

Original Research Article

A systemic analysis of patients undergoing open ventral hernia repair (2011-2017)

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ABSTRACT

Background: The use of prosthetic mesh for reinforcing a hernia repair is considered most valid. Controversy exists regarding the use of the type of meshplasty. An insufficient evidence exists as to which type of mesh and mesh position (onlay, inlay, sublay (retrorectus) or preperitoneal) should be used. The effectiveness these methods have been systematically analysed in order to accelerate functional recovery and shorten hospitalization in patients undergoing open ventral hernia repair (VHR).

Methods: This was a Prospective randomized single blinded comparative study conducted in the Department of Surgery at SMIMER hospital, Surat for patients presenting with the complaint of anterior abdominal wall hernia over a duration of 6 years (September 2011 - September 2017) with an average follow up period of 12 months, including 318 adult patients. All patients were preoperatively assessed clinically and by ultrasonography to confirm the diagnosis and randomized for open VHR after obtaining a well-informed written consent and satisfying the inclusion and exclusion criteria. 67% Patients (213/318) underwent retrorectus Meshplasty and were categorized into group A. The rest underwent Onlay (16.3% - 52/318)/Inlay (4.7% - 15/318)/Preperitoneal Meshplasty (11.9%-38/318) and were collectively (33% (105/318)) categorized into group B. Both Groups were Compared in terms differences in intra operative timing, intra operative complications, immediate post-operative outcome, early and delayed post-operative complications including readmission and recurrence rates.

Results: Authors observed significantly lesser post-operative pain, higher well being, reduced wound complications and recurrence rate in group A. Mean duration of surgery was insignificantly higher for retrorectus meshplasty.

Conclusions: Despite each method having its own advantages and disadvantages, retrorectus mesh repair was found superior because the mesh is placed with significant overlap under the muscular abdominal wall.

Keywords: Inlay, Onlay, Retrorectus, Ventral Hernia Repair, Sublay

INTRODUCTION

Hernias of the anterior abdominal wall or ventral hernias represent defects in the parietal abdominal wall fascia and muscle through which intra abdominal or pre peritoneal contents can protrude.

Ventral Hernias may be Congenital or Acquired. Acquired hernias may develop via slow architectural

distortion of the musculoaponeurotic tissues or may develop from failed healing of an anterior abdominal wall incision (Incisional Hernia). Primary ventral Hernias, identified by their anatomic locations are: epigastric, umbilical, spigelian, supra umbilical, infra umbilical. Secondary Ventral Hernias, better known as Incisional Hernias.¹ Numerous patient related factors lead to the formation of ventral hernias and are associated with recurrences and include obesity, older age, male gender,

sleep apnea, smoking, emphysema and other chronic lung conditions, prostatism, abdominal distention, steroids, and jaundice. Some evidence suggests that certain biochemical processes, including collagen deficiencies, also lead to an increased rate of hernia formation.¹

Laparotomy is associated with an incisional hernia rate of 3-23%.¹ Ventral hernia recurrence rates also remain unacceptably high, particularly considering the healthcare and societal costs. Mesh repair has decreased the long-term rate of recurrence from 6.3% for primary anatomical repair to 1.41%, but questions remain as to the optimal positioning of the mesh for reduction in hernia recurrence and other complications.² Herein, onlay, sublay, inlay and preperitoneal mesh placement are explored.

Onlay Mesh placement involves placement on the anterior rectus fascia below the subcutaneous layer after approximation of the anterior rectus fascia.² Sublay/Retrorectus refers to placement of the prosthetic in the retromuscular space posterior to the rectus abdominis and anterior to the posterior rectus fascia. Underlay mesh placement describes mesh positioning in the preperitoneal subfascial space or the intraperitoneal space deep to the fascia and peritoneum.³ The Retrorectus Repair, popularized by Rives and later Stoppa and Wantl, revolutionized hernia repair by offering a robust treatment of complicated incisional hernias with a low recurrence rate.⁴ Contemporary series of the Rives-Stoppa repair have reaffirmed the value of the repair with reports of a low hernia recurrence rate while demonstrating an improved Wound infection rate.

METHODS

This Prospective study of VHR by was carried out on a total of 339 cases, visiting the OPD of Surgery Dept, Surat Municipal Institute of Medical Education and Research, Surat; over a period of six years from September 2011 to September 2017 with the complaint of anterior abdominal wall Hernia. During the 6 years period 21 patients were excluded from the study due to:

1. New disease realized which was part of the exclusion criteria (3/21)
2. Adverse reaction (2/21)
3. On Request of the patient (10/21)
4. Patient passed away during the study (6/21).

Inclusion criteria

- Good Patient compliance
- Adequate wound healing conditions
- all pts >15 and <65 years of age
- all patients fit for G/A or S/A
- all patients who give consent for the undertaken study.

Exclusion criteria

- All the patients with chronic obstructive pulmonary disease (COPD) like asthma
- Patients with abdominal malignancy and cirrhosis with end stage liver disease/Renal disease
- Planned other gastrointestinal surgery, unstable circulation, uncontrollable diabetic or autoimmune diseases
- Patients with previous loss of the abdominal wall and large scarred area of the abdominal skin
- Patients with age less than 15 years and more than 65 years.

Hence a total of 318 patients were involved in the study. The age of the patients included in the study varies from 15 years to 60 years with a mean age of 44.5 years. Regarding the sex wise distribution, 60.06% patients were females (191/318) and 39.94% were male (127/318). Mean BMI of 28.2 kg/m² with SD 3.9 kg/m².

From these, Percentage distribution of diagnosis according to type of hernia was

- 1) Epigastric – 8.6%,
- 2) Incisional Hernia – 37.0%,
- 3) Umbilical Hernia – 48.7%,
- 4) ParaUmbilical – 3.7%,
- 5) SupraUmbilical Hernia – 0.9%
- 6) InfraUmbilical Hernia – 1.1%

88.05% (280/318) patients were given spinal anaesthesia and 11.95% (38/318) underwent general anaesthesia.

All patients were admitted through outpatient department (OPD). The epidemiological data i.e. the name, age, sex, medical record number, postal address and phone number was noted at the time of admission. The clinical features and their duration, time of initial operation and the interval between the first surgery and appearance of incisional hernia were asked from patients and recorded in the data. The known suspected risk factors like obesity, diabetes, history of wound infection, type of incision, patient's general conditions (ASA Score), hernia location, Radiological assessment of defect Size (preoperative USG Abdomen), prophylactic antibiotic or antithrombotic therapy were also recorded.

Operative panel summarized the exact size of the musculoaponeurotic defect, type of implanted prosthesis and used suture (for closing peritoneal sac, fixing mesh, closing fascia and skin), date and duration of operation, type of anaesthesia. Usage of different types of prosthesis, types of applied sutures and sutures technique were optional, but exact record in database were done.

In the postoperative period early complications (bleeding, infections, foreign body reaction, ileus, etc.) were recorded and individual pain was evaluated using verbal

analogue scale on the 1st, 2nd and the 7th postoperative days. Visual analogue scale was applied at early postoperative period and at each follow-up as well. First sign of bowel motion, mobilization, and local status of the wound were also recorded. The postoperative pain was divided into early postoperative pain (within 30 days) and chronic pain (over a month). Postoperative monitoring was done by a surgeon who had not operated on the patient.

All the details were entered in the database and results were statistically analyzed by Statistical Package for Social Sciences (SPSS). Results are expressed as mean values and standard deviation (SD). Data were analysed by many ways of statistical analysis, like chi-square test, K-S test, Mann-Whitney test, Fischer's exact-test. The level of significance was set at $p < 0.05$.

The follow up of the patients every three monthly for two years was carried out in the OPD to see the complications like wound infection and recurrences if any.

Operative Technique

Main steps of operative techniques were standardized:

- Preparation of hernia orifice or sac,
- Resection and suture of the peritoneum.
- Polypropylene prosthesis
- Fixing 5 cm on each side of defect margin in each mesh repair.
- Lower margin - pubic Symphysis
- There was difference among the randomized groups in method of fascia closure or positioning and fixating of implanted mesh.
- In sublay mesh repair after suturing the peritoneum, mesh was implanted under the musculo-aponeurotic layer fixed by stitches, and then fascia was closed over the mesh. In midline hernia the mesh was placed behind the rectus muscle but over the back sheet of rectus fascia. Below the arcuate line, the mesh was placed into the preperitoneal space. Component separation (CS) technique was also used if it was needed to reach the tension free state.
- Drainage was applied following each mesh repair. Drains were removed when drainage was less than 20ml in 24 hours. Fixation of the implanted mesh was also optional, absorbable-running, absorbable-interrupted, non-absorbable-running and non-absorbable-interrupted sutures could be chosen.
- Subcutaneous or skin closure techniques were optional.
- All the patients were given 1gm cephalosporin antibiotic preoperatively at the time of induction and continued till 5th post-operative day twice daily.

RESULTS

67% patients (213/318) Underwent retrorectus meshplasty and were categorized into group A. The rest

Underwent Onlay (16.3%-52/318)/Inlay (4.7%-15/318)/Preperitoneal Meshplasty (11.9% - 38/318) and were collectively (33% (105/318)) categorized into group B. Mean operative time was 104.7 mins for patients in group A while 104.1 mins for pts in group B which was statistically insignificant - shorter in onlay than in sublay subgroup which could be explained with easier operative technique.

Drain was used in all patients in group B while 22 patients in Group A had no requirement to keep negative suction drain as compared to group B (P value < 0.0001) - statistically significant.

Mean Hospital stay was 6-8 days averaging to 7 days in both cohorts.

Intra operative Complications

Intra-operative complications observed were as mentioned in the following table. Hypotension, Nausea/Vomiting, Hypothermia had similar occurrences and no statistical difference was observed. Spinal and epidural anesthesia gives excellent relaxation with minimal respiratory depression, However, in large hernias (defect size > 8 cm) and in patients with severe comorbidities, such as morbid obesity, Severe uncontrolled diabetes and hypertension, known case of respiratory disorders, due to higher morbidity and mortality rates, it was observed that general Anaesthesia would be a better mode of Anaesthesia.

Immediate post-operative period:

All Patients were mobilised on the same day in the evening 6 hours after the procedure.

Post-operative pain

Early postoperative pain (within 30 days) was evaluated by the VAS (Visual Analogue Scale) Scale. VAS value revealed Retrorectus meshplasty was significantly less painful, P value < 0.05 from POD 1 to 4. After POD- 5 no significant difference was noted.

Well Being Score

WHO approved wellbeing score by association of psychiatrists measured from post-operative 1 to 7 days, ranging from 0-25. According to T test, p value was < 0.05 from day1 to 5, showing statistical significance. Wellbeing score was better in group A attributable to less post-operative pain and no drain requirement and if drain kept then early removal, compared to group B.

Early Post-operative complications

All patients were catheterized pre-operatively and Catheter removed the following morning. Urinary retention was not seen in any patients after removal of

catheter. Paralytic Ileus developed in 8 patients in group A and 7 patients in group B, Having P value (<0.05) showing it to be statistically significant. This could arise from direct manipulation of the bowel during surgery or

from medications. Post-operative vomiting had similar incidence between the two groups. Complications like pneumonia and DVT were not seen in present study.

Table 1: Age distribution of patients.

	Group A	Group B
Hypotension	(32/213) = 14%	(15/105) = 12.4%
Nausea & Vomiting	(17/213) = 7.4%	(9/105) = 7.4%
Hypothermia	(11/213) = 4.8%	(6/105) = 4.9%
Laryngospasm	(0/213) = 0%	1 - (Spinal anaesthesia converted to G.A. in a K/c/o laryngospasm due to bronchial asthma)
Cardiac Arrest	(1/213) – 0.4%(Probable cause - Spinal Anaesthesia for a Large defect Size in an obese hypertensive, diabetic female)	Nil
Perioperative death	Nil	1 - (Large hernia >10 cm defect with onlay meshplasty) given spinal anaesthesia – converted to GA intraoperatively.

Table 2: Comparison of early post-operative complications.

	Group A	Group B
Urinary retention	0	0
Paralytic Ileus	3.7% (8/213)	6.7% (7/105)
Pneumonia	0	0
DVT	0	0
Vomiting	17.5% (40/213)	21.6%(24/105)

Wound complications (early)

Most Common Complication observed was Seroma formation; higher in Onlay technique. (In group B; 7 were in preperitoneal and 12 in onlay category) (P value = 0.037), making this statistically significant. Technique requires significant subcutaneous dissection to place the mesh, leading to devitalized tissue with seroma formation or infection.

Also, superficial location of the mesh places it in danger of infection if there is a superficial wound infection.

Superficial Wound Infection

Wound Infection was evaluated as per Southampton Wound Grading system. The difference between total incidence of wound infection between both groups was statistically significant, higher in group B ($p = 0.029$), Maximum belonging to Grade I in both groups. Morbidity was increased in Grade V in terms of: 1.) increased average hospital stay:2) Requiring local debridement. However, no serious complications such as Septicaemia, renal insufficiency were observed.

Late wound complications

Chronic pain is due to mesh being placed below subcutaneous plane, or under the muscle and sutured causing chronic muscle irritation especially if the closure is in tension. There was no remarkable difference between the two groups. Sinus formation was sequelae of delayed wound abscesses, which are either drained surgically or spontaneously, leading to a persistently draining sinus. These draining sinuses usually track to the edge of the mesh and communicate with a suture. C/S most commonly indicated were *Staphylococcus Aureus* and Occasionally, *E coli*.

Readmission rates

Readmissions included any readmission “likely related to the principal surgical procedure” that was not planned at the time of the initial operation. Most Common Causes for Readmission were: 1. Surgical site infections; 2. Urinary tract infections; 3. Chronic pain; 4. Recurrence.

Readmitted Pts were found to have Significantly higher Incidence of hypertension, diabetes mellitus, obesity, COPD, steroid usage (P value = 0.002). Predicting which patients are most likely to be readmitted is fundamental to tailoring preoperative and postoperative therapies.

Recurrence Rate

P value (<0.0001) Shows Statistically significant difference between the two Groups and Hence proves that retrorectus meshplasty has more favourable recurrence rates.

Table 3: Wound complications - early and late in Group A vs Group B.

	Group A	Group B
Early		
Seroma	12.7% (27/213)	18% (19/105)
Haematoma	NIL	12.4% (13/105)
SSI	19.2% (41/213)	26.7% (28/105)
Grade I	46.3% (19/41)	35.7% (10/28)
Grade II	24.4% (10/41)	28.6% (8/28)
Grade III	12.2% (5/41)	17.8% (5/28)
Grade IV	9.7% (4/41)	10.7% (3/28)
Grade V	7.3% (3/41)	7.1% (2/28)
Late		
Late abdominal pain/ chronic pain (>1 month)	3.0%	3.4%
Mesh infection	Nil	7.6%(8/105). Required mesh extrusion in one case of Onlay meshplasty. Rest were managed conservatively by dressing and higher antibiotics
Sinus Formation	Nil	9.5% (10/105)

Table 4: Comparison of readmission rates between Group A and B.

Readmission rate	Group A	Group B
1-30 days	8.4%(18/213)	11.4%(12/105)
31-90 days	3.7%(8/213)	3.8%(4/105)
91 days to 1 year	6.1%(13/213)	10.5%(11/105)

Table 5: Comparison recurrence rates between Group A and B.

Group A	Group B
RetroRectus/ Sublay (9/213) = 4.2%	N.A.
	Onlay (15/52) = 26.3%
	Inlay (11/15) = 20.4%
	Preperitoneal (6/38) =15.8%

DISCUSSION

As inferred from the results of our Study, Mean Duration of Surgery was Insignificantly Higher for Retrorectus Meshplasty which could be attributed to: 1) More time required for creating pre-peritoneal space, 2) Securing adequate hemostasis. The ease of the procedure in performing onlay mesh repair over retrorectus repair gives it the points but associated complications limits its use.

Less post-operative pain may be due to less tissue dissection and proper tissue handling in retromuscular meshplasty. Readmitted Pts due to wound infections, were found to have Significantly higher Incidence of hypertension, diabetes mellitus, obesity, COPD, steroid sage. Retrorectus is superior to onlay repair in these

patients. Pascal's principles of hydrostatics states that the intra-abdominal cavity functions as a cylinder, and, therefore, the pressure is distributed uniformly to all aspects of the system.⁶ Consequently, the same forces that are attempting to push the mesh through hernia defects are also holding the mesh in place against the intact abdominal wall.

In this manner, the prosthetic mesh is held firmly in place by intra-abdominal pressure. The mechanical strength of the prosthetic mesh prevents protrusion of the peritoneal cavity through the hernia because the hernial sac is indistensible against the mesh. Over time, the prosthetic mesh is incorporated into the fascia and unites the abdominal wall, now without an area of weakness.

Placement of mesh allows for a tension-free restoration of the abdominal wall.⁷ The ultimate goal when using mesh is for it to become incorporated into the surrounding tissues. The onlay technique is popular among surgeons because it avoids direct contact with the bowel and technically is not difficult for surgeons.⁸ However, it requires wide tissue undermining, which may predispose wound-related complications.

Only a few controlled trials have compared the different open mesh techniques. Notwithstanding this, onlay and sublay mesh repair with different implanted materials are the most popular procedures.^{9,10} Couple of studies have not found difference in recurrence rate between onlay and sublay reconstruction techniques (Shell et al, Csaky et al, den Hartog et al. in Cochrane database 2008).¹¹⁻¹³

On the other hand, there are also studies which prove lower recurrence rate following sublay mesh repair (Israelsson et al, Schumpelick et al, Langer et al.^{2,14,15}

Furthermore, some of the non-randomised showed a tendency towards less recurrences after sublay compared to onlay repair, but longer hospital stay.^{16,17}

Sublay placement of mesh (Rives and Stoppa) has been used with increasing frequency because it has the Pascal's hypothesis to support its background statistically, however it is technically more difficult.²⁻⁴ It is generally recommended to place the mesh with at least 4-5 cm contact between the mesh and fascia, which allows for distribution of pressure over a wider area.⁹

This surgical technique also requires wide tissue undermining like onlay does, when forming space for mesh implantation. This certainly predisposes to wound-healing problems as well. Using this type surgeons need to prepare greater internal surface causing higher tissue reaction. That can be the basic reason why several studies with high number of patients cannot find significant difference between recurrence of onlay and sublay hernia reconstructions.¹⁸

In present current study each participating surgeon had good experience in VHR. To retain variability every qualified surgeon was allowed to operate patients within the study which is one important pile of an objective randomized trial.

Most of the papers demonstrate higher wound infection when the mesh is used in onlay position.¹⁹ Higher infection risk of onlay repair has been confirmed. However fluid production is increased with mesh implantation (foreign body reaction), and the perigrift fluid was the most frequent complication in our trial, and that is the potential base of infection, according to this study this has also been confirmed.

CONCLUSION

Finally, to conclude, the Bottom line from our study is that all ventral hernias are difficult to manage, regardless of the approach; however good judgement comes from experience. Every approach has its own issues, fraught with wound morbidity, long recovery periods and potential destabilization of the abdominal wall.

Hence it is of key essence to know precisely the anatomy of the anterior abdominal wall and the advantages and disadvantages of each procedure and tailoring it to meet the patients' requirements.

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