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**Dr. HC Chaluvannarayana**

Post, Assistant Professor in  
Surgery, Meenakshi Academy of  
Higher Education and Research,  
Meenakshi University, Meenakshi  
Medical College Hospital and  
Research Institute, Enathur,  
Kanchipuram, Tamil Nadu, India

## Standardized sublay technique in polypropylene mesh repair of incisional hernia: A prospective clinical study

**Dr. HC Chaluvannarayana**

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### Abstract

**Introduction:** With the introduction of meshes to support hernia repairs the recurrence rates were reduced from 50% to less than 10%. Special complications such as scar plates with restriction of the mobility of the abdominal wall, pain and fistula formation are described.

**Methods:** In a prospective study trial 40 patients with incisional hernia were treated with polypropylene mesh repair in the standard sublay technique.

**Results:** Within a mean follow-up period of 2 years, 6-12-2018 to 25-12-2020, most of the patients were free from pain and very satisfied. Two recurrences, occurred and 2 hematomas had to be removed surgically.

**Conclusions:** Using a standard operation technique with the mesh in sublay position, even with polypropylene mesh, good clinical results can be achieved compared to published findings. To our surprise we found two central recurrences through the mesh.

**Keywords:** Sublay technique, polypropylene mesh, incisional hernia

### Introduction

There has been confusion in defining IH and differentiating these from primary abdominal wall hernias which occur in the absence of the previous operation and are identified by their site of occurrence, namely, epigastric umbilical. The term Ventral hernia is also used to describe these primary abdominal wall hernias. IH, on the other hand, is a bulge of tissue or an organ through an operation scar in the abdominal wall. The incidence varies from one center to another anywhere, between 11% and 23%. Approximately 50% of all IHs develop or present within the first 2 years following surgery, and 74% occur within 3 years, and continue to increase with a risk of 2% with each year. The weighted mean IH rate at 23.8 months was 12.8% in a systematic review and meta-regression study, but incidence rates up to 69% have been reported in high-risk patients with prospective long-term follow-up. The incidence of IHs increase from 12.6% at 1 year to 22.4% at 3 years. The American College of Surgeons reports that recurrence rates after the first repair of an IH range from 25 to 52%. Dehiscent laparotomy wounds have much higher risk of hernia development over a 10-year period, the majority of which develop over the first 2 years. Dehiscent wounds associated with evisceration or those in patients that had undergone abdominal aneurysm repair had an even higher rate of hernia development. A number of authors including Chevrel have defined IH considering the size of the defect, its location and the etiology. European Hernia Society (EHS) has found the definition given by Korenkov and his associates as most appropriate and adopted the same. Korenkov *et al.* defined IH as "Any abdominal wall gap with or without a bulge in the area of a post-operative scar perceptible or palpable by clinical examination or imaging." Post-operative wound healing and subsequent development of IHs is dependent on various factors, which may be either patient related (biological and others) or technique related. The various patient-related factors contributing include age (>60 years), obesity (body mass index >25 kg/sq m), cough, constipation, prostatism, diabetes mellitus, steroid therapy, malnutrition, obstructive disease, immunosuppression or smoking status, and previous abdominal surgical history. Operation related factors are surgical technique, emergency surgery, prolonged surgery, large size of the defect, presence of hematoma, dehiscence and wound infection, and laparotomy for abdominal aortic aneurysm. Some of the biological factors include defects in collagen and metalloproteinase synthesis.

**Corresponding Author:**

**Dr. HC Chaluvannarayana**

Post, Assistant Professor in  
Surgery, Meenakshi Academy of  
Higher Education and Research,  
Meenakshi University, Meenakshi  
Medical College Hospital and  
Research Institute, Enathur,  
Kanchipuram, Tamil Nadu, India

The decreased ratio of Collagen I/III is due to a relative increase of Collagen Type III, which is characterized by thin fibril diameters and lowered mechanical strength. The altered collagen ratio may be due to the decreased activity of MMP1 matrix metalloproteinase. The absence of MMP-13 expression may not modify the scar formation. Certain connective tissue diseases (Marfan's syndrome, osteogenesis imperfecta, and Ehlers-Danlos syndrome) have an increased incidence of IHs. The risk of IH varies with the type of incision, 10.5% for midline and 7.5% for transverse incisions. Chevrel initially described the classification of IHs based on their dimension. EHS has suggested the following classifications of IH. They may be midline or lateral abdominal IH. Midline hernias occur in the region between xiphoid cranially, pubis caudally and lateral borders of rectus on either side. Lateral hernias occur in the region lateral to linea semilunaris on either side up to anterior axillary lines.

### Materials & methods

Between 6-12-2018 to 25-12-2020, In a prospective study trial 40 patients with incisional hernia were treated with Marlex mesh repair in the standard sublay technique, patients who were scheduled to undergo repair of a primary hernia or a first recurrence of hernia at the site of a vertical midline incision to suture repair or mesh repair, after stratification according to the type of hernia and the hospital. The preoperative length or width of the fascial defect was not to exceed 6 cm, and patients could be enrolled only once. Exclusion criteria were the presence of more than one hernia, signs of infection, prior hernia repair with mesh, and plans to repair the hernia as part of another intraabdominal procedure. The study was approved by the ethics committees of the participating hospital, and all the patients gave informed consent after a physician told them about the details of the trial.

The patient-related factors of sex; age; presence or absence of obesity, cough, constipation, prostatism, diabetes mellitus, glucocorticoid therapy; smoking status; and abdominal surgical history were recorded. Obesity was defined as a body-mass index (the weight in kilograms divided by the square of the height in meters) of at least 30. Factors related to the operation, including the surgical technique and the presence or absence of hematoma, dehiscence, and infection, were also analyzed. Wound infection was defined by the discharge of pus from the wound, evaluated up to the one-month visit. We also recorded factors related to the hernia, such as whether the hernia was primary or a first recurrence, the preoperative and intraoperative size of the hernia, and the exact location of the hernia (the upper median, 3 cm or less proximal or distal to the umbilicus, or the lower median).

At the onset of anesthesia, a cephalosporin was administered intravenously. In the patients assigned to undergo repair with sutures, the two edges of the fascia were approximated in the midline, usually with a continuous polypropylene suture (Prolene no. 1, Ethicon,) with stitch widths (tissue bites) and intervals of approximately 1 cm. In the patients assigned to undergo repair with use of mesh, the dorsal side of the fascia adjacent to the hernia was freed from the underlying tissue by at least 4 cm. A polypropylene mesh (Marlex or Prolene) was tailored to the defect so that at least 2 to 4 cm of the mesh overlapped the edges of the fascia, and the mesh was sutured to the back of the abdominal wall 2 to 4 cm from the edge of the defect with a continuous suture (Prolene no. 1). To minimize contact between the mesh and the underlying organs, any peritoneal defect was closed or the omentum was sutured in between. When this could not be done, a polyglactin 910 (Vicryl, Ethicon) mesh was fixed in between. The fascial edges

were not closed over the prosthesis unless a completely tension-free repair could be performed. Drainage and closure of the subcutis and closure of the cutis were optional. The duration of surgery and the hospital stay was noted.

The patients were evaluated by physicians 1, 6, 12, 18, 24 months after surgery. Patients awareness of any recurrence of the hernia and concern about the scar were noted. When patients were asked whether they had pain, their responses were recorded as simply "yes" or "no." The scar was examined for recurrence of hernia, which was defined as any fascial defect that was palpable or detected by ultrasound examination and was located within 7 cm of the site of hernia repair. The examination included palpation while the patient was in the supine position with legs extended and raised. Ultrasound examinations were performed only when physical examinations were not definitive.

### Results

Postoperative results are frequently complicated by seroma formation, wound infections, wound discomfort and recurrence. Whereas a sizable seroma is seen in about 30% of the patients, it rarely requires reintervention apart from aspiration. However, there always are a few patients with excessive fluid accumulation around the wound who require surgical intervention and removal of the seroma capsule, which may have persisted for months. Infections may be expected in about 10% of the patients. Usually restricted to the subcutaneous space, they should be treated conservatively as common wound infections. Even if the infection encroaches into the mesh itself, a conservative attempt is justifiable, provided the mesh is porous. Late infections appearing after months or even years are more challenging. They are often combined with complex fistulas including bowel. In these cases, preservation of the mesh is likely to fail and sooner or later most of the mesh has to be removed. After a temporary mesh-free closure, any subsequent mesh repair should be performed no sooner than 6 months later. Moderate complaints after incisional hernia repair are quite common, especially in patients with a long history of previous incisions. Fortunately, the development of a 'stiff abdomen' is rare, although it sometimes requires a mesh exchange. Whether modern large-pore meshes with preserved elasticity can prevent this unpleasant complication is not yet clear. For patients and surgeons, recurrence is the most concerning complication. Owing to the stability of the implants, mesh ruptures remain rare. Recurrences are mainly at the border of the mesh, indicating insufficient overlap. Of 40 incisional hernia repairs performed in our department, only 2 patients required reoperation for recurrence after mesh repair. The median time to recurrence was 21 months. In 40 patients, the previous incision crossed the *Linea alba*. In 1 case, the recurrence manifested in the subxiphoidal area. In 1 cases of abdominal wall defect, the recurrent hernia passed through the mesh. Those affected underwent a second mesh implantation at a revisional operation and an attempt was made to increase the width of overlap by healthy tissue & the other patient received a complete mesh exchange, a closure of the circumscriptive defect reinforced by the onlay technique.

### Discussion

The techniques used for repairing incisional hernias have generally developed in a practical, experiential way. Several authors have reported favorable results with mesh repair, but to date this technique has not been studied systematically. We now report the results of a prospective, randomized, multicenter trial in which suture repair was compared with mesh repair; the latter was determined to be more effective.

In techniques for the repair of incisional hernias in which sutures

are used, the edges of the defect are brought together, which may lead to excessive tension and subsequent wound dehiscence or incisional herniation as a result of tissue ischemia and the cutting of sutures through the tissues. With prosthetic mesh, defects of any size can be repaired without tension. In addition, polypropylene mesh, by inducing an inflammatory response, sets up a scaffolding that, in turn, induces the synthesis of collagen. Our study establishes the superiority of mesh repair over suture repair with regard to the recurrence of hernia.

Patients with hernias who had undergone surgery for an abdominal aortic aneurysm had significantly higher recurrence rates than patients without such a history. An increased frequency of primary or recurrent inguinal and incisional hernia in patients who have had an aneurysm has been previously reported in some retrospective studies but not in others. Whether an inherent defect in healing exists in patients with aortic aneurysms or hernial disease is not known, but possible defects in healing may be explained by defects in collagen and elastin cross-linkages, increased activity of elastase with reduced content of elastin, and different relative proportions of collagen subtypes. Smoking may also be a factor, but it was not a factor in this study (data not shown).

We took no measures to prevent the evaluating clinicians and patients from knowing the type of repair used in each case; this might be considered a limitation of the study. The forms used to record the findings of the postoperative examinations did not include information on the type of repair used. Furthermore, in a thorough examination, the technique performed may be detected, because after mesh repair, a fascial rim can be palpated in some patients with a large fascial defect. Therefore, the examining physicians may have known which technique was used, and bias on their part may have affected the outcome. However, the rate of recurrence after suture repair was similar to that predicted on the basis of our previous work. Also, when only the self-reported recurrences, which are likely to be less susceptible to biased ascertainment, were counted, the difference remained significant.

The size of the hernia was an independent risk factor for recurrence in two retrospective studies by our group, in which "approximating" (edge-to-edge) fascial repairs and "overlapping" repairs were evaluated, but not in another study. In medical records, however, the size of the defect is often described insufficiently, so analyses of retrospective data are less reliable. Also, the extent of the decrease in laxity of the tissue surrounding the hernia, which is influenced by retraction of muscle and scarification of tissues, may be more important than the actual size of the fascial defect. In this prospective study, the size of the defect was not a risk factor for recurrence. Infection did not lead to the removal of mesh in this and most other series, but it was a risk factor for recurrence. Therefore, the administration of broad-spectrum antibiotics at the induction of anesthesia is recommended.

On the basis of our results, we recommend attachment of the prosthesis to the dorsal side of the defect with an overlap as large as possible, and we recommend that the mesh be sutured to the surrounding fascia with intervals of no more than 1 to 2 cm between stitches. Bulging must be prevented, but the mesh should not be implanted under tension. Contact between the polypropylene mesh and the viscera must be avoided because of the risk of adhesions, intestinal obstruction, and fistulas. When the peritoneum cannot be closed or when omentum cannot be interposed, polyglactin 910 (Vicryl) mesh may be interposed to protect the viscera, but experimental and clinical studies are not conclusive with respect to the efficacy of the interposition of the polyglactin mesh in preventing these complications.

In conclusion, in patients with incisional hernias, retrofascial

preperitoneal repair with polypropylene mesh is superior to suture repair with regard to the recurrence of hernia, even in patients with small defects.

## Conclusion

Despite recurrences after mesh implantation, the recently published data are encouraging. These series prove the superiority of mesh compared to simple suture repair. In summary, the use of mesh can reduce the recurrence rate from 40–50% to about 10%. Even if this effect represents only a delay in the appearance of a recurrence, it reduces morbidity and the rate of reoperation required for re-recurrence. Perhaps an extensive overlap can prolong this delay for the rest of the patient's life. Lacking valid data, mesh should be positioned behind the abdominal wall muscles (sublay technique) using physiologic abdominal wall pressure for further fixation of the implant. If (and only if) retromuscular placement cannot be achieved, an onlay implant is justified. In the absence of results from randomized trials, closure of the covering fascia is preferred with nonabsorbable suture material because it is a logical step when utilizing nonabsorbable mesh. Extended defects of the abdominal wall where the fascia cannot be closed and the mesh is used to bridge the defect must be reinforced by materials with a tensile strength of >32 N/cm. Further technical pitfalls mainly refer to anatomy but usually can be answered successfully. Mesh explantation is strictly limited to patients with complex infections or a 'stiff abdomen.'

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