

Comparison of On-lay (On the Rectus Sheath) and Sub-lay (Retromuscular) Mesh Repair of Ventral Abdominal Hernias

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ABSTRACT

Background: Ventral hernia is a defect in the anterior abdominal wall which may be spontaneous or acquired like incisional hernia after an abdominal operation. Management of these hernias remains challenging for the surgeon with significant risk of complications most notably seroma formation, surgical site infection and recurrence. Various methods for repair have been described most of which require use of mesh to bridge the defect. Although Laparoscopic repair has increasingly become popular but it requires specialised equipment and special mesh which is expensive and not widely available in Pakistan. Open repair is commonly practised and two most commonly performed methods are on-lay (on anterior rectus sheath / external oblique) or sub-lay (retro-muscular / pre-peritoneal) placement of polypropylene mesh.

Aim: To compare the rate of seroma formation, infection and recurrence following on-lay versus sub-lay polypropylene mesh repair for ventral hernias.

Methods: A total of 64 patients with ventral hernias planned for elective surgery were included in the study. These were randomised in two groups to undergo either on-lay mesh repair (On-lay group) or sub-lay mesh repair (sub-lay group). 32 patients were included in each group. Rate of seroma formation, surgical site infection and recurrence were compared between the two groups.

Results: The rate of complications of seroma formation, surgical site infection and recurrence was significantly higher in on-lay group compared to sub-lay group.

Conclusion: Sub-lay polypropylene mesh repair is far superior with much lower rate of complications of seroma formation, surgical site infection and recurrence compared to on-lay polypropylene mesh repair of ventral hernias.

Keywords: Ventral Hernia, On-lay mesh repair, sub-lay mesh repair

INTRODUCTION

Surgery for correction of Ventral hernia is one of the most common surgical procedures performed worldwide^{3,4,15}. The defect in the abdominal wall may be spontaneous or acquired developing as incisional hernias complicating up to 15% of Laparotomies^{16,17}. Repair of ventral hernias and in particular Incisional hernias is an ongoing challenge in surgical practice^{8,15,16}. Number of surgical techniques have evolved over the years ranging from direct suture techniques to the use of various types of mesh to avoid recurrence^{8,10,15,18}. However controversy remains and consensus has not been reached for the management of abdominal wall hernias^{2,4,19}.

Silver coils were used first time for the repair of groin hernia in 1844¹⁵. Francis Usher revolutionised the hernia surgery by introducing Marlex mesh for hernia repair in 1950s^{22,23} and polypropylene in 1962²¹. In 1980s French surgeons Stoppa and Rives

reported using mesh for repair of Ventral / Incisional hernias with low recurrence rate²⁴. Surgeons are confronted with the dilemma to choose the best method of repair for ventral hernias to minimise the complications notably seroma formation, surgical site infection and recurrence. Although laparoscopic repair of ventral hernias has become increasingly popular in recent years with various studies claiming efficacy and improved results, its wide use in developing countries is prohibited due to high cost of equipment and the availability and cost of special mesh^{12,16,19}. Hence open repair with direct suturing of defect or use of polypropylene mesh is widely practised. When mesh is used it is either secured on the anterior rectus sheath (on-lay repair) or retro-muscular / pre-peritoneal position (sub-lay repair)^{1,3,17}. Post-operative complications notably seroma formation, surgical site infection and recurrence are the main concerns following ventral hernia surgery and major causes of post-operative morbidity^{8,15,17}.

The aim of this study was to compare the outcome following on-lay versus sub-lay polypropylene mesh repair of ventral hernias with particular reference to

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the complications of seroma formation, surgical site infection and recurrence.

MATERIAL & METHODS

This prospective study was conducted in unit 1 of the department of General surgery in Nawaz Sharif Social Security teaching hospital Lahore over a period of 18 months from January 2013 to June 2014. Approval from the hospital ethical committee was obtained. Patients listed for elective repair of Ventral hernias from the outpatients department during the study period were included and randomised to undergo either on-lay mesh repair (on-lay group) or sub-lay mesh repair (sub-lay group). Patients presenting as emergency, Recurrent hernias, Previous mesh repair, BMI >35, Defect <3cm, Defect >10cm, Diabetes Mellitus, CLD and Pregnant patients were excluded from the study (Table 1). Procedure was discussed in detail with the patient and written informed consent was obtained. Procedure was performed under GA or Spinal anaesthesia by surgeons with experience of mesh repair of hernias. All patients had Inj. Cefuroxime 1.5gms IV at induction. The surgical technique for on-lay repair included raising skin / subcutaneous flaps and clearing the margins of the defect for 4-5cms all around. Hernia sac was dissected carefully to avoid opening the peritoneum and reduced. Any inadvertent breaches in peritoneum were closed with 2/0 or 3/0 polyglactin suture. If possible small hernia defects were approximated with continuous 0 polypropylene sutures without tension, otherwise no attempt was made to close the facial defect. Polypropylene mesh was cut to size with at least 4-5cms overlap beyond the margins of the defect. It was anchored onto the anterior rectus sheath / aponeurosis with interrupted 2/0 propylene sutures. Skin was closed with interrupted 3/0 propylene sutures over size 12 suction drain.

In patients undergoing sub-lay repair, the dissection and reduction of the hernia sac proceeds as for on-lay repair. It was followed by dissecting the margins of the defect to create a space behind the rectus muscle in the pre-peritoneal space or between the rectus muscle and posterior rectus sheath where possible ensuring the dissection extends for at least 4-5cms from the margin of the defect all around. Any inadvertent peritoneal breaches were closed with 2/0 or 3/0 polyglactin sutures. Polypropylene mesh was cut to the required size. The mesh was anchored securely in the space created with 2/0 polypropylene sutures ensuring at least 4-5cms overlap of the margins of the defect. Meticulous haemostasis was secured. Attempt was made to close the anterior sheath with '0' polypropylene over the mesh without

tension if possible otherwise no attempt was made to close the facial defect. The edges of the defect, however were anchored to the mesh with continuous 2/0 polypropylene sutures to minimise the exposed mesh. Skin was closed with interrupted 3/0 polypropylene sutures over size 12 suction drain. Post-operatively all patients received two doses of injection Cefuroxime 750mgs IV. Drains were kept until daily drainage was less than 30 mls. Patients were kept in the hospital until the drains were removed. After discharge the patients were followed up in the out patients department at 1, 3, 6, 12 and 18 months. Seroma formation, wound infection and recurrence of hernia were compared between the two groups and statistically analysed.

RESULTS

In total 64 patients included in the study underwent Polypropylene mesh repair for ventral hernia. Out of 64 ventral hernias, 43(67.2%) were Para umbilical hernias, 16(25%) Incisional hernias, 4(6.25%) Epigastric hernias, and 1(1.56%) Spigelian hernia. 45(70.31%) were female and 19(29.68%) were male with female to male ratio of 2.3:1.0. Mean age was 48.70 (20 – 68) years (Table 2).

32(50%) patients had on-lay mesh repair and 32(50%) had sub-lay mesh repair. Mean age in on-lay group was 48.03 (20 – 66) years versus 49.37 (22 – 68) years in sub-lay group. Female to Male ratio in on-lay group was 2.5:1.0 (23 F and 09 M) while it was 2.2:1.0 (22 F and 10 M) in sub-lay group (Table 3). On-lay group had 21(65.62%) Para-umbilical hernias versus 22(68.75%) in sub-lay group, 9(28.12%) incisional hernias in on-lay group versus 7(21.87%) in sub-lay group, 2(6.25%) Epigastric hernias in on-lay group versus 2(6.25%) in sub-lay group and 1(3.12%) Spigelian hernias in sub-lay group (Table 3).

8(25%) cases in on-lay group developed seroma requiring multiple aspirations. 02 (06.25%) cases in sub-lay group developed seroma that settled with aspiration. The ratio of seroma formation between On-lay and Sub-lay group was 4:1 which is statistically significant ($p=0.039$).

4(12.5%) cases in on-lay group versus 1(3.12%) in sub-lay group developed wound infection which is however not statistically significant ($p=0.167$). 03 out of 04 cases in on-lay group settled after wound drainage, administration of antibiotics after culture & sensitivity and dressings. In the remaining one case the infected mesh had to be removed. The single infected case in sub-lay group settled within two weeks with dressings and a course of antibiotics.

Patients were examined after 1, 3, 6, 12 and 18 months for hernia recurrence. 04 (12.5%) patients in

on-lay group had hernia recurrence after 12 -18 months. One was the patient in whom the infected mesh was removed. The other three patients had recurrence of hernia without infection. There was no hernia recurrence in sub-lay group. The ratio of hernia recurrence between On-lay and Sub-lay group was 4:0 which is statistically significant ($p= 0.039$) (Table 4).

Table 1: Exclusion Criteria

Emergency presentation
Recurrent Hernias
Previous Mesh repair
BMI >35
Defect <3cm
Defect >10cm
Diabetes Mellitus
CLD
Pregnant Patients

Table 2: Characteristics of Patients

	On-lay	Sub-lay
Total	n=32	n=32
Mean Age (Years)	48.03 (20 – 66)	49.37 (22 – 68)
Female : Male	2.5 : 1.0 (23 F,09 M)	2.2 : 1.0 (22 F,10 M)

Table 3: Characteristics of Hernia

	On-lay	Sub-lay
Para-umbilical Hernia	21 (65.62%)	22 (68.75%)
Incisional Hernia	09 (28.12%)	07 (21.87%)
Epigastric Hernia	02 (06.25%)	02 (06.25%)
Spigelian Hernia	n=0	01 (03.12%)
Size of defect (mean) cms	6.31 (03 – 10)	6.87 (04 – 10)

Table 4: Complications: On-lay vs Sub-lay Repair

	On-Lay n=32	Sub-Lay n=32	P-Value
Seroma	08 (25.0%)	02 (06.25%)	$p= 0.039$
Infection	04 (12.5%)	01 (03.12%)	$p= 0.167$
Recurrence	04 (12.5%)	0	$p= 0.039$

DISCUSSION

Abdominal wall hernia is a common surgical problem in clinical practice^{3,4,15}. The rate of surgical failure following ventral hernia repair is embarrassing high up to 50%^{4,10,16}. The outcome of the surgery depends upon a number of factors including experience of surgeon, meticulous dissection and the operative technique used. Although many surgical techniques have been introduced over the years, direct suture for small defects, repair with on-lay or sub-lay mesh placement and recently Laparoscopic in-lay mesh repair are most commonly used operative techniques^{8,10,15,18}. Suture less on-lay technique for incisional hernia repair using fibrin glue alone for

mesh fixation has also been introduced although not widely practiced²⁰. Direct suture may be suitable for smaller defects (<2.5cms)⁴, high rate of recurrence is recorded in direct suture repair for larger defects^{4,9,10,15,16,17,18} while use of various types of mesh have remarkably improved the outcome of ventral hernia surgery^{2,4,6,7,11,13}. Laparoscopic equipment, special mesh and training is not widely available in developing countries although studies from developed countries have shown promising results with this technique^{10,14,16,19}. The two operative techniques most frequently used are the open on-lay and sub-lay mesh repair^{1,3}. However, it remains unclear which technique is superior^{1,3,4,16}. Mesh placement in the Sub-lay position with overlapping the hernia defect was introduced in the late 1980s²⁴, presumably restricting transmission of infection from subcutaneous tissues down to the mesh^{8,17}. Stoppa and Rives technique whereby the mesh is placed between the rectus muscle and posterior rectus sheath was popularised in 1990s¹⁵ with remarkably improved results^{5,6,7,15,16}. The sub-lay technique has shown superior results compared to the on-lay mesh placement with low recurrence rates and minimum rates of complications^{1,9,15,17,18}. Infection in a mesh repair is a dreaded complication and may necessitate removal of mesh and predispose to recurrence of hernia⁵. Seroma whereby reactionary fluid accumulates at the surgical site due to extensive dissection is very common may disappear spontaneously in 6 – 8 weeks¹⁵. However majority of large seromas and persistent seromas require multiple aspirations and are prone to secondary infections^{15,17}.

On-lay mesh repair shows a high rate of wound infection and seroma formation^{8,15} as the polypropylene mesh is placed under less vascular fatty tissue, while in Sub-lay mesh repair mesh is placed in well vascularised space under the muscle possibly helping to minimise the rate of wound infection^{1,8,18} and seroma formation⁸. The placement of mesh behind the rectus muscle is more secure as the force of abdominal pressure holds the mesh against deep surface of the muscle^{4,8,15,16}. This helps to keep the rate of recurrence of hernia less with Sub-lay technique compared to on-lay technique^{8,16}.

CONCLUSION

Sub-lay mesh repair technique remains the gold standard for repair of Ventral hernias⁸ with Rives Stoppa modification providing the best results^{6,7}. Laparoscopic repair as an alternative is safe and has shown promising results^{10,13,14,16,19} but its availability in developing world is limited¹⁶, thereby open mesh

repair remains the most commonly performed procedure for Ventral hernia repair.

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