A CLINICAL STUDY OF ABDOMINAL SURGICAL SITE INFECTION

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ABSTRACT

BACKGROUND

Infections which develop at or near surgical site within 30 days of surgery if no prosthesis is used, and within one year if prosthesis is used are defined as 'Surgical Site Infections'. This study was conducted to find out incidence, associated risk factors and microbial profile of surgical site infections after abdominal surgeries.

MATERIALS AND METHODS

It was an observational descriptive study which included 102 patients who got admitted for routine and emergency surgeries. Preoperatively, routine investigations were done, and patients were operated and followed for signs of surgical site infections. Surgical wound was examined on 3rd, 5th and 10th post-operative day, pus was collected on swab sticks and sent for culture and antibiotic sensitivity. Results were calculated as p value, and statistical significance was determined.

RESULTS

Overall incidence of SSI was 22.5% which was more in emergency surgeries (35.2%) as compared to routine surgeries (9.2%). SSI rate was more in patients with diabetes ($p<.05$), pre-obese and obese patients ($p<.05$), hypo proteinaemic patients ($p<.05$), surgeries which lasted more than 2 hours, dirty procedures and in GI surgeries. Most common organism was E. coli, followed by S. aureus, Klebsiella and pseudomonas. All these microorganisms were 100% sensitive to imipenem.

CONCLUSION

With this study we can conclude that microorganisms which are normal inhabitants of human body are responsible for SSI. Host factor, treatment factor and environmental factor are equally responsible for SSI. Quality of surgical care, resuscitation, patient preparation, aseptic environment and proper antibiotic coverage are important for the control of SSI.

KEY WORDS

SSI, Abdominal Incision, Infection, Nosocomial.

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BACKGROUND

Infections that occur in the wound created by an invasive surgical procedure are generally referred to as surgical site infections (SSIs). SSIs are the third most important causes of Hospital acquired infections & they account for a quarter of all nosocomial infections.[1] These infections are associated with considerable morbidity and has been reported that over one-third of postoperative deaths are related to it. SSIs can range from a relatively trivial wound discharge with no complications to a life-threatening condition. They can double the length of stay in the hospital and thereby increase the costs of health care which can be related to re-operation, extra nursing care and interventions, and drug treatment costs. Frequency of these infections varies from patients to patients. There are numerous patient-related (Endogenous) and process/procedural related (Exogenous) risk factors that can affect a patient's risk of developing an SSI.

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Some of these risk factors such as age and gender cannot be changed. However, number of other factors, such as diabetes, smoking, proper use of antibiotics and intraoperative technique can be improved to reduce the chances of developing SSIs Despite improved understanding of the pathophysiology and improved methods of prevention and prophylaxis, surgical site infection remains the common cause of postoperative morbidity and mortality. It is therefore imperative to implement adequate measures to reduce these incidences and to prevent them, it is necessary to identify the epidemiology of these infections. So, the present study was conducted with the objective to know the incidence of surgical site infections, its association with various risk factors, frequencies of various pathogens causing SSIs and their antibiotic profile.

MATERIALS AND METHODS

It was an observational descriptive type of study. 102 patients were included in this study who were admitted in department of surgery in Dr. B. R. A. M. Hospital Raipur from March 2015 to august 2016. Approval from ethical committee was taken. After taking written and informed consent patients were included in study. Patients presenting for routine surgeries as well as emergency surgeries were included in this study. Preoperative data regarding patients name, age, sex associated co morbidities such as diabetes, hypertension was collected. All completing routine investigations (complete blood counts, liver function test, renal function test, x- ray chest, ultrasonography), patients were posted for surgery. Delay in hospital presentation after delay in surgery were considered as risk factor for emergency surgeries. Intraoperative factors (Duration of surgery, type of surgery, type of wound, sutures used in surgery) were taken in to consideration as risk factors for development of SSI. Patients were shifted to post-operative ward. Since same operation theatre, instruments and post-operative ward was used for all the patients, Environmental factors were nullified.

Diagnosis of surgical site infection was made as per CDC definitions

- Superficial incisional, affecting the skin and subcutaneous tissue. These infections may be indicated by localized (Celsius) signs such as redness, pain, heat or swelling at the site of the incision or by the drainage of pus.
- Deep incisional, affecting the facial and muscle layers. These infections may be indicated by the presence of pus or an abscess, fever with tenderness of the wound, or a separation of the edges of the incision exposing the deeper tissues.
- Organ or space infection, which involves any part of the anatomy other than the incision that is opened or manipulated during the surgical procedure, for example joint or peritoneum. These infections may be indicated by the drainage of pus or the formation of an abscess on radiological examination or during re-operation.

Once wound infection was suspected swabs or aspirates were collected from these sites following all aseptic precautions. These samples were then cultured, and antibiotic susceptibility was checked. P value was calculated, and statistical significance was determined for risk factors.

RESULTS

Study Population

Out of 102 patients 22.5% were females and 77.5% were males. 51% were aged less than 45 years and 49 patients were aged more than 45 years. 51 patients were operated during emergency. 83 surgeries involved GI tract and 19 involved genitourinary tract. 8 surgeries were clean, 46 were clean-contaminated, 21 were contaminated and 27 were dirty. Age and gender wise distribution is shown in table 1.

Incidence

Out of 102 patients 23 developed SSI (22.5%). SSI rate was higher in emergency procedures as compared to routine procedures (35.2% vs 9.2%). SSI rate was higher in > 45 yrs. age group (56-85 yrs., 50%). 21.5 % males (17/79) developed SSI while 26% females (6/23) developed SSI.

SSI rate was 12.5% in clean wounds, 13% in clean contaminated wounds, 23.8% in contaminated wounds and 40.7% in dirty wounds.

Risk Factors and SSI

There was significant correlation (P<.05) between SSI and some risk factors. Among host factors significant correlation was seen in patients age, BMI, associated co morbidities (Diabetes, renal function status and jaundice), hypoproteinaemia while patients' sex, hypertension, preoperative haemoglobin were not significantly associated with SSI.

Among treatment factors significant correlation was seen in delay between onset of symptom and hospital presentation, type of wound, suture material used, duration of procedure, type of incision while type of system which was involved (GIT OR GUT) does not significantly affects the development of SSI. All environmental factors were nullified

Microbiology

E. coli (43.7%) was most common bacteria isolated from pus culture followed by S. aureus (30.4%),

Klebsiella (13%), Pseudomonas (8.6%) and no growth was seen in 4.3% of pus.

All these microorganisms were 100% sensitive to imipenem. S. aureus was resistant to amikacin and gentamycin. Klebsiella was resistant to ciprofloxacin and norfloxacin. pseudomonas was resistant to ceftriaxone. (Table 2)

Age Range (in Yrs.)	No. of Patients	% of Patients	% of PT. with SSI
15-25	22	21.6	4.5
26-35	12	11.8	16.6
36-45	18	17.6	16.6
46-55	29	28.4	24.1
56-65	18	17.6	50
66-75	1	1	-
76-85	2	2	50
Total	**102**	**100**	

Patient Distribution According to Age

Type of System	Total Patient	Patient with SSI in Routine Surgeries	% of Patient with SSI	Over all % With SSI (23)
Clean	8	1	12.5	4.4
Clean Contaminated	46	6	13	26
Contaminated	21	5	23.8	21.8
Dirty	27	11	40.7	47.8
Total	**102**	**23**		**100**

Table 1. Distribution of Patients Who Developed SSI According to Type of Wound

Bacteria	Imipenem	Ceftriaxone	Tazobactam- Piperacillin
E. coli	10 (100%)	6 (60%)	7 (70%)
S. aureus(2)	7 (100%)	4 (57%)	5 (71%)
Klebsiella(3)	3 (100%)	1 (33.3%)	2 (66.6%)
Pseudomonas(1)	2 (100%)	-	1 (50%)
Bacteriae And Their Antibiotic Sensitivity			

Bacteria	Ciprofloxacin	Norfloxacin	Amikacin	Gentamycin
E. coli	5 (50%)	6 (60%)	5 (50%)	4 (40%)
S. aureus(2)	2 (28.5%)	3 (42.8%)	-	-
Klebsilla(3)	-	-	1 (33.3%)	2 (66.6%)
Pseudomonas(1)	1 (50%)	1(50%)	2 (100%)	1 (100%)

DISCUSSION

In the present study rates of SSI in different types of surgeries and its contributing factors with microbiological profile were analysed.

It was revealed that among 102 patients 23 (22.5%) developed surgical site infection (SSI). This finding is consistent with the finding of- (1) Where they found 165 patients among 716 (23%) suffered from SSI. (2) found SSI rate of 7.44%, (3) observed SSI rate of 15.7%, (4) observed SSI rate of 14% in abdominal surgeries. In study by (5) the incidence was 13.7% while study by (6) it was 14.33%. The infection rate is lower in USA (2.8%) and 2-5% in European countries. (7) But some African countries like Northern Ghana has higher SSI rate 39% (8). The higher infection rate in Indian hospitals may be due to the poor set up of our hospitals and also due to the lack of attention towards the basic infection control measures. (5)

It was evident that SSI increases with an increase in the degree of contamination of the wounds operated upon. The infection rate was found to be almost 4-times higher following emergency procedures than planned elective procedure. This finding is consistent with findings of other studies. (5) Found infection rate was with emergency surgery (25.2%) when compared to elective surgery (7.6%) which was statistically significant. (2) Also observed higher rate of SSI in cases of emergency surgeries. (3) Also found similar results. In Elective surgeries SSI rate was 5.7% and in Emergency surgeries it was 28.6%. (1) observed. The infection rate was higher in patients undergoing emergency surgeries than in elective surgeries., SSI was 20% in elective and 28% in emergency surgery (4) found the risk of SSI to be less in elective surgeries (6.5%) than the emergency (26.3%) surgeries like acute abdomen. 11). This high rate of SSI in Emergency surgery may be a result of inadequate preoperative preparation the condition which predisposed to patients to the emergency surgery and more chances of contaminated or dirty wounds in emergency surgeries.

It was observed that rate of SSI in different age groups was 4.5 % in the 15-25 years, 16.6 % in the 26-35 years, 16.6 % in the 36-45 years, 24.1 % in the 46-55 years, 50 % in the 56-65 years, 50.00 % in the 76-85 years and It was highest 50 % (9 among 18 and 1 among 2) in the 46-55 and 76-85 years age group.[4,3,5,6] also found similar results. More the age, more are the chances for certain chronic conditions, malnutrition and decrease in immunological efficiency, leading to more SSI. SSI is not related to sex,[7] in agreement with previous findings. The literature shows that SSI increases with obesity. In this study, it is found that high BMI are associated with increased incidence of infection, due to decrease in blood circulation in fat tissues.[8] Diabetes causes vasoconstriction and affects circulation of tissue leading to local tissue hypoxia. In the present study diabetes increased the risk of SSI by 2.38 times.[9] Various studies conducted by[15] have found out diabetes as a risk factor for SSI.

Anaemia itself is not an established factor for post-operative wound infections. However, a higher incidence of postoperative wound infections was noted with the initial low haemoglobin levels. It can be due to the effect of the blood transfusions which were given pre-operatively to bring the haemoglobin level to up to 10 gm/dl. Ford et al., [10] postulated this in 1993.

In relation to different types of wounds, by the degree of contamination, it was observed that among 102 cases 8 were clean wounds, SSI developed only in 1 (12.5 %) of these clean cases. There were 45 clean contaminated cases, among them SSI occurred in 6 (13.00 %); whereas SSI developed in 5 among 21 (23.8%) contaminated wounds. The rate of SSI was as high as 11 among 27 (40.7%) dirty cases. It was revealed that the infection rate increased with that of degree of wound contamination (Table 3). This difference is statistically significant. These findings were consistent with the findings of 10 years prospective study of 62, 963 wounds by Cruse and Frood in 1980, where infection rate was 1.5%, 7.7%, 15.2% and 40% in clean, clean contaminated, contaminated and dirty wounds respectively (Cruse and Frood 198) and other Indian studies.[4,1,5,11,6]

In the present study surgeries of> 2 hours of duration developed SSI significantly more frequently ($p<0.002$) than surgeries of ≤2 hours of duration. Other studies also define duration of surgery as significant risk factor.[1,5,12]

E. coli were found in 10 (43.7%) cases, the commonest organism causing surgical site infections (SSI). Staph. aureus was the second most common organism found in 7 (30.40%). Klebsiella and pseudomonas were causing 3 (13%) cases and 2 (8.6%) of SSI respectively. These are supported by the findings of study conducted by (Barnali et al 2013).[1] They detected E. coli as principal incriminated organism for SSI. Distribution of microflora involved was E. coli 41.17 %, Staphylococcus 17.2, Klebsiella 9.8%, Pseudomonas 7.8%. (AMIT AGRAWAL et al 2014).[3] Observed E.coli 63.8% as most common organism. Others were sterile culture 27.7%, Methicillin Resistant Staphylococcus Aureus (MRSA) 4.3%, Klebsiella 2.1%, mixed infection 2.1%. (Fadnis MP et al 2014) observed The organism that was most frequently isolated was Escherichia coli (38.89%), this was followed by Klebsiella pneumonia (22.22%), Acinetobacter baumannii

(22.22%), Staphylococcus aureus 16.67% and Pseudomonas aeruginosa.[5] observed pseudomonas 42.85% and Klebsiella 28.5% as principal organism in his study.

All the organisms isolated (100.00%) were sensitive to Imipenem because this is an excellent newer drug with broad spectrum of activity and another fact is that it is not a commonly used drug. so, development of resistance is uncommon. Use of newer drugs should be reserved for specific cases and must not be used empirically or prophylactically.

Escherichia coli were sensitive to Imipenem (100% cases), Ceftriaxone (60% cases), Tazobactam-piperacillin (70 % cases), Ciprofloxacin (50 % cases), Norfloxacin (60% cases) and Amikacin (50% cases) and Gentamycin (40%). These findings are consistent with that of (Iqbal et al 2002).[13] They studied sensitivity pattern on 378 isolates of E. coli from different sources and found susceptible to imipenem (99.7%), Tazobactam (99%), Amikacin (99%), Nitrofurantoin (92%), Ceftriaxone (66%) and ciprofloxacin (55%). (Fadnis et al 2014)[14] also observed sensitivity of e. coli for Gentamycin, Amikacin and Imipenem.

Staphylococcus aureus were sensitive to Imipenem (100% cases), Ceftriaxone (57% cases), Tazobactam-piperacillin (71 % cases), Ciprofloxacin (28.5% cases), Norfloxacin (42.5% cases) and resistant to Amikacin and Gentamycin. These findings can be compared with the findings of a national survey in Ireland done in 1993. The overall percentage of S. aureus sensitivity to the tested antibiotics were as follows: Methicillin 85%, penicillin 8%, ciprofloxacin 85%, erythromycin 80%, fusidic acid 96 % and mupirocin 98% (Moorhouse et al. 1996).[15] Here, sensitivity of the organisms to ciprofloxacin is much higher than the present study. Results are inconsistent with that of present study; it may be due to limited number of isolates in the present study and variation in the methodology. (Fadnis et al 2014). Also observed sensitivity of Staphylococcus aureus for Vancomycin and Linezolid.

Klebsiella were sensitive were sensitive to Imipenem (100% cases), Ceftriaxone (33.3% cases), Tazobactam piperacillin (66.6 % cases), Amikacin (33.3% cases), Gentamycin (66.6% cases) and resistant to Ciprofloxacin and Norfloxacin. (Fadnis et al 2014) Also observed sensitivity of Klebsiella for Gentamycin, Amikacin and Imipenem.

Pseudomonas were sensitive to Imipenem (100% cases), Tazobactam-piperacillin (50 % cases), Amikacin (100% cases), Gentamycin (100% cases Ciprofloxacin and Norfloxacin (50%) and resistant to Ceftriaxone

These findings is comparable with that of (Ozumba et al Nigeriaet al 2003) (134) who studied antibiotic sensitivity pattern on 229 clinical isolates of Pseudomonas aeruginosa. Majority of isolates tested were susceptible to Ceftazidime (88.5%), Colistin (83.75%), Ciprofloxacin (62.1%) and Ofloxacin (62.5%). These were less susceptible to Ceftriaxone (45.1%), Gentamycin (44.1%), Cotrimoxazole (0.7%) and Nitrofurantoin (6.7%). (Fadnis et al 2014) Observed Pseudomonas aeruginosa was sensitive to drugs like ciprofloxacin amikacin, imipenem and polymyxin B.

CONCLUSION

This descriptive type of observational study was conducted in Department of Surgery, Dr. B. R. A. M. Hospital, Raipur, from 1 March 2015 to September 2016. It can be concluded from the findings of the study that microorganisms that are normal inhabitants of our body are mainly responsible for surgical site infection (SSI). Various host factors like malnutrition, obesity, patient's knowledge about hygiene, presence of co-morbidity etc. coupled with environmental factors such as condition of the wounds, delay to initiate operation, duration of operation, prolonged exposure of peritoneal cavity to environment, and factors associated with surgery like type of incision, type of system involved, wound contamination greatly contribute to occurrences of SSI. All these factors can be modified, by modifying these factors, SSI incidence can be curtailed to significantly low levels.

Quality of surgical care including immediate assessment of patients, resuscitative measures, adequate preparation of patients, aseptic environment proper antibiotic coverage are important for control of SSI.

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