International Surgery Journal
Keswani S et al. Int Surg J. 2018 Mar;5(3):971-974
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20180813

Original Research Article

Predictive factors of surgical site infections in abdominal wall hernias

Siddharth Keswani, Murtaza Akhtar*, Divish Saxena, Gayatri Deshpande

Department of Surgery, NKP Salve Institute of Medical Science, Nagpur, Maharashtra, India

Received: 22 December 2017
Revised: 10 January 2018
Accepted: 30 January 2018

***Correspondence:**
Dr. Murtaza Akhtar,
E-mail: murtazaakhtar27@gmail.com

ABSTRACT

Background: Surgical site infections (SSI) are infections presents in any location along the surgical tract after a surgical procedure. Knowledge of predictive factors associated with SSI is important for planning remedial measures. Abdominal wall hernia repair is a common procedure in general surgery practice and knowing the predictors of SSI in these clean surgeries requiring placement of mesh is the aim of the present study.
Methods: In a hospital based longitudinal study the subjects were diagnosed cases of anterior abdominal wall hernias undergoing planned or emergency surgeries. Patients of either gender and age group of 18 to 80 years were included in the study. Patients undergoing laparoscopic hernia repair were excluded. The study factors were patient and the surgeon related factors like laboratory parameters, surgeon experience etc. The outcome was SSI assessed with up to 30 days post-operative follow up.
Results: Total 198 patients were enrolled with a mean age of 42.49±15.72 years and male preponderance. Overall SSI rate was 9.09% and in planned cases it was 7.07% and 50% in emergency cases. Pre-operative hospital stays of >5 days was the only patient factor associated with increased risk of SSI (p=0.0004) and operating surgeon's experience was associated with increased risk if SSI i.e. cases operated by junior surgeons had a higher risk of SSI (p=0.013).
Conclusions: The only modifiable factor associated with SSI was pre-operative hospital stay of >5 days while high incidence of SSI with junior surgeons cannot be modified in a teaching institute.

Keywords: Abdominal wall hernia, Pre-operative hospital stays, SSI, Surgeon seniority

INTRODUCTION

Surgical site infection is a disastrous adverse event both for the patient and surgeon especially after clean surgeries with the placement of a mesh in abdominal wall hernia surgeries. It increases post-operative morbidity, prolongs hospital stay and increases hospital cost. Surgical site infection is categorized broadly as nosocomial infection acquired during hospital stay. The exact source of infection is difficult to trace.[1] It develops where medical and paramedical staff is in close contact with the patient at various stages of treatment. About 25-35% of these infections would be prevented by adhering to strict asepsis guidelines.[2]

Factors associated with surgical site infection include patient factors like co-morbid illness, age, gender, smoking, length of preoperative stay, nature of surgery and factors associated with the operating surgeon like the duration of surgery, seniority of surgeon and the placement of mesh. All these factors are because of a disturbed host-bacteria equilibrium that is in favour of the bacteria and lead to SSI. Carrying out a SSI estimation study for all surgical patients is the need of the hour but, the present study focuses on anterior abdominal wall

hernia surgery which is one of the commonest performed surgical procedure in general surgical practice. This study aims to identify risk factors associated with SSI and also study their wound microbiology and management of SSI in abdominal wall hernia surgeries.

METHODS

This was a tertiary care hospital based longitudinal study carried out in the Department of Surgery of NKP Salve Institute of Medical Sciences and Research Centre, Nagpur during a two years period from September 2015 to October 2017 on 198 patients admitted to the surgical wards/SICU with abdominal wall hernias. The aims of the present study were to estimate the incidence, predicative factors and microbiology of SSI.

The selection criteria were patients aged 18-80 years of either gender undergoing planned or emergency hernia surgeries with or without co-morbidities. Patients undergoing laparoscopic hernia repair were excluded.

The study factors included patient's age, gender, diabetes mellitus, ASA grade, pre-operative hospital stay, HIV, anaemia, nature of surgery (emergency or elective) and other surgeon's factors affecting SSI like surgeon seniority and type of surgery (clean, clean-contaminated and dirty).

SSI was the primary outcome factor in this study and was assessed according to CDC guidelines of 1999. Patients were followed up to 30 days for any evidence of surgical site infection. Irrespective of any obvious signs of SSI like pus discharge from the surgical site, the wounds were examined on the fourth post-operative day or earlier. Any finding of an unexplained fever or pain in the wound suggestive of wound infection was recorded. Pus discharge, if present was aseptically sent for culture.

RESULTS

Based on enrolment criteria, 198 patients who underwent open abdominal wall hernia repairs were enrolled in the study. As per CDC guidelines, 18 patients (9.09%) developed SSI. The incidence of SSI in emergency cases was 50% while it was 7.07% in planned hernia cases, all patients who developed SSI were superficial incisional SSI with no patients having deeper infection requiring mesh removal.

The mean age was 42.29±15.72 years, with the youngest patient being 18 years and oldest being 80 years. Highest incidence of SSI was noted in patients between 50 to 60 years age group (16.66%). The male: female ratio was 4.07:1 and there was no statistical difference in gender on the development of SSI. This study had 42 smokers and 156 non-smokers. smoking did not appear to be a statistically significant factor in the development of SSI. Of the total 198 cases, 5 patients were HIV seropositive of which no patient developed SSI suggesting that HIV seropositivity is not a factor associated with increased incidence of SSI. This study had 26 diabetics and 172 non-diabetics and diabetic status of patients in this study was not a statistically significant factor associated with SSI.

Table 1: Patient factors associated with development of SSI.

Patient factor	SSI		Total	P-value
	Present	Absent		
Age (years)				
≤40	7 (6.93%)	94 (93.06%)	101	0.281 (ns)
>40	11 (11.34%)	86 (88.65%)	97	
Gender				
Female	4(10.25%)	35 (89.74%)	39	0.77 (ns)
Male	14 (8.80%)	145 (91.19%)	159	
Smoking status				
Smoker	4 (9.52%)	38 (90.48%)	42	0.91 (ns)
Non-smoker	14 (8.97%)	142 (91.03%)	156	
Diabetes mellitus				
Diabetic	3 (11.5%)	23(88.5%)	26	0.64 (ns)
Non-diabetic	15 (8.8%)	157 (91.2%)	172	
Pre-operative stay (days)				
≤5 days	12 (6.85%)	163 (93.1%)	175	0.0004 (hrs)
>5 days	6(26.08%)	17 (73.9%)	23	
ASA grade				
1	9 (8.33%)	99 (91.67%)	108	0.42 (ns)
2	3 (6.38%)	44 (93.62%)	47	
3	6 (13.95%)	37 (86.05%)	43	
Haemoglobin (gm/dl)				
<10	7 (7.52%)	86 (92.48%)	93	0.47 (ns)
≥10	11 (11.48%)	94 (89.52%)	105	

Lengthy pre-operative stay (>5 days) is a known predictor to be associated with increased incidence of SSI. The present study showed a higher incidence of SSI in patients (26.08%) with a pre-operative stay of >5 days which was statistically significant (p=0.0004). ASA grade and anaemia (Hb <10gm/dl on admission) were factors which were not statistically significant predictors of SSI (Table 1). It was hypothesized that the seniority of operating surgeon would be a factor associated with SSI, where few good practices incorporated by senior surgeons may not be practiced by junior surgeons. Maximum incidence of SSIs was seen in cases operated by junior consultants (15.2%) followed by residents (10.3%) and least in cases operated by senior consultants (2.38%) which was a statistically significant difference (p=0.013).

Emergency surgeries had a higher incidence of SSIs (50%) as compared to elective surgeries (8.24%) and this difference was statistically significant (p=0.004). Placement of mesh was not a factor associated with SSI (p=0.08) (Table 2).

Table 2: Surgeon factors associated with development of SSI.

Surgeon factors	SSI		Total	P-value
	Present	Absent		
Seniority				
Senior consultant	2 (2.38%)	82 (97.6%)	84	0.013 (s)
Junior consultant	13 (15.2%)	72 (84.7%)	85	
Resident	3 (10.3%)	26 (89.6%)	29	
Nature of surgery				
Elective	16 (8.24%)	178 (91.75%)	194	0.004 (s)
Emergency	2 (50%)	2 (50%)	4	
Mesh				
Used	13(7.64%)	157(92.35%)	170	0.08 (ns)
Not used	5(17.86%)	23(82.14%)	28	

In the present study out of 18 cases of SSI, 2 cases (11.1%) showed positive cultures of Staphylococcus aureus and the rest of 16 cases of SSI were culture negative.

Table 3: Comparison of Incidence of SSI with literature.

Authors	No. of operations	SSI %
Cruse and foord[7]	62939	4.7%
Hernandez K et al[8]	486	18 %
Anvikar et al[3]	3280	6.09%
Lilanisp et al[4]	190	8.95%
Masood a et al[9]	100	11%
Sahus et al[10]	200	5%
saxena et al[11]	300	14.33%
Present study	198	9.09%

DISCUSSION

SSI though preventable, continues to remain high. These surgical site infection rates in India range between 4 to 30% and vary from surgeon to surgeon, hospital to hospital, one procedure to another and even from one patient to another.[3-6] The surgical site infection rate in Indian hospitals continues to remain much higher than western countries like United States of America and European nations where it is 2.8% and 2.5% respectively.[5] The higher infection rate in Indian scenario could be due to poor set-up and lack of attention to basic infection control. Recording the data of surgical site infections of all surgical patients is a herculean task, hence the present study was restricted to SSI in abdominal wall hernias.

The overall incidence of SSI in the present study was 9.09% which included abdominal wall hernia surgeries. If the emergency cases were excluded the incidence of SSI was 7.07% and the incidence in emergency cases was 50%. These statistics are quite consistent with the studies available in literature where the incidence quoted is from 5 to 18% (Table 3).[3,4,7-11]

The factors predicting development of SSI were evaluated as patient factors and surgeon factors. In patient factors, age wasn't associated with development of SSI though Masood et al in their study found increasing trend of SSI with advancing age.[9] The reason for this could be decreasing immunity with age. Gender was also not a significant factor. Western literature quotes incidence between 8.3 to 25% in smokers which was 9.52 % in the present study and this was statistically insignificant.

Considering the immunocompromised state of HIV seropositive patients, it was expected that SSI incidence should be high, but it was only 2.52% and this was not consistent with prevailing literature.[12] Diabetes mellitus, a predominant co-morbid condition was observed in 11.5% of SSI patients as compared to an SSI rate of 8.8% in non-diabetic patients which is statistically insignificant. This result is not consistent with literature quoting between 20 to 33% SSI rate in diabetic patients. The reason for low incidence in the present study was tighter control of diabetes in planned hernia surgeries and strict asepsis guidelines.

ASA grade of the patient was usually 1 and 2 in majority of the patients and hence SSI was not significantly related to ASA grade. Similarly, haemoglobin percentage indirectly depicting anaemia showed SSI in 7.52% patients which is quite lower than (18 to 21%) reported in literature.[9,11] The reason for lack of correlation was that majority of surgeries were done as planned cases where haemoglobin was >10gm%.

Pre-operative hospital stay leads to colonization of hospital acquired micro-organisms which are the ultimate cause for hospital acquired infections including SSI with the hypothesis that if the patient stays longer in the ward pre-operatively, increased colonization would increase the incidence of SSI. taking a cut-off of 5 days, it was observed that SSI was significantly higher in patients staying for 5 days or more in the hospital. These results are consistent with literature where researchers taking a cut-off of 5 days have shown a definite increase in the rate of SSI. The commonest cause of delay in the present study was due to fitness issue for anaesthesia due to cardiorespiratory problems. From the result, this was the only modifiable predictor of SSI with an easy interventional strategy of not admitting the patient unless they are fit or switch over to day care surgery for abdominal wall hernia cases.

Surgeon factors associated with development of SSI included nature of surgery and experience of operating surgeon. SSI incidence was 50% in emergency unplanned patients usually obstructed hernias with intestinal loop. The SSI rate in emergency surgeries was quite high as

compared to literature solely because of a very small number of patients undergoing emergency hernia surgery.

Experience of the operating surgeon of 5 or more years of completion of post-graduation had SSI incidence lesser than trainee surgical residents or junior consultants with less than 5 years surgical experience. The reason for this finding was practice of absolute strict aseptic protocol, less tissue handling and better haemostasis by senior surgeons. The reason for higher incidence in patients operated by junior consultants was because all the emergency cases were operated by them.

The wound swab culture of SSI patients showed a majority of them having no growth (89.9%). *Staphylococcus aureus* was the organism grown in 11.1% culture positive cases of SSI. These results are consistent with literature except for one study by Lilani SP et al where pseudomonas was found to be the commonest organism, *Staphylococcus aureus* being the commonest commensal and organism responsible for SSI logically conveys the consistency with literature.[4,9,12]

The main limitation of the present study is that it is just a longitudinal study with within group comparative analysis. No formal sample size calculation was carried out due to multiplicity of the factors under study. Certain factors like shaving versus trimming were not included because of the existing old policy of shaving the patient a day prior to surgery. Also, the role of prophylactic antibiotics which would have had a bearing on SSI was not studied due to no formal antibiotic policy in the institute. The choice of antibiotic was dependent on the operating surgeon and the concerned unit.

Of the patient factors and surgeon factors, the present study could identify one patient factor and one surgeon factor which was statistically significant, however only the patient factor could be modified by changing hospital admission policy or operating patient as a day care case. As the study was conducted in an academic institution with post graduate training, it was not feasible that all the surgeries could be done by senior surgeons of more than 5 years' experience after post-graduation.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Ahmed MI. Prevalence of Nosocomial wound Infection among Postoperative patients and Antibiotics patterns at Teaching Hospital in Sudan. North Am J Med Sci. 2012;4(1):29-34.
2. Anusha S, Vijaya LD, Pallavi K, Manna PK, Mohanta GP, Manavalan R. An Epidemiological Study of Surgical Wound Infections in a Surgical unit of Tertiary Care Teaching Hospital. Indian J Pharm Pract. 2010;3(4):8-13.
3. Anvikar AR, Deshmukh AB. A one-year prospective study of 3280 surgical wounds. IJMM. 1999;17(3):129-32.
4. Lilani SP, Jangale N, Chowdhary A, Daver GB. Surgical site infection in clean and clean-contaminated cases. Indian J Med Microbiol. 2005;23:249-52.
5. Mahesh C B, Shivakumar S, Suresh BS, Chidanand SP, Vishwanath Y. A prospective study of surgical site infections in a teaching hospital. J Clini Diag Res. 2010;4:3114-9.
6. Ganguly PS, Khan Y. Malik A. Nosocomial infection and hospital procedures. Indian J. Common Med. 2000;990-1014.
7. Koch R. Investigations into the etiology of traumatic infective diseases. New Sydenham Society; 1880.
8. E-medicine. Inguinal Region Anatomy: overview, gross anatomy, pathophysiological variants. Available at: http://emedicine.medscape.com/article/2075362-overview#showall. Accessed 9 November 2015.
9. Masood A, Nadeem SL. Post-operative wound infection: A surgeon's dilemma. Pakistan J Surg. 2007;3(1):42-5.
10. Sahu S, Shergill J, Sachan P, Gupta P. Superficial incisional surgical site infection in elective abdominal surgeries-A prospective study. Internet J Surg. 2011;26(1):514-24.
11. Saxena A. Surgical site Infection among postoperative patients of tertiary care centre in Central India-A prospective study. Asian J Biomed Pharma Sci. 2013;3(17):41.
12. Drapeau CM, Pan A. Surgical site infections in HIV-infected patients: results from an Italian prospective multicentre observational study. Infect. 2009;37(5):455-60.

Cite this article as: Keswani S, Akhtar M, Saxena D, Deshpande G. Predictive factors of surgical site infections in abdominal wall hernias. Int Surg J 2018;5:971-4.