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Incidence of surgical site infections after emergency laparotomy for perforation peritonitis

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Abstract
Background: Generalized peritonitis as a result of gastrointestinal perforation is a common surgical emergency and one of important morbidity is surgical site infection (SSI).
Objectives: to evaluate the incidence of SSI after emergency laparotomy for perforation peritonitis**.**
Methodology: A prospective interventional study was conducted in the Department of Surgery, Sylhet MAG Osmani Medical College Hospital, Sylhet from December 2019 to November 2020. Ninety patients who underwent emergency laparotomy for perforation peritonitis aged 18 years or above were included. After laparotomy standard closure technique was applied in all cases and subcutaneous closed suction drain was given in 43 cases.
Results: The mean age of the patients was 32.59 ± 11.88 years, 58.9% of patients were in 21-40 years and male preponderance (66.7%). Peritonitis was most commonly due to peptic ulcer perforation (38.7%) followed by burst appendix (27.8%). Incidence of SSI was 26.7%. Subcutaneous closed suction drain was used in 47.8% of cases and its use reduced the incidence of SSI [OR=0.344 (95% CI=0.126-0.937) χ^2=4.543; p=0.033].
Conclusion: Perforation peritonitis is associated with higher incidence of SSI and subcutaneous closed suction drain is effective in reducing the chances of SSI.

Keywords: SSI, perforation peritonitis; subcutaneous closed suction drain

Introduction
Surgical site infection (SSI) previously termed postoperative wound infection is defined as that infection presenting up to 30 days after a surgical procedure if no prosthetic is placed and up to 1 year if a prosthetic is implanted in the patients [1]. Surgical site infections (SSI) are still a major problem to surgeons and patients particularly in heavy contamination, because they are responsible for significant discomfort for patients and excess morbidity and mortality, which also translates into a financial burden on the health system. It is reported an incidence of 2% to 30%, or even higher, depending on the type of surgery and patient characteristics [2, 4].
Generalized peritonitis as a result of gastrointestinal perforation is a common surgical emergency [5]. The spectrum of gastrointestinal perforation is having a wide geographical variations; in western countries with preponderance of lower gastrointestinal perforations as opposed to upper gastrointestinal perforations in developing countries [6, 8].
In majority, cases present late to the hospital with well-established generalized peritonitis with purulent or fecal contamination and septicemia of varying degree. Thus surgical management of perforation peritonitis becomes highly demanding and more complex. A combination of anti-microbial therapy, improved surgical technique, and intensive care support may improve the outcome of such cases [9]. In cases of perforation peritonitis abdominal closure is sometimes challenging to the surgeon where bowel become oedematous in severe peritonitis. There will be outpouring of fluid or pus from peritoneal cavity to the surgical wound-subcutaneous tissues that can lead to wound infection and wound dehiscence. If the wound kept open then there is high risk for developing nosocomial infection [10]. Incisional surgical site infection causes increasing patient suffering and a decreased quality of life (QoL) [11, 12].

It also causes increased hospital stay, bad cosmetic result, increased cost of treatment and high risk for developing incisional hernia later on [13, 14]

It has been postulated that the presence of haematoma, serous fluid and dead space in surgical incisional wounds increases the risk of surgical site infection [15]. Subcutaneous drain removes this collections, eliminates the dead space and may result in lowering rate of wound complications [16, 17]. However, the use of postoperative subcutaneous wound drainage is not universally accepted. In addition drains may not be efficacious and cause discomfort and increased hospital stay on their own [18].

This study was aimed to see the incidence of surgical site infections after emergency laparotomy for perforation peritonitis.

Materials and Methods

This prospective interventional study was conducted in the Department of Surgery, Sylhet MAG Osmani Medical College Hospital, a referral hospital in Sylhet, Bangladesh and the main teaching hospital for both clinical and preclinical trainings of most disciplines. The study period was from December 1, 2019 to November 30, 2020. Ninety patients who were underwent emergency laparotomy for perforation peritonitis aged 18 years or above were included in the study. Cases with simultaneous medical diseases e.g. diabetes, hepatic or renal impairment, severe anaemia, poor nutritional status, immunocompromised patients and malignancy were excluded.

After getting informed and signed consent from the patients or legal guardian, data were collected using a structured questionnaire. After a detailed, general and abdominal examination (suggesting perforation peritonitis), an X-ray abdomen upright was done. A diagnosis of gastrointestinal perforation was made on the basis of history, clinical examination, and presence of free gas under diaphragm on abdominal X-ray. Other emergency investigations like full blood count, random blood glucose, serum electrolytes, serum creatinine, and ECG will be done.

After adequate resuscitation, all patients underwent exploratory laparotomy in emergency setting. All were given prophylactic antibiotic, Injection Ceftriaxone 1gm and injection Metronidazole 500mg/100ml iv were given at the time of induction and were continued twice for 5 days and thrice for 3 days respectively after completion of surgery.

After opening the peritoneal cavity the content was inspected and was sent for microbiological examination. Content was sucked out and adequate peritoneal toileting was done. The primary pathology was tackled and a drain tube was placed in pelvic cavity in all cases. The midline laparotomy wound was closed in continuous fashion using 1-0 polypropylene suture in all cases. Wound was irrigated with normal saline (0.09%) before closing the abdomen. A subcutaneous closed suction drain was inserted along the entire length of the subcutaneous tissue in 43 (47.8%) cases according to the choice of the surgeon. The exit of the drain was separated from the incisions. The suction drain was removed on postoperative day five.

SSI cases were diagnosed within 30 postoperative days by infection control team (ICT) according to the centers for disease control and prevention (CDC) criteria:

1. Purulent drainage with or without laboratory confirmation from the superficial incision
2. Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision
3. At least one of the following signs or symptoms of infection: Pain or tenderness, localized swelling, redness, or heat and superficial infection were deliberately opened by surgeon, unless the incision was culture-negative; and
4. Diagnosis of superficial SSI by the surgeon or ICT [19].

Data analysis: After data were checked for completeness and consistency, they were analyzed using SPSS version 26. All continuous variables were reported as mean ± standard deviation. All categorical variables were reported as frequency and percentage. Chi-square test was used to see the association between SSI and subcutaneous closed suction drain. Odd ratio was calculated to assess the reduction of risk of SSI by using subcutaneous closed suction drain. A p-value <0.05 was deemed significant.

Ethical Issue: Approval of the study protocol was obtained from the ethics committee of Sylhet MAG Osmani Medical College, Sylhet, Bangladesh before the commencement of the study. Informed consent was taken from all participants or their legal guardians before enrolment in this study.

Results

The mean age of the patients was 32.59 ± 11.88 years (range 18 to 60 years). Distribution of the patients according to age was shown in figure-1. Maximum numbers of patients (41.1%) were in the age group of 21-30 years, followed by age group 31-40 years (17.8%), 18-20 years (16.7%), 41-50 years (15.5%) and 51-60 years (8.9%).

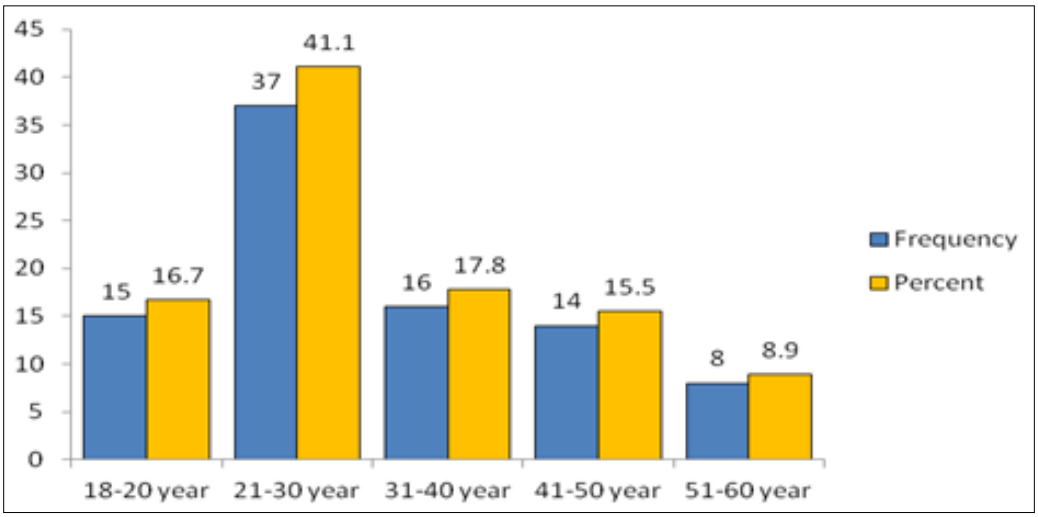

Fig 1: Distribution of the patients according to age (n=90)

Two third of cases were male (66.7%) and one-third of cases were female (33.3%) with a ratio of male to female of 2:1 (Figure-2).

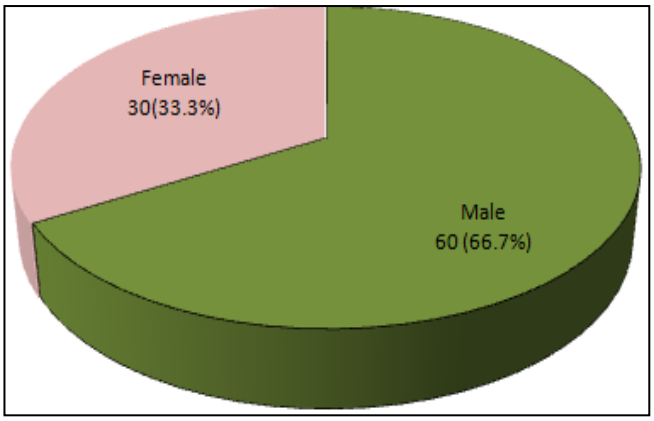

Fig 2: Distribution of the patients according to sex (n=90)

The most common perforation peritonitis was duodenal ulcer perforation (28.9%), followed by burst appendix (27.8%), traumatic small bowel perforation (18.9%), ileal perforation (17.5%) and gastric ulcer perforation (6.7%) (Table-I).

Table 1: Distribution of the patients according to causes of perforation peritonitis (n=90)

Causes of perforation peritonitis	Frequency	Percentage
Duodenal ulcer perforation	26	28.9
Gastric ulcer perforation	6	6.7
Traumatic small bowel perforation	17	18.9
Ileal perforation	16	17.8
Burst appendix	25	27.8
Total	90	100.0

Surgical site infection developed in 24 (26.7%) patients and surgical site infection did not develop in 66 (73.3%) patients (Figure-3).

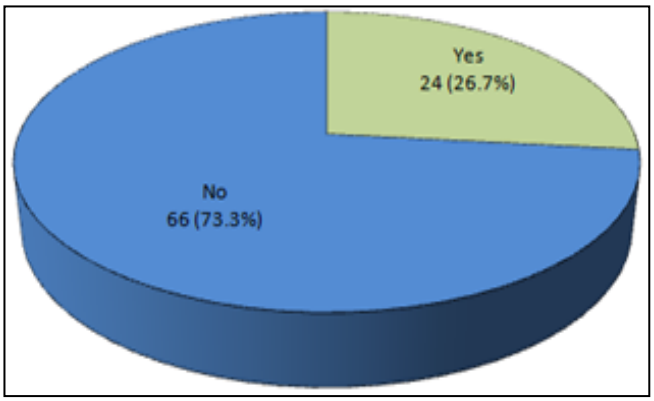

Fig 3: Frequency of surgical site infection in emergency laparotomy in class IV surgical wound (n=90)

Surgical site infection developed in 7 (16.3%) patients of those with subcutaneous suction drain and 17 (36.2%) patients of those without subcutaneous suction drain. Development of surgical site infection was significantly reduced in those with subcutaneous suction drain [OR=0.344 (95% CI=0.126-0.937); χ^2=4.543; p=0.033] (Table II).

Table 2: Association subcutaneous suction drain and development of surgical site infection

Surgical site infection	Subcutaneous suction drain		Odd Ratio (95% CI)	p-value
	Used	Not used		
Develop	7 (16.3%)	17 (36.2%)	0.344 (0.126 0.937)	*p=0.033
Not develop	36 (83.7%)	30 (63.8%)		
Total	43 (47.8%)	47 (52.2%)		

*Chi-Square (χ^2) test was applied to analyse the data. OR=Odd ratio, CI=Confidence interval

Discussion

This study was planned to study the incidence of SSI following emergency laparotomy for perforation peritonitis. The causes of type of perforation peritonitis and operative procedure depends on patient general condition, peritoneal contamination, site of pathology, gut viability and surgeon's decision.

Perforation peritonitis is a class IV surgical wound and several approaches to preventing SSI in such cases such as perioperative high inspired oxygen therapy, wound protectors, timing of antimicrobial prophylaxis, and subcutaneous drains have been reported [10].

In this study mean age of study population 32.59 ± 11.88 years. Saigal *et al.* [20] reported the mean age of study population was 45.34 ± 17.02 years. This study also showed that 41.1% of patients were in the age group of 21-30 years, followed by age group 31-40 years (17.8%), 18-20 years (16.7%), 41-50 years (15.5%) and 51-60 years (8.9%). Patel *et al.* [21] found that highest patients (38.71%) in 21-30 years age group followed by 31-40 years age group (24.19%).

In the present study 66.7% of patients were male and 33.3% of cases were female with a ratio of male to female of 2:1. Gupta and Kumar [19], supported this result that 72% of patients were male and 38% were female. Kumar *et al.* [22] found 58.0% of patients were male and 42.0% of cases were female.

The most common perforation peritonitis was duodenal ulcer perforation (28.9%), followed by burst appendix (27.8%), traumatic small bowel perforation (18.9%), ileal perforation (17.5%) and gastric ulcer perforation (6.7%). Patel *et al.* [21] found the pathology in decreasing order was peptic perforation (40%), enteric perforation (27%), colorectal pathology (13%), perforated appendix (10%) and gall bladder pathology (10%). Kumar *et al.* [22] found peptic perforation (34%), enteric perforation (21%), colorectal (11%), perforated appendix (23%) and jejunum (21%).

In this study surgical site infection developed in 26.7% of patients. Patel and Koyani [23], reported SSI in 22.7% of cases which was closed to the present study. However Gupta and Kumar [19], found that 37% patients developed surgical site infection post emergency abdominal surgery. Kumar *et al.* [22] also found 37% patients developed surgical site infection in laparotomy for perforated peritonitis.

Surgical site infection developed in15.5% of duodenal ulcer perforation, 16.7% of gastric ulcer perforation, 23.5% of traumatic small bowel perforation, 37.5% of ileal perforation and 36% of burst appendix. In this regards Patel and Koyani [23], found surgical site infection following operation after perforation of peptic ulcer (17.5%), enteric perforation (40.1%), appendicular perforation (10.0%), gall bladder and liver pathology (30.0%) and colorectal colorectal pathology (46.1%).

Virulence of organism increases as distal bowel involved. Reduction of enteric perforation was observed in this study may due to improvement of sanitation and living conditions. In peptic perforation, the virulence of organisms is low. Initially chemical peritonitis occurs followed by bacterial peritonitis. In appendicular and gall bladder causes, there is limited peritonitis.

Surgical site infection developed in 7 (16.3%) patients of those with subcutaneous suction drain and 17 (36.2%) patients of those without subcutaneous suction drain. Development of surgical site infection was significantly reduced in those with subcutaneous suction drain [OR=0.344 (95% CI=0.126-0.937); p=0.033]. Gupta and Kumar [19], supported this result that the incidence of surgical site infection in drain group was lower than the no drain group, which was statistically significant ($p<0.05$). Kumar *et al*. [22] found that the use of a subcutaneous closed suction vacuum drain resulted in statistically significant reduction in wound infection (58% vs. 16%) with a p value of <0.001).

This study was not without limitations. The limitations were (1) single centre study and (2) small sample size.

Conclusion

Perforation peritonitis is associated with higher incidence of SSI and subcutaneous closed suction drain is effective in reducing the incidence of SSI. However multicentre study involving large sample is warranted.

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Conflict of interest: None declared

Authors' Contribution

Dr. Md. Babul Akter contributed to study conception, design and acquisition of data; Dr. Md. Tabibul Islam contributed to data interpretation, the statistical analyses and the writing of the manuscript; Dr. Md. Ashik Anwar Bahar, Dr. Md. Mizanur Rahman, Dr Mohammad Abdul Quadir, Dr. Muhammad Faridul Haque, Dr. Arun Kumar Baishnab, Dr. ASM Anwarul Kabir contributed to critical revision of the manuscript. All the authors finally contributed to the final approval of the version to be published.

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