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Postoperative Infection in Mesh Repair Hernias, Risk Factors and Management

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ABSTRACT

Background: A hernia occurs when a portion of the abdominal cavity's contents protrudes through a defect or weakness in the abdominal wall. Incisional hernias occur after surgery and are very common and challenging to repair. Mesh-related infections following incisional hernia repairs are significant complications with considerable morbidity.

Aim of the Study: to describe our technique and management of patients with mesh related infection and offer a comprehensive review of surgical site infections following hernia surgery, focusing on the associated risk factors and management strategies.

Methodology: a prospective interventional study that was conducted at Safeer Al-Imam Al-Hussain Surgical Hospital, Imam Hussain Medical City, Zain Al-Abedin Surgical Hospital and Al-Kafeel Specialized Hospital / Karbalaa/ Iraq over 10 years (2014-2024). Forty patients with mesh infections post-incisional hernia repair were included. Data collected included demographic variables, risk factors, clinical variables, and treatment outcomes.

Results: The study sample comprised 40 patients with a mean age of 52.3 years. Females comprised 32 (80%) of the patients. The infection resolved in 77.5% of patients with conservative treatment, while 22.5% required surgical mesh removal.

Conclusions: Mesh-related infections after incisional hernia repair may occur as a complication after repair. Conservative treatment is often effective, but surgical removal is necessary for persistent infections. Addressing risk factors preoperatively may improve outcomes. Further research and refined techniques are needed to reduce infection rates and improve patient outcomes.

Keywords: Incisional hernia, Mesh-related infections, surgical site infection

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INTRODUCTION

The repair of an incisional hernia varies depending on its size, ranging from simple suturing to extensive reconstruction of the abdominal wall, which may involve creating muscle flaps and using large mesh pieces. This procedure can be carried out through either an open technique or a laparoscopic method (Köckerling, 2019). Repairing incisional hernias is a complex procedure. This is especially true in the case of recurrent hernias, where the chances of failure rise with each subsequent surgical intervention (Dietz *et al.*, 2018)

Research has indicated that using mesh to repair incisional hernias decreases recurrence rates by about 30%. However, complications associated with the mesh, including seromas, adhesions, persistent severe pain, mesh migration or rejection, and infections, have become increasingly prominent (Kokotovic, Bisgaard & Helgstrand, 2016; Jamal et al., 2024). Smoking increases the risk of wound infections, which in turn raises the likelihood of incisional hernias. Patients should be advised to stop smoking at least 2 weeks before surgery, although 8 weeks is preferable (Borad & Merchant, 2017; Al Qurani. 2024).

Mesh-related infections have been reported in up to 8% of cases following hernia repair. The incidence of infection is notably higher in patients with underlying conditions such as diabetes, immunosuppression, or obesity (Plymale *et al.*, 2020)

Mesh-related infections can develop anywhere from 2 weeks to 39 months after surgery. Common symptoms include localized acute inflammation, with pain, redness, tenderness, swelling, and elevated temperature at the site of the mesh. Systemic symptoms, such as fever, fatigue, chills, or rigors, may also be present. In certain instances, the infection may manifest as a draining fistula or an intra-abdominal abscess (Bueno Garcia Reyes and Hashim, 2020).

The surgeon should suspect a mesh-related infection in any patient who presents with unexplained fever, signs of inflammation in the abdominal wall near the mesh, or less typical symptoms such as an enterocutaneous fistula or an abdominal abscess at the site of the mesh (Sanchez, Abi-Haidar and Itani, 2011). Diagnostic paracentesis of mesh-related seromas should not be attempted if there are no symptoms or signs of inflammation in the abdominal wall, as introducing bacteria during the procedure could lead to an infection (Sanders and Kingsnorth, 2012).

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When a mesh-related infection occurs, the preferred management involves a combination of intravenous antimicrobial therapy and complete surgical removal of the mesh (Arnold *et al.*, 2018)

Aim of the Study

To describe our technique and management of patients with mesh-related infections and also to offer a comprehensive review of surgical site infections following hernia surgery, focusing on the associated risk factors and management strategies.

METHODOLOGY

Study design: prospective interventional study

Methodology: the study was conducted in multiple hospitals at Safeer Al-Imam Al-Hussain Surgical Hospital, Imam Hussain medical city, Zain Al-Abedin surgical hospital and Al-Kafeel specialized hospital in Karbalaa/ Iraq over 10 years data was collected prospectively and the study involved 40 patients that were treated for mesh infection after incisional hernia repair that fit the inclusion criteria

Inclusion criteria:

1. Patients that were treated for incisional hernia using onlay mesh and have signs and symptoms of mesh related infection confirmed with clinical examination and radiology (abdominal CT scan and ultrasound exam)
2. Patient between age (20-75)

Exclusion criteria:

1. Patient with BMI above 40 kg/m^2
2. Patients with known collagen or connective tissue disorder (such as: Marfan syndrome)
3. Immunocompromised patients (AIDS, genetic disorders)

Data collection:

After verbal consent was taken from each patient, demographic variables, including age, gender, BMI, residency, and risk factors (e.g., diabetes, smoking), and clinical variables, including past medical history, past surgical history, drug history, and physical examination, were collected.

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Findings related to mesh repair infection (site of infection, antibiotic regimen, management) were documented

Outcome Measures were recorded including Infection resolution, duration of hospital stay, recurrence of infection and complications and the treatment variables and the outcome of surgical treatment.

Procedure

The patients underwent conservative measure using double or triple antibiotics with regular cleaning of the wound by surgical debridement and through washing with normal saline. The wound is then dried and disinfected with hydrogen peroxide 3% diluted with same amount of normal saline and used to wash the wound for 1 to 2 minutes (this procedure was used for 12 patients), also local gentamicin irrigation (2 ampule of 80 mg gentamicin diluted with 10 cc of normal saline then sprayed on the wound) this procedure was used for 7 patients.

povidone iodine 3% used in all patients. and the dressing is placed, this procedure is repeated three times per day for 5-7 days then once or twice daily until the wound is dry and clean.

Vacuum assisted closure (VAC) was used by applying intermittent negative pressure of – 125 mmHg this device has several parts.

A foam or gauze dressing is applied directly to the wound, with dressing changes occurring every 24 to 72 hours. An adhesive film is used to cover and seal both the dressing and the wound. A drainage tube is placed beneath the adhesive film, connecting to a portable vacuum pump. The pump creates negative pressure over the wound and assists in draining any fluid from the area. During the treatment, the portable pump is carried with the patient; VAC was used for 4 patients only.

Mesh removal surgery was planned when the infection is persistent with local and systemic signs and symptoms of no improvement after (6 to 8) weeks.

Statistical Analysis

Analysis of data was carried out using SPSS-27 for window 10, Data were presented in simple measures of frequency, percentage, mean, range and standard deviation. A P value of <0.05 for all variables was considered significant.

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RESULTS

The study sample consists of 40 patients with a mean age of 52.3 years, 20% (8) of the patients are males and 80% (32) are females, the mean BMI was 28.1 kg/m² with a standard deviation of 2.9 kg/m². table 1

Regarding the risk factors associated with incisional hernia infection in the study sample. Diabetes is reported in 45%, Obesity is noted in 32.5% of the patients, smoking in 15%, hypertension in 25%, chronic kidney disease in 5%, and a history of steroid use in 2.5%. It is important to note that a patient may have one or more risk factors. Table 2

Infection resolved in 77.5% (31) of patients on conservative treatment while 22.5% (9) patients required mesh removal surgically. The mean duration of hospital stay was 19.3 days. Table 3

Complications were absent in 75% of the cases, while 25% encountered complications, the complications following mesh infection included recurrent infection 5% of the patients, recurrence of hernia in 12.5%, adhesion formation in 2.5%, and chronic pain in 2.5%. table 4

For the final resolution of mesh-related infection, 65% of the patients required triple antibiotics, 35% required double antibiotics, all the patients were treated with povidone iodine cleaning and regular change of dressing (once or twice daily), hydrogen peroxide was used for 12 patients (30%), and topical gentamicin was used for 7 patients (17.5%) and vacuum assisted closure (VAC) was used in 4 patients (10%). Table 5

Table 1: *Demographic characteristics of the study sample (n=40)*

Variable		Number of Patients	Percentage (%)
Age	20-30 years	4	10%
	31-40 years	5	12.5%
	41-50 years	9	22.5%
	51-60 years	15	37.5%
	61-70 years	7	17.5%
	Mean ± SD	52.3 ± 12.1	
Gender	Male	8	20%
	Female	32	80%
BMI kg/m^2	Mean ± SD)	28.1 ± 2.9	
	Normal	6	15%
	Overweight	21	52.5%
	Obese	13	32.5%

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Table 2: *Risk factors for incisional hernia infection among the study sample patients (n=40)*

Risk factor	frequency	Percentage (%)
Diabetes mellitus	18	45%
Obesity	13	32.5%
Hypertension	10	25%
Smoking	6	15%
Chronic Kidney Disease	2	5%
History of Steroid Use	1	2.5%

A patient may have one or more risk factors.

Table 3: *Outcomes of Management*

Outcome Measure		Frequency (n)	Percentage (%)
Infection Resolved on conservative treatment	Yes	31	77.5%
	No	9	22.5%
Complications	no	30	75%
	yes	10	25%
Duration of Hospital Stay days	**Mean ± SD**	**19.3 ± 5.8 days**	
	1-5	2	5%
	6-10	4	10%
	11-15	15	37.5%
	16-20	10	25%
	>20	9	22.5%

Table 4: *Complications encountered after mesh infection management among the studied patients. (n=40)*

Complication	Frequency (n)	Percentage (%)
Recurrence of Hernia	5	12.5%
Recurrence infection	2	5%
Adhesion Formation	1	2.5%
Sinus formation	1	2.5%
Chronic Pain	1	2.5%
Total	10	25%

Table 5: *Treatments required for final resolution of mesh-related infection among the study sample patients. (n=40)*

Variable	Number of Patients	Percentage (%)
Dual Antibiotics	14	35%
Triple Antibiotics	26	65%
Povidone iodine	40	100%
Hydrogen peroxide	12	30%
Mesh Removal Surgery	9	22.5%
Local gentamicin	7	17.5%
VAC	4	10%

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DISCUSSION

Our study reported a mean age of 52.3 years, with 20% of patients being male and 80% female. The mean BMI was 28.1 kg/m², with 70% of patients residing in rural areas and 30% in urban areas.

Other studies have reported various demographics. Each study will have its own characteristics of patients based on the geographical location. For instance, a study by Kaoutzanis et al. (2015) on 25172 cases of surgical site infection after incisional hernia repair found a mean age of 51 years and a gender distribution of 60% females and 40% males. They also concluded that Obesity and smoking are risk factors.(Kaoutzanis *et al.*, 2015).

In our study, obesity was noted in 32.5% of patients, smoking in 15%, diabetes in 45%, hypertension in 25%, chronic kidney disease in 5%, and a history of steroid use in 2.5%.

Similarly, a study by Mavros et al. on 2,418 mesh hernioplasties found a crude mesh infection rate of 5%. Statistically significant risk factors included smoking, as well as patient age and the duration of the hernioplasty. There was also a trend indicating higher mesh infection rates in obese patients. Mesh infections often required mesh removal, with common pathogens identified as Staphylococcus spp., Enterococcus spp., and gram-negative bacteria. The study highlighted that factors such as patient age, smoking, and the duration and emergency nature of the surgery were linked to the development of synthetic mesh infections (Mavros *et al.*, 2011).

77.5% of infections resolved with conservative treatment, while 22.5% required surgical intervention. The recurrence of infection occurred in 5% of patients, and 25% experienced complications. The mean duration of hospital stay was 19.3 ± 5.8 days, similarly a study by Forbes et al. found that 75% of infections resolved with conservative treatment, with 25% needing surgical intervention. Recurrence rates were higher in their study at 15%, and complication rates were close to our study around 25%, The average hospital stay they reported was 11.5 days which is shorter but comparable to our study (Forbes *et al.*, 2009).

FALAGAS et al. literatures review has also concluded that the incidence of mesh-related infection after hernia repair ranges from 1% to 8% across different studies. This rate is affected by underlying comorbidities, the surgical technique used, and the strategies implemented to prevent infections. For cases of mesh infection, a combined medical and surgical management

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approach is necessary with conservative management being curative for most cases and that the initial antimicrobial treatment regimen should provide coverage for Staphylococcus spp., especially Staphylococcus aureus (Falagas and Kasiakou, 2005).

The current study reported persistent infection that required surgical removal in 22.5% of patients, recurrence of hernia in 12.5%, adhesion formation in 2.5%, and chronic pain in 2.5%, A study by van der Linden et al. also showed persistent infection rates of 20%, hernia recurrence at 13%, adhesion formation at 15%, and chronic pain at 18% (Van der Linden and Van Vroonhoven, 1988)

While another study by Ahmad S et al. on 13 cases of mesh infection after incisional hernia repair have also stated that they managed all the cases conservatively without the need for mesh removal, and that the most causative organisms was staphylococcus aureus yet, their study only involved patients with polypropylene meshes and the antibiotics resistance profiles are different from region to another (Ahmad *et al.*, 2007).

Another study by Arnold et al. concluded that risk factors for mesh infection include active smoking, poorly controlled diabetes mellitus, abdominal skin or wound complications, and obesity. The study recommended using biologic or biosynthetic mesh for repairing incisional hernias after the removal of infected mesh, as it likely offers the best chance for a definitive hernia repair. For higher-risk patients, the use of a wound VAC-assisted delayed primary closure should be considered (Arnold *et al.*, 2018).

In our study triple antibiotics were used in 65% of patients, dual antibiotics in 35%, with all patients receiving Povidone iodine cleaning and 30% treated with hydrogen peroxide. VAC was used in 10% of patients, Mesh removal surgery was required for 22.5% of patients, another descriptive study by Meagher et al. on 13 patients have showed that 12 out of 13 patients were successfully treated conservatively with local wound care and antibiotics and only one patient required mesh removal for complete resolution of the infection, this variation between studies could be explained by the different antibiotics' sensitivity profile among various populations.(Meagher, Clarke Moloney and Grace, 2015).

Several studies have demonstrated the beneficial effect of using topical gentamycin in treating surgical wound infection after various operations (Musters *et al.*, 2015)(Yetim *et al.*, 2010)

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A literature review by Guillaume et al. suggests that a conservative approach with mesh salvage is preferred, as it is less invasive for the patient than mesh removal and reduces the risk of reherniation. Upon diagnosing an infection, the initial treatment involves draining any seroma, followed by washing and disinfecting the area with an antibiotic-containing irrigation solution, such as gentamicin. Patients are typically treated with intravenous antibiotics initially, followed by a course of oral antibiotics for up to 12 weeks (Guillaume *et al.*, 2018)

Povidone iodine is also recommended for disinfecting wounds and promoting healing. A study by Bigliardi et al. found that topical antiseptics like povidone iodine can reduce the risk of antibiotic resistance. Povidone iodine is a highly effective antiseptic that does not hinder wound healing. It has bactericidal properties against both Gram-positive and Gram-negative bacteria, with no reports of acquired bacterial resistance or cross-resistance. Moreover, it promotes healing in a range of acute and chronic wounds. In our study, we adopted this method, with 77.5% of patients receiving povidone iodine as a part of their ongoing conservative treatment (Bigliardi *et al.*, 2017).

In our study 12 patients treated with 3% hydrogen peroxide and the results was excellent from earlier granulation tissue, faster wound healing and less hepatization stay. Sanjay et al. study that they treated 43 patients out of 53 patients that were having deeply contaminated surgical wounds by using 7% hydrogen peroxide solution give excellent results (Rai *et al.*, 2023).

CONCLUSION

Most of the patients who developed mesh related infections can be treated with conservative treatment, in some cases persistent infection that requires surgical removal may occur.

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