

Compare the Surgical Site Infection in Elective Laprotomy versus Emergency Laprotomy

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Abstract

Background: Laparotomy is a surgical term that refers to the exploration of the abdomen and subsequent steps depending on the underlying cause. In elective laprotomy, patients get pre-operative examination in addition to having any co-morbid conditions including anemia, diabetes, hypertension, or respiratory infections treated. The majority of infections at the surgical sites of the abdomen by laprotomy are simple infections that only affect the skin and subcutaneous layer, although they can occasionally develop into necrotizing infections.

Aim: To compare the surgical site infection in elective laprotomy versus emergency laparotomy.

Methods and Materials: A total of 450 patients underwent laparotomy, among which 400 patients underwent emergency laparotomy and 50 patients underwent elective laparotomy. Highly specialized microbiological methods were used for the processing of samples obtained from the infected wounds at abdominal surgical sites. Most recently approved standard CLSI guidelines were followed to process these samples. The modified Kirby-Bauer disc diffusion method was utilized for the examination of antimicrobial vulnerability.

Results: In the present study the overall rate of SSI was 18.9% in emergency laprotomy and 17.2% in elective laprotomy. The proportion of male study participants was greater than female participants. The ratio of males to females was 2.7:1. The patients with an age of more than 50 years had a higher proportion of infection at the surgical site of the abdomen in comparison to the patients who were less than the age of 50 years. Regarding the duration of the operation, a prolonged time was found to be a significant risk factor for SSI and it was observed that as the order and the duration of surgery increased, the rate of infection also increased.

Conclusion: The overall incidence of infection at the surgical site in emergency laparotomy is greater than the elective laprotomy, however, the difference is not significant statistically.

Keywords: Surgical site infection, elective laprotomy, emergency laparotomy

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Background

The most frequent surgical procedure performed by a routine surgical team is a laparotomy. Laparotomy is a surgical term that refers to the exploration of the abdomen and subsequent steps depending

on the underlying cause. In elective laprotomy, patients get pre-operative examination in addition to having any co-morbid conditions including anemia, diabetes, hypertension, or respiratory

infections treated. While in emergency laprotomy patient undergoes a sudden surgical procedure [1,2].

Although they occasionally turn into necrotizing infections, the majority of infections at the surgical sites of the abdomen by laprotomy are straightforward infections that only affect the skin and subcutaneous layer. A contaminated surgical wound frequently exhibits tenderness, pain, increased body temperature, increased redness, swelling, and pus establishment [3,4]. Numerous patient-related factors, including as advanced age, poor nutritional status, the presence of pre-existing infections, and other co-morbidity disorders, might have a substantial impact on the risk of infections at the surgical site of the abdomen. Infection at the surgical sites can also be caused by factors related to the surgical procedure, such as poor surgical technique, prolonged surgery, improper preoperative surgical part preparation, and insufficient sterilization of surgical instruments.

The pathogenicity and invasiveness of the organisms involved, the physiological state of the tissue surrounding the wound, and the host's immunological coherence are additional significant factors that influence whether an infection develops or not. Bacteriological studies have shown that infections are always present at the abdominal surgery site. Additionally, according to these studies, the etiological agents for these infections at surgical sites can vary depending on the location, the procedure, the surgeon, the institution, and even the ward [5,6].

Gram-negative organisms have become more common in recent years as a major source of dangerous infections in several hospitals. Resistance against antimicrobial agents which results from the inappropriate utilization of broad-spectrum antibiotics has further aggravated the situation in this regard. Due to substandard infection control procedures, congested hospitals, and incorrect antibiotic use, the issue becomes more challenging in developing

nations. This research was conducted to compare surgical site infection in elective versus emergency laparotomy.

Methods and Materials

Total of 450 patients underwent laparotomy, among which 400 patients underwent emergency laparotomy and 50 patients underwent elective laparotomy.

The study population consisted of 450 patients with infections at the surgical sites of the abdomen from our hospital's surgical unit (general surgery unit). Individuals of both sexes who were older than 14 and had surgical incisions with pus discharge, watery or seropurulent discharge, and concurrent signs of sepsis were included in the study (redness, induration at the surgical wounds, soreness, pain, increased local temperature). The study did not include patients with suture abscesses, cellulitis-infected wounds, or no drainage. A detailed medical history was supplied by the patients, which included details on their age, gender, disease type, diagnosis, kind of procedure, length of the procedure, use of antibiotics, and co-morbid illnesses. Culture and sensitivity of lesions were obtained from 83 patients who were clinically confirmed of having infections at the abdominal surgical site. Highly specialized microbiological methods were used for the processing of samples obtained from the infected wounds at abdominal surgical sites. Most recently approved standard CLSI guidelines were followed to process these samples. The modified Kirby-Bauer disc diffusion method was utilized for the examination of antimicrobial vulnerability.

Statistical Analysis

The analysis of all data was carried out with the help of statistical tests like independent sample t-tests, binary logistic regression and chi-square test. A convergence difficulty developed when we attempted to use binomial regression analysis to estimate the antibiotic vulnerability and bacterial isolates from wounds at the surgical site of the abdomen. To calculate the values

pertaining to overall RRs i.e risk ratios and their 95 CIs i.e confidence intervals, a simplified Poisson regression method was established. All analysis were carried out by applying Stata software version 14.

Results

In the present study, the overall rate of SSI was 18.9% in emergency laprotomy and 17.2% in elective laprotomy. The proportion of male study participants was greater than female participants. The ratio of males to female was 2.7:1. The patients with age more than 50 years had a higher proportion of infection at the surgical site of the abdomen in comparison to the patients who were in the age group of ≤ 50 years. Regarding the duration of the operation a prolonged time was found to be a significant risk factor for SSI and it was observed that as the order and the duration of surgery increased, the rate of infection also increased.

The most common microorganism isolated in emergency laprotomy was *Staphylococcus aureus* constituting 51.52% of total samples. Among these species of *Staphylococcus aureus*, 81.2% specimens were resistant against Methicillin while 18.8% specimens were Methicillin sensitive. *Escherichia coli* was the second most common microorganism being isolated from 24.13% of total samples. *Pseudomonas aeruginosa* constituted 8.6% of total infections while *Citrobacter* species constituted 8.2% of infections. *Citrobacter freundii* microorganisms constituted 62.5% of *Citrobacter* species and *Citrobacter koseri*

microorganisms constituted 37.4%. *Klebsiella* species microorganisms constituted 3.1% of bacterial isolates while *proteus* species constituted 3.2% of total isolates. *Klebsiella pneumonia* constituted 23% of infections by *klebsiella* species while *Klebsiella oxytoca* constituted 77% of infections by *klebsiella* species. The *Acinetobacter* species microorganisms constituted 4.91% of total infection. Among these *Acinetobacter baumannii* constituted 72.3% of *Acinetobacter* species infection while *Acinetobacter lowfii* constituted 27.7% infections by *Acinetobacter* species infection. *Proteus* species microorganisms constituted 3.2% of total infection. Among these *Proteus mirabilis* constituted 48% of infections by *Proteus* species while *Proteus vulgaris* constituted 52% of infections by *Proteus* species. The findings were found to be significant statistically. The percent of bacteria isolates was lower in elective laprotomy in comparison with emergency laprotomy. (Table 1)

When antimicrobial vulnerability of gram positive microorganisms was carried out in emergency laprotomy then maximum vulnerability was found against linezolid, teicoplanin and vancomycin while resistance was observed against penicillins and cephalosporin. The percentage of resistance against penicillin was found to be 99.67% while it was 99.11 in case of cephalosporins. The percentage of resistance against linezolid, teicoplanin and vancomycin was less than 10%. The antibiotic resistance was lower in infections in elective laprotomy. (Table 2)

Table 1: Percent distribution of different bacterial isolates derived from sites of infection at surgical sites of abdomen

Bacterial Species	Emergency laprotomy	Elective laparotomy
<i>Staphylococcus aureus</i> microorganisms	51.52 %	50.52 %
MSSA microorganisms	81.2 %	80.2 %
MRSA microorganisms	18.8 %	20.8 %
<i>Escherichia coli</i> microorganisms	24.13%	23.13%
<i>Pseudomonas aeruginosa</i> microorganisms	8.6 %	7.6 %
<i>Citrobacter</i> species microorganisms	8.2%	7.2%
<i>Citrobacter freundii</i> microorganisms	62.6%	61.6%

Citrobacter koseri microorganisms	37.4%	38.4%
Acinetobacter species microorganisms	4.91	3.91
Acinetobacter baumannii microorganisms	72.3	74.3
Acinetobacter lowfii microorganisms	27.7	25.7
Klebsiella species microorganisms	3.1	2.1
Klebsiella pneumoniae microorganisms	23	21
Klebsiella oxytoca microorganisms	77	79
Proteus species microorganisms	3.2	3.1
Proteus mirabilis microorganisms	48	47
Proteus vulgaris microorganisms	52	53

Table 2: Antibiotic resistance of different Gram-positive bacteria in emergency laprotomy

	MSSA bacteria	MRSA* bacteria	CONS bacteria	Enterococcus bacteria	P value
	%	%	%	%	
Ampicillin Antimicrobials	92.92	99.91	98.97	99.67	
Amoxy/clav Antimicrobials	84.51	87.51	81.23	99.89	
Pip./Tazo. Antimicrobials	12.32	72.56	21.42	1.21	
Cephalosporins Antimicrobials	78.91	87.83	61.11	99.11	0.002
Ciprofloxacin Antimicrobials	28.91	29.68	21.23	02.10	
Cefoxitin Antimicrobials	01.12	98.21	63.41	01.14	
Doxycycline Antimicrobials	28.91	29.61	41.11	01.11	
Amikacin Antimicrobials	23.33	24.51	21.11	01.12	
Clindamycin Antimicrobials	28.91	86.82	21.23	1.67	
Vancomycin Antimicrobials	1.32	0.00	0.00	0.00	
Linezolid Antimicrobials	00.00	8.27	0.00	0.00	

Discussion

Despite advancements in surgical techniques and a better understanding of the etiology of infection of wounds following surgery, management of infections at the surgical sites of the abdomen continues to be a significant worry for surgeons and doctors in a medical facility. Patients who undergo abdominal procedures are more likely to be exposed to circulating microbiota in a hospital setting where microbial pathogens are continually present. The majority of infections at abdominal surgery sites only affect the skin and subcutaneous tissue, while necrotizing infections can occasionally develop [6,7]. A laparotomy is a surgical technique that a normal surgical team does the most frequently. The surgical procedure known

as a laparotomy involves the exploration of the abdomen and following procedures depending on the underlying cause. Patients in the elective group get a preoperative checkup and receive treatment for any co-morbid illnesses, such as anemia, diabetes, hypertension, or respiratory infections, before undergoing a laparotomy [8,9].

Common signs of a contaminated surgical wound include tenderness, pain, elevated body temperature, increased redness, swelling, and pus formation. Numerous patient-related factors, including advanced age, poor nutritional status, the presence of pre-existing infections, and other co-morbidity disorders, might have a substantial impact on the risk of infections at the surgical site of the abdomen. These

infections can also be caused by variables related to the surgical method, such as poor surgical technique, prolonged surgery, inappropriate preoperative surgical part preparation, and insufficient sterilization of surgical instruments [10,11].

The unchecked and quick spread of resistance to the wide range of antimicrobials that are currently available exacerbates the current issue. The majority of infections at the surgical sites of the abdomen are hospital-derived and differ between hospitals. According to reports, the prevalence of infections at the surgical sites of the abdomen ranges from 2.5 percent to 41.9 percent.

The overall percentage of infections at the surgical sites of the abdomen in the current study was 18.9%, which was consistent with Satyanarayana *et al* study which revealed the overall prevalence of infections at the surgical site of the abdomen as 13.7 percent. The rate of SSI might range from 6.1% to 38.7%, according to numerous other Indian research. The incidence rate of infections recorded from other nations is, however, fairly low when compared to Indian institutions; for example, it is believed to be 2.8% in the USA and 2-5% in European nations. The major factors that contribute to the elevated infection frequency in Indian hospitals may include a lack of focus on infection control methods, improper hand hygiene habits, and overcrowding in the hospitals. The proportion of males to females in this research was 2.7:1, which was greater than the male-to-female ratio reported in earlier studies. Male patients made up the majority of the study's participants. Individuals above the age of 50 had an increased prevalence of infection at the surgical site of the abdomen (52.9%) compared to patients under the age of 50, where the prevalence was 13.5%. The development of infections at the surgical sites of the abdomen is significantly influenced by advancing age since older patients have lower healing rates, lower immune systems, higher catabolic

activities, and co-morbid illnesses like diabetes, hypertension, etc [12].

In the present study, the overall rate of SSI was 18.9% in emergency laprotomy and 17.2% in elective laprotomy. The proportion of male study participants was greater than female participants. The ratio of males to females was 2.7:1. The patients with an age of more than 50 years had a higher proportion of infection at the surgical site of the abdomen in comparison to the patients who were in the age group of ≤ 50 years. Regarding the duration of the operation, a prolonged time was found to be a significant risk factor for SSI and it was observed that as the order and the duration of surgery increased, the rate of infection also increased.

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Conclusion

The overall incidence of infection at the surgical site in emergency laprotomy is greater than the elective laprotomy, however, the difference is not significant statistically.

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