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OUTCOME OF SYNTHETIC MESH REPAIR IN OPEN INCISIONAL VENTRAL HERNIA REPAIR IN PATIENTS WITH COMORBIDITIES

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ABSTRACT: BACKGROUND: The VHWG recommend synthetic mesh in Grade I, biologic mesh in Grade III and Grade IV. The use of synthetic mesh in Grade II comorbid patient is matter of consideration and debate. Our aim was to examine the outcome of synthetic mesh repair in open incisional ventral hernia repair in patients with comorbidities. **METHODS:** Retrospective review of all open, grade II VHR performed by single surgeon over 5 years was evaluated. **RESULTS:** Seventy-six patients with grade II ventral hernia underwent open hernia repair with synthetic mesh during the study period. There were 40 males and 36 females in our study with mean age of 53 years (range 30-85). Comorbidities associated with these patients included obesity in 43 (56%), smoking in 25 (32%), COPD in 19 (25%), diabetes mellitus in 32 (42%), and immunosuppression in 2 (2.6%). Surgical site occurrence as defined by VHWG was identified in 12 (16%) patients which included 8 (10%) surgical site infection (SSIs), 3 (4%) seroma and 1 (1%) wound dehiscence. One patient developed recurrence during the follow-up period. **CONCLUSION:** Synthetic macroporous mesh can be used in co morbid patients with no long term complications with recurrence of less than 1.3%. although surgical site occurrence in this cohort of patients is high (16%), they can be managed conservatively with antibiotics.

KEYWORDS: Synthetic mesh, Surgical site occurrence, ventral hernia.

INTRODUCTION: Abdominal wall herniorrhaphies are one of the most common procedure performed by the general surgeons, with more than 100,000 repairs performed annually.¹ The true prevalence of abdominal wall hernias are difficult to ascertain and each patient should be evaluated on a case-by-case basis for the best approach, taking into account the patient's age, comorbidities, risk of surgical site occurrence, defect size, and physiologic and functional status. 4 to 5 million laparotomies are performed every year with hernia developing in 2% to 36% in these incisions.^{12,3} The increased rate of incisional hernia is due to technical errors such as use of rapidly absorbable sutures, excessive tension, slippage of knots, suture fracture. Surgical site infection at the time of initial surgery doubles the risk of herniation.²

The introduction of synthetic mesh has drastically reduced the rate of recurrence in open VHR, but their implementation has presented new set of complications like surgical site infection, bowel adhesions and enterocutaneous fistula.⁴ The rate of wound complication is reported to be up to 27%.⁵⁻⁷ These series represent a heterogeneous group of patients without stratification of inherent risk factors for SSO, such as smoking, diabetes, immunosuppression and obesity limiting the universal application of these results.⁸⁻¹⁰ The Ventral Hernia Working Group (VHWG) established a grading system for management of incisional ventral hernias and the risk of SSO.¹¹ SSO is defined as an infection, seroma, wound dehiscence, or the formation of an enterocutaneous fistula after abdominal wall reconstruction.

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According to grading system proposed by VHWG, patients were stratified into 1 to 4 groups based on SSO risk. Grade I, low risk; grade II, comorbid patients without history of wound infection; Grade III, potentially contaminated; or Grade IV, infected patients. VHWG recommends synthetic mesh repair for Grade I patients, biologic mesh repair for Grade III and Grade IV patients due to high risk of SSO. However no clear recommendations were possible for Grade II ventral hernia due to lack of data regarding outcomes in this comorbid cohort.

METHODS: A retrospective analysis of all subjects with comorbidities undergoing open ventral hernia repair with synthetic mesh by a single surgeon consecutively between August 2009 to August 2013 at Victoria hospital, Bangalore were included in the study. Patients were excluded from the study if they had undergone laparoscopic repair or flank hernia repair. Variables included in age, gender, comorbidities, body mass index (BMI), history of prior abdominal operation and hernia repair, characteristics of hernia defect and operative technique, and duration of surgery and nature of previous surgeries, time of onset of incisional hernia following previous surgery. Smoking was defined as active smoking within 3 months of operation. Based on the VHWG classification, obesity was defined as a BMI > 30 kg/m².

During the ventral hernia repair macroporous synthetic mesh was placed in pre-peritoneal or retrorectus position. The primary outcome variable of our study was the incidence of SSO, defined based on VHWG as infections, clinically relevant seroma requiring intervention, dehiscence, or formation of an enterocutaneous fistula. Surgical site infection (SSI) was defined as those patients requiring antibiotics for wound erythema, opening of postoperative incisions, percutaneous drainage, or postoperative debridement. Follow-up visits were also reviewed for patients when possible to look for evidence of hernia recurrence. Recurrence was defined as a defect in the abdominal wall appearing at or close to the site of the previous hernia. Clinical examinations, radiological imaging, and subsequent reoperations were evaluated to assess for recurrences.

Data analysis was performed using SPSS software. The t-test, chi-square test and logistic regression were used to perform data analysis where appropriate.

RESULTS: After retrospective review of the hospital records 76 patients with comorbidities underwent open hernia repair with synthetic mesh during the study period. Descriptive analysis of study population is summarised in table 1. There were 40 males and 36 females in our study with mean age of 53 years (range 30-85). Mean American Society of Anaesthesiologists score (ASA) was 2.4. The mean number of previous abdominal surgeries was 1.4, with a mean of 1.2 previous hernia repairs. Fifty two (68%) patients were undergoing initial hernia repair, the remaining patients had more than 1 hernia repair [1 previous repair (n=19); 2 previous repair (n=5)]. Forty nine (64%) patients developed incisional ventral hernia following prior laparotomy, 20 (26%) patients following prior hysterectomy, 7 patients (9%) following lower segment caesarean section.

The mean hernia defect size was 5.96 cm. Thirty three (44%) patients had hernia defect less than 5cm as detected by ultrasonography, 38 (50%) cases defect varied between 5-10 cm, 5 (6%) cases had defect more than 10 cm. Co morbidities associated with these patients included obesity in 43 (56%), smoking in 25 (32%), COPD in 19 (25%), diabetes mellitus in 32 (42%), and immunosuppression in 2 (2.6%). In our study mean number of comorbidities is 1.3. 51 patients had one comorbidity, multiple comorbidities were present in 25 patients: 1 (n=55), 2 (n=22), 3 (n=3).

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In our study the mean duration of onset of incisional hernia following previous surgery was 3.9 years. 5 patients (6.5%) developed incisional ventral within one year following prior abdominal surgery, 13 patients (17%) between 1-2 years, 43 (56%) patients between 2-5 years and 15 patients (20%) presented with hernia more than 5 years following previous surgery.

Macroporous synthetic mesh was used in the ventral hernia repair, forty-eight (63%) patients underwent preperitoneal mesh repair, 24 (31%) patients underwent retrorectus mesh repair and 4 (5%) patients underwent onlay mesh repair. The mean duration of surgery in our study was 74 min, duration of surgery in 47 (61%) patients was between 40-80 minutes, in 26 (34%) patients the duration was less than 40 minutes and in remaining 3 (4%) patients the duration was more than 80 minutes. Suction drain was used in 4 patients who underwent onlay mesh repair. (Table 2)

In our study surgical site occurrence as defined by VHWG was identified in 12 (16%) patients which included 8 (10%) surgical site infection (SSIs), 3 (4%) seroma and 1 (1%) wound dehiscence and none had enterocutaneous fistula. 8 patients who developed surgical site infection (SSIs) were managed with antibiotics (n=5), antibiotics and wound debridement in outpatient setup (n=2), antibiotics and wound debridement in operating room (n=1). Univariate analysis revealed that the defect area ($P=.04$) and operative time ($P=.01$) were associated with increased risk of developing SSO in this cohort of comorbid patients. Operative time ($P=.01$), defect area ($P=.01$) and BMI ($P=.03$) were all associated with increased risk of developing surgical site infection within this cohort. (Table 3)

Multivariate analysis of the 5 co morbidities was performed to determine whether either of the variables was more important than other at predicting SSO in this co morbid cohort. None of these variables was more important than other in predicting SSO or SSI, suggesting that all 5 comorbidities contribute equally in the development of SSO or SSI in patients with grade II ventral hernias. Multiple comorbidities increase the risk of developing SSO in these cohort of patients. ($P=.02$).

All patients included in the study were followed at 1 month, 6 month and 1 year interval. 1 patient developed recurrence during the follow-up period. This patient initially had surgical site infection following on lay mesh repair. As the patient was symptomatic and the defect was large, subsequent pre-peritoneal mesh repair was performed.

DISCUSSION: The use of prosthetic mesh is considered gold standard in the repair of complex ventral hernia, with a significant reduction the rate of recurrence compared with primary suture repair. However, mesh-related complications have become increasingly important. Such complications include seromas, adhesions, chronic severe pain, migration and rejection of the mesh, and mesh-related infections. These complications are more in patients with several risk factors like smoking, diabetes mellitus, COPD, immunosuppression, obesity. Our study evaluated this complex group of patients with relevant comorbidities undergoing open ventral hernia repair using synthetic mesh. Patients with smoking, COPD, diabetes mellitus, immunosuppression had 16% risk of developing SSO similar to that reported in other studies.¹⁵

In an attempt to assist the reconstructive surgeon in better defining preoperative risk, the Ventral Hernia Working Group stratified cases into a 4-tier grading system based on risk of developing a surgical site complication. Technique and material preferences varied based on case grade, with the Ventral Hernia Working Group expressing a stronger preference for bioprosthetic materials with increasing case grade and ultimately recommending staged or delayed repair in grade

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4, actively infected, cases.¹¹ However there was controversy regarding the use of synthetic mesh in grade II patients. We evaluated this controversial group of patients and as predicted we found that the grade II patients had high incidence of SSO. Only 3 patients with SSI required debridement for their infection. Only one patient developed recurrence during the study period, the remaining patients retained their mesh and did not develop prosthetic infection during the study period.

Several studies have particularly evaluated the effect of COPD, diabetes mellitus, obesity, smoking and immunosuppression on SSO. Kaafarani et al⁶ report the result of a prospective, randomized trial comparing laparoscopic versus open ventral hernia in much less complex group of patients than in our study over 85% of the patients in their study were ASA class 1, with a mean BMI of 30.9 and less than 5% were diabetics. Our study population consisted of comorbid patients with a median ASA of 3, 42% of patients being diabetic, 33% of patients being obese (Mean BMI, 31.4kg/m²) and smokers. Prior studies have evaluated much less complex hernias, limiting their applicability to comorbid patients with complex defects. We adopted a standardized technique by a single surgeon unlike other series which have reported wide range of open repairs with some series allowing a multitude of open approaches to be evaluated as single group.

Several prospective randomised trials have compared laparoscopic and open ventral hernia repairs although most of these studies were small, with fewer than 100 patients, the results tend to favour a laparoscopic approach.^{16,17} Laparoscopic incisional hernia repair results in fewer postoperative complications, lower infection rate and decreased hernia recurrence.^{17,18} But the laparoscopic hernia repair was reserved to small defect with associated comorbidities. The role of laparoscopic repair in patients with comorbidities needs further evaluation.

We used synthetic macroporous mesh in our patients. Despite high rate of surgical site infection, most of them are managed conservatively without long term mesh related complications. Macroporous mesh have shown to be relatively resistant to infection and can be salvaged if infection does occur unlike microporous mesh which must be explanted after infection.¹⁹ The composite graft (Macroporous mesh coated with ePTFE) is also not resistant to infection. Problems can occur when there is a differential contraction between the polypropylene and the ePTFE layers, which leads to rolling of the mesh edges and thus exposure of the polypropylene to bowel. If the surgeon prefers to use this mesh in intraperitoneal position, there will be higher rate of infection, small-bowel obstruction, recurrence, and fistula.²⁰

The overall recurrence in our study was 1% with mean follow-up time of 1 year. other groups have also reported recurrence rates of <5% after similar retromuscular approach.²¹ The placement of macroporous mesh in retromuscular position allows for maximal mesh incorporation and durability, which is attributed to low recurrence rate in this comorbid patients.

Our study has many limitations. First, we included tertiary referral practise of complex ventral hernia. Second, there are unmeasured events that may influence the rate of wound infections, such as prophylactic antibiotic use, intraoperative hyperglycemia, method of hair removal, and surgical site preparation.

In conclusion, the incidence of SSO in grade II ventral hernia undergoing open mesh repair is 16%. Multiple comorbidities increases the rate of SSO in this cohort of patients. Although the rate of infection is high in these comorbid patients, they can be managed conservatively with antibiotics without long-term mesh related complications. Synthetic macroporous used in retromuscular space is safe (Recurrence rate 1.3%) in grade II ventral hernia patients.

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Variable	Open repair patients
Age	53+10.9
ASA	2.4+1.21
Female gender	36 (47%)
No. of comorbidities	1.3
Obese (BMI > 30kg/m ²)	25 (33%)
BMI (kg/m ²)	31.8
DM	32 (42%)
COPD	19 (25%)
Smoker	25 (33%)
Immunosuppression	2 (2.6%)

TABLE 1: Descriptive analysis of patients undergoing open ventral hernia repair (n =76)

ASA, American Society of Anesthesiologists score; BMI, body mass index; COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus.

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	Mean + SD or n (%)
Number of previous abdominal surgeries	1.4
Number of previous hernia repair	1.2
Defect area (in cm)	
1-5 cm	33 (43%)
5-10 cm	38 (50%)
>10cm	5 (6%)
Operative procedure	
Preperitoneal	48 (63%)
retrorectus	24 (31%)
onlay	4 (5%)
Duration of surgical procedure (in min)	
<40	26 (34%)
40-80	47 (61%)
>80	3 (4%)
Time of onset of incisional hernia following previous surgery	
Within 1 year	5 (6%)
1-2 years	13 (17%)
2-5 years	43 (56%)
More than 5 years	15 (20%)
Complications	
Surgical Site Occurrence (SSO)	12 (16%)
Surgical site infection	8 (10%)
Seroma	3 (4%)
Wound dehiscence	1 (1%)

TABLE 2: Operative demographics of patients undergoing open ventral hernia repair

	SSO (n =12)		SSI (n = 8)	
	P (SSO)	P value	P (SSI)	P value
Obesity	5/25 (20%)	0.51	1/25 (4%)	0.25
Smoker	5/25 (20%)	0.51	4/25 (16%)	0.42
Immunosuppressed	0/2 (0%)	1	0/2 (0%)	1
COPD	3/19 (15.7%)	1	3/19 (15.7%)	0.40
DM	7/32 (21.8%)	0.33	5/32 (15.6%)	0.26

TABLE 3: Univariate analysis of co morbid patients for Surgical site occurrence(SSO) and surgical site infection (SSI)

COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus

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ABBREVIATIONS:

- VHWG – ventral hernia working group.
SSO – surgical site occurrence.
SSI – surgical site infection.
ASA – American society of anaesthesiologists.
COPD – chronic obstructive pulmonary disease.
BMI – body mass index.

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