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Editorial

Evolving concepts in ventral hernia repair

Even though the description of laparotomy and abdomen closure dates back to hundreds of years, it was not until the period of renaissance that description of abdominal wall anatomy became available. In 1836, a French surgeon, Pierre Nicholas Gerdy, was the first to document an incisional hernia repair through large closure of the abdominal wall.[1]

Despite the development of laparoscopic surgery, every year, there are more than two million laparotomies performed in the USA. Although there are no accurate data for the estimates in our country, it can safely be assumed that it is likely to be much more. Almost 11–30% of previous abdominal operations will lead to an incisional hernia. A similarly huge number of other ventral hernia repairs could be due to a primary weakness of abdominal musculature. In 2012, a study conducted by Poulose et al.[2] estimated that nearly 350,000 ventral hernia repairs were performed on an annual basis in USA alone. Thus, the staggering cost of treating the disease of incisional hernia is a global problem.

There could be several reasons for a high rate of hernia formation in previous abdominal operations. These could be "surgery related" – type of incision, suture, technique of closure, wound infection, etc. – or "patient related" – obesity, smoking, immunosuppression, malnourishment, poor diabetic control, etc.

Before the advent of mesh, the hernias were repaired using sutures, and several techniques were described. However, the incidence of incisional hernia and recurrence after repair remained frustratingly high at about 50–60%. Few surgeons attempted using metallic meshes, but it was Francis Usher who popularized and introduced plastic (polypropylene) in the late 1950s with validity. Polypropylene solved many problems, such as with extreme stiffness, fragility, migration, corrosion, and toxicity, encountered with the metallic meshes.

What had remained consistent through the years of open surgery for incisional/primary ventral hernia was that the fascial defects were always closed. With only suture closure, there was often excessive tension leading to tissue breakdown and a recurrence. During breathing, coughing, or physical activity, the oblique muscles tend to flex laterally pulling the median fascial repair apart. The argument for mesh is that the tension is now countered by the strength of the incorporated mesh. Although several studies reported advantages of mesh, it was not until the year 2000 when the first randomized, multicentre study of patients with midline abdominal incisional hernias confirmed the mesh repair to be superior to suture repair.[3] In the context of groin hernia, Lichtenstein[4] was the first to coin the concept of mesh "tension-free repair" in 1986.

In the 1970s, two techniques of open ventral/incisional hernia repair became popular. One proposed by Chevrel[5] involved a sutured closure of fascial defect followed by onlay placement of mesh fixed with sutures. Rives[7] and Stoppa[6] described the other technique which entailed retro muscular and preperitoneal dissection, closure of posterior sheath, and a retrorectus/sublay placement of mesh – which was fixed with transfascial sutures.

Chevrel in his work found that the anterior sheath provides much more strength to linea alba. In the original description of his technique, he closed the fascial defect after mobilizing from the subcutaneous fat and then gave a lateral incision on the anterior sheath. The two cut edges of the incised sheath were turned medially and sutured to create another linea alba. This was then strengthened by putting an onlay polypropylene or polyester mesh. Ramirez[8] proposed the use of anterior component separation using myofascial advancement to facilitate the closure of midline defects in large, complex hernia. This involved incising the anterior oblique aponeurosis lateral to the linea semilunaris from the costal margin to the inguinal ligament.[8] The separation of external and internal oblique muscles leads to significant medialization, thus facilitating a midline closure. Stoikes et al.[9] have proposed the use of fibrin glue for fixation of mesh in onlay repair. The proponents of onlay repair point toward the relative simplicity of procedure, less need for extensive intraperitoneal adhesiolysis, and equivalent results in terms of hernia recurrence. Those not in favor point toward more wound morbidity (surgical site infection (SSI)/SurhicSu site occurrence (SSO)) due to devascularization of skin flaps, more chances of seroma, potential of mesh infection, and possibly poor biomechanical factors in onlay placement vs sublay placement. To obviate some of these issues, surgeons have used an endoscopic anterior component separation (eACST) technique using either the subcutaneous or subexternal oblique approach.[10]

While both techniques were used simultaneously in Europe, in 1980s, Wantz[12] introduced the technique of open sublay repair in the USA, and it rapidly gained popularity. With the guiding principle of giant prosthetic reinforcement of visceral sac (GPRVS), the "Rives–Stoppa–Wantz" repair was declared as the gold standard for midline incisional hernia repair by the Americas Hernia Society in 2004.[11] The retro muscular mesh placement has advantages in accordance with Pascals law – any rise in intra-abdominal pressure only pushes the mesh further toward the muscle and also results in mesh being in a well-vascularized plane leading to good incorporation and better chances to withstand an infection. The incision on posterior sheath and retrorectus dissection till linea semilunaris is part of posterior component separtion technique.[12]

Limited myofascial advancement leading to inability to close large defects and limited area for the placement of mesh (between two linea semilunaris) of this procedure in ventral/incisional hernia repair are some of the drawbacks of Rives–Stoppa repair. The

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posterior component separation using transversus abdominis release (TAR) was first described by Novitsky and Rosen.[13] Since its introduction at the world hernia congress in 2009, this procedure has gained rapid popularity in large, complex abdominal wall reconstruction. Its use is generally reserved in patients with defect size more than 10 cm. Anatomically, transversus abdominis release (TAR) utilizes the benefit of TA muscle fibers becoming part of posterior sheath medial to the linea semilunaris. The neurovascular bundles are preserved, and the fibers of TA are cut to enter the preperitoneal or pretransversalis fascia laterally. This space can then be dissected all the way up to retroperitoneum, thus allowing placement of large 50 × 50-cm uncoated mesh. Concomitant performance of an anterior and posterior component separation is contraindicated as it leads to destabilization of the lateral abdominal wall via a disconnection of the major components of linea semilunaris aside from the internal oblique.[14]

Laparoscopic ventral hernia repair (LVHR) was introduced in 1992 when Karl Leblanc described an intraperitoneal placement of ePTFE mesh to cover the hernia defect.[15] This repair has become popular under the name of intraperitoneal onlay mesh (IPOM) repair. At that time, many surgeons wee concerned with the wound morbidity, pain, recovery time, and mesh infection rates of an open repair. Minimally invasive technique brought the advantages of smaller incision, much less incidence of SSI/SSO, better cosmesis, and ability to place a large prosthesis in intraperitoneal position without any tissue dissection. Pain, however, remained a serious factor with LVHR, and several modalities including transversus abdominis plane (TAP) block have been used to overcome this issue. Surgeons applied the concept of tension-free repair, as espoused by Lichtenstein to inguinal hernia, for ventral/incisional hernia. Hence, defects were not closed, and hernial sac was not excised. This led to a high incidence of seroma, which was accepted a benign consequence of LVHR requiring minimal intervention. Over a period of time, several new composite mesh materials were introduced with a layer for protection of bowel from getting adherent to polypropylene/polyester. A defect size larger than 8–10 cm is considered a relative contraindication to LVHR as the mesh itself can herniate into the large defect causing a pseudo recurrence. Many surgeons such as Chelala et al.[16] and others have supported closure of defect during LVHR, citing lesser incidence of seroma and recurrence. When the fascial defect is closed, the procedure is often termed as IPOM +.[16] The debate over closure vs nonclosure of defect in LVHR continues, but most recent studies have shown advantages of defect closure, especially in hernial defects more than 5 cm. Those that are larger than 10 cm will require some kind of component separation to achieve midline closure with acceptable tension.

For hernias in lower abdomen, the peritoneal flap was created, and the bladder was pushed down. The composite mesh is then taken down up to retropubic space and fixed to coopers ligament. The peritoneal flap is then tacked up, and part of the mesh is intraperitoneal and part is extraperitoneal. This technique is called the transabdominal partial extraperitoneal (TAPE) repair.[17]

Despite the success of LVHR over the past two decades, many surgeons remained concerned over the incidence of bowel adhesions/fistulation due to placement of an intraperitoneal mesh. There is resurgence of interest in closing the defect and attempting to keep the mesh out of peritoneal cavity and, at the same time, using minimally invasive techniques. This could possibly provide patients with the advantages of restoration of functionality of abdominal wall and extraperitoneal/retro muscular mesh placement using principles of Rives–Stoppa repair. Restoration of the midline helps in physiological functions such as movement/bending, breathing, defecation, etc. The sublay position for mesh is considered most appropriate.[18]

Jorge Daes first introduced the concept of enhanced view totally extraperitoneal (eTEP) repair for inguinal hernia. Igor Belyansky extended the principle of eTEP to ventral/incisional hernia.[19] The technique involves endoscopic creation of retrorectus space on one side, crossing over to the other side by division of medial ends of both posterior sheath, and creation of a large retro muscular space. Caution has to be taken to avoid any injury to linea alba, neurovascular bundle, or linea semilunaris. In some ways, the term eTEP is a misnomer here because at some point in the conduct of surgery, the peritoneum is opened, contents are reduced, and dissection is carried on. As this is only a minimally invasive reproduction of open technique, it is possible to perform the posterior component separation – TAR (eTEP-TAR). The defects in anterior and posterior sheath are closed, and a large piece of uncoated mesh is placed in between. This technique can also be used for flank hernia and subcostal, subxiphoid, or suprapubic hernia. Thus, the eTEP technique can be used to either perform Rives–Stoppa repair (eTEP-RS) or extend it to TAR. Sometimes, the tension at the time of closure of posterior sheath may require a partial TAR. Posterior sheath disruption is a known complication of eTEP-RS, and thus, closure under minimal tension is desirable. The usage of eTEP technique helps in medialization of trocars so that the lateral trocars are medial to linea semilunaris. This is ergonomically advantageous while closing the hernial defect in anterior sheath.

Ashwin Masurkar and others have made similar efforts at retro muscular placement of mesh through transperitoneal route using superior and inferior trocar placement. As in eTEP technique, the dissection can be carried out laterally by performing a TAR. This technique has now been labeled as transabdominal retro muscular (TARM) approach.

The da Vinci robot system has been used to replicate many of these procedures including transabdominal preperitoneal (TAPP) repair of ventral/incisional hernia, TAR (rTAR), and IPOM + repair. The use of robot greatly enhances the surgeons ease and capability of suturing at difficult angles.[20]

For small umbilical/epigastric hernia in a nonobese patient with divarication of recti, a new technique has been used which is called subcutaneous onlay/preaponeurotic repair (REPA/SCOLA).[21] In this technique, a subcutaneous space is developed by blunt finger dissection in suprapubic area. Two lateral ports are placed, and a subcut dissection is carried out up to the xiphoid. Using a nonabsorbable locking suture, the defects in anterior sheath are reclosed, divarication is plicated, and an onlay mesh of adequate size is fixed with sutures or glue. Postoperatively, compression dressing is given for 7–10 days.

Needless to say that virtually all ventral/incisional hernia repairs today are synonymous with mesh repair except those such as a small umbilical or trocar site hernia where size of defect is less than 2 cm. In this situation, a sutured repair may also suffice. A primary repair with suture is also preferred in women of child-bearing age who wants further pregnancy or in a contaminated field.

Despite hernia being an age-old problem, many of the techniques and prosthetic material used are under continuous evaluation to find the best long-term solution for patients. For herniologists, these are exciting times as there are a variety of options available, and one has to fit the right technique as per the need of the patient rather than other way around. This choice of right technique with the right suture and prosthetic material for the right patient is called the “tailored approach”. Only time- and better-quality-randomized trials will provide evidence and answer as to which repairs have better results.

References

1. Sanders DL, Kingsnorth AN. From ancient to contemporary times: a concise history of incisional hernia repair. *Hernia*. 2012;16:1–7.
2. Poulose BK, Shelton J, Phillips S, et al. Epidemiology and cost of ventral hernia repair: making the case for hernia research. *Hernia*. 2012;16:179–183.
3. Luijendijk RW, Hop WC, van del Tol MP, et al. A comparison of suture repair with mesh repair for incisional hernia. *N Engl J Med*. 2000;343:392–398.
4. Lichtenstein IL, Shulman AG. Ambulatory outpatient hernia surgery. Including a new concept, introducing tension-free repair. *Int Surg*. 1986;71:1–4.
5. Rath A, Zhang J, Chevrel J. The sheath of the rectus abdominis muscle: an anatomical and biomechanical study. *Hernia*. 1997;1:139–142.
6. Stoppa RE. The treatment of complicated groin and incisional hernias. *World J Surg*. 1989;13:545–554.
7. Rives J. Major incisional hernia. In: Chevrel JP, ed. *Surgery of the Abdominal Wall*. New York: Springer; 1987:116–144.
8. Ramirez OM, Ruas E, Dellon AL. "Components separation" method for closure of abdominal-wall defects: an anatomic and clinical study. *Plast Reconstr Surg*. 1990;86:519–526 [Internet].
9. Stoikes N, Webb D, Voeller G, et al. Preliminary report of a sutureless onlay technique for incisional hernia repair using fibrin glue alone for mesh fixation. *Am Surg*. 2013;79:1177–1180.
10. Giurgius M, Bendure L, Davenport DL, Roth JS. The endoscopic component separation technique for hernia repair results in reduced morbidity compared to the open component separation technique. *Hernia*. 2012;16:47–51.
11. Jin J, Rosen MJ. Laparoscopic versus open ventral hernia repair. *Surg Clin North Am*. 2008;88:1083–1100.
12. Wantz GE. Giant prosthetic reinforcement of the visceral sac. The Stoppa groin hernia repair. *Surg Clin North Am*. 1998;78:1075–1087 [Internet].
13. Novitsky YW, Elliott HL, Orenstein SB, Rosen MJ. Transversus abdominis muscle release: a novel approach to posterior component separation during complex abdominal wall reconstruction. *Am J Surg*. 2012;204:709–716.
14. Novitsky YW, Fayezizadeh M, Majumder A, Neupane R, Elliott HL, Orenstein SB. Outcomes of posterior component separation with transversus abdominis muscle release and synthetic mesh sublay reinforcement. *Ann Surg*. 2016;264:226–232 [Internet].
15. LeBlanc KA, Booth WV. Laparoscopic repair of incisional abdominal hernias using expanded polytetrafluoroethylene: preliminary findings. *Surg Laparosc Endosc*. 1993;3:39–41.
16. Chelala E, Baraké H, Estievenart J, Dessily M, Charara F, Allé JL. Long-term outcomes of 1326 laparoscopic incisional and ventral hernia repair with the routine suturing concept: a single institution experience. *Hernia*. 2016;20:101–110.
17. Sharma A, Dey A, Khullar R, Soni V, Baijal M, Chowbey PK. Laparoscopic repair of suprapubic hernias: transabdominal partial extraperitoneal (TAPE) technique. *Surg Endosc*. 2011;25:2147–2152.
18. Criss CN, Petro CC, Krpata DM, et al. Functional abdominal wall reconstruction improves core physiology and quality-of-life. *Surgery*. 2014;156:176–182 [Internet].
19. Belyansky I, Daes J, Radu VG, et al. A novel approach using the enhanced-view totally extraperitoneal (eTEP) technique for laparoscopic retromuscular hernia repair. *Surg Endosc*. 2018;32:1525–1532.
20. Carbonell AM, Warren JA, Prabhu AS, et al. Reducing length of stay using a robotic-assisted approach for retromuscular ventral hernia repair: a comparative analysis from the Americas Hernia Society Quality Collaborative. *Ann Surg*. 2018;267:210–217.
21. Claus CMP, Malcher F, Cavazzola LT, et al. Subcutaneous Onlay Laparoscopic Approach (SCOLA) for Vventralhernia and rectus abdominis diastasis repair: technical description and initial results. *Arq Bras Cir Dig*. 2018;31:e1399.

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