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OCCURRENCE, MANAGEMENT AND COMPLICATIONS OF SURGICAL SITE INFECTIONS IN EMERGENCY VS ELECTIVE EXPLORATORY LAPAROTOMY

General Surgery

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ABSTRACT

Purpose: This research aimed to evaluate and compare the frequency, clinical features, and outcomes of surgical site infections (SSIs) following elective and emergency exploratory laparotomy procedures. It also explored associated risk factors, microbial patterns, and therapeutic responses unique to each surgical setting. **Methodology:** A prospective observational study was conducted involving 102 patients who underwent exploratory laparotomy at Dhiraj Hospital. Of these, 61 (59.8%) underwent elective procedures, while 41 (40.2%) had emergency surgeries. Information regarding patient demographics, clinical presentation, surgical indications, medical history, comorbidities, and postoperative results was gathered. Categorical variables were analyzed using chi-square tests, and continuous variables were evaluated with independent t-tests. A p-value of less than 0.05 was considered statistically significant. **Results:** No significant age difference was observed between the two groups (p=0.519). Theemergency group had a significantly higher proportion of male patients (80.5% vs. 57.4%, p=0.015). Diagnoses varied notably between groups (p=0.002), with conditions such as intestinal perforation (26.8%) and gastrointestinal perforation (17.1%) being more frequent in emergency cases. There was also a significant difference in medical history (p=0.015), particularly with a greater incidence of alcohol use among emergency patients. The rate of SSIs was significantly higher in emergency surgeries (41.5%) compared to elective ones (19.7%, p=0.017). **Limitations:** The study does have limitations, such as being conducted at a single center, involving a modest sample size, and lacking long-term follow-up data. These constraints may limit the broader applicability of the results. **Conclusion:** Emergency exploratory laparotomy is associated with a markedly increased risk of postoperative surgical site infections when compared to elective surgeries. Despite similar microbial findings and antibiotic effectiveness between the two groups, emergency procedures demand stronger preventive measures. The insights from this study may support the creation of focused strategies to reduce infection rates and enhance patient recovery through optimized perioperative care.

KEYWORDS

Surgical site infections , Laparotomy; Elective surgery; Emergency surgery; Postoperative complications.

INTRODUCTION :

Exploratory laparotomy is a fundamental surgical operation that exhibits different infection risk profiles when conducted in an emergency compared to elective circumstances. Emergency laparotomies, required for severe illnesses including peritonitis, intestinal perforation, or abdominal trauma, inherently present heightened infection risks due to existing contamination, impaired patient physiology, and restricted chances for preoperative optimisation. (1) The National Surgical Quality Improvement Program database reveals that emergency laparotomies carry a two to three-fold increased risk of surgical site infections compared to elective procedures. In contrast, elective laparotomies allow for thorough preoperative preparation, careful patient selection and stabilisation, and optimal surgical settings, theoretically resulting in enhanced infection prevention outcomes. In India, where emergency surgical services frequently encounter issues such as delayed presentations, resource constraints, and elevated patient numbers, comprehending these differential risks is very relevant to clinical practice (2,3)

The etiopathogenesis of post-laparotomy surgical site infections (SSIs) entails a complex interaction among host factors (such as nutritional status, comorbidities, and immunocompetence), surgical parameters (including technique refinement, duration, and tissue handling), and microbial characteristics (notably virulence factors and antimicrobial susceptibility patterns). (4) The microbiological profile significantly differs between emergency and elective situations, with emergency procedures often resulting in polymicrobial infections dominated by enteric organisms. In contrast, elective cases generally involve skin commensals, especially Staphylococcal species.

The time-dependent risk stratification model proposed by the Centers for Disease Control and Prevention categorises superficial incisional SSIs affecting the skin and subcutaneous tissues, deep incisional SSIs involving fascial and muscle layers, and organ-space SSIs impacting anatomical spaces altered during surgery, each presenting unique clinical challenges and management considerations. (5)

Current epidemiological trends in SSI microbiology indicate a rising issue of antibiotic resistance, characterised by a troubling predominance of multidrug-resistant organisms that complicate therapy strategies. Indian institutional data indicate notably elevated rates of methicillin-resistant Staphylococcus aureus (MRSA), comprising 38-78% of Staphylococcal isolates in diverse surgical environments, and extended-spectrum beta- lactamase (ESBL) producing organisms impacting up to 68% of Enterobacteriaceae isolates from surgical sites. (6)

The changing resistance environment requires advanced antimicrobial stewardship and evidence-based infection control approaches customised for particular surgical situations. The Indian Council of Medical Research (ICMR) has underscored this issue in its antibiotic resistance surveillance network data, stressing the necessity for institution-specific susceptibility patterns to inform empirical therapy in surgical infections. (7)

This research aims to examine the prevalence, management strategies thoroughly, and outcomes of SSIs in emergency versus elective exploratory laparotomy, focusing specifically on the Indian surgical context(8). This study aims to provide comprehensive insights into the distinct characteristics of infection across surgical settings by utilizing standardised surveillance criteria from the Centers for Disease Control and Prevention and incorporating demographic, clinical, microbiological, and outcome parameters.(9)

The findings seek to enhance infection prevention methods, improve antimicrobial tactics, and advance quality improvement activities in surgical treatment. The investigation aims to discover modifiable risk variables pertinent to each surgical scenario, thereby guiding focused treatments to mitigate infection burden.(10)

MATERIALS AND METHODS:

Study Design : A prospective observational research project
Study Duration : November 2023 to march 2025
Study Area : Department of General Surgery, Dhiraj General Hospital, Pipariya, Vadodara
Study Population: All eligible cases undergoing Emergency & Elective Exploratory Laparotomy in Department of surgery , Dhiraj General Hospital, Pipariya, Vadodara during this study period the below mentioned criteria.

Inclusion Criteria:

1. Patients of either gender that age more than or equal to18 years.
2. All patients who report to surgery department and underwent either elective or emergency surgeries.
3. Patients who develop post operative surgical site infections within 7days of post operative period.

4. Patient that give written informed consent.

Exclusion Criteria:

1. Patients having history of previous surgical site infection.
2. Patients who receive antibiotics more than a week prior to surgery.
3. Patients that undergo re-operation, except for the management of surgical site infection.
4. Patients who take DAMA, or do not follow up within 30 days of operation.
5. Patient who do not wanted to participate in the study.

Sample Size: 103 (This was calculated with the formula of n = Z 2 P(1-P) d2)

Methodology Of Study:

To conduct this prospective, observational study in the Surgical Department of Dhiraj General Hospital, Piparia. This study was conducted over a period of one and half year that is from June of 2023 to December of 2024. The patients that met all the criteria for inclusion and none of the criteria for exclusion were enrolled in the study. The study was conducted as per local ethical guidelines as well as the bioethical guidelinesprovided by ICMR 2016 and in accordance to ICH (International Conference on Harmonization) E6 (R2) 'Guideline for Good Clinical Practice'.

RESULTS AND OBSERVATIONS:

Table 1: Distribution Of Participants Based On Type Of Exploratory Laparotomy

Groups	Description	N	%
Group 1	Elective Exploratory Laparotomy	61	59.8%
Group 2	Emergency Exploratory Laparotomy	41	40.2%
Values are expressed in frequency and percentage.			

Table 2: Comparison Of Mean Age Between Elective And Emergency Exploratory Laparotomy Groups

Age	Mean	Std. Deviation	Mean Difference	t-value	p-value
Group 1	45.84	15.067	-2.164	-0.647	0.519
Group 2	48.00	18.589			
Values are expressed as mean and SD, the p-value is by independent sample t-test and <0.05 is considered statistically significant.					

Table 3: Gender Distribution Among Elective And Emergency Exploratory Laparotomy Groups

Gender	Group 1		Group 2		Chi square	p-value
	N	%	N	%		
Male	35	57.4%	33	80.5%	5.893	.015*
Female	26	42.6%	8	19.5%		
Values are expressed as mean and SD, the p-value is by chi-square test and <0.05 is considered statistically significant.						

Table 4: Distribution Of Diagnoses Among Elective And Emergency Exploratory Laparotomy Groups

Diagnosis	Group 1		Group 2		Chi square	p value
	N	%	N	%		
Abdominal Infection	2	3.3%	2	4.9%	47.073	0.002
Abdominal Tumour	5	8.2%	0	0.0%		
Appendicitis	3	4.9%	4	9.8%		
Oesophageal Disorder	1	1.6%	0	0.0%		
Gallbladder Disorder	3	4.9%	0	0.0%		
GI Cancer	2	3.3%	0	0.0%		
GI Perforation	0	0.0%	7	17.1%		
Gynaecological Cancer	3	4.9%	0	0.0%		
Gynaecological Tumor	1	1.6%	0	0.0%		
Hernia	5	8.2%	2	4.9%		
Intestinal Cancer	1	1.6%	0	0.0%		
Intestinal Obstruction	8	13.1%	9	22.0%		
Intestinal Perforation	2	3.3%	11	26.8%		
Intestinal Tumour	2	3.3%	0	0.0%		
Liver Disorder	1	1.6%	2	4.9%		
Liver Injury	1	1.6%	0	0.0%		
Ovarian Cancer	4	6.6%	0	0.0%		
Pancreatic Disorder	2	3.3%	1	2.4%		
Parasitic Infection	3	4.9%	0	0.0%		
Postoperative Complication	2	3.3%	2	4.9%		
Postoperative Infection	1	1.6%	0	0.0%		
Splenic Disorder	4	6.6%	1	2.4%		
Splenic Injury	1	1.6%	0	0.0%		
Tumour	4	6.6%	0	0.0%		
Values are expressed as frequency and percentage; the p-value is by chi-square test, and <0.05 is considered statistically significant.						

Table 5: Distribution Of Past Medical History Among Elective And Emergency Exploratory Laparotomy Groups

Past History	Group 1		Group 2		Chi square	p value
	N	%	N	%		
Alcoholic	3	4.9%	8	19.5%	17.371	.015*
Cancer History	0	0.0%	2	4.9%		
Drug History	0	0.0%	2	4.9%		
Nil	44	72.1%	20	48.8%		
Previous Surgery	7	11.5%	4	9.8%		
Smoker	4	6.6%	0	0.0%		
TB	1	1.6%	2	4.9%		
Trauma	2	3.3%	3	7.3%		
Values are expressed as frequency and percentage; the p-value is by chi-square test, and <0.05 is considered statistically significant.						

Table 6: Distribution Of Comorbidities Among Elective And Emergency Exploratory Laparotomy Groups

Comorbidities	Group 1		Group 2		Chi square	p value
	N	%	N	%		
Asthma	1	1.6%	0	0.0%	15.078	0.303
Ca Ovary	2	3.3%	0	0.0%		
Diabetes	1	1.6%	0	0.0%		
Diabetes and Cardiovascular Disease	1	1.6%	0	0.0%		
Endometrium Cancer	3	4.9%	0	0.0%		
Hypertension	0	0.0%	2	4.9%		
Hypertension and Diabetes	0	0.0%	1	2.4%		
IBD	0	0.0%	1	2.4%		
Infectious Disease	1	1.6%	1	2.4%		
No Comorbidities	47	77.0%	34	82.9%		
Pancreatitis	2	3.3%	0	0.0%		
Rectum Cancer	1	1.6%	2	4.9%		
Sickle Cell Anemia	1	1.6%	0	0.0%		
TB	1	1.6%	0	0.0%		
Values are expressed as frequency and percentage; the p-value is by chi square test, and <0.05 is considered statistically significant.						

Table 7: Occurrence Of Surgical Site Infections Among Elective And Emergency Exploratory Laparotomy Groups

Surgical Site infection	Group 1		Group 2		Chi square	p value
	N	%	N	%		
Present	12	19.7%	17	41.5%	5.722	.017*
Absent	49	80.3%	24	58.5%		
Values are expressed as frequency and percentage; the p-value is by chi-square test, and <0.05 is considered statistically significant.						

Table 8: Comparison Of Pus Culture Organisms Between Elective And Emergency Exploratory Laparotomy Groups

Pus Culture	Group 1		Group 2		Chi square	p-value
	N	%	N	%		
E. coli	4	33.3%	8	47.1%	0.829	0.824
Klebsiella	3	25.0%	3	17.6%		
P. Aeruginosa	1	8.3%	2	11.8%		
S. Aureus	4	33.3%	4	23.5%		
Values are expressed as frequency and percentage; the p-value is by chi square test, and <0.05 is considered statistically significant.						

Table 9: Response To Broad-spectrum Antibiotics Between

Elective And Emergency Exploratory Laparotomy Groups

Response to broad spectrum antibiotics	Group 1		Group 2		Chi square	p value
	N	%	N	%		
Responsive	9	75.0%	10	58.8%	0.815	.367[a]
Non Responsive	3	25.0%	7	41.2%		
Values are expressed as frequency and percentage; the p-value is by chi-square test, and <0.05 is considered statistically significant.						

Limitations:

This study offers significant insights but has limitations that should guide the interpretation of its findings. The limited sample size, especially in subgroup analyses, may constrain statistical power and elevate the likelihood of type II errors. Subsequent studies using bigger cohorts may more clearly define the associations among procedure urgency, patient attributes, and infection outcomes.

The study also neglects to consider other possible confounders, including operation duration, blood loss, surgeon expertise, and particular prophylactic measures, which Rodrigues et al. (2019) recognised as critical factors influencing SSI risk. Enhanced data collection that includes these variables would improve our comprehension of the relative impacts of modifiable and non-modifiable risk factors on infection development.

CONCLUSION:

This study, which compares elective and emergency exploratory laparotomy operations, uncovers numerous notable findings with critical therapeutic implications. The significantly greater occurrence of surgical site infections in emergency laparotomies (41.5%) relative to elective operations (19.7%) highlights the increased infection risk associated with urgent surgical interventions. Our analysis reveals that although the microbiological profiles of infections were comparable across groups, with E. coli as the predominant pathogen, variables such as gender distribution, presenting diagnoses, and medical history exhibited significant differences between elective and emergency contexts.

The elevated ratio of males in the emergency group indicates possible gender-related disparities in presentation patterns or disease severity necessitating immediate attention. The prevalence of intestinal and gastrointestinal perforations in emergencies contrasts with the greater incidence of tumours and malignancies in elective surgeries, highlighting the differing clinical processes that influence surgical scheduling.

Both cohorts exhibited analogous responses to broad-spectrum antibiotics, suggesting that whereas emergency interventions increase infection rates, the resultant illnesses are not inherently more resistant to antimicrobial treatment. This discovery has ramifications for antibiotic stewardship measures, indicating that standardised treatment methods may be beneficial irrespective of the urgency status of the initial procedure.

The findings underscore the necessity for improved preventive efforts specifically designed for emergency laparotomies, including perhaps more assertive prophylactic measures, particularly for high-risk individuals such as males and those with histories of alcohol use. This study underscores the significant economic and clinical impact of surgical site infections, emphasising the necessity of prioritising infection prevention in surgical quality enhancement efforts.

In conclusion, emergency exploratory laparotomy presents a markedly elevated risk of surgical site infection relative to elective operations, albeit comparable microbiological profiles and antibiotic response patterns.

This study offers critical insights for formulating focused preventive strategies and enhancing perioperative care to reduce infectious complications in exploratory laparotomy, thereby improving patient outcomes and decreasing healthcare expenses related to surgical site infections.

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