

Assessment of Microbiological Profile in Surgical Site Infections Following Hollow Viscus Injury at a Tertiary Care Teaching Hospital

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ABSTRACT

Background: Surgical site infection is defined as an infection occurring within 30 days after a surgical operation (or within 1 year if an implant is left in place after the procedure) and affecting either incision or deep tissues at the operation site. Infections may be a superficial or deep incisional infection or infections involving organ or body space. The incidence of surgical site infections (SSI) following hollow viscus injury (HVI) remains high despite perioperative antimicrobial administration, ranging from 4% to 31%. Hence; the present study was undertaken for assessing microbiological profile in surgical site infections following hollow viscus injury.

Materials and Methods: The present study was conducted in the Department of Microbiology, Krishna Mohan Medical College & Hospital, Mathura, Uttar Pradesh, India. For the study, medical records of previous patients were reviewed to identify patients sustaining a stomach, small bowel, or colonic injury for study period. A total of 40 patients were selected for the study from the medical records. SSI was defined as a wound infection or intra-abdominal collection confirmed by positive cultures and requiring percutaneous or surgical drainage.

Results: Specimen cultures were collected from 40 patients and were sent to laboratory for culture study. It was observed that most common pathogen in colon perforation patient were Enterobacteriaceae, found in 65% patients. Of these,

Escherichia coli were the most common (60.23%). Enterococcus was seen in 38.65% of samples in colon perforation patients and in 36.23% in small bowel injury patients. Bacteroides were observed in 9.68% patients for colon injury and in 7.36% in small bowel and stomach injury patients.

Conclusion: The distribution of the microorganisms isolated from traumatic SSIs differed significantly according to whether or not the colon was injured. Enterobacteriaceae were the most common isolates, comprising almost three quarters of the total.


Keywords: Surgical Site Infection, Hollow Viscus Injury.

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INTRODUCTION

Surgical site infection is defined as an infection occurring within 30 days after a surgical operation (or within 1 year if an implant is left in place after the procedure) and affecting either incision or deep tissues at the operation site. These infections may be a superficial or deep incisional infection or infections involving organ or body space.¹ The incidence of surgical site infections (SSI) following hollow viscus injury (HVI) remains high despite perioperative antimicrobial administration, ranging from 4% to 31%. There is an extensive body of literature examining the risk factors associated with an SSI following trauma, which include gross contamination by colonic content, advanced age, requirement for blood product transfusion, and concomitant stomach injury.^{2,3} Multiple investigations have also attempted to assess the efficacy of various antimicrobial regimens aimed at reducing the incidence of

postoperative infections after abdominal surgery.⁴ The treatment of cIAI is based on a few simple principles, including focus elimination, lavage concepts, intensive care medicine and application of antibiotics.⁵ While innovative surgical techniques and intensive care management constantly improved treatment modalities for critical ill patients, the development of new potent antibiotics was unable to follow the rapidly increasing number of resistant germs.⁶ Hence, the present study was conducted to assess microbiological profile in surgical site infections following hollow viscus injury.

MATERIALS AND METHODS

The present study was conducted in the Department of Microbiology, Krishna Mohan Medical College & Hospital,

Mathura, Uttar Pradesh, India. The ethical clearance for the study was approved from the ethical committee of the hospital. For the study, medical records of previous patients were reviewed to identify patients sustaining a stomach, small bowel, or colonic injury for study period. A total of 40 patients were selected for the study from the medical records. SSI was defined as a wound infection or intra-abdominal collection confirmed by positive cultures and requiring percutaneous or surgical drainage. Specimen cultures included samples of fluid or wound cultures or percutaneous aspiration of intra-abdominal collections. The

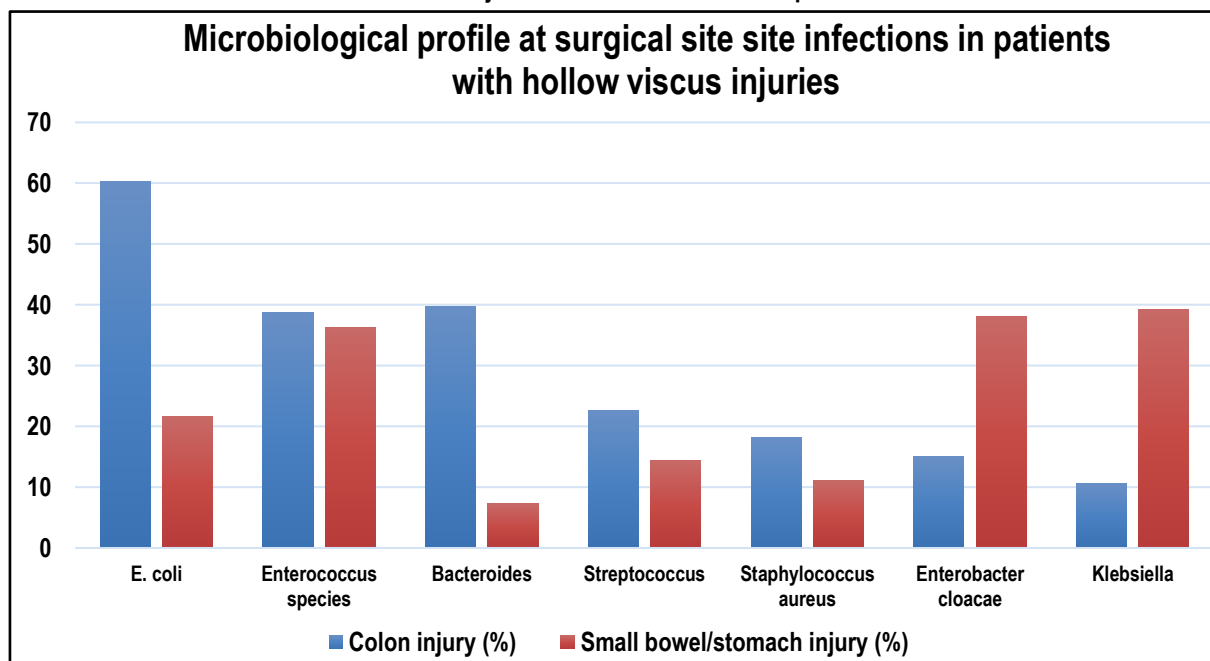
microbiological profiles of patients with and without colonic perforations were compared. In addition, the microbiological profiles of early (within 7 days from injury) versus late (after 7 days) SSI as well as wound infections versus intraabdominal collections were compared. The results were represented as mean values.

The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistical significant.

Table 1: Microbiological profile of surgical site infections in patients with hollow viscus injuries with or without colonic perforation

Microorganism	Colon injury (%)	Small bowel/stomach injury (%)
E. coli	60.23	21.65
Enterococcus species	38.65	36.23
Bacteroides	9.68	7.36
Streptococcus	22.63	14.32
Staphylococcus aureus	18.21	11.09
Enterobacter cloacae	14.98	38.14
Klebsiella	10.65	39.21

Fig 1: Microbiological profile of surgical site infections in patients with hollow viscus injuries with or without colonic perforation



RESULTS

Specimen cultures were collected from 40 patients and were sent to laboratory for culture study. Table 1 shows microbiological profile of surgical site infections in patients with hollow viscus injuries with or without colonic perforation. It was observed that most common pathogen in colon perforation patient were Enterobacteriaceae, found in 65% patients. Of these, Escherichia coli were the most common (60.23%). Enterococcus was seen in 38.65% of samples in colon perforation patients and in 36.23% in small bowel injury patients. Bacteroides were observed in 9.68% patients for colon injury and in 7.36% in small bowel and stomach injury patients.

DISCUSSION

In the present study, it was observed that most common pathogen in colon perforation patient were Enterobacteriaceae, found in 65% patients. Of these, Escherichia coli was the most common (60.23%). Enterococcus was seen in 38.65% of samples in colon perforation patients and in 36.23% in small bowel injury patients. Mawalla B et al conducted this study to establish the prevalence, pattern and predictors of surgical site infection at Bugando Medical Centre Mwanza (BMC), Tanzania. This was a cross-sectional prospective study involving all patients who underwent major surgery in surgical wards between July 2009 and March 2010. After informed written consent for the study and HIV testing,

all patients who met inclusion criteria were consecutively enrolled into the study. Pre-operative, intra-operative and post-operative data were collected using standardized data collection form. Wound specimens were collected and processed as per standard operative procedures; and susceptibility testing was done using disc diffusion technique. Data were analyzed using SPSS software version 15 and STATA. Surgical site infection (SSI) was detected in 65 (26.0%) patients, of whom 56 (86.2%) and 9 (13.8%) had superficial and deep SSI respectively. Among 65 patients with clinical SSI, 56(86.2%) had positive aerobic culture. *Staphylococcus aureus* was the predominant organism 16/56 (28.6%); of which 3/16 (18.8%) were MRSA. This was followed by *Escherichia coli* 14/56 (25%) and *Klebsiella pneumoniae* 10/56 (17.9%). Among the *Escherichia coli* and *Klebsiella pneumoniae* isolates 9(64.3%) and 8(80%) were ESBL producers respectively. A total of 37/250 (14.8%) patients were HIV positive with a mean CD4 count of 296 cells/ml. Using multivariate logistic regression analysis, presence of pre-morbid illness (OR = 6.1), use of drain (OR = 15.3), use of iodine alone in skin preparation (OR = 17.6), duration of operation \geq 3 hours (OR = 3.2) and cigarette smoking (OR = 9.6) significantly predicted surgical site infection (SSI) SSI is common among patients admitted in surgical wards at BMC and pre-morbid illness, use of drain, iodine alone in skin preparation, prolonged duration of the operation and cigarette smoking were found to predict SSI. Prevention strategies focusing on factors associated with SSI is necessary in order to reduce the rate of SSI in their setting.⁷ Mulu W et al identified post-operative bacterial infections and determine their current antimicrobial resistance to commonly prescribed drugs. A cross sectional study was conducted on patients under gone operation from October 2010 to January 2011 and followed for development of clinical signs and symptoms of surgical site and blood stream infection until the time of discharge. Structured questionnaire was used to collect socio demographic characteristics. Wound swab and venous blood samples were collected and processed for bacterial isolation and antimicrobial susceptibility testing following standard bacteriological techniques. Out of 294 patients who had clean and clean-contaminated operation, 10.9% were confirmed of bacterial nosocomial infections. The rate of nosocomial infections among clean and clean-contaminated operations was 3.3% and 12.8% respectively. Nosocomial surgical site and blood stream infection rate was 10.2% and 2.4% correspondingly. A total of 42 bacterial pathogens were identified of which *S. aureus* was the leading isolates accounting 26.2% followed by *E. coli* and Coagulase negative *Staphylococcus* species each 21.4%. Nearly 100% of Gram positive and 95.5% of Gram negative bacterial isolates showed resistance against two or more antimicrobial drugs. They concluded that multiple drug resistance of isolates to antimicrobials was alarmingly high so that any empirical prophylaxis and treatment needs careful selection of effective drugs. To minimize such infections, adherence of strict aseptic surgical procedures and proper management of wounds is required.⁸

Schnüriger B et al assessed the microbiological profile, antimicrobial susceptibility, and adequacy of the empiric antibiotic therapy in surgical site infections (SSI) following traumatic hollow viscus injury (HVI). The study included patients admitted with an HVI from March 2003 to July 2009. SSI was defined as a wound infection or intra-abdominal collection confirmed by positive

cultures and requiring percutaneous or surgical drainage. A total of 91 of 667 (13.6%) patients with an HVI developed an SSI confirmed by positive culture. Mean age was 33.0 +/- 14.1 years, mean Injury Severity Score (ISS) was 17.7 +/- 9.6, 91.2% were male, and 80.2% had sustained penetrating injuries. The SSI consisted of 65 intra-abdominal collections and 26 wound infections requiring intervention. The most commonly isolated species in the presence of a colonic injury was *Escherichia coli* (64.7%), *Enterococcus* spp. (41.2%), and *Bacteroides* (29.4%), and in the absence of a colonic perforation, *Enterococcus* spp. and *Enterobacter cloacae* (both 38.9%). Susceptibility rates of *E. coli* and *E. cloacae*, respectively, were 38% and 8% for ampicillin/sulbactam, 82% and 4% for cefazolin, 96% and 92% for cefoxitin, with both 92% to piperacillin/tazobactam, and 100% to ertapenem. The initial empirical antibiotic therapy adequately targeted the pathogens in 51.6% of patients who developed an SSI. They concluded that the distribution of the microorganisms isolated from SSIs differed significantly according to whether or not a colonic injury was present. Empiric antibiotic treatment was inadequate in upwards of 50% of patients who developed an SSI. Further investigation is warranted to determine the optimal empiric antibiotic regimen for reducing the rate of postoperative SSI.⁹ Kirton OC et al compared the safety and therapeutic efficacy of a 24-hour versus 5-day course of ampicillin/sulbactam for the prevention of postoperative infections in high-risk patients sustaining hollow viscus injury from penetrating abdominal trauma. total of 317 patients from four Level I trauma centers with penetrating abdominal injuries and at least one hollow viscus perforation each received one preoperative and three postoperative doses of ampicillin/sulbactam 3 g intravenously. After receiving 24 hours of unblinded ampicillin/sulbactam, patients were then randomized into one of two groups. Group 1 received 4 additional days of blinded ampicillin/sulbactam (5 days total of antibiotic), and Group 2 received 4 days of placebo (24 hours of antibiotic). Patients were assessed postoperatively for occurrence of deep surgical-site infections (intra-abdominal abscess, fasciitis, and peritonitis) and superficial (wound) surgical-site infections. Development of nonsurgical-site infections (e.g., pneumonia, urinary tract infection, phlebitis, and cellulitis) was also recorded. Continuous variables were analyzed by analysis of variance and discrete variables by the Cochran-Mantel-Haenszel chi² test. Multivariate logistic regression analyses were also performed to identify independent risk factors for postoperative infection. A total of 159 patients were randomized into Group 1, and 158 patients were randomized into Group 2. The Injury Severity Score and penetrating abdominal trauma index were 18+/-8 and 21+/-13, respectively, for Group 1 and 18+/-9 and 20+/-15, respectively, for Group 2. A total of 162 (51%) patients sustained one or more colon injuries (82 in Group 1 and 80 in Group 2). There were 16 (10%) surgical-site infections in Group 1 and 13 (8%) surgical-site infections in Group 2 ($p = 0.74$). Group 1 patients experienced 17 (11%) nonsurgical-site infections, whereas Group 2 had 32 (20%) nonsurgical-site infections. This difference, however, was not statistically significant ($p = 0.16$). Only the total number of blood units transfused and the presence of a PATI score greater than or equal to 25 were found to be independently associated with the development of a postoperative surgical- and nonsurgical-site infections ($p = 0.001$ and $p = 0.003$, respectively). Of note, the presence of a colon injury was not

found to be an independent risk factor ($p = 0.11$) for either surgical or nonsurgical site postoperative infection in our study. They concluded that high-risk patients with colon or other hollow viscus injuries from penetrating abdominal trauma are at no greater risk for surgical-site or nonsurgical-site infection when treated with only a 24-hour course of a broad-spectrum antibiotic.¹⁰

CONCLUSION

The distribution of the microorganisms isolated from traumatic SSIs differed significantly according to whether or not the colon was injured. Enterobacteriaceae were the most common isolates, comprising almost three quarters of the total.

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