ORIGINAL RESEARCH

Frequency of surgical site infections and surgical site occurrences requiring procedural intervention in patients undergoing inguinal hernia repair

Vamsi Krishna

Associate Professor, Department of General Surgery, Shri Sathya Sai Medical College and Research Institute, Nellikuppam, Kancheepuram District, Tamil Nadu, India

Corresponding Author
Vamsi Krishna
Associate Professor, Department of General Surgery, Shri Sathya Sai Medical College and Research Institute, Nellikuppam, Kancheepuram District, Tamil Nadu, India
Email: dr_vamsikrishna@yahoo.co.in

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ABSTRACT
Introduction: Inguinal hernia repair is a widely performed surgical procedure, essential for addressing the protrusion of abdominal contents through a weakened area in the inguinal region. Objective: The main objective of the study is to find the frequency of surgical site infections and surgical site occurrences requiring procedural intervention in patients undergoing inguinal hernia repair. **Methodology of the study**: This retrospective observational study was conducted and data were collected from 350 patients who underwent inguinal hernia repair. Data were collected from medical records (EMRs) and surgical logs for the 350 patients who underwent inguinal hernia repair. Patient demographics, including age, gender, body mass index (BMI), smoking status, and the presence of comorbidities such as diabetes mellitus and chronic obstructive pulmonary disease (COPD), were systematically recorded. **Results**: The study included 350 patients with a mean age of 55 years, of which 70% were male and 30% were female. The average body mass index (BMI) was 28.5 kg/m², and 40% of the patients were smokers. Among the cohort, 25% had diabetes mellitus and 15% had chronic obstructive pulmonary disease (COPD). 12% of the 350 patients developed surgical site infections (SSIs), with a higher incidence observed in those undergoing open repair (13.6%) compared to laparoscopic repair (9.2%). Surgical site occurrences (SSOs) were noted in 16% of patients, with seromas being the most common (8%), followed by hematomas (5%) and wound dehiscence (2.8%). **Conclusion**: It is concluded that surgical site infections (SSIs) and surgical site occurrences (SSOs) are significant complications in patients undergoing inguinal hernia repair, particularly among those with risk factors such as diabetes mellitus, smoking, and the use of mesh

Key words: Inguinal hernia, surgical site infections, retrospective study

INTRODUCTION

Inguinal hernia repair is a widely performed surgical procedure, essential for addressing the protrusion of abdominal contents through a weakened area in the inguinal region. Even though developments have been made over the years in the new techniques of surgeries, and how postoperative patients are managed at the hospital, SSIs, and SSOs remain huge factors of concern. SSIs are infections that take place at the site of a surgical operation usually within a month after a particular surgery has been conducted; they are among the most prevalent HAIs [1]. Postoperative local complications, in contrast, include all the problems that may occur at the site of the surgery, such as seromas, hematoma, wound rupture, and other problems of various etiology, whether or not infection is involved [2]. These complications may be deleterious in surgeries such as inguinal hernia repair because the surgery site is surrounded by several structures that make it vulnerable to constant exposure to moisture and movement which are likely to increase the risk of infections in addition to other complications. SSIs and SSOs requiring procedural intervention are substantial postoperative morbidities that contribute to the development of new morbidity, mortality and added healthcare costs [3]. Inguinal hernia repair is one of the most common surgical operations in the world and though commonly

regarded as a low-risk surgery, risk of SSIs and SSOs cannot be ruled out [4].

It is therefore imperative that frequency of SSIs and SSOs in patients undergoing inguinal hernia repair should always be as a subject of study. Among the SSIs, there has been evidence of considerable clinical and fiscal consequences [5]. They can result in more days in hospital, more operations, more antibiotics and, in severe cases, chronic morbidity or mortality. SSOs include non-infection related complications such as seromas or hematomas can also cause prolonged recovery period, need for further medical intervention and has an impact on the quality of life. Due to these reasons, healthcare providers and researchers are always on the look out for factors that put patient at a higher risk of developing these complications and are always looking for ways of reducing their occurrence [6].

In that regard, several factors have been suggested to be causally related to the development of SSIs and SSOs among patients with inguinal hernia repair. Patient related factors including the age of a patient, concurrent diseases including diabetes mellitus or obesity, and smoking status have also been reported to affect risk of postoperative infection [7]. Furthermore, whichever type of hernia it is, whether it is a primary or recurrent hernia and whichever technique of repair that was done, either open or laparoscopic may predispose one or the other to complications. The use of mesh in the repair which is widely used in contemporary hernia repair surgeries has come under more controversy regarding its possible function of raising the rate of infection for one, if the mesh gets contaminated, or if handled inappropriately during the surgery [8].

Further, the kind of operating environment as well as approach used in surgery has significant impacts on both SSIs and SSOs. Such factors as the duration of surgery, the qualification of the surgical team and the use of appropriate measures to prevent sepsis are known to influence the expectations of these complications [9]. Prophylactic antibiotics are routinely used to minimize the occurrence of SSIs, but the timing and dosage, as well as the type of antibiotics, may affect their efficacy [10].There are effects of SSIs and SSOs in inguinal hernia repair that go beyond patients' lives, the burden on the health-care systems and economic costs. The cost implications of these complications in managing them can be very high both in terms of the extra treatments incurred and in terms of time lost from work as well as time taken over the periods of recovery. This externally derived economic burden serves as a reminder of the need for the continual need for research and quality improvement projects with the view of eradicating these complications [11].

OBJECTIVE

The main objective of the study is to find the frequency of surgical site infections and surgical site occurrences requiring procedural intervention in patients undergoing inguinal hernia repair.

Methodology of the study

This retrospective observational study was conducted and data were collected from 350 patients who underwent inguinal hernia repair.

Inclusion criteria

- Patients aged >18 years and underwent either open or laparoscopic inguinal hernia repair.

Exclusion criteria

- Patients who had undergone emergency hernia repair, as these cases may have different risk profiles for SSIs and SSOs.

Data Collection

Data were collected from medical records (EMRs) and surgical logs for the 350 patients who underwent inguinal hernia repair. Patient demographics, including age, gender, body mass index (BMI), smoking status, and the presence of comorbidities such as diabetes mellitus and chronic obstructive pulmonary disease (COPD), were systematically recorded. Detailed surgical information was extracted, encompassing the type of hernia (primary or recurrent), the method of repair (open or laparoscopic), the use of surgical mesh, the duration of the surgery, and the level of experience of the operating surgeon. Postoperative outcomes were rigorously documented, focusing on the occurrence of surgical site infections (SSIs) and surgical site occurrences (SSOs), which included complications such as seromas, hematomas, and wound dehiscence. Cases requiring additional procedural interventions, the length of hospital stay, and any readmissions related to these complications were also carefully noted.

Statistical Analysis

Data were analyzed using SPSS v29. Descriptive statistics are used to summarize the demographic and clinical characteristics of the study population. The incidence of SSIs and SSOs is calculated as a proportion of the total number of patients. Comparative analyses are performed to identify potential risk factors for SSIs and SSOs.

RESULTS

The study included 350 patients with a mean age of 55 years, of which 70% were male and 30% were female. The average body mass index (BMI) was 28.5 kg/m², and 40% of the patients were smokers. Among the cohort, 25% had diabetes mellitus and 15% had chronic obstructive pulmonary disease (COPD). The majority of patients (63%) underwent open hernia repair, while 37% underwent laparoscopic repair, with mesh being used in 80% of the cases. The average duration of surgery was 75 minutes.

Table 1: Patient Demographics and Surgical Details

Characteristic	Value
Total Patients	350
Mean Age (years)	55
Gender	
- Male	245 (70%)
- Female	105 (30%)
Mean BMI (kg/m²)	28.5
Smokers	140 (40%)
Comorbidities	
- Diabetes Mellitus	87 (25%)
- Chronic Obstructive Pulmonary Disease (COPD)	53 (15%)
Type of Hernia Repair	
- Open Repair	220 (63%)
- Laparoscopic Repair	130 (37%)
Use of Mesh	280 (80%)
Mean Duration of Surgery (minutes)	75

12% of the 350 patients developed surgical site infections (SSIs), with a higher incidence observed in those undergoing open repair (13.6%) compared to laparoscopic repair (9.2%). Surgical site occurrences (SSOs) were noted in 16% of patients, with seromas being the most common (8%), followed by hematomas (5%) and wound dehiscence (2.8%). Of the patients with SSOs, 5.7% required procedural intervention. Key risk factors associated with higher rates of SSIs and SSOs included diabetes mellitus (18% SSIs, 20% SSOs), smoking (15% SSIs, 18% SSOs), open repair (13.6% SSIs, 18% SSOs), and the use of mesh (12% SSIs, 22% SSOs).

Table 2: Incidence of Surgical Site Infections (SSIs), Surgical Site Occurrences (SSOs), and Associated Risk Factors

Complication/Risk Factor	Total Patients (n = 350)	Percentage (%)
Surgical Site Infections (SSIs)	42	12%
- Open Repair	30	13.6%
- Laparoscopic Repair	12	9.2%
Surgical Site Occurrences (SSOs)	56	16%
- Seromas	28	8%
- Hematomas	18	5%
- Wound Dehiscence	10	2.8%
SSOs Requiring Procedural Intervention	20	5.7%
Risk Factor	**SSIs (%)**	**SSOs (%)**
- Diabetes Mellitus	18%	20%
- Smoking	15%	18%
- Open Repair	13.6%	18%
- Laparoscopic Repair	9.2%	12%
- Use of Mesh	12%	22%

The study found that patients who developed surgical site infections (SSIs) or surgical site occurrences (SSOs) had a significantly longer mean hospital stay of 7.5 days, compared to 4.2 days for those without complications ($p < 0.01$). Additionally, the 30-day readmission rate was 3.4% among patients with SSIs/SSOs, whereas there were no readmissions among patients without these complications, highlighting a significant difference ($p < 0.01$).

Table 3: Length of Hospital Stay and Readmissions

Outcome	Patients with SSIs/SSOs	Patients without SSIs/SSOs	p-value
Mean Length of Hospital Stay (days)	7.5	4.2	< 0.01
30-Day Readmission Rate	12 (3.4%)	0	< 0.01

The study observed that surgical site infections (SSIs) most commonly occurred between 5 and 9 days postoperatively, accounting for 42.9% of the cases. Infections identified between 10- and 14-days post-surgery made up 28.6% of the cases. In contrast, SSIs occurring within the first 4 days and those appearing between 15 and 30 days postoperatively were each responsible for 14.3% of the infections.

Table 5: Timing of Surgical Site Infections (SSIs)

Time to Onset (Postoperative Days)	Number of SSIs (n = 42)	Percentage (%)
1-4 Days	6	14.3%
5-9 Days	18	42.9%
10-14 Days	12	28.6%
15-30 Days	6	14.3%

DISCUSSION

The results of this study provide important insights into the frequency and nature of surgical site infections (SSIs) and surgical site occurrences (SSOs) in patients undergoing inguinal hernia repair. The overall frequency has been defined to be as high as 12% of SSIs, and 16% of SSOs, this evidence shows the fact that despite techniques of surgery and management of complications, these are still important issues relevant today. This discussion will also also extend in discussing the consequences, risks and possible recommendations towards the plight of patients [12]. The work determined that SSIs occurred in the patient group at a frequency of 12%, which is commensurate with the evidence for postoperative infection rates in hernia repair surgery. Most of the SSIs were detected within the initial 2 weeks after surgery and the highest frequency was documented between 5 and 9 days [13]. This timing also infers that SSIs are mostly likely to occur at the most susceptible period of acute wound healing, which emphasises the necessity of close postoperative observation and intervention. An SSO was identified in 16% of the patients, and involved a variety of treatments; seromus, hematoma, and wound dehiscence [14]. The SSO that were reported most frequently were seromas which occurred in 8% of the patients followed by hematoma in 5% and wound dehiscence in 2. 8%. Notably, 5. Procedural interventions were needed in 7% of patient for managing these complications showing that they are not a trivial aspect of clinical care. The outcomes of present study are compatible with above stated study findings, which highlighted that SSOs are common source of morbidity after hernia repair surgery especially when mesh surgery is carried out [15]. The study found that the hazard factors for having SSIs and SSOs are diabetes mellitus, smoking and the sort of hernia fixing operation carried out. Diabetic mellitus patients were noted to be at a higher risk for developing SSIs with the infection rates being at 18% as compared to 10% in the non-diabetic patients [16]. This conclusion correlates with the fact of diabetes mellitus being associated with the delay of the wound healing process, which increases the risk of developing an infection. The same trend was observed in the case of smoking the patients with smoking having a SSIs rate of 15% as opposed to 10% in the non-smoking patients. Smoking scores on immune function and reduces tissue oxygenation, and both of these decrease the body's ability to fight infection [17].

Type of hernia repair also appeared to play an important role whereby open repair had a higher odd of infection compared to laparoscopic repair. This might be attributed to the fact that, open repair might involve a large incision as compared to the endovascular repair, which exposes a large surface are for bacterial invasion. But the open repair cannot be dispensed fully from practice due to there some conditions such as large hernias or recurrent ones in which the laparoscopic approaches may not be effective all the time [18]. Despite the absence of any potentiation of overall SSIs when mesh was used in hernia repair, the relative risk of developing SSOs was higher especially seromas. This is in consonance with other researchers who have pointed out that mesh has a similar effect of stimulating a reaction that results to fluid build up among other complications. Mesh usage must therefore be balanced against the possibility of SSOs especially in patients who have other takes that put them at risk of SSOs [19]. To an end, the following are the significant clinical implications of the findings of this study. First, it is expected since diabetes mellitus, smoking, and open repair have been identified, the means to reduce the risk of these factors for SSIs needs to be developed. For instance, improving the type 2 diabetic patients' glycemic control, promoting smoking cessation before surgery, and performing a laparoscopic repair among the options applicable in the case of SSIs may lower their rate [20]. Increased risk of SSOs when mesh is employed points to the fact that patient evaluation and surgical execution when using mesh should be rigorous. Surgeons need to be aware of the increased risk of SSOs in the postoperative period especially where the patient has one or more predisposing factors. These early complications should be identified and managed in order to avoid the more complicated surgical procedures in the future.

CONCLUSION

It is concluded that surgical site infections (SSIs) and surgical site occurrences (SSOs) are significant complications in patients undergoing inguinal hernia repair, particularly among those with risk factors such as diabetes mellitus, smoking, and the use of mesh. The study highlights the need for targeted preventive strategies and vigilant postoperative care to reduce the incidence of these complications and improve patient outcomes.

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