International Surgery Journal
Jain S et al. Int Surg J. 2021 Oct;8(10):3088-3092
http://www.ijsurgery.com
pISSN2349-3305 | eISSN2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20214000

Original Research Article

A prospective study of post-operative surgical site infections after abdominal surgeries

Sanjay Jain[1], Rahul Shivhare[1]*, Shoranki Pardhan[1], Deepti Chaurasiya[2]

[1]Department of General Surgery, [2]Department of Microbiology, Gandhi Medical College, Bhopal, Madhya Pradesh, India

Received: 21 July 2021
Revised: 27 August 2021
Accepted: 01 September 2021

***Correspondence:**
Dr. Rahul Shivhare,
E-mail: rahulshivhare93@gmail.com

ABSTRACT

Background: Surgical site infections have plagued surgeons since time immemorial. There is significant morbidity and mortality associated with surgical site infections. In this study we tried to identify the incidence, various patient and procedure related factors, which could have led to SSIs, the various organism associated with the SSIs and their pattern of sensitivity and resistance to various antibiotics.
Methods: This study was conducted in the department of general surgery, Gandhi medical college and Hamidia hospital Bhopal. In this prospective study, we included all patients more than 12 years of age undergoing abdominal surgeries between 2018-2020. Patient data was recorded in a case recording form and all patients were examined post-operatively for soakage along with culture and antibiotic testing.
Results: A total of 299 patients were included. Overall incidence of SSI was 23.07%, elective surgeries showed 19.5% incidence and elective showed 26.08% incidence. Higher incidence of SSI was found in, male patients (25.9%), contaminated and dirty surgeries, higher ASA scores, smokers, alcoholics diabetics, anaemics, and malnourished patients. *E. coli* and klebsiella were the most common organisms isolated in both elective and emergency setting. Organisms isolated were highly sensitive to colistin, meropenem, imipenem, gentamicin and amikacin. Amoxycillin, ceftriaxone, doxycycline were fairly resistant in the current study.
Conclusions: Modifiable risk factors like smoking, alcoholism, anaemia, malnourishment, contaminated wound class and emergency surgeries should be addressed systematically along with judicious use of antibiotics and tailoring then according to culture profile whenever possible is needed to reduce SSI rate.

Keywords: Surgical site infections, Abdominal surgeries, SSI

INTRODUCTION

Surgical site infections (SSIs) have plagued surgeons since time immemorial.[1] Infection is encountered by all surgeons by nature of their craft, they invariably impair the first line of host defences, the cutaneous or the mucosal barrier. There seems to be a perception among some surgeons that surgical site infection is a relatively trivial infection. However, Klevens et al in 2002 in their study on estimating health care associated infections and death in USA hospitals, there were 290,000 infections in hospitalized patients and surgical site infection was estimated to be directly responsible for 8205 deaths of surgical patients that year thus, mortality rate was 3%.[2] There is also significant morbidity associated with surgical site infections. A large number of patients develop long term disabilities as a result of poor wound healing and overt tissue destruction following these infections. Finally, the economic cost of surgical site infections to the patient and health care delivery system are high.[3] In this study we tried to identify the incidence, various patient and procedure related factors, which could have led to SSIs, the various organism associated with the SSIs and their pattern of sensitivity and resistance to various antibiotics.

Since these factors keeps changing with time along with the causative organisms and their sensitivity pattern, through this study we aim to provide essential data and tools to genuinely attempt to decrease the rate of infections and wound and tissue complications in our institute by suggesting remedial measures and possible modifications in our setup.

METHODS

The present study, "a prospective study of post-operative surgical site infections after abdominal surgeries" was conducted in the department of general surgery, Gandhi medical college and Hamidia hospital Bhopal (Madhya Pradesh). The source material for our study is the patients undergoing abdominal surgeries in the department of general surgery at Hamidia Hospital Bhopal. Our study was carried out on a cohort of 299 consecutive patients operated for abdominal diseases, during the period of November 2018 to July 2020.

Inclusion criteria

Inclusion criteria for current study were; patients undergoing open gastrointestinal surgeries, emergency/elective surgeries, age >12 years and all abdominal surgeries, including surgeries of gastric, intestinal, biliary, pancreatic, adrenal, renal.

Exclusion criteria

Exclusion criteria for current study were; patients with history of previous abdominal surgery and laparoscopic surgeries.

Method of data collection

The source of data is collected in a specially designed case recording form (CRF) from the patient by taking history and by doing detailed clinical examination and relevant investigations. The following data was recorded preoperatively: patients age, gender, smoking or alcohol intake history, co-morbidity data, their American society of anaesthesiology (ASA) preoperative assessment score, presence or absence of clinical signs of peritonitis as a questionnaire. Intra-operative data pertaining to kind of operation, spillage of hollow visceral contents, kind of wound, duration of operation, presence of peritonitis, blood transfusion was collected. Whether it was an emergency or elective procedure and data regarding postoperative tissue and wound infection were noted. All patients were examined after 24-72 hours for soakage after primary dressing or even earlier if there was a lot of soakage. Culture swab was taken and subjected to bacteriological examination, culture and antibiotic sensitivity in the college's microbiology laboratory.

Data entry and statistical analysis

The collected data were transformed into variables, coded and entered in Microsoft Excel. Data were analysed and statistically evaluated using Epi Info software tool of CDC. Qualitative data were expressed in percentage. Separate analysis was conducted on elective and emergency operations with post-operative surgical site infection as the dependent variable. Statistical differences between the proportions were tested by chi square test or Fisher's exact test $p<0.05$ was considered statistically significant.

RESULTS

This study included 299 patients, out of which 69 developed surgical site infections. So, the incidence was found to be 23.07%. The incidence of SSI among male was 25.9%, whereas the incidence among females was 19.37%. Patients more than 60 years of age showed highest incidence of surgical site infections (33.3%) compared to patients in other age groups. Of the total 299 patients included in this study, 138 patients underwent elective surgeries and 161 patients underwent emergency surgeries. The incidence of post-operative SSI in elective surgeries was 19.5% and among emergencies was 26.08%.

Overall, 85 patients had clean wounds, out of which, 7 patients (8.2%) developed SSI, 105 patients had clean contaminated wound, out of which 24 patients (22.8%) developed SSI, 46 patients had contaminated wound, out of which 12 patients (26.1%) developed SSI, and 63 patients had dirty wound, out of which 26 patients (41.3%) developed post-operative surgical site infections. So, in the current study, the incidence of post-operative surgical site infections after abdominal surgeries was highest among dirty wounds, followed by contaminated, then clean-contaminated and least among clean wounds. The total number of patients with ASA score of 1 was 74, out of which 7 patients (9.4%) developed SSI, total no. of patients with ASA score 2 were 42, out of which 10 patients (23.8%) developed SSI, total no. of patients with ASA score of 3 was 22, out of which 10 patients (45.5%) developed surgical site infections.

Patients who had anemia was 74, out of these patients, 27 (36.5%) developed SSI, total no of people who had diabetes was 55, out of these patients, 20 (36.4%) developed SSI and total no. of patients with low serum albumin was 110, out of which, 44 (40%) developed SSI. So, the incidence of post-operative surgical site infections in comorbid patients (anemics, diabetics and malnourished) was considerably higher in this study. In this study, total no of smokers was 111, out of these patients, 31 (27.9%) developed SSI whereas, the no. of people who did not smoke was 188, out of these, 38 patients (20%) developed SSI. Total no of people who consumed alcohol was 77, out of these patients, 25 (32.5%) developed SSI whereas, the no. of people who did not consume alcohol was 222, out of these patients, 44 patients (19.8%) developed SSI.

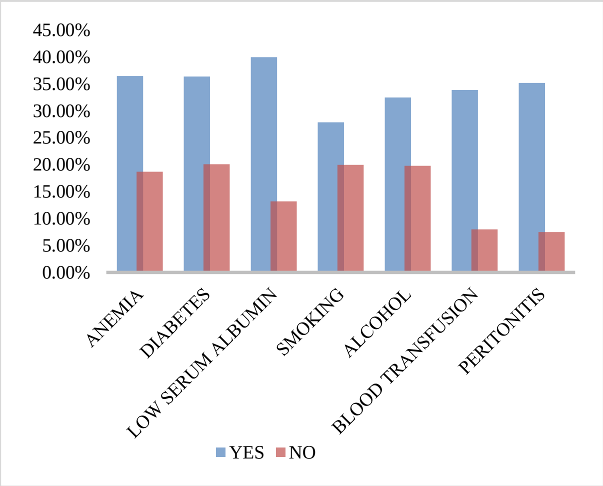

Figure 1: Incidence of SSI among various risk factors.

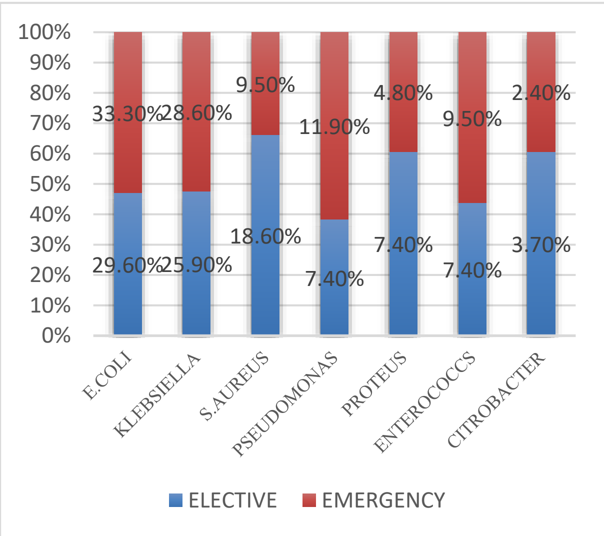

Figure 2: Organism isolated from SSI.

Overall, 174 patients received transfusions during surgery, out of which 59 patients (33.9%) developed SSI, whereas a total of 125 patients did not receive blood transfusions during surgery, out of which, 10 patients (8%) developed SSI. In the elective setting, *E. coli* was the most common organism isolated, from 8 cases out of total 27 SSIs (29.6%), followed by *Klebsiella* from 7 patients (25.9%), *S. aureus* from 5 cases (18.6%), pseudomonas, proteus and enterococcus from 2 cultures each (7.4% each) and citrobacter from 1 culture (3.7%). In the emergency setting, *E. coli* was the most common organism isolated, from 14 cases out of total 42 SSIs (33.3%), followed by klebsiella from 12 patients (28.6%), pseudomonas from 5 cases (11.9%), *S. aureus* from 4 patients (9.5%), enterococcus from 4 patients (9.5%), proteus from 2 cases (4.8%) and citrobacter from 1 (2.4%).

In the elective setting colistin was the most sensitive antibiotic, sensitive in all 27 cultures out of total 27 (100%), followed by meropenem and imipenem (74.1%), gentamicin and amikacin (60%) piperacillin were positive in 14 out of 27 cultures (51.8%), levofloxacin in 10 (48.1%) and ceftazidime in 10 cultures (37%). In the emergency setting, colistin was the most sensitive with sensitivity of 42 out of total 42 cultures (100%), meropenem and imipenem in 32 and 25 cultures, respectively (76.2% and 60%), amikacin and gentamicin in 29 cultures (69% each), piperacillin in 18 (42.8%), levofloxacin in 16 (38.1%) and ceftazidime in 10 (7.1%).

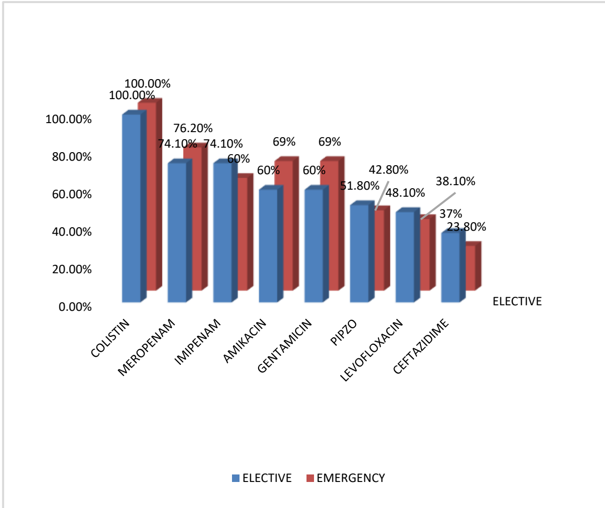

Figure 3: Culture and sensitivity pattern of antibiotics.

DISCUSSION

In the present study, a total of 299 patients were included, out of which 69 patients developed surgical site infections with an overall infection rate of 23.07%. Mekhla et al in 2019 in a teaching hospital in central India reported an overall SSI rate of 39% which was higher than the present study.[4] Janugade et al in 2016 reported an overall incidence of 14%, Singh et al in 2018 reported incidence of 26.4% but he only included emergency surgeries, but in our study both emergency and elective surgeries were included.[5,6]

International studies done on similar subject found a low rate of SSI compared to Indian studies, Raka et al in 2006 found an overall incidence of 12% in his study, Cheng et al in 2015, in a teaching hospital in China found an overall incidence of 3.34% in post-operative surgical site infections.[7,8] The incidence of SSI in the present study was found to be 19.5% for elective and 26.08% for emergency surgeries. Similar studies found a higher incidence of surgical site infection in the emergency setup compared to elective setup, which is consistent with the present study.[4,5,7] Higher infection in patients of emergency setting is due to various factors like poor general condition of the patient, improper patient preparation, operations performed in usually contaminated sites e.g., intestinal perforation, intestinal obstruction etc.

The incidence of SSI in male was 25.9% and for female was 19.37% in the present study and also observed in other studies.[5,6] The higher incidence of SSI among males could be explained by multiple factors like higher prevalence of smoking, alcohol consumption, tobacco chewing etc among males compared to female patients. Extremes of age have long been thought to influence the chances of wound infections, perhaps because of decrease immune competence. This idea was reinforced in the present study as extremes of age showed increased rate of infection with patients above 60 years of age showing highest incidence of SSI (33.3%) among different age groups incidence of SSIs was highest among dirty wounds (41.3%), followed by contaminated (26.1%), then clean-contaminated (22.8%) and least among clean wounds (8.2%) which was consistent with the findings of Janugade et al Raka et al and Mekhla et al showing that endogenous contamination remains a high-risk factor for development of surgical site infection because of enormous dose of the organism available from the bowel and other hollow organs.[4,5,7]

Patients with anaemia had two times higher risk of developing post-operative SSI compared to patients having normal Hb levels, and this was found to be statistically significant in the present study with $p<0.05$. Patients with diabetes showed a higher rate of SSI (36.4% in diabetics v/s 20.1% in non-diabetics) and a significant association was established between presence of diabetes and higher SSI rate with a $p<0.05$. Patients with diabetes have been shown to have higher infective rates compared to non-diabetic patients in the previous studies and this was also confirmed in our study.

The significance of hypoalbuminemia causing decreased wound healing and leading to higher rates of infection has been established in studies described above[5] and this association was also noted in our study as the incidence of SSI was significantly higher in patients with hypoalbuminemia compared to patients having normal serum albumin levels. Smoking delays the healing by causing local and systemic vasoconstriction, this results in tissue hypoxia and hypovolemia, resulting in higher rate of infection. This association between smoking and SSI has been established by several previous studies.[4-6] The present study also showed a higher incidence of post-operative surgical site infections among smokers compared.

Alcohol abusing patients have significantly increased postoperative morbidity, prolonged hospital stays and requirement for secondary surgery. Therefore, alcohol consumption should be included in any preoperative assessment. Interventional studies on preoperative alcohol abstinence and/or prophylactic alcohol administration to avoid the acute withdrawal response are much needed. Since our study has showed that alcohol is a risk factor for wound and tissue complication, therefore it seems appropriate that patients should stop alcohol intake prior to any elective surgery.

In the present study, we have found higher rates of SSI in patients with ASA score of III, (45.5%), in comparison to rates SSIs in patients with ASA score of II and in patients with ASA score of I. There were no patients of ASA score IV or beyond in this study. This difference in rates could be due to the fact that higher ASA score means the presence of coexisting morbid conditions like diabetes mellitus, hypertension, anaemia, hypoproteinaemia, jaundice etc. The association between ASA score and surgical site infections was also reported by Raka et al who reported that higher preoperative ASA score to be significant risk factor for the development of post-operative surgical site infection. Our findings are supportive of the above-mentioned data.[7]

In the current study the incidence of SSI was higher in patients receiving transfusion of blood during surgery (37.3% in elective and 32.2% in emergency) compared to patients who did not receive blood transfusion during surgery (6.3% for elective and 10.9% in emergency). This finding was statistically highly significant with $p<0.01$in the present study. The relationship between blood transfusion and SSI has been a matter of debate for a long time. It has been established that incidence of SSI increases with increasing volume of blood transfusions in the previous described studies[8] and several others.

Overall, E. coli was the most common organism isolated, followed by klebsiella which was the 2nd most common, followed by *Staphylococcus aureus*, pseudomonas, enterococcus and proteus. Singh et al and Raka et al also found *E. coli* to be the most common organism causing SSIs.[5,7] The reason *E. coli* being most common organism is that majority of patients having SSI, have undergone surgery for intestinal pathology (perforation, abscess, appendicitis) and E. coli being the most common organism found in the intestinalflora, might have contaminated the wound and handling of tissues being another major factor in development of SSI. Resistance to commonly used antibiotics and sensitivity to higher antibiotics by various cultured organism in this study signifies the prevalence of multidrug resistant organism in our hospital and the need for more judicious use of antibiotics is needed to reduce this scenario.

CONCLUSION

From this study we can draw the following conclusions. There was increased risk of SSI in patients operated in emergencies, patients above 60 years of age, surgeries with dirty and contaminated wounds, patients having comorbidities like anaemia, DM, hypoalbuminemia, addiction to Smoking, alcohol, and patients having higher ASA scores.

Therefore, following steps may be recommended for reduction in incidence of post-operative SSI after abdominal surgeries. Stoppage of smoking and drinking alcohol, correction of anaemia and hypoalbuminemia, optimum control of blood sugar levels in diabetics, avoidance of blood transfusions as far as possible, extra care for elderly patients and patients with contaminated and dirty wounds, rationale use of antibiotics according to culture and sensitivity.

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

REFERENCES

1. Siguan SS, Ang BS, Pala IM and Reynaldo M, Baclig. Aerobic surgical infection: A surveillance on microbiological etiology and Antimicrobial sensitivity pattern of commonly used Antibiotics. Phil J MicrobiolInfect Dis. 1990;19(1):27-33.
2. Klevens RM, Edwards JR, Richards CL, et al. Estimating health care-associated infections and deaths in U.S. Hospitals, 2002. Public Health Rep. 2007;122(2):160-6.
3. Kirby JP, Mazuski JE. Prevention of Surgical site infection. Surg Clin N Am. 2009; 89:365-89.
4. Mekhla, Borle FR. Determinants of superficial surgical site infections in abdominal surgeries at a Rural Teaching Hospital in Central India: A prospective study. J Family Med Prim Care. 2019; 8(7):2258-63.
5. Janugade HB, Nagur BK, Sajjan KR, Biradar SB, Savsaviya JK, Reddy M. Abdominal surgical site infection occurrence and risk factors in krishna institute of medical science, Karad. Int J Sci Stud. 2016;3(11):53-6.
6. Singh LM, Yadalwar V. Study of post-operative surgical site infection in patients of emergency laparotomy in teaching hospital of central India. J Surg. 2018;4(1):59-64.
7. Raka L, Krasniqi A, Hoxha F, Musa R, Mulliqi G, Krasniqi S, et al. Surgical site infections in an abdominal surgical ward at Kosovo teaching hospital. World Hosp Health Serv. 2008;44(2):32-6.
8. Cheng K, Li J, Kong Q, Wang C, Ye N, Xia G. Risk factors for surgical site infection in a teaching hospital: a prospective study of 1,138 patients. Patient Prefer Adherence. 2015;9:1171-7.

Cite this article as: Jain S, Shivhare R, Pardhan S, Chaurasiya D. A prospective study of post-operative surgical site infections after abdominal surgeries. Int Surg J 2021;8:3088-92.