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Review and Follow up of Open Pre-rectus Mesh Repair in the Management of Midline Incisional Hernias

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Abstract

Background: Repair of incisional hernia with prosthetic mesh provides tension free closure of the abdominal wall with improved results. Different methods of fixation of mesh have been described with varying results. Mesh fixation to the fascia is the most important part of a hernia repair. Anterior rectus sheaths are tough aponeurotic structures and so are ideal for mesh fixation. This study reports the long-term results of placement of prosthetic mesh in pre-rectus position and fixation to anterior rectus sheaths along with linea alba by open technique, for incisional hernias occurring in the midline. The primary end point was hernia recurrence.

Patients and Methods: A total of 126 consecutive patients with incisional hernias occurring in the midline were operated from July 2009 to October2020. After dissection of the plane between rectus muscles and anterior rectus sheath, a polypropylene mesh of suitable size was placed in front of the rectus muscles and fixed to the posterior surfaces of anterior rectus sheaths and the linea alba. In 2013, cases were reviewed and the study continued. The patients were followed on phone or by personal visits up to March 2021.

Results: The average period of follow up was 60 months. There were five recurrences. Wound infection was noted in 16 patients with complete healing in all cases with antibiotics and dressings. There were 4 cases of seroma, 5 cases of skin edge necrosis and two cases of suture sinus. There was no mortality, mesh infection or extrusion.

Conclusion: Open 'pre-rectus' technique for repair of midline incisional hernias is effective with a low recurrence rate.

Keywords: Midline Incisional, Mesh Fixation, Polypropylene Mesh.

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Introduction

Incisional hernias are more frequent following midline laparotomies. Incisional hernia results in considerable morbidity and complications requiring re operation. The incidence of incisional hernia varies from 7.4 % to 11%.[1,2] All incisional hernias occurring between the lateral margins of both rectus sheaths are classified as midline hernias.[3] Suture repair of incisional hernia has a high recurrence rate of 63% and should be abandoned.[4] Repair with prosthetic mesh provides tension free closure and restoration of structural integrity of the abdominal wall.[5] A decrease in the risk of recurrence by 24% is reported when repair is done with prosthetic mesh.[6] Prosthetic mesh repair is the present standard of care for repair of incisional hernias.[7] Proper positioning of the mesh and secure fixation to the fascia with adequate overlap are the most important components of the

repair of an incisional hernia. Securing the mesh to the fascia is done by many methods with varying results. There is controversy amongst surgeons about the positioning of the mesh and its fixation.[8]

Prosthetic mesh repair can be performed by open or laparoscopic method. In the open method, the mesh can be placed subcutaneously as 'on-lay' repair, or posterior to the rectus muscles as 'sub-lay' technique. In the 'on-lay' technique, direct contact of the mesh with the bowel is prevented as the mesh is placed subcutaneously, over the facial defect. On-lay technique requires wide undermining of skin to accommodate the mesh which increases the risk of seroma formation, skin necrosis, and wound infection.[9,10] The risk of separation of mesh from the fascia is high because of the less force required for separation during the activities that raise the intra-abdominal pressure.[11] Mesh repair by on-lay technique is considered as an additional procedure to suture repair and not a planned procedure of choice.[12] Recurrence rates of 12%[13] and in large hernias, 23%[14] are reported with this technique.

In the retro muscular 'sub lay' technique, prosthetic mesh is placed behind the rectus muscles. Below the arcuate line, posterior rectus sheath is not available for mesh fixation. This method is more complicated.[15,10] Recurrence rates of 4 to 20% [16, 17,13] are reported.

In the laparoscopic method, the mesh is placed over the defect from inside the peritoneal cavity. This technique is known as 'intra peritoneal on lay mesh-plasty' (IPOM). Laparoscopic repair (LR) of incisional hernia has the advantage of being less painful with less chance of infection and reduced hospital stay. Reported recurrence rates range from 4.6% to 20%[17-20] Though the risk of bowel injury with perforation is low {1.6% to 6%}[18,21, 22,19,23], it can be fatal. In cases with accidental enterotomy, mortality rate of 0.8% to 2.8% is reported.[18,24] The risk of intestinal injury increases in recurrent hernias. The incidence of seroma after LR is from 6.8% to 11%.[25,23] Not all cases are suitable for LR. Large hernias, recurrent hernias, hernias with thinned out skin, those requiring conversion to open and those involving additional surgical procedure, require open mesh repair. Scar excision and abdominoplasty are usually not part of LR, which may cause patient dissatisfaction.

The technique of placing the mesh between the rectus muscles and the anterior rectus sheath in the 'pre-rectus' position (Fig 1) is suitable for incisional hernias occurring in the midline. It keeps the mesh away from bowel and skin and so reduces the risk of infection. This study reports the long-term results of placement of mesh in pre-rectus position and fixation to the anterior rectus sheath. The primary end point was hernia recurrence. Secondary end points were wound infection, seroma formation, necrosis of skin, sinus formation and mesh infection or extrusion.

Aims and Objectives

To identify the rate of recurrence, wound infection, seroma formation and mesh infection or extrusion in patients with incisional hernia repaired by open pre-rectus technique.

Patients and Methods

Between July 2009 and October 2020, a total of 126 consecutive incisional hernias (Table 1) occurring in the midline were repaired in 123 patients by open 'pre-rectus' technique. All the cases were operated by the author after obtaining consent. One hundred and eight hernias were in females (86%) and 18 hernias were in males (14%). The mean age was 46years (28-75) In March 2013, cases were reviewed and institutional ethical committee permission was obtained. Patients were followed up to March

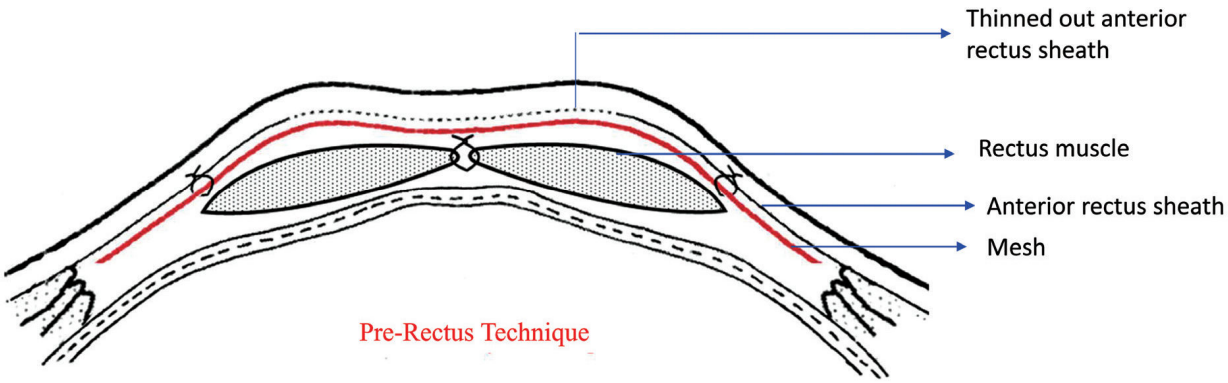


Fig. 1: Pre rectus plane

2021 either by phone call or by personal visits at 6 months intervals.

Table 1. Demographic and Hernia data

No. of Patients	:	123
No. of Hernia repairs	:	126
F:M	:	6:1
Age (years) mean and range	:	46 (28-75)
No previous repair (R0)	:	86
One previous repair (R1)	:	32
Two previous repairs (R2)	:	6
Three previous repairs (R3)	:	2
Total	:	126

Operative Technique

At the time of anaesthesia 1000mg of ceftriaxone sodium and 500mg of amikacin were given intravenously. Ceftriaxone was repeated if the surgery time extended for more than 3 hours. A transverse incision over the hernia defect was employed in all the cases. A vertical incision was added to the procedure when necessary. The hernia sac was opened and adhesions were released. The contents were replaced into the peritoneal cavity. The inside of parietal peritoneum was palpated for more defects. The rectus sheaths on both sides were opened at 3 "O' clock and 9 "O' clock positions in relation to the defect with transverse incisions in the anterior layer of both the rectus sheaths, for about 1 to 2cms from the medial edge of rectus sheaths (Fig 2).

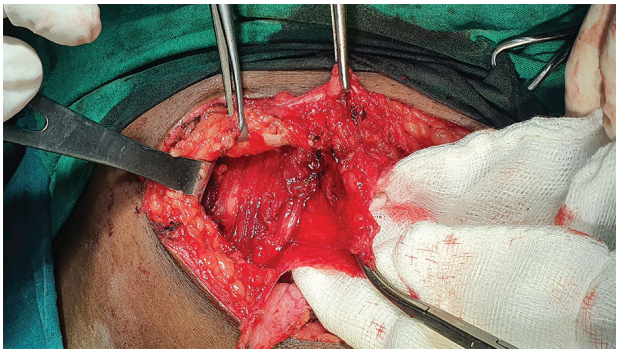


Fig 2. Rectus sheath dissection

This facilitated the dissection of anterior rectus sheath from the rectus muscles. Above the arcuate line, posterior rectus sheaths were divided and separated from the anterior rectus sheath, for about 3 to 5cms above the upper end of the defect. The peritoneum in the midline was carefully separated from the linea alba. Below the arcuate line, the peritoneum was separated from the medial edge of the rectus muscles and the linea alba. The rectus muscles were separated from the anterior rectus sheaths laterally up to the lateral border of the rectus muscles. This process included the dissection of tendinous intersections where ever necessary. Thus, the linea alba together with anterior rectus sheath is cleared off the rectus muscles laterally and peritoneum in the middle.

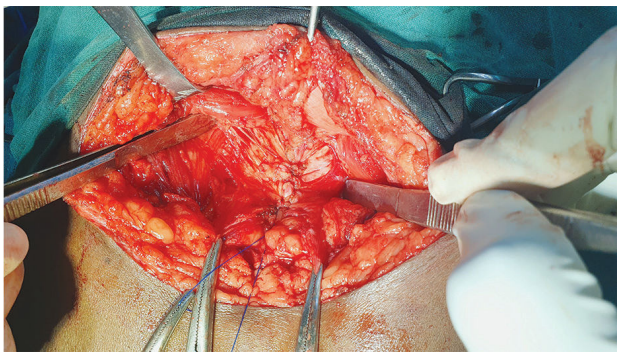


Fig 3. Closure of posterior Rectus sheathperitoneum.

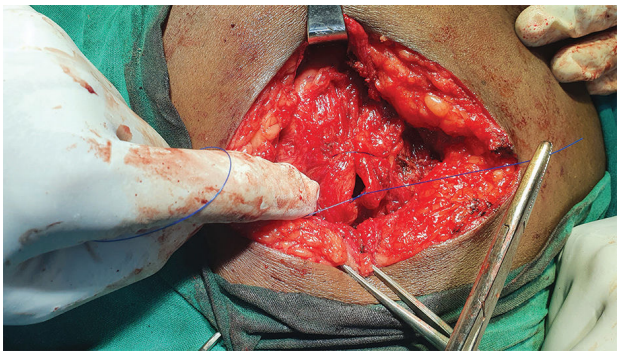


Fig 4. Approximation of rectus muscles.

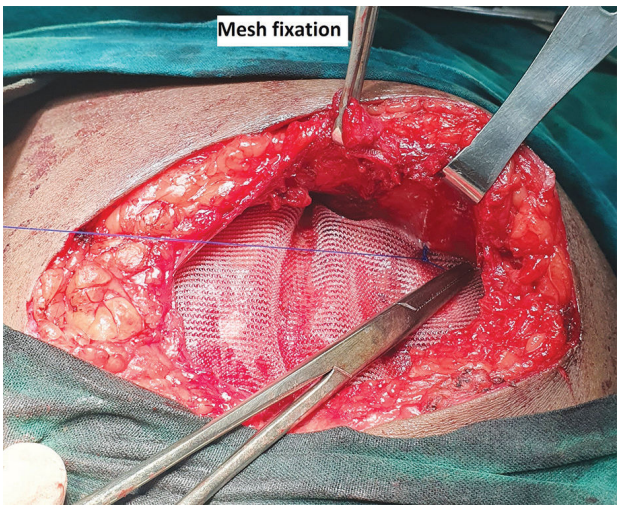


Fig 5. Mesh fixation.

The posterior layers of the rectus sheaths were approximated and stitched together with 2/0 polypropylene continuous suture which was continued downwards to close the peritoneum (Fig

3). The rectus muscles were brought to the mid line and approximated whenever possible (Fig 4). A polypropylene mesh of suitable size is placed over the rectus muscles and fixed to the under surface of anterior rectus sheath with an overlap of 3 to 5cms all around the margin of the defect with eight to twelve interrupted sutures of 2/0 poly-propylene on all the sides and angles (Fig 5).

After performing 29 procedures, one recurrence was noted. Hence, it was decided to provide additional strength to the repair by applying a circumferential, continuous suture about 0.5 to 1cm inner to the interrupted sutures with 1/0 polypropylene. This additional procedure which helped to 'seal-off the defect', was done in all the rest of the 97 cases. In large hernias, another continuous suture was placed, 1cm inside the first continuous suture.

The stretched out and thin layer of anterior rectus sheath, which was trimmed, if necessary, was closed over the mesh with running suture of 1/0 or 2/0 polypropylene (mesh augmentation [26]). In cases where excision of sac along with scar tissue resulted in a gap, which could not be closed or could be closed partially, it was left open to subcutaneous plane (mesh bridging.[26] When proper size of mesh was not available, two meshes were stitched together by quilting technique, with an overlap of 5cms to create a mesh of adequate size.

Abdominoplasty in the form of excision of scar, lose skin or fatty apron was done whenever necessary. Two vacuum drains of FG16 were placed, one deep to the anterior rectus sheath and one in the subcutaneous plane. Skin was closed with interrupted stitches of nylon.

Post-Operative Care and Follow-up

Post operatively, one dose of injection ceftriaxone sodium was given 8 to 10 hours after surgery and from day one tablet cefuroxime axetil 500mg was given twice a day for 5 days. Antibacterial was continued parenterally, when required, until patient was allowed orally. Drains were removed on the 6th postoperative day and the patient was discharged between 7th to 10th postoperative day. Sutures were removed on 10th or 12th day. All patients were asked to visit out patient department, once, twice, or thrice a week, for 4 weeks or until the wound healed completely. Abdominal support with a binder was advised for three months. Further follow up was done every 6 months by personal visit or phone call.

Results

Wound infection occurred in 16 patients (13%) (Table 2), seven of which were due to seromas or necrosis of skin edge. Seroma was noted in 4 patients (3%). Two seromas were aspirated and two were drained. Infection developed in the two cases which were drained. There were 5 cases of skin edge necrosis (4%). All the five got infected. In all the cases there was complete healing with wound dressings and antibiotics. Suture sinus occurred in two cases (1.6%) which healed after removal of suture. There were no major systemic complications or mortality.

Table 2. Complications n=126

Wound infection	:	9
Seroma with infection	:	2
Necrosis of skin with infection	:	5
Seroma	:	2
Suture sinus	:	2
Mesh infection/extrusion	:	0
Total	:	20 (16%)

There were no cases of mesh infection or extrusion. The follow up period varied from 2 to 139 months with an average of 60 months. Eighty-eight patients could be followed up to March 2021 and they were all doing well. Three patients, were included twice in the study; two cases were done for recurrences in this study, and the other was for a hernia following a laparotomy through the in-situ mesh for ovarian carcinoma at 34 months. Eight patients died after follow up periods of 120, 96, 2, 78, 31, 59, 10 and 41 months due to unrelated causes. There were of recurrence (4%) after follow up periods of 8, 22, 32, 38 and 29 months.

Twenty-five patients were followed for incomplete periods ranging from 2 months to 121 months, because, after some period of follow up, they were not traceable. Out of the 5 recurrences, three (10%) were in the initial 29 cases in whom only interrupted stitches were employed to fix the mesh (Table 3). In the rest of 97 cases in whom additional circumferential and continuous stitch was applied, there were two recurrences (1.6%).

The average size of the defect was 46 cm2 (range:9–240cm2). The average size of the mesh used was 225 cm2 (range: 82.5-576cm2). The ratio of mesh size to defect size (M:D) was 4.9. Forty patients were operated for recurrent hernias (32%), out of which 32 were suffering from one recurrence (R1), 6 from two recurrences (R2) and 2 from three recurrences (R3). The previous repairs in these patients were, 12 suture repairs, 24 open mesh

Table 3. Recurrence (n = 126)

	N	Mean follow up (months)	Recurrence
Mesh fixation-			
-Interrupted sutures only	29	95	3
-Interrupted andcontinuous sutures	97	46	2
Recurrent hernias	40 (32%)	60	0
Large hernias	15 (12%)	82	0

on-lay repairs, 2 IPOM procedures and two open pre-rectus repairs. The 2 open pre-rectus repairs were from this study. No recurrence was noted in these 40 patients at a mean follow up of 60 months (range:2-136). Incisional hernias with a width of more than or equal to10cms are classified as large hernias [10]. There were 15(12%) large hernias in this study, out of which 6 were recurrent. No recurrence was noted in the large hernias at a mean follow up of 85 months (range:13-139).

Four patients presented with intestinal obstruction, out of which, two were treated by release of obstructing bowel loops and repair and in other two patients, resection of small bowel with anastomosis was done. In one of these two patients with three previous hernia repairs, the bowel was devitalized and in the other patient, the bowel was densely adherent to the mesh placed intraperitoneally in the previous IPOM procedure. Superficial wound infection occurred in both patients, but there was no mesh infection, extrusion or recurrence. In one patient with previous open mesh repair, there was accidental enterotomy which was closed with 2/0 polygylactin suture and the patient made uneventful recovery. All these 3 patients in whom two small bowel resections and one closure of enterotomy were done, were suffering from recurrent hernias and hence, the risk of infection was explained to the patient and mesh implantation was done to avoid the need for another repair.

Discussion

This study aimed at assessment and evaluation of open pre-rectus technique in the treatment of midline incisional hernias. There was no selection of cases except for their midline nature. In the consensus study on classification of abdominal wall planes by Delphi method[27] this plane was labelled as 'plane B' and described as 'ante-rectus'. This technique is comparatively new and there are no reports in the literature with large sample and long term follow up. The two anterior rectus sheaths, with linea alba in the middle, form a tough aponeurotic structure to which the mesh is fixed with a horizontally oriented repair. Horizontally oriented repair causes less tension on the suture line.[10] Because the mesh is sandwiched between rectus muscles and anterior rectus sheath, a bolstering effect is produced, which results in a more secure repair. M/D ratio is an important parameter which indicates the strength of repair. The M/D ratio in this study was 4.9. Increased fixation strength is required as the defect becomes larger and the M/D ratio decreases.[28] For secure fixation of mesh, M/D ratio of 5 or >5 is necessary. Recurrence is the most important outcome to be studied in any type of repair of incisional hernia.

Proper estimation of recurrence rates, requires a 10 year follow up because 92% of recurrences occur in the first 10 years.[29] The recurrence rate of 4% in this study is comparable to that of most other series. The 3 cases of recurrence in the initial 29 cases can be attributed partly to the inexperience with this technique in the beginning of this study and partly to inadequate fixation. The technique of applying a continuous stitch in addition to the interrupted stitches helps to 'seal off the defect'. In the later 97 cases in this study, wherein, this technique was used, the recurrence rate was 1.6%. Mesh infection or extrusion is a serious complication after hernia repair, leading to recurrence and re operation. There was no case of mesh infection or extrusion in this study in spite of wound infection rate of 13%.

Repair of recurrent incisional hernias is technically difficult and very little data is available on the treatment of recurrent incisional hernias.[30] The reported recurrence rate after laparoscopic repair of recurrent hernias was 5.7%[31] and after retro muscular mesh repair it was 8%.[32] For large midline incisional hernias repaired with on-lay, in-lay and sub-lay techniques, an overall recurrence rate of 28.3% was reported.[14] No recurrence was noted either in the recurrent hernias or large hernias in this study.

The important limitations of this study were that it was observational and partially retrospective. Another limitation was that 100% follow up was possible in 101 out of 126 cases (80%). Randomized controlled studies comparing pre-rectus technique with other open repair techniques are necessary.

Conclusion

Open pre-rectus technique of mesh repair is effective in the treatment of midline incisional hernias with low recurrence rate and low risk of mesh infection.

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