of the supra-pubic area because the vectors of the intra-abdominal pressure are directed inferiorly. Cranially 2 stitches fixe the mesh around the xiphoid covering the epigastric area and retrosternal space. Three bilateral stitches bellow the costal margin, medial to the anterior superior iliac spine and medial to the psoas muscle are taken for complete mesh fixation. Lateral wide overlap and intra-abdominal pressure maintain the mesh in position without the fear of lateral recurrence. Two closed suction drains are placed on the ventral face of the mesh i.e. retrorectus .

9.Anterior fascial closure with a running slowly nonabsorbable no 1 suture recreates the linea alba. Two subcutaneous drain are placed. The subcutaneous tissue is closed with interrupted absorbable sutures and then skin closure done. An abdominal binder is recommended in the first postoperative days in order to reduce seroma formation.

CASE 1

A 54 year old female presented to opd with a abdominal wall swelling since 20 years which has grown to a gaint hernia through incision site of ceasarian section 22 years back.

Fig 5.

CASE 2

A 31 year old male presented to opd with a abdominal wall Swelling since 5 months which has grown to a gaint hernia through Incision site of midline laparotomy 5 months back.

Fig 6.

Table 1

Case	Prebotox rectus thickness	Post botox rectus thickness	Tanaka index=HSV/ACV
Case1	4.2 mm	3.1mm	33%
Case2	2.4 cm	1.9 cm	26%

DISCUSSIONS

The repertoire of the retro-rectus repair of abdominal wall defects has been well documented over the years by many authors after Rives and Stoppa published their researches. This technique

provides many advantages in the reconstruction of complex defects

1. The retro-rectus space is an easily dissected potential space;
2. It is a well vascularized compartment with a more efficient collagen deposition and mesh integration;
3. In a recent systematic review and network meta-analysis sublay was associated with lower risk of recurrences and SSI compared to on-lay, inlay and underlay. Sub-lay was ranked the best mesh placement option with a high probability of being the best treatment (94.2% probability of having the lowest odds of recurrence and 77.3% probability of having the lowest odds for SSI)[20].
4. Prior Botox injection to abdominal wall musculature helped flattening of abdominal wall muscles and hence easier closer.

All this advantages are limited by the frequent impossibility of closing the anterior fascia in large defects with increasing SSE, recurrence and inability to properly heal. The goal of any herniorraphy is first of all the restoration of a functional abdominal wall by recreating the linea alba reinforced with a large prosthetic mesh overlap and with minimal early and late wound morbidity. The posterior component separation by transversus abdominis muscle release (simply TAR) is a modification of the Rives-Stoppa procedure which combines it with developing of a large retro-muscular/pre-peritoneal plane and a consistent medial advancement of the abdominal wall musculature and accompanying fascia. Dividing the TA fibers the hoop tension around the abdomen is released and the abdominal cavity is increased. The intra-abdominal pressure (IAP) is also lowered by drawing the abdominal wall upward . Also the force vector of the TA directly opposing the medialisation of the fascia is abolished. The result is a fascial advancement of 8 to 12 cm on each side which allows restoration without tension of the linea alba with improved abdominal core muscle function. Fascial closure rates of 91% for defects of 472 cm2 with 50% reduction in wound morbidity where obtained in a recent study[21] . Closure of the posterior rectus fascia and the large preperitoneal compartment avoids the use of expensive meshes and minimizes mesh-bowel interaction. Bi-laminar closure of the abdominal wall prevents mesh migration and protection against the infection. working outside the rectus sheath the procedure avoids disruption of the neurovascular bundles that supply the antero-medial abdominal wall. Unnecessary extensive skin flaps and preservation of a significant portion of the abdominal wall blood supply improves healing and decrease wound morbidity .

A wide range of patients benefits from the advantage of the procedure :

1. Any patient with large abdominal wall incisional or ventral hernia (defects larger than 10 cm in width, loss of domain);
2. Large subxiphoid, parailiac, and suprapubic hernias, subcostal/bisubcostal hernias;
3. Recurrent incisional hernias after intra-abdominal mesh plasty;
4. Recurrences after anterior component separation;
5. Parastomal hernias with or without medial incisional hernias;
6. Incisional hernias after open abdomen with or without planned ventral hernia.

Difficulties could be encountered for recurrent hernia after Rives-Stoppa repair or after primary or secondary preperitoneal fibrosis due to extensive necrotizing pancreatitis.

CONCLUSIONS

TAR is superior to Rives-Stoppa repair and seems to be the best option for a wide spectrum of complex primary and incisional hernias, Hernias with LOD with tanaka index[22] ≥25% where anatomical closure is impossible with low morbidity and good long-term results. Good anatomy knowledge and surgical skills are necessary for valid outcomes. TAR is very nascent in the global scenario of abdominal wall reconstruction. This has helped brighten many lives in our country and world over to hapless people who battled debility, morbidity and half cooked treatments.

Declarations:
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Conflict of interest: None declared
Ethical approval: Not required

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