Journal of Surgical Sciences (2012) Vol. 16 (2) : 71-75

JOURNAL OF SURGICAL SCIENCES

Original Article

RISK FACTORS ASSOCIATED WITH SSI IN ELECTIVE GASTROINTESTINAL SURGERY: A PROSPECTIVE STUDY IN A SPECIALIZED SURGICAL CENTRE

Aminul Islam Joarder[1], Mohammad Salahuddin Faruque[1], M. Nur-E-Elahi[2], Ishrat Jahan[3], Omar Siddiqui[4], Md. Muniruzzaman Siddiqui[5], Samia Mubin[1], Sadia Imdad[6], Rakibul Hasan[7]

Abstract

Background Understanding SSI and providing feedback to the surgical team has been shown to reduce the incidence of surgical site infection and the cost incurred due to it.

Objective To assess the risk factors of surgical site infection (SSI) in elective gastrointestinal surgery.

Methods Prospective data were collected on 1122 surgical patients admitted in the surgery department in BSMMU from January 2010 to July 2012. All preoperative risk factors were evaluated .Patients operated were followed in the post operative period and if any wound infection noted, swab from the site of infection was sent for culture and sensitivity and antibiotics were given accordingly.

Results The incidence of SSI was 183(16.31%).Out of this 183 cases 65.6% had BMI <25. Anaemia was present in 45.90% cases, bronchopulomnary disease was present in 11.5% cases and DM & jaundice was present in 8.19% and 28.9% cases accordingly. 69(37.7%) cases were habitual smoker.SSI rate progressively increased with rate of contamination and maximum infection occurred in lower GIT surgery which was 144(17.84%). SSI developed more, in 102 (55.74 %) cases when duration of operation was more than 2 hours. In 73.8% cases of SSI drain tube was used. Statistically significant risk factors for SSI were found to be smoking habit, BMI <25, preoperative anaemia and duration of operation more than two hours.

Conclusion Specific optimization of the patients' preoperative condition is essential to reduce the risk of SSI following elective gastrointestinal surgery. Surveillance should be conducted and maintained in all hospitals to promote better surgical outcomes. Cessation of smoking, optimization of nutritional status, correction of anaemia and reduction of operation time should be associated with a lower incidence of SSI.

Key Words Surgical site infection, wound infection, nosocomial infection, anemia, risk factor,

1. Assistant Professor, Department of Surgery, BSMMU, Dhaka.
2. Medical Officer, Department of Surgery, BSMMU, Dhaka.
3. Registrar, Department of Surgery, SSMCMH, Dhaka
4. RS General, SSMCMH, Dhaka.
5. Deputy Director, MFSTC, DGFP/MOHFW, Dhaka
6. Assistant Registrar, Department of Surgery, SSMCMH, Dhaka.
7. MS (CT Surgery) Course student, BSMMU, Dhaka.

Correspondence to: Dr. Aminul Islam Joarder, Assistant Professor, Department of Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, E-mail: fasa0103@yahoo.com
Received: 08 November, 2012 **Accepted:** 09 December, 2012

Introduction

Surgical site infection (SSI) accounts for about 15% of all nosocomial infections and occurs in 10%–30% of all patients undergoing gastrointestinal surgery.[1,2] Examination of the causes of late mortality in individuals seeking surgical attention reveals that as much as 78% of all deaths may be attributed to septic complications[3], suggesting the value of understanding the prevention and treatment of sepsis. Despite

adequate systemic support and meticulous application of the principles of appropriate wound care, certain wounds are still prone to infection.[4]

In 1970, the Centers for Disease Control and Prevention (CDC) in US set up the National Nosocomial Infection Surveillance (NNIS) system that later in 1992 redefined and classified SSI and established the guidelines for the prevention of SSI.[5] The CDC also reported that surveillance plays an important role in decreasing the incidence of SSI.[5] To date no national nosocomial infection surveillance system is in practice in the country even not in the specialized surgical centers.

Over the past decade increased attention has been focused on the risk factors both intrinsic[6], such as weight, presence of diabetes, haemoglobin values etc. and extrinsic risk factors[7], such as shaving, preoperative skin preparation, skin asepsis, operative room ventilation, inadequate sterilization of instrument, poor haemostasis, duration of operation etc. that contribute to the development of these infections. But these factors whether they carry the same potential as risk factors for SSI in our context need confirmation and vigilant evaluation from time to time.

The aim of this study was to evaluate the possible risk factors of SSI in elective gastrointestinal surgery with special attention to demographic variables, smoking, anemia, body built and operating time.

Methods

This cross sectional observational study was done in the Department of surgery of Bangabandhu Sheikh Mujib Medical University from January 2010 to July 2012 where purposive sampling technique was done. Out of 1122 patients having elective gastrointestinal surgery who developed SSI (183 cases) were included in the study. Patients having operation other than gastrointestinal tract, pediatric patients, patients with operations involving obviously infected wounds and those requiring more than one operation in the same admission were excluded.

Socio-demographic variables were collected from all the patients by thorough history. Detailed clinical examination and baseline investigations and relevant investigations where necessary were done for diagnosis and assessment of general condition of the patients and fitness for general anesthesia. Operative procedure, findings, time were recorded. Operated patients were followed up in the post operative period till discharge.

Quantitative data were analyzed by mean and standard deviation and qualitative data were analyzed by chi-square test and chi-square (with yate's correction) test. P value equal or less than 0.05 was considered significant.

Results

Table-I

Patients Characteristics and SSI. (n=183)

Age	Frequency	Percentage
< 20 years	18	9.8
20-50 years	123	67.2
> 50 years	42	23.0
Total	183	100.0
Mean ±SD	38.52±15.80	
Body built	**Frequency**	**Percentage**
BMI > 25	120	65.6
BMI < 25	63	34.4
Total	183	100.0
Comorbidity	Present	Absent
DM	15(8.2%)	168(91.8%)
Broncho-pulm. disease	21(11.5%)	162(88.5%)
Jaundice	53(28.9%)	130(71.1%)
HTN	15(8.2%)	168(91.8%)
Anaemia	84(45.90%)	99(54.1%)
Addiction	Present	Absent
Smoking	69(37.7%)	114(62.3%)

Table-II

SSI rate according to site of surgery. (n=183)

Site of Surgery	No of cases	No of infection	Percentage
Upp. GIT	314	39	11.30
Low GIT	808	144	17.84

Table-III

Operating time (Hour) and SSI. (n=183)

Time taken for operation (hr.)	Frequency	Percentage
< 2 hours	81	44.26
>2 hours	102	55.74
Total	183	100.0

Table-IV

Relationship of SSI with smoking, anaemia, body build, and operating time.(n=183)

Smoking		Infection		Total	χ^2	P
		Present	Absent			value
3rd POD	Smoker	7	62	69	1.12	0.28
	Non-smoker	1	113	114		
5th POD	Smoker	61	5	69	6.33	0.011
	Non-smoker	78	36	114		
7th POD	Smoker	66	3	69	1.25	0.26
	Non-smoker	99	15	114		
Anaemia						
		Present	Absent			
3rd POD	Anemic	12	72	84	1.15	0.28
	Non-anemic	6	93	99		
5th POD	Anemic	81	3	84	3.64	0.05
	Non-anemic	81	18	99		
7th POD	Anemic	84	0	84	0.86 ÷2	0.35
	Non-anemic	96	3	99		
Body build						
		Present	Absent			
3rd POD	BMI > 25	3	117	120	7.05	0.007
	BMI< 25	15	48	63		
5th POD	BMI > 25	72	48	120	8.05	0.003
	BMI< 25	60	3	63		
7th POD	BMI > 25	117	3	120	0.53	0.46
	BMI< 25	63	0	63		
Operating time						
		Present	Absent			
3rd POD	< 2 hr	3	78	81	2.05	0.15
	> 2 hr	15	87	102		
5th POD	< 2 hr	63	18	81	5.50	0.018
	> 2 hr	99	3	102		
7th POD	< 2 hr	81	0	81	0.80	0.36
	> 2 hr	99	3	102		

Discussion

Out of 1122 patients, 183 patients were enrolled as sample according to selection criteria. SSI rate following elective gastrointestinal surgery was 16.31%, mostly developing within 5th to 7th POD. The mean age of the patients was 38.52 ± 15.80 years and dominant sufferer was male patients. Sorensen et al[8], Graham et al[9], Watanabe et al [10] found that chance of SSI is higher in > 60 years of age. The exact reason for a higher rate of SSI in male gender remains unclear. Male predominance correlates well with the study of Offner[11] and Hermandez et al [12].

Certain conditions like diabetes mellitus, cardio-vascular disease, lung disease, malignancy, anaemia are frequently associated with surgical site infection found in the study of Malone et al.[13], Sorensen et al.[8] and others. In this study 84(45.90%) patients were anaemic, 53(28.9%) patients had jaundice, 21(11.5%) patients had bronchopulmonary disease, 15(8.2%) patients were diabetic and 15(8.2%) patients were found hypertensive.

37.7% patients were habitual smoker and smoking had significant effect on SSI (p= 0.01, x^2 = 6.33). Thus well correlating with the previous reports of Sorensen et al.[8]and Shamimi et al[14].

Hb% below 10 mg/dl was taken as anemic. 45.90% cases of SSI developing patient had anaemia. SSI

rate between anemic and non anemic patients significantly differed (p = 0.05, ÷2 = 3.64). Malone et al[13] found that both preoperative anaemia (P < 0.001) and postoperative anaemia (P = 0.001) were associated with an increased risk for SSI. Watanabe et al.[10] showed increased risk of SSI if blood transfusion is given within 7 days prior to surgery. Further insight is needed about when to correct anaemia preoperatively to reduce SSI.

Body built of 34.4% cases were below average with BMI < 25 which has significant effect on wound infection (p = 0.003, c^2 = 8.05). Malone et al[13] found weight loss >10% over the 6 months period prior to operation was associated with increased risk of SSI.

The incidence of SSI following upper alimentary tract operation, which consisted of gastric and duodenal surgery, was 11.30%. Conversely, the incidence of SSI following lower alimentary tract operation, which consisted of small intestine and colorectal surgery, appendicectomy and stoma operations including Hartmann's operation was 17.84% .Watanabe et al.[10] and Tang R et al.[16] found incidence of SSI following upper and lower alimentary operation 8% and 20% - 30% respectively. Konishi et al.[17] found that among lower alimentary tract surgeries, the SSI rate was higher in rectal surgery 18.0%.

Risk of SSI had repeatedly been shown to be proportional to the length of operative procedures found in previous study results done by Tang R et al.[16] Cruse PJE et al.[6], Coblo et al[18] and Imai et al.[19] In our series there was a significant difference of wound infection (p = 0.018, ÷2 = 5.50) between duration of operation of < 2 hours and > 2 hours. Cruse PJE et al. [6] found an increase in wound infections with longer procedures roughly doubling with every hour of the procedure. Vvhnanek et al.[20] found that an operative duration of greater than two hours to be associated with more infection. The possible explanations are– i. Doses of bacterial contamination increases with the time, ii. Wounded tissues are damaged by drying and by exposure to air and retraction, iii. Increased amount of suture and electrocoagulation may reduce the local resistance of the wounds, iv. Longer procedures are more liable to be associated with blood loss and shock, thereby reducing the general resistance of the patients.

Thus in our series demographic variables of our patients, nutritional status, personal habits, preoperative co-morbidity, and operating time had significant impact on SSI following elective gastrointestinal surgery.

Conclusion

SSI causes substantial morbidity, mortality and increases economic burden. Present study depicted significant relationship between potential risk factors and SSI like smoking habit, BMI < 25, preoperative anemia and operating time. Optimizing these risk factors can promote better surgical outcome. Multicenter comparative study may be done to combat SSI rate and to formulate a national guideline.

References

1. Emori TG, Gaynes RP. An overview of nosocomial infections, including the role of the microbiology laboratory. Clin Microbiol Rev 1993;6(4):428–42.
2. Smith RL, Bohl JK, McElearney ST, Friel CM, Barclay MM, Sawyer RG, et al. Wound infection after elective colorectal resection. Ann Surg 004;239(5):599–607.
3. Al-awami S M, Breiki H A, Grant C. Wound infection following biliary surgery. INT SURG 1991; 76: 77-80.
4. Nicholas RL, Barie PS, Condon RE, Fry DE, Gorbach SL et al. Risk factors and surveillance in surgical wound infections, Surgery 2000; 128:2-13.
5. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection 1999. Infection Control Hosp Epidemiol 1999;20(4):247–78.
6. Cruse PJE. The epidemiology of wound infection: a 10-year prospective study of 62,939 wounds. Surg Clin North Am 1980; 60(1):27–40.
7. Beya S C, Preventing surgical site infections – guiding with evidence. AORN J 2000; 128:1.
8. Sorensen LT, Malaki A, Jorgensen PW et al., 2007, Risk factors for mortality and postoperative complications after gastrointestinal surgery, J Gastrointest Surg, vol. 11, pp. 903-910.
9. Graham DJ, Slevasson JT, McTherry CR, 1998, the association of intra-abdominal infection and abdominal wound dehiscence, Am Surg, vol. 64, pp. 660-665.
10. Watanabe A, Kohnoe S, Shimabukuro R, et al., 2008, Risk factors associated with surgical site

infection in upper and lower gastrointestinal surgery, Surg Today, vol. 38, pp. 404-12.

11. Offner PJ, Moore EE, Biffl WL. Male gender is a risk factor for major infection after surgery, Arch Surg 1999. vol. 134, pp. 935-940.
12. Hernandez K, Ramas E, Sease, Henostroza G, Gotuzzo E. Incidence of and risk factors for surgical site infections in a Peruvian Hospital, Infect Control Hosp Epidemiol 2005, vol. 26, pp. 473-477.
13. Malone DL, Genuit T, Trauy JK et al. Surgical site infection: reanalysis of risk factors. J Surg Research 2002. vol. 103, pp. 89-95.
14. Shamimi K, Alaviyon M, Moazami F, Jalali SM. Evaluation the risk factors of surgical site infection after elective colorectal operation. Achieve of SID 2007. vol. 54, pp. 71-77.
15. Weiss CA, Statz CL, Dahms RA et al. Six years of surgical wound infection surveillance at a at a tertiary care center, Arch Surg 1999. pp. 134, pp. 1041-1048.
16. Tang R, Chen HH, Wang YL, et al. Risk factors for surgical site infection after elective operation of the calon and rectum. Ann Surg 2001. vol. 234(2), pp. 181-189.
17. Konishi T, Watanabe T, Kishimoto J, Nagawa H. Elective colon and rectal surgery differ in risk factors for wound infection. Ann Surg 2006. vol. 244(5), pp. 758-63.
18. Culer AIG, Clark C, Smith G. Postoperative wound infection: A computer analysis. Brit J Surg 1971, vol. 58(5), pp. 333-337.
19. Imai E, Veda M, Kanaok et al. Surgical site infection risk factors identified by multivariate analysis for patient undergoing laparoscopic, operation and gastric surgery, AJIC 2008. vol. 36(10), pp. 727-731.
20. Vuhnanek F, Duchae V, Skala P, Teplan V. Surgical site infection following proximal GIT procedures, Rozhl Chir 2008. vol. 87(6), pp. 297-300.