



Umbilical Hernia Mesh Repair: Overview on its Safety, Efficacy, and Techniques

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ABSTRACT

Adult umbilical hernias make up about 6 to 14% of all abdominal wall hernias. Surgical intervention is usually indicated when the umbilical hernia becomes symptomatic and poses a risk of incarceration. The hernia contains a stable, fibrotic hernia void that does not enlarge, rather a hernia sac that enlarges in most patients. Because the hernia sac neck is usually small compared to the hernia sac size, confinement and suffocation are ordinary. As a result, after diagnosis, an elective repair is recommended. The ideal repair approach is still controversial, and there are a lot of options. However, mesh repair has shown superiority regarding the complications and the recurrence rates. To review mesh repair's role in umbilical hernia and to evaluate the efficacy and the techniques of this intervention. The following keys are used to select articles from the PubMed database and in the mesh ("umbilical hernia mesh repair" [mesh]) and ("efficacy" [mesh]) or ("technique" [mesh]). The use of mesh in umbilical hernia repair compared to tissue repair for primary umbilical hernia leads to a lower recurrence rate and equivalent wound complication rate. However, surgeons have to make their choice based on the magnitude of the umbilical defect.

Keywords: Umbilical hernias, Management, Diagnosis, Mesh

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INTRODUCTION

Adult umbilical hernias all abdominal wall hernias make up about 6 to 14%, and more than 90% of adult umbilical hernias are acquired (Muschaweck, 2003; Asolati *et al.*, 2006; Shankar *et al.*, 2017). The hernia contains a stable, fibrotic hernia void that does not enlarge, rather a hernia sac that enlarges in most patients (Tollens *et al.*, 2010; Xie *et al.*, 2018). Surgical intervention is usually indicated when the umbilical hernia becomes symptomatic and poses a risk of incarceration. Repairing umbilical and epigastric hernias is a common surgical treatment with a 3.5% predicted complication risk. In the United States, about 175,000 umbilical hernia repairs are

performed annually (Helgstrand *et al.*, 2013; Henriksen *et al.*, 2020). Since conventional suture repair methods have a high chance of recurrence of approximately 11% to 54%, accumulated research shows that prosthetic mesh is the preferred alternative for hernia repair (Arroyo *et al.*, 2001; Muschaweck, 2003; Aslani & Brown, 2010). The ideal repair approach is still controversial, and there are a lot of options. However, we aim in this article to review and evaluate mesh repair's role in the umbilical hernia.

MATERIALS AND METHODS

The following keys are used to select articles from the PubMed database and in the mesh ("umbilical hernia mesh repair") and ("efficacy" [mesh]) or ("technique" [mesh]).

The articles were selected based on the inclusion of one of the following topics according to the inclusion criteria: umbilical hernia mesh repair. Exclusion criteria were all other articles that did not have one of these topics as their primary final stage. Around 104 publications were chosen as the most clinically relevant out of 333 articles indexed in the last decade, and their full texts were evaluated. A total of 20 of the 104 were included after a thorough examination. Additional research and publications were found using reference lists from the recognized and linked studies. Expert consensus recommendations and commentary were added where relevant to help practicing physicians assess cirrhosis most simply and practically possible.

RESULTS AND DISCUSSION

A ventral hernia at or near the umbilicus is known as an umbilical hernia. Following inguinal hernia, it is the second most common type of hernia in adults. It is more frequent in women or those that have high intra-abdominal stress, such as fatness, pregnancy, ascites, or chronic abdominal expansion. The abdominal muscles extension and the adipose tissue existence that separates the muscle groups and layers, weaken the aponeurosis, and increase the risk of umbilical hernia (Muysoms *et al.*, 2009; Dabbas *et al.*, 2011).

In the general adult population, the incidence of umbilical hernia is 2%, although it is significantly more prevalent in obese multiparous women and people with cirrhosis. An umbilical hernia occurs in up to 20% of cirrhotic individuals with ascites. It is more common in women with a 3:1 ratio. Men are more likely to develop an incarcerated umbilical hernia, while women are more likely to develop an asymptomatic recurrent hernia. Men are responsible for 70% of umbilical hernia repair (Dabbas *et al.*, 2011; Wang *et al.*, 2016).

Pathophysiology

A potential weakness in the outlet of the dislocated umbilical veins, particularly the umbilical vein, or weaker umbilical fascia (Richter fascia) may cause an umbilical hernia. As a result, the epidermis, subcutaneous tissue, weak superficial fascia, weakened umbilical fascia, and peritoneum containing umbilical hernia are all considerably attenuated and fused. Umbilical fascia is not usually present in people with an umbilical hernia and the round hepatic ligament is not attached to the lower umbilical cord edge. Umbilical hernia can be caused by chronic dilation of the abdominal wall with expanded intra-abdominal stress, such as pregnancy, in patients with ascites or peritoneal dialysis, abdominal muscle fibers stretches, and connective tissue decay (Celdran *et al.*, 1995).

Umbilical hernia affects around 20% of cirrhotic individuals. Increased abdominal pressure due to ascites, dilated umbilical veins, and weakened muscle or connective tissue because of poor nutritional conditions, are all predisposing to hernias. Preperitoneal adipose tissue, omentum, and small intestine, or a mix of these, may be present in an umbilical hernia. The transverse colon is only affected in a small percentage of cases. Because the hernia sac neck is usually small compared to the hernia sac size, imprisonment and strangulation are common. As a result, after diagnosis, a selective repair is recommended (Kulaçoğlu, 2015).

Multiple hernias in the umbilical area are caused by a weak spot in the alba line, not by the umbilicus itself, and its clinical course and management above or below the umbilicus are usually the same. The umbilical hernia is defined by the European Hernia Society as a hernia that is positioned between 3 cm above and 3 cm below the umbilicus. The umbilical fascia on one side, the linea alba on the other, and the medial margins of the two rectus sheaths on both sides define the umbilical canal's boundaries. Increased intra-abdominal pressure causes herniation. Obesity, many pregnancies, ascites, and abdominal tumors are all risk factors (Salameh, 2008; Muysoms *et al.*, 2009; Kulaçoğlu, 2015).

Repair options

Suture and mesh are the two most common umbilical hernia repair methods. For minor defects which are less than 3 cm, a simple primary suture repair can be used. William Mayo described the technique of overlaying abdominal wall fascia in a "vest-over-pants" fashion, and it remained the most well-known surgical procedure for a long time. Nevertheless, recurrence rates as high as 28% have been reported (Martis *et al.*, 2011; Lee *et al.*, 2021).

Today, prosthetic materials are commonly utilized to correct all types of abdominal hernias. In an average follow-up of 64 months postoperatively, a randomized clinical trial of Arroyo *et al.* showed that the recurrence rate following mesh repair was lower than that after suture repair (1% vs. 11%). In a retrospective clinical study of 100 patients, the suture and mesh repair groups had recurrence rates of 11.5% and 0%, respectively, with equivalent infection rates favoring the mesh repair (Arroyo *et al.*, 2001; Sanjay *et al.*, 2005). According to Aslani, Brown, and meta-analysis, the use of mesh in umbilical hernia repair compared to tissue repair for primary umbilical hernia leads to lower recurrence rate and equivalent wound complication rate (Aslani & Brown, 2010). However, many surgeons base their choice on the magnitude of the umbilical defect. According to Dalenbäck, suture-based treatments for lesions less than 2 cm can have an acceptable recurrence rate (6%) in long-term follow-up. A postal survey in Scotland found that surgeons prefer mesh repair for abnormalities of more than 5 cm, while suture and mesh methods are equally preferred for defects of less than 2 cm (Witherspoon & O'Dwyer, 2005; Dalenbäck *et al.*, 2013).

Meshes can be implanted using either an open or laparoscopic procedure. Surgeons, on the whole, prefer to use the procedure that they are most experienced with or to follow the wishes of their patients. Using an open onlay mesh is the easiest method, although it necessitates subcutaneous dissection, which can lead to seroma or hematoma and, in certain cases, infection at the surgical site. The mesh can also be used in the sublay or preperitoneal area (Kurzer *et al.*, 2004; Kulacoglu *et al.*, 2012). This may demand greater surgical experience and skill, but it minimizes extensive subcutaneous dissection, decreases seroma production, and may lead to fewer recurrences. In complicated or recurrent cases, onlay and sublay mesh installation might be performed altogether to enable better-strengthened repair. Although some authors prefer not to approximate the facial edges, it is recommended to suture closure before onlay mesh or after the preperitoneal mesh. Plug mesh repair for umbilical hernia is also documented. It can be performed under local anesthesia.

However, no controlled studies are corresponding to plug repair with other methods. Moreover, there is a risk of migration and enterocutaneous fistula for plug repair (Brancato *et al.*, 2002; Costa *et al.*, 2004).

Since the late 1990s, laparoscopic umbilical hernia repair has been used. Repairs with single-port have also been recorded recently. Although the laparoscopic approach is mostly used for mesh repair, it has also been used for primary suture repair without the use of prosthetic material. On the other hand, Banerjee *et al.* Compared the installation of laparoscopic mesh without defect closure to laparoscopic sutures with mesh in a clinical study and found that the latter group had a slightly lower recurrences rate, especially for recurrent hernias (Anadol *et al.*, 2010; Roberts *et al.*, 2010; Banerjee *et al.*, 2012; Kosilov *et al.*, 2021).

Currently, the use of laparoscopy for umbilical hernia repair is still uncommon. In just a small proportion of the situations, laparoscopy is preferable (Funk *et al.*, 2013). Several studies have compared open and laparoscopic umbilical hernia procedures. The short-term results of the American College of Surgeons National Surgery Quality Improvement Program recently showed a significant reduction in total and side effects of laparoscopic wound healing for selective primary umbilical hernia repairs as well as with longer operating costs and hospitalization. As well as increased respiratory and cardiac complications (Cassie *et al.*, 2014). The odds ratio for total complications favored laparoscopic surgery in their multivariate model. This difference was mostly due to the laparoscopy group's lower wound complication rate. The Danish hernia database did not show a significant difference between open and laparoscopic procedures in terms of surgical or medical complications rates or risk factors for 30-day readmission (Helgstrand *et al.*, 2013).

Hernia defects >2 cm and stapled mesh fixation were independent risk factors for readmission after open surgery. The woman was the only independent threat aspect for readmission after laparoscopic repair. Obese people that have umbilical hernias fall into a special class. According to Colon *et al.*, new comparative research, laparoscopic umbilical hernia repair should be the preferable method in obese individuals (Colon *et al.*, 2013). When compared to the laparoscopic treatment, the open mesh repair group had a much higher prevalence of wound infection (26% vs. 4%). They found zero hernia recurrence in the laparoscopic group, but a 4% recurrence rate in the open group. Kulacoglu *et al.*, on the other hand, found that obese individuals require a higher dosage of local anesthetic in open mesh repair (Kulacoglu *et al.*, 2012; Alwosaibei *et al.*, 2021).

Mesh repair techniques

As stated earlier, the decision to apply mesh is influenced by a variety of patient variables and hernia features. In certain circumstances, this option is taken during surgery when the hernia defect and fascia integrity are assessed. The potential risks and benefits should be considered with the patient before surgery when choosing to employ mesh is made. The surgeon must determine the type of mesh and the optimal implant location after deciding to use the mesh. Most selective umbilical hernia surgeries are clean, so a constant prosthetic mesh is normally suggested. Due to the relatively small number of wound problems and mesh infections associated with mesh-

based umbilical hernia surgeries, there is minimal evidence of the use of biological or bioabsorbable meshes. As a result, these high-priced mesh technologies are likely to be of limited use and should only be utilized for certain conditions.

The choice of the mesh should depend on the repair method chosen. Like other abdominal hernia repairs, the mesh can be identified as a sublay (intra-abdominal, pro-peritoneal, or retro-rectal position), the inlay (mesh branches sewn to the facial edges), or the onlay (placing the mesh on a mostly closed fascia). There is no agreement on the best position for mesh installation for ventral hernia repairs generally, and this should depend on the clinical condition. Understanding the potential advantages and disadvantages of different lace products and mesh placement is crucial. In general, inlay methods have a higher recurrence rate and should not be utilized regularly. Sublay methods propose the theoretical advantages of using the body's natural forces to help keep the mesh in position, possibly allowing for more mesh overlap without the need for subcutaneous flaps, which can raise wound infection rates. Under certain conditions, onlay methods are acceptable, but for optimal mesh overlap, a subcutaneous flap autopsy is needed, and if the incision becomes infected, it can lead to mesh exposure.

The procedure for an open umbilical hernia repair with a sublay mesh approach is the same as for the main suture repair. The patient is draped and prepared for operation, as customary for abdominal surgery. The hernia sac is removed from the umbilical stalk using a curvilinear incision below the umbilicus. The hernia sac does not open, and when the mesh is placed in the pre-peritoneal area, it can be removed at the fascia surface by blunt incision. A pre-peritoneal autopsy is performed circumferentially for a few centimeters and the peritoneal holes are sealed with absorbable sutures. The surgeon's selected mesh is placed and secured at the surgeon's discretion after a proper pre-peritoneal autopsy. Although flat sheet meshes may be used for this repair, existing commercial mesh types also perform well. These include the Ventralex ST hernia patch, PROCEED Ventral patch and C-QUR V-Patch are among them. To facilitate the placement of the mesh, these nets contain a string-like appliance that connects to a smooth sheet of coated polypropylene mesh. The intra-abdominal implantation of mesh, which is technically easier than pre-peritoneal repair, is another alternative to sublay repair. If the contents of the hernia sac are fat or omentum, the hernia sac can be opened and the contents decreased or removed using this procedure. The hernia sac is cut to the surface of the fascia, and the defect is circumferentially dissected intra-abdominally (usually with a finger) to check that there are no other defects in the hernia. The mesh is selected, implanted intra-abdominally, and sutured to the abdominal wall. The fascia is closed on top of the mesh in each of these procedures after the mesh tails are cut flush with the fascia. Dressings are placed on the skin after it has been closed.

The retrorectus repair is the last choice for a sublay repair. Due to the modest size of the abnormalities, this is seldom necessary for umbilical hernias. This is a possible alternative in some situations with big umbilical hernias. In this process, a vertical cut is made around the umbilicus and the hernia sac is scrutinized, and reduced or protrudes from the umbilical stalk. The posterior rectal sheath is cut on both sides and closed in the middle, preventing the mesh from coming into contact with the

contents of the abdomen. Because the incision is generally relatively small, closing the posterior rectal sheath at the top and bottom of the incision can be difficult. However, with constant dissection, this is usually possible. After the posterior rectus sheath is sealed, a flat mesh plate is inserted and fastened, generally with sutures, according to the surgeon's judgment. The anterior fascia is closed, then the skin is closed and the dressing is applied. Incorrectly chosen individuals, onlay procedures for mesh repair of umbilical hernias are feasible choices. Patients with obesity, diabetes or smoking are unlikely to benefit from onlay. The umbilical hernia is dissected and fixed in the same way as a primary repair is performed. Subcutaneous flaps are dissected after the fascia is closed to facilitate mesh insertion. Because there is a connection between broad mesh overlap and disorder, the width of the subcutaneous autopsy must be controlled carefully. Infection is more likely to be associated with the wider the subcutaneous dissection. Mesh fixing is according to the surgeon's discretion. Fixation methods such as suture, adhesive, and tack have all been reported. The umbilical stalk can be sutured to the mesh after implantation of the mesh and then the skin is closed and a dressing is applied. Although there is no conclusive evidence to support a mesh-based approach to umbilical hernia repair, surgeons should be aware of all possible options as well as the benefits and drawbacks of each treatment. Because there are so many different types of umbilical hernias, the kind and treatment approach should be adapted to each clinical situation (Appleby et al., 2018).

CONCLUSION

The use of mesh in umbilical hernia repair compared to tissue repair for primary umbilical hernia leads to a lower recurrence rate and equivalent wound complication rate. However, surgeons have to make their choice based on the magnitude of the umbilical defect.

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