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Original Research Article

A Study of Mesh-Related Infections After Hernia Repair Surgery: A Retrospective Analysis

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Abstract

Aim: The aim of this study to analysis of mesh related infections in a tertiary care centre

Methods: The A retrospective observational study was conducted in the Department of General Surgery, Jannayak Karpoori Thakur Medical College and Hospital Madhepura, Bihar, India for 1 year. All cases that underwent ventral and groin hernia surgeries and reported with mesh infections in the Department of General Surgery were included in the study. Demographics like age, sex and factors associated with mesh infection like BMI, comorbidities, time of presentation, tobacco consumption, ASA grade, type of hernia, type of hernia repair done were taken from medical records of the patients and their association with mesh infections were analyzed.

Results: Total 20 cases of mesh infection were recorded out of 600 open repair hernia surgeries. The incidence was 0.033%. 70% of patients with mesh infection had a history of tobacco consumption, i.e., out of the 20 patients, 15 patients consumed tobacco, and 5 patients had no history of tobacco consumption. 65% patients had co morbidities. HbA1c of all diabetic patients was >16 is noteworthy, emphasizing the fact that tight control of blood sugars is vital to prevent mesh infection. Out of 20 cases, 7 cases took less than 100minutes to be performed, and 13 cases took more than 100mins to be performed. The time duration of open surgery was 94+/-21.17mins and in patients who eventually had mesh infection were118.0+/- 20mins. Duration of surgery in patients who underwent laparoscopic surgery was 111.50+/-13mins, and in patients with mesh infection post, the laparoscopic repair was 133.45+/-30mins. 11 patients were of ASA grade 3 who developed mesh infection, and 9 patients were ASA grade 2 i.e 55% patients were ok ASA grade 3.

Conclusion: In our study the incidence of mesh infection after the open procedure was 0.033%. As ours is a teaching hospital, surgeries are performed by surgeons in the early phase of the learning curve, so it takes much longer to perform surgery than an experienced surgeon would take.

Keywords: Mesh, Infection, Open Repair.

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Introduction

Over 300,000 ventral hernia repairs are performed annually in the United States [1]. A majority of ventral hernias are repaired using mesh, with synthetic mesh being the most common choice [2]. Synthetic mesh has been well demonstrated to significantly reduce the hernia recurrence rate in ventral hernia repairs [3,4]. However, synthetic mesh is susceptible to becoming infected in both clean and contaminated repairs, resulting in the need for additional procedures to remove the infected mesh and repair a now larger hernia defect [5,6]. This adds additional costs due to extra procedures and a longer duration of stay in the hospital. The development and use of biologic mesh has been identified as an alternative to synthetic mesh for reducing infections. Biologic mesh has been used in contaminated cases to resist infection, thereby reducing the morbidity of post-operative wound infection and the need for additional procedures, which may justify the high cost of the mesh itself [6,7]. In today's environment, biologic mesh is primarily used in patients with class 3 (contaminated) and class 4 (dirty) wounds [7]. Its use in class 1 (clean) and class 2 (clean- contaminated) wounds has not been well studied. Its efficacy has been debated in the recent medical literature with some studies finding that biologic mesh is associated with higher recurrence rates than synthetic mesh and others finding similar performance between the two techniques [7,9]. Patient co morbidities have been reported to contribute to a higher risk of postoperative infection and complications including higher recurrence rates [10]. A diagnosis of chronic obstructive pulmonary disease (COPD), diabetes mellitus, and obesity have been shown to leave patient sat higher risk to postoperative complications [11]. The association between high body mass index (BMI) and ventral hernias, as a result of increased stress on the abdominal wall, has also been well demonstrated [12]. Further, a history of smoking, prior ventral hernia repairs, and subsequent infections following repair have also been shown to contribute to complications [6,11].

Material and methods:

The A retrospective observational study was conducted in the Department of General Surgery, Jannayak Karpoori Thakur Medical College and Hospital Madhepura, Bihar, India for 1 year.

Methodology

All cases that underwent ventral and groin hernia surgeries and reported with mesh infections in the Department of General Surgery were included in the study. Files with incomplete and inappropriate data needed for the study were excluded from the study. All primary hernia repairs were done on an elective basis, and antibiotics are given as per the protocol of our hospital.

All cases of mesh infection during the study period (n=20) were analysed. Demographics like age, sex and factors associated with mesh infection like BMI, comorbidities, time of presentation, tobacco consumption, ASA grade, type of hernia were taken from medical records of the patients and their association with mesh infections were analyzed.

Analysis:

Results were tabulated in the form of mean, standard deviations and percentages.

In this retrospective study, we reviewed the incidence of mesh infection after hernioplasty over the last two years and estimated the incidence of mesh infection and the associated risk factors among the included patients. In our study, 20 cases of

mesh infection were recorded out of 600 hernia surgeries.

Table 1: Incidence after open repair

Incidence after open repair	**20**	**600**	**0.033**

In our study, the incidence of mesh infection was recorded in 0.033%.

Table 2: Profile of 20 patients

Age (Years)	N=20
<40	5
>40	15
Mean±SD	51.10±13.78 years
Gender	
Male	15
Female	5
History of tobacco consumption	
Present	15
Absent	5
BMI (Mean±SD)	32.70+/-1.78kg/m2

Mesh infection was more common in males. Among 20 patients, 15 were males and 5 female patients. About 15 patients were above the age of 40years, The Mean ± SD: 51.10±13.78. In our study, mesh infection was more common in obese patients with a mean BMI of 32.70+/-1.78kg/m2. (Range being 30.40-34.10).

The time of presentation after surgery was more after 5 months. The Mean ± SD being 5.55±3.27 (Range being 1-10 months). In our study, 70% of patients with mesh infection had a history of tobacco consumption, i.e. out of the 20 patients, 15 patients consumed tobacco, and 5 patients had no history of tobacco consumption.

Table 3: Time of presentation of mesh infection after primary repair

Time in months	No. of patients	%
1-5	13	65
6-10	7	35

Table 4: Co morbidities in cases of mesh infection

Co morbidities	**No. of patients**	**%**
Present	**13**	**65**
Absent	**7**	**35**

65% patients had comorbidities. HbA1c of all diabetic patients was >16 is noteworthy, emphasizing the fact that tight control of blood sugars is vital to prevent mesh infection. Out of 20 cases, 7 cases took less than 100minutes to be performed, and 13 cases took more than 100mins to be performed.

Table 5: Details of co morbidities in cases of mesh infection

co morbidities	No. of patients=13	%
COPD	4	20
COPD+Type 2 DM	4	20
Type 2 DM	3	15

COPD +HTN	2	10

The time duration of open surgery was 94+/-21.17mins and in patients who eventually had mesh infection were118.0+/- 20mins.

The antibiotic protocol was followed in 19 cases out of 20. Antibiotic has used according to the protocol of our hospital; it was followed in 19 patients in the first surgery i.e., hernia repair surgery. Parenteral cephalosporin was used in 19 patients and amoxicillin-clavulanic acid in 1 patient. Antibiotic has repeated if the procedure was beyond 2 hours. After postoperative day 2, patients were switched over to oral antibiotics for three days. Likewise, during the second admission, i.e., when the patient was admitted with mesh infection, nine patients were given cephalosporin, and one patient was given Piperacillin tazobactam. Polypropylene mesh was used in 17patients, and the composite mesh was used in 3 patients who underwent IPOM. Polypropylene suture was used in all ten patients.

11 patients were of ASA grade 3 who developed mesh infection, and 9 patients were ASA grade 2 i.e 55% patients were ok ASA grade 3.

In our study, 17 patients under- went mesh explantation, i.e., complete removal of the mesh, the infected sinus, and the surrounding infected tissue, followed by proper drainage of the surgical site. 1 patient was managed conservatively with an antibiotic wash, and parenteral antibiotics and 2 patients were tried to manage conservatively but later underwent mesh explantation.

Discussion:

Abdominal wall and inguinal hernia are common clinical scenarios in surgical practice. It is widely accepted that any sizable abdominal wall defect requires placement of mesh for reinforcement of repair and longer recurrence-free period [13]. SSI is defined as infections occurring within 30 days after surgery and affecting either the incision, organs, or body spaces at the site of the operation [14]. According to the definitions developed by the United States Centre for Disease Control (CDC), SSIs were categorized into

1. Superficial SSIs which involve the skin and subcutaneous tissue.

2. Deep SSIs which involve fascia and muscle layers; and

3. Organ/Space SSIs [15].

Mesh infection is a type of surgical site infection (SSI). Patient factors known to increase the risk of SSI and mesh infection are morbid obesity, tobacco abuse, chronic obstructive pulmonary disease (COPD), diabetes mellitus (DM), and immunosuppression [16]. The incidence of SSIs varies across surgical procedures, with a range of 0.1% to 50.4% reported in a systematic review by Korol et al [17].

In our study, the incidence of mesh infection after the open procedure was 0.033%. This is in contrary to the world literature, which shows a higher incidence of mesh infection after open procedures. A study by Sauer land S et al. in 2011 showed 13% incidence of mesh infection after open surgery [18]. Another study by Brett L. Ecker et al. in 2016 showed 1.9% incidence of mesh infection after the open procedure [19].

Operative time is an independent risk factor for SSI that may be partially modifiable. The variables that can impact operating time are pre-operative planning, surgeon experience, operating room staff experience and access to equipment. The mechanism by which prolonged surgery can lead to infection is with increased operative time, incisions are exposed to the environment longer, thus increasing the risk of bacterial contamination. Also,

longer operative time predisposes incisions to tissue desiccation that may also increase the probability of contamination [20,21] Tissue concentrations of antibiotics will decrease as the procedure continues and may be inadequate if not re-administered during the surgical procedure [22,23]. However, in our centre, according to the antibiotic protocol, the antibiotic dose was repeated if the procedure took more than 120 minutes. In line with the world literature even our study showed mesh infections in procedures' that took more than 100 minutes to complete. The time duration of open surgery was 94+/- 21.17mins and in patients who eventually had mesh infection were118.0+/- 20mins. Time duration to complete a laparoscopic procedure is more compared to open procedure. The cause of prolonged surgery could be that the procedure was performed by surgeons in the early phase of their learning curve. The risk for complications after hernia repair is increased among patients with comorbid conditions, such as obesity or diabetes [24]. Diabetes is a marker for other conditions like vascular changes and white blood cell dysfunction, which makes the patient prone to infection. Perioperative hyperglycaemia and subsequent immune suppression are affected by the complex contributions of factors in addition to the diabetic history of the patient, including physiologic stressors and exogenous glucose administration [25]. Studies by Rosemar A et al. and Lledo JB et al. have reported that patients with a BMI>25 kg/ m2 had 50% higher risk of surgical site infection than those with normal body weight, thereby concluding that obesity is an independent risk factor for mesh infection following inguinal hernia repair [26,27]. In our study, 7 patients had Type 2 DM with Hba1C more than 16 which could be the reason of mesh infection in these patients. Likewise, the body mass index of >30kg/m^2 was associated with mesh infection. Proper selection of the patient, ensuring good control of comorbid medical conditions will prevent mesh infections [28]. Patient age, ASA score, smoking and were found to be associated with the development of mesh infection. In a study conducted by Mavros et al [29]. showed that statistically significant risk factors were smoking (risk ratio [RR] = 1.36 [95% confidence interval (CI): 1.07, 1.73]; 1,171 hernioplasties), American Society of Anesthesiologists (ASA) score C3 (RR = 1.40 [1.15, 1.70]; 1,682 hernioplasties) and in obese patients (RR = 1.41 [0.94, 2.11]; 2,243 hernioplasties) and in patients operated on by a resident (in contrast to a consultant; RR = 1.18 [0.99, 1.40]; 982 hernioplasties). A study by Yang H et al. showed that obesity (46.5%), smoking (39.3%) and diabetes (8.9%) were significant risk factors for mesh infection [30]. Even our study showed an increased incidence of mesh infection in elderly patients, The Mean ± SD: 51.10±13.78years and in patients who consumed tobacco (70%), ASA grade >3 in 55% patients. The most common type of hernia was a paraumbilical hernia, and none of the patients had any superficial skin infection or enterocutaneous fistula at the time of surgery. There is also evidence that the development of mesh infection may be related to the type of material used [31,33]. Micro porous, multifilament mesh, and laminar mesh construction increase the surface area for bacterial adherence, impede leukocyte migration for bacterial clearance and leads to biofilm formation [34]. Pre-treatment of mesh with antimicrobial agents is not done in our setting. In our study, polypropylene mesh was used in 17 patients and composite mesh in 3 patients. The antibiotic protocol was followed in 19 cases out of 20. Antibiotic has used according to the protocol of our hospital; it was followed in 19 patients in the first surgery i.e., hernia repair surgery. Parenteral cephalosporin was used in 19 patients and amoxicillin-clavulanic acid in 1 patient. Antibiotic has

repeated if the procedure was beyond 2 hours. After postoperative day 2, patients were switched over to oral antibiotics for three days. Likewise, during the second admission, i.e., when the patient was admitted with mesh infection, nine patients were given cephalosporin, and one patient was given Piperacillin tazobactam. Different guidelines exist to treat mesh infections but not very clear evidence in the literature to support a single optimal approach. While some studies prefer conservative management, some others prefer complete mesh removal. Large-pore monofilament mesh seems to be salvable in a majority of cases, particularly when placed in an extra peritoneal position, while micro porous, multifilament, and composite meshes typically require explantation [35].

Conclusion:

In our study the incidence of mesh infection after the open procedure was 0.033%. As ours is a teaching hospital, surgeries are performed by surgeons in the early phase of the learning curve, so it takes much longer to perform surgery than an experienced surgeon would take. Many parameters impact operating time, including pre- operative planning, surgeon experience, operating room staff experience, and access to equipment etc., which would lead prolonged exposure of the incision site to the environment and bacterial contamination.

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