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General Surgery

MANAGEMENT OF LARGE INCISIONAL HERNIAS WITH MULTIPLE PROLENE MESH SUTURES : OUR EXPERIENCE

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ABSTRACT Management of Large incisional hernias (LIH) measuring more than 10 cm in diameter or surface area of more than 100cm² is very challenging because of the varied presentation at the time of admission like presence of skin necrosis , features of obstruction and strangulation, enterocutaneous fistulae, immobility etc. and propensity for myriads of post operative complications .18 patients with Large incisional hernias i.e. 12 females and 6 males with age varying between 23 and 65 years were treated in a tertiary service hospital with a new modality of incisional hernia repair by using Multiple Prolene Mesh Sutures either alone or with reinforcement by low profile polypropylene with e PTFE prosthesis . All patients were followed up for a period of 12 months. The result were extremely satisfying with significant reduction in post operative complictions like infection, pain , mesh extrusion and recurrance and much reduction in Hospital stay.

KEYWORDS : Large Incisional Hernia (LIH) ; Multiple Prolene Mesh Sutures

INTRODUCTION

Surgical mesh has become an indispensable tool in hernia repair to improve outcomes and reduce costs ; however, efforts are constantly being undertaken in mesh development to overcome postoperative complications. Common complications include infection, pain, adhesions, mesh extrusion and hernia recurrence [1]. The use of mesh during LIH repair displayed the best recurrence rates and hazards. Of all the mesh techniques, sublay repair, sandwich technique with sublay mesh and aponeuroplasty with intraperitoneal mesh displayed the best results [2]. The impact of mesh was clearly demonstrated in a multicentre randomized study published in the New England Journal of Medicine. Luijendijk et al reported that patients undergoing standard suture repair experienced a recurrence rate of nearly double that of patients with mesh repair [3[.Prosthetic meshes are widely applied to reduce hernia recurrence rates. The 10-year incisional hernia recurrence rate is reported to be 63% for traditional suture repair without mesh and 32% for repairs using prosthetic mesh. While meshes are obviously beneficial, they remain associated with several serious complications including hernia recurrence, infection, chronic pain and adhesions [1]. Innovations by plastic surgeons in the field of abdominal wall reconstruction have served to limit the morbidity and increase the durability of ventral hernia repair procedures [4]. However, the most significant innovation would be one that effectively prevents the laparotomy failure that drives incisional hernia formation [5]. Over the past 3000 years, sutures used to oppose divided tissues have changed little from their initial flexible linear design [6]. In a classic study published in 2015 the authors demonstrated it is possible to modulate the suture-tissue interface with a novel mesh suture design. This suture design aims to decrease suture pull-through by means of increased elasticity, larger suture-tissue interface area, and progressive tissue incorporation of the suture .They concluded Mesh sutures better resisted suture pull-through than conventional polypropylene sutures. The design elements of mesh sutures may prevent early laparotomy dehiscence by more evenly distributing distracting forces at the suture-tissue interface and permitting tissue incorporation of the suture itself [7].Similar encouraging results has been demonstrated in other experimental studies [8]. In this study we present our experience in management of 18 Large Incisional Hernias with Multiple Prolene Mesh Sutures where a strip of planar mesh is introduced through either side of the abdominal wall with a sharp instrument and simply tied as a suture.

MATERIAL AND METHODS

This study is based on the experience in treating 18 patients of Large incisional hernias (LIH) measuring more than 10 cm in diameter or surface area of more than 100cm²[**Fig 1**] in a tertiary service hospital by using Multiple Prolene Mesh Sutures either alone or with reinforcement by low profile polypropylene with e PTFE prosthesis. Of the 18 patients 12 were females and 6 were males. Age of patients varied from 23 years to 65 years. On admission, a comprehensive history was taken and detailed clinical assessment was carried out with emphasis on the previous surgery undergone and if associated with any complication, how long back, history suggestive of obstruction or strangulation, presence of any enterocutaneous fistula , history of smoking , presence of obesity, any bleeding disorder ,any evidence of skin necrosis, any associated pain , any difficulty in locomotion or in carrying out routine activities , presence of anaemia, any other co-morbidities , history of medication with oral anticoagulants and associated conditions like pregnancy. The patient presentation at the time of admission to the hospital is depicted in [**Table 1].**

Polypropylene mesh (PROLENE Mesh, Ethicon) of size 30 × 30 cms was cut into 20-mm-wide and 15 cm long strips or mesh sutures. The decision to use the Multiple Prolene Mesh Sutures either alone or with reinforcement by low profile polypropylene with e PTFE prosthesis was taken based on contraindication to the use of sheet mesh including the added time needed for placement, contamination, lack of a posterior sheath for avoidance of intraperitoneal mesh placement against bowel and considering the size of the fascial defect. For lateral defects, Multiple Prolene Mesh Sutures repairs were conducted to avoid the surgical difficulties required for placement of a planar mesh and due to the known failure rates associated with standard suture applications. All patients were informed preoperatively about the benefits and risks of repair with sutures, meshes, and mesh strips used as sutures. In all cases prophylactic antibiotics were given (Inj Cefotaxime and Inj Amikacin) and surgery carried out under general anaesthesia.

The surgical technique involved is initially, separation and elevation of the subcutaneous tissue from abdominal wall to achieve a 1-cm bite of unscarred abdominal wall at distance of 1 cm from each other for the interrupted mesh suture closure. After thorough debridement of the abdominal wall defect edges, a sharp hemostat was used to make holes in the abdominal wall approximately 1 cm from edge of the abdominal wall defect or the rectus muscle. The mesh strip was then pulled through the substance of the abdominal wall and then tied like a suture with 3 throws to close the defect **[Fig 2]**.

In two cases where the the fundal diameter of the incisional hernia was > 40 cms and the abdominal defect was > 15 cms omentectomy was performed to accommodate the bowel in the repaired abdomen without tension on the repair. In these cases, reinforcement with Ellipse shaped (21cm X 26.1cm) low profile polypropylene with e PTFE prosthesis was carried out with the prosthesis overlapping 4 cms the abdominal defect margin and secured to the abdominal wall undersurface with non absorbable sutures **[Fig 3]**. The amount of excised hernia tissue prior to LIH repair can be appreciated from **Fig 4**. In four cases which presented with bowel obstruction, adhesiolysis and bowel viability and continuity was ensured before hernia repair.

All patients were followed up for any post operative complications requiring intervention, readmission and reoperation for 30 days, duration of hospital stay and the findings recorded. Surgical site occurrence (SSO) defined as any surgical site infection (SSI), seroma,

hematoma, delayed wound healing, enterocutaneous fistula, reoperation, or dehiscence. Seroma was defined as any appreciable subcutaneous fluid collection in the postoperative period that was drained to promote healing and not treated with antibiotics. SSI was defined as a clinical diagnosis of wound infection based on the appearance of wound erythema, drainage, and need for postoperative antibiotics. Follow up detailed physical examination with CT Scan of abdomen was carried out at 03,06 and 12months.All patients were contacted either physically or telephonically at 18 months to get a feedback.

Table 1 Patient presentation of patients with LIH treated with Multiple Prolene Mesh Suture technique

S. no.	Age (Yrs)	Sex (M/F)	BMI Kg/m²	Known Smoker (Y/N)	Other Co-morbidities	H/O of COPD	Previous Surgery approach	Previo-us surgery how long back	Complications In previous Surgery	Fundal Diameter of Hernia/Actual abd wall defect at surgery	Skin necrosis present	Pain	Others (Physical Limitation/Bowel obstruction, strangulation /Entero-cut fistula
1.	23	M	32	Y	-	-	Midline Laparotomy	1yr	SSI	14.0/10.4 cm	no	yes	no
2.	35	M	30	Y	-	yes	Rt Subcostal Incision	2½yr	no	16.5/10.6 cm	no	no	no
3.	41	F	32	N	Diabetes Mellitus	no	Midline Laparotomy	1½yr	Wound dehiscence	22.0/12.2 cm	no	yes	no
4.	36	M	24	Y	Immunosurveillance for HIV	no	Midline Laparotomy	2yr	no	14.5/10.3 cm	no	yes	Bowel obstruction
5.	42	F	32	N	-	no	Pfannenstiel	3yr	SSI	18.0/12.1 cm	no	yes	no
6.	51	F	35	N	Diabetes Mellitus	no	Pfannenstiel	8yr	SSI	21.5/13.3 cm	yes	yes	no
7.	30	M	25	Y	no	no	Midline Laparotomy	3yr	no	14.0/10.5 cm	no	yes	Bowel obstruction
8.	28	F	30	N	no	no	Pfannenstiel	5yr	no	15.0/11.0 cm	no	yes	no
9.	52	F	32	N	no	yes	Midline Laparotomy	7yr	no	18.5/12.5 cm	no	yes	no
10	52	M	26	Y	Diabetes Mellitus	yes	Midline Laparotomy	4yr	no	15.0/10.4 cm	no	no	Bowel obstruction
11.	62	F	32	N	no	no	Pfannenstiel	10yr	no	21.0/12.0cm	no	yes	no
12.	65	F	46	N	Anaemia	no	Pfannenstiel	10yr	SSI	42.0/16.0cm	yes	yes	Bed Ridden for weight of hernia
13.	28	F	25	N	no	no	Pfannenstiel	2yr	SSI	14.0/10.5cm	no	yes	no
14.	48	M	28	Y	Diabetes Mellitus	yes	Transverse	5yr	SSI	14.5/11.2cm	no	yes	no
15.	62	F	42	Y	no	yes	Pfannenstiel	12yr	Wound dehiscence	44.0/18.0cm	yes	yes	Bed Ridden for weight of hernia
16.	52	F	30	N	no	no	Transverse	5yr	no	15.5/11.0cm	no	no	no
17.	48	F	26	N	no	no	Midline Laparotomy	4yr	no	15.0/12.0cm	no	yes	Bowel obstruction
18.	46	F	32	N	no	no	Pfannenstiel	6yr	SSI	14.5/10.5cm	no	yes	no

Fig 1 Phototograph of a patient with LIH with hernia fundal diameter more than 40 cm before and after surgery

Fig 2 Large i ncisional hernia repair with Multiple Prolene Mesh Sutures (16 cases)

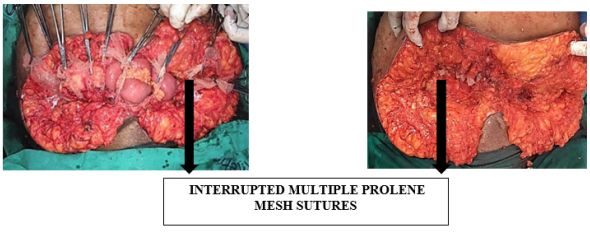


Fig 3 Reinforcement with Ellipse shaped (21cm X 26.1cm) Low profile polypropylene with e PTFE prosthesis prior to multiple prolene mesh sutures at the edges of the abdominal wall defect in LIH > 40 cm fundal diameter(2 cases)

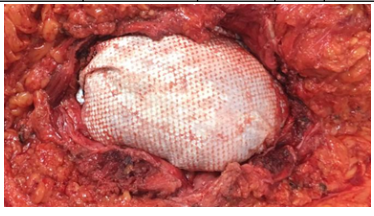
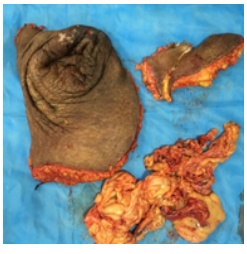


Fig 4 Excised tissues prior to LIH Repair including excised omentum



RESULTS

We managed 18 patients with Large Incisional Hernias measuring more than 10.0 cms in diameter or surface area of more than 100 cm² in 12 females and 08 males with age varying between 23 and 65 years in our hospital with a new modality of Incisional Hernia Repair by using Multiple Prolene Mesh Sutures in all cases. In addition in 02 cases,

where the fundal diameter of the hernia was in excess of 40.0 cms and the abdominal defect was more than 15.0 cm, the repair was re-inforced by low profile polypropylene with e PTFE prosthesis. The fundal diameter of the hernias was found to vary between 14.0 cms and 44.0 cms. And at surgery, the abdominal wall defect was found to vary between 10.3 cms and 18.0 cms.

The deductions drawn from study of patient profile, co-morbidities and clinical history is presented in **[Table 2] .**

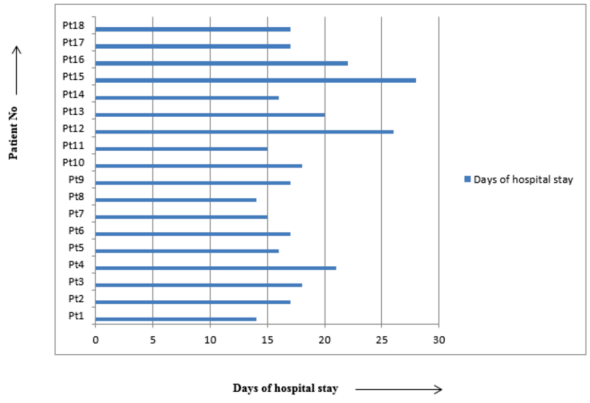
Table 2 Patient profile ,Co-morbidities and Clinical Hisory of patients with LIH Treated by multiple prolene mesh suture technique

S.No	Patient Parameters	No of patients (% of Total No of patients)
1.	Age > 40 years	12 (66.66%)
2.	Sex	12 (66.66%) females ; 06 (33.33%) males
3.	BMI > 30 kg/m²	12 (66.66%)
4.	Associated co-morbidities like Diabetes Mellitus, Anaemia, Immunosurveillance for HIV	06 (33.33%)
5.	Smokers	07 (38.88%)
6.	Presence of COPD	05 (27.77%)
7.	Previous surgery and approach	08 (44.44%) Pfannenstiel incision; 07 (38.88%) Midline Laparotomy
8.	Complications at previous surgery	09 (50.00%)
9.	Presence of skin necrosis	03 (16.66%)
10.	Presence of pain	15 (83.33%)
11.	Bowel obstruction at presentation	04 (22.22%)

Only 02 cases of Seroma were recorded as complication in total of 18 cases of Hernia Repair by multiple prolene mesh suture technique in our study. Both cases occurred in the 02 patients with massive LIH, where the fundal diameter of the hernia was in excess of 40.0 cms and the abdominal defect was more than 15.0 cms and the repair was re-inforced by low profile polypropylene with e PTFE prosthesis. In these cases the Seroma was drained and Vacuum assisted closure applied for one week and patients discharged from Hospital after the wounds healed.

The length of hospital stay in cases of LIH managed by us varied between 14 days and 28 days [Chart 1]

Chart 1 Chart showing the length of hospital stay in 18 cases of LIH managed with multiple prolene mesh suture technique



DISCUSSION

In the literature, many different definitions of LIH are proposed but consensus is lacking [2]. In our study, LIH is defined as ventral incisional hernia with a fascial defect of 10 cm or more in any direction according to the definition of the European Hernia Society [9] or a defect surface area of 100 cm² or more. Patients with LIH often experience severe symptoms and associated co-morbidities. Patients with LIH may have complaints of severe back pain, disturbance of ventilatory function, chronic wounds or enterocutaneous fistulas, resulting in a major decrease in quality of life and daily activities [10-11]. LIH repair is technically challenging and is associated with a longer hospital stay, impaired wound healing, a higher rate of reoperations and readmissions and increased recurrence rates [12-13]. The factors that showed a significant relationship with the occurrence of complications were diabetes mellitus, obesity, smoking, hypoproteinemia, advanced age, size of fascial defects, and number of defects [14]. Recurrence rates of 50% after suture repair of an incisional hernia were reproduced in several studies [15]. It was the introduction of mesh by Usher et al in 1958 that opened a new era.[16]. Reinforcement of the abdominal wall with strong polyester or polypropylene nets produced a resilient scar-mesh compound that prevented recurrences through the mesh. Indeed, recurrences through mesh are still a rarity. In accordance with the widespread use of mesh, several personal series reported excellent results, with recurrence rates of far less than 10% [17]. All high-tension internal surgical closures require that the ultimate tensile strength (UTS) of the repair remains greater than the forces applied. Otherwise, changes at the suture/tissue interface (STI) will lead to acute or chronic suture pull-through and surgical failure. For the abdominal wall, prophylactic flat meshes have been shown to improve outcomes of laparotomy closures and hernia repairs [18]. Unfortunately, flat planar meshes have their own drawbacks, including increased time for placement, increased foreign material, increased tissue dissection, pain, infection, and cost. Planar meshes reduce hernia formation by improving the UTS of the repair and by better distributing forces at the STI. Yet, all these theoretic benefits of planar meshes could be achieved with a better-designed suture [19] .

In a pathbreaking experimental study, the authors put forward a novel mesh suture design aimed at minimizing the early laparotomy dehiscence that drives ventral hernia formation. The authors hypothesized that modulation of the suture-tissue interface through use of a macroporous structure and increased aspect ratio (width-to-height ratio) would decrease the suture pull-through that leads to laparotomy dehiscence. Mesh sutures better resisted suture pull-through than conventional polypropylene sutures. The design elements of mesh sutures may prevent early laparotomy dehiscence by more evenly distributing distracting forces at the suture-tissue interface and permitting tissue incorporation of the suture itself. They concluded that Mesh sutures better resisted suture pull-through than conventional polypropylene sutures. The design elements of mesh sutures may prevent early laparotomy dehiscence by more evenly distributing distracting forces at the suture-tissue interface and permitting tissue incorporation of the suture itself [7].

Encouraged by the outcome of above study we managed 18 cases of LIH in our Hospital with multiple prolene mesh suture technique. There are several factors affecting the risk of incisional hernia development. Age, obesity, infection, immunomodulating therapy, diabetes and smoking are well-known factors [20]. We found that 12 patients (66%) were above 40 years of age and a similar number of our patients were females and had BMI > 30 kg/m². 07 patients (38.88%) were smokers and 06 patients (33.33%) had associated co-morbidities like Diabetes Mellitus , Anaemia and immunodeficiency due to HIV infection .

Common sites of incisional hernias are midline incision, lower transverse incisions in gynecological operations. They are also seen in different sites of incisions on anterior abdominal wall. Complications seen are cutaneous atrophy and necrosis, hernia sac thickening and adhesions, obstruction, strangulation, enterocutaneous fistula [21]. 08 (44.44%) of our patients had herniation from previous Pfannenstiel incision site and 07(38.88%) had herniation at midline laparotomy site. 09 patients (50%) gave history of complications at time of previous surgery i.e . history of SSI in 07 patients and wound dehiscence in 02 patients. Pain as a presenting complaint was present in 15 (83.33%) of our patients. 04 (22.22%) of our patients presented with bowel obstruction and 03 patients (16.66%) had skin necrosis.

Steven T. Lanier et al (2016), for management of abdominal wall defects presented a series of "mesh sutured" repairs where a strip of planar mesh is introduced through either side of the abdominal wall with a sharp instrument and simply tied as a suture. SSO occurred in 8 patients (17%), with the most common postoperative complication being a seroma treated in the office with drainage in 11 (10.3%), whereas 30-day SSI was 4.6%. Three hematomas and two infections required operative treatment of the subcutaneous tissues, and there were no deep infections or fistulas. Nine patients were readmitted within 30 days. Only one knot located at the bottom of a seroma cavity was excised in the office, and no other mesh sutures have required early

or late removal. The hernia recurrence rate of <4% at the early mean follow-up time of 234 days was encouraging [19]. In our series of cases, 02 patients (11.11%) had SSO (Surgical site occurrence) in form of Seroma. Both occurred in the 02 patients with massive LIH, where the fundal diameter of the hernia was in excess of 40.0 cms and the abdominal defect was more than 15.0 cms and the repair was re-inforced by low profile polypropylene with e PTFE prosthesis. In these cases the Seroma was drained and Vacuum assisted closure applied for one week and patients discharged from Hospital after the wounds healed. There were no cases of SSI or wound dehiscence. No recurrence of Hernia was noted at 12 months follow up in any of the patients.

The results of our management of LIH with with multiple prolene mesh suture technique has been very gratifying with low incidences of wound infections, no recurrences and reduced hospital stay. Similar results have been reported by other authors. Some of the likely reasons for the favourable outcome of mesh sutured repairs are given below.

Mesh sutured repairs employ far less foreign material and require less tissue dissection than do planar mesh repairs. The fact that the majority of the prosthetic material is incorporated and thus located within tissue, as opposed to lying on its surface as do planar meshes, most probably is protective against infection. There is a minimal contact of the mesh strip with the bowel unlike intra-abdominal meshes [19]. The physical attributes of the mesh are extremely important. Biomaterials with pores >1 mm generate the most biocompatible tissue response [22]. Another issue for tissue tolerance is the physical characteristics of the mesh strip knots. Mesh strips are predominantly air and therefore the filaments collapse when tied to produce a small knot. Unlike the knots of solid sutures, the knots of mesh sutures still maintain an element of porosity (confirmed by microCT) that permit tissue incorporation[19]

CONCLUSION

Multiple Prolene Mesh suture technique is a versatile and useful technique for management of large incisional hernias and is associated with minimal complications and reduced hospital stay.

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