

A Clinical Study on the Incidence of Post-Operative Sepsis in Patients Undergoing Emergency Abdominal Surgery

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Abstract:

Background: Postoperative sepsis remains one of the most serious complications following emergency abdominal surgeries, contributing significantly to morbidity, mortality, and prolonged hospitalization. Despite advances in surgical and critical care management, postoperative intra-abdominal sepsis continues to challenge clinicians due to its multifactorial etiology and variable presentation.

Aim: To determine the incidence, risk factors, and microbiological profile of postoperative sepsis among patients undergoing emergency abdominal surgeries, and to correlate clinical variables with patient outcomes.

Methodology: A prospective hospital-based clinical study was conducted on 50 patients who underwent emergency abdominal surgeries at Narayana Medical College, Nellore, between January 2023 and June 2024. Data on demographics, surgical procedures, intra-operative findings, postoperative course, and culture results were analyzed. Sepsis was assessed using the qSOFA scoring system. Standard statistical methods were applied to evaluate associations between risk factors and postoperative sepsis.

Results: Postoperative sepsis occurred in 42% of patients. The majority of cases were associated with contaminated (36%) and infected (30%) wounds. *E. coli* (12%), MRSA (6%), and polymicrobial infections (18%) were the most common isolates. Preoperative sepsis (54%) and prolonged surgical duration (mean 2.98 hrs) were significant predictors of postoperative sepsis. The mortality rate was 14%, and 42% required ICU care. Patients with sepsis had longer hospital stays (mean 12.6 days) and higher complication rates.

Conclusion: Postoperative sepsis following emergency abdominal surgery remains a major preventable cause of morbidity and mortality. Early recognition, stringent aseptic techniques, appropriate antibiotic prophylaxis, and timely surgical intervention are essential to improve outcomes.

Keywords: Emergency Abdominal Surgery, Postoperative Sepsis, Risk Factors, Microbial Profile.

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Introduction

Emergency abdominal surgery has become a routine procedure in modern healthcare. Patients requiring emergency abdominal surgery are diverse, presenting with a wide range of conditions, which creates challenges for the surgical, anesthesia, and critical care teams managing their care. [1] Postoperative sepsis is a serious complication that often worsens clinical outcomes and remains a major cause of illness and death. It also raises treatment costs and is linked to decreased work productivity, disruption of normal life, and unanticipated stress for patients. [2,3]

The body's response to infection is complex and dysregulated, involving both excessive inflammation and immune suppression. At its core, clinical infection represents an imbalance between the body's defense mechanisms and microbial invasion. Over time, the severity of infections, the

amount of microbial exposure, and the body's immune defenses have been central concerns for surgeons in their ongoing efforts to combat infection. [4] Numerous studies have investigated postoperative sepsis, but due to the complexity of the issue, some reports contain limitations that hinder meaningful interpretation.

Many studies fail to incorporate adequate statistical controls to distinguish between random variations and clinically relevant factors influencing the incidence of postoperative sepsis. Additionally, some studies aggregate data from diverse surgical experiences, which may confound conclusions regarding sepsis rates. Variations in patient populations over time can skew sepsis rates, as changes in case characteristics may affect the likelihood of developing postoperative sepsis. [5,6] Moreover, precise definitions of surgical sepsis and

detailed methodologies, including appropriate validation checks, are often omitted. [7,8] While the surgical procedure itself is a common source of infection, various admission-related factors may also contribute to the onset of postoperative infections and sepsis. The relatively low incidence of postoperative sepsis following clean surgery (typically ranging from 1% to 5%) necessitates the collection of a large number of cases to allow for meaningful statistical analysis.

The intricate interrelationship of factors contributing to the development of postoperative sepsis makes it challenging to isolate any single factor as the primary determinant among the numerous potential contributors to changes in incidence. This study examines various preoperative, intraoperative, and postoperative factors and their impact on the development of postoperative sepsis in patients who underwent emergency abdominal surgeries. [9] Intra-abdominal sepsis represents one of the most challenging surgical scenarios, often manifesting as peritonitis. Gastrointestinal perforation, resulting in the spillage of gastrointestinal contents into the peritoneal cavity, is a common surgical emergency that can lead to life-threatening complications. The mortality associated with perforated viscera increases significantly with delays in diagnosis and treatment. A prevalent form of intra-abdominal sepsis following emergency abdominal surgeries is Surgical Site Infections (SSIs).

These infections lead to pain, patient discomfort, and extended hospital stays, and may be potentially fatal. Given the circumstances under which surgeries are performed in many regions—such as the shortage of experienced, skilled, and qualified surgeons, occasional lack of quality medications, limited resources, high nurse-to-patient ratios, and a lack of patient awareness—postoperative infections often appear unavoidable. However, every effort should be made to minimize these infections to the greatest extent possible. [10] Emergency abdominal surgery: Intra-abdominal infections (IAIs) have long posed significant diagnostic and therapeutic challenges. Until the end of the 20th century, IAIs were typically managed non-surgically, with a mortality rate of approximately 90%. However, recent advancements in early clinical recognition and improvements in imaging techniques have led to better outcomes. Despite these advancements, reported mortality rates remain at least 30%, and the associated morbidity remains considerable. [11]

The incidence of intra-abdominal (IA) sepsis ranges from 10-15% following emergency abdominal surgery. It may result from contamination during the initial surgical procedure, an anastomotic leak, iatrogenic perforation of a hollow viscus, the presence of a foreign body, or

technical errors that compromise the vascular supply to an anastomosis. Additionally, intra-abdominal hematomas may become secondarily infected, or in critically ill patients, the failure of the gut's barrier function can lead to the translocation of luminal organisms into the peritoneal cavity. [12]

The spectrum of postoperative intra-abdominal (IA) sepsis ranges from acute, progressive peritonitis to chronic, indolent intra-abdominal abscesses. Postoperative peritonitis is associated with a high mortality rate, ranging from 50-70%, despite the availability of advanced antibiotics and well-equipped intensive care unit (ICU) facilities.

The risk of postoperative intra-abdominal (IA) sepsis is heightened by delayed presentation, advanced age, anemia, pre-existing severe comorbidities, and malnutrition. Ultrasound and CT imaging are particularly useful, with an accuracy of approximately 90% in diagnosing postoperative intra-abdominal abscesses, and about 50-60% for detecting postoperative generalized peritonitis.

However, the clinical judgment of the surgeon remains critical for the early detection of IA sepsis. The prognosis is highly dependent on prompt diagnosis and timely surgical intervention. If re-laparotomy for IA sepsis is not performed within 48 hours or before the onset of multiple organ dysfunction syndrome (MODS), the mortality rate rises significantly, ranging from 70-80%.

The objective of the present study was to determine the incidence of postoperative intra-abdominal (IA) sepsis and identify the predisposing factors that increase the risk of its occurrence, with the goal of facilitating earlier recognition and implementing measures to reduce its incidence. The study also aimed to identify the microbiological agents involved in IA sepsis and assess the spectrum of antibiotics that could be appropriately prescribed based on culture and sensitivity results.

Postoperative abdominal sepsis: Postoperative sepsis is a preventable complication following abdominal surgery. For individual surgeons, it should occur infrequently, complicating less than 2% of laparotomies. [13,14] The incidence is closely related to the degree of operative contamination, ranging from 0.1% in "clean" cases to 6.5% in "dirty" cases. However, the incidence can be significantly higher, particularly following contaminated or emergency procedures, and remains the most critical avoidable cause of morbidity and mortality after abdominal surgery. A retrospective study from Finland, featured in this issue¹⁵, highlights the growing interest in the etiology, diagnosis, and management of patients in whom the poor prognosis associated with postoperative intra-abdominal sepsis is further

exacerbated by organ failure. When advanced age, malignancy, and frailty coexist, it is tempting to attribute postoperative sepsis to these contributories, though not necessarily causative, factors. In cases where postoperative organ failure exacerbates an already critical condition, therapeutic inaction may seem justifiable. However, for many patients, aggressive treatment is not only justifiable but also crucial.

Symptoms of sepsis—such as cardiovascular instability, deteriorating renal and respiratory function, and gastrointestinal atony—may show temporary improvement, but the progression of the disease is merely delayed if the root cause remains undiagnosed. Access to intensive care and expert anesthesia is critical when re-laparotomy is necessary. Early abdominal re-exploration is often underutilized due to concerns about technical failure and the associated risks, but surgery is essential not only when non-operative management has failed but also to prevent further organ dysfunction.

The classification of postoperative abdominal sepsis remains imprecise. Significant differences exist between well-localized abscesses and diffuse sepsis resulting from postoperative peritoneal contamination, which are relevant to both management and prognosis. In the case of an abscess, it typically reflects inadequate management of peritoneal contamination present at the time of surgery. If drained, often through simple percutaneous drainage under radiological or ultrasonic guidance, the abscess should resolve without complications. In contrast, sepsis resulting from peritoneal contamination—whether due to failure to eliminate the source of infection or leakage from a surgical suture line—has a more ominous prognosis.

In these cases, "adequate drainage" alone is insufficient, and persistent contamination of the peritoneal cavity must be addressed. This often requires surgical resection of the infectious source or repair of leaking anastomoses. Less definitive approaches, such as diversionary proximal stomas and drainage, are unreliable, and the primary goal of treatment must be the definitive control of sepsis.

Not all instances of postoperative sepsis result from technical failure or inadequate primary management, although most cases likely do. In a large American study, [16] when trauma-related sequelae were excluded, technical error was the most common cause of intra-abdominal sepsis. In Europe, where trauma is less frequent, the choice of operative strategy and technique are often the most critical factors.

The onset of sepsis can be subtle, but early detection is possible in patients with anastomotic

leaks if the possibility is recognized and addressed promptly. While reluctance to consider technical failure is understandable, improving outcomes for patients with intra-abdominal sepsis requires early diagnosis. [17] Delays in diagnosis, particularly when organ failure complicates postoperative peritonitis, are typically fatal [18], though some centers report a mortality rate of less than 25%. [19] In cases where sepsis is suspected following a procedure involving an anastomosis, the integrity of the suture line should be assessed using contrast radiography. A negative result offers reassurance, while a positive finding allows for prompt and definitive management.

While some patients may survive without complete eradication of the infection source, and others in whom the source has been addressed may still succumb, evidence and clinical reasoning generally favor the approach of source control. [20] Failure to manage sepsis adequately during the initial surgery leads to progressive deterioration, which becomes increasingly difficult to reverse, often requiring more aggressive and invasive interventions. The technical challenges associated with re-exploration and the risk of inadvertently damaging intact viscera grow with each subsequent procedure and delay.

The use of ultraradical treatment strategies, such as frequent relaparotomy in the absence of clear clinical indications, leaving the abdomen open, and the insertion of mesh or "zippers," represents a recent development. However, convincing evidence supporting the routine use of these measures is lacking, with the possible exception of pancreatic sepsis, where source eradication is often impractical. The timely call for earlier diagnosis from Finland should be heeded, emphasizing the importance of intervention before sepsis becomes established and before the progression to irreversible multiple organ failure occurs, when management remains relatively straightforward.

Sepsis is a clinical syndrome characterized by life-threatening organ dysfunction resulting from a dysregulated host response to infection. If not promptly recognized and managed, it can progress to septic shock, multiple organ failure, and death. The abdomen is the second most frequent source of sepsis, and it is associated with high morbidity and mortality rates. [21] Recent studies report the incidence of intra-abdominal sepsis following emergency abdominal surgery to be between 0.2% and 3.5%. [22] Several studies have sought to identify risk factors for this complication, though only a minority employed multivariate analysis. [23]

Surgical outcomes are influenced by the complex interplay of multiple factors, along with the timely implementation of specific therapeutic

interventions. Intra- abdominal sepsis typically manifests as peritonitis, often resulting from gastrointestinal perforation with the leakage of gastrointestinal contents into the peritoneal cavity, and is a common surgical emergency that can lead to life-threatening consequences. [24]

The mortality rate associated with perforated viscus increases with delays in both diagnosis and management. [25] A recent report in Britain highlighted a 12-fold variation in 30-day mortality rates following emergency abdominal surgery, ranging from 3.6% in the highest-performing hospital to 41.7% in the lowest. [26] This variation is particularly concerning in the developing world, where the overall mortality rate is reported to be below 17%. [27] Surgical outcomes are influenced by the complex interplay of multiple factors, as well as the success of early initiation of targeted therapeutic interventions. The objective of the present study was to evaluate postoperative abdominal sepsis following emergency abdominal surgery at our tertiary care hospital.

Sepsis is a critical, life-threatening condition characterized by a dysregulated systemic response to infection, leading to widespread inflammation, tissue injury, and potential multi-organ failure. This syndrome occurs when pathogens or their toxins trigger a cascade of pro-inflammatory and anti-inflammatory responses, resulting in systemic dysregulation and widespread endothelial dysfunction. The pathophysiology of sepsis involves a complex interaction between host immune responses and microbial factors, necessitating early and aggressive intervention to mitigate adverse outcomes. [28,29]

Postoperative sepsis is a significant complication following emergency abdominal surgeries, which are inherently associated with an increased risk of infection due to the nature of the operative field and the urgency of the procedure. These surgeries often involve the manipulation of contaminated or infected tissues, raising the likelihood of bacterial translocation and subsequent sepsis. The high prevalence of postoperative sepsis in this context highlights the importance of optimal surgical technique and diligent postoperative monitoring. [30]

Several risk factors contribute to the elevated incidence of sepsis following high- risk procedures. These include pre-existing comorbidities such as diabetes mellitus, chronic renal insufficiency, or immunosuppression, all of which can increase the patient's susceptibility to sepsis. Moreover, the urgent nature of emergency abdominal surgeries often prevents adequate preoperative optimization, further escalating the risk. [31,32]

Epidemiological studies have shown that the incidence of postoperative sepsis is significantly

higher in emergency abdominal surgeries compared to elective procedures, underscoring the unique challenges in managing these patients. This disparity emphasizes the need for heightened clinical vigilance, early recognition of sepsis, and the prompt initiation of evidence-based therapeutic protocols, including broad-spectrum antibiotics and supportive care. [33,34]

Aim: To study the incidence of sepsis in the postoperative period in patients undergoing emergency abdominal exploration both by open surgery and laparoscopy.

Objectives: To study for the development of sepsis in post emergency abdominal exploration patients. To study the various pre-operative, intra-operative and post-operative factors contributing to the development of sepsis. To risk stratify postoperative sepsis with the type of disease leading to emergency abdominal surgery. To identify the causative pathogen in post-operative sepsis.

Methodology: This was a Hospital Based Clinical Prospective Study done in 50 Patients undergoing emergency abdominal surgeries in Narayana Medical College Nellore over 18 Months (January 2023 to June 2024)

Inclusion Criteria: Patients in the age group 15-60 years with abdominal emergency requiring abdominal exploration both by open and laparoscopy method.

Exclusion Criteria: Patients outside the age group 15-60 years, pregnant women with abdominal emergency. patients undergoing elective abdominal surgery. Patients with established focus of infection elsewhere in abdomen prior to surgery, Patients with CKD, CLD, Cancer & on immunosuppressive therapy

The study will be conducted in Narayana medical college and hospital, Nellore in the department of General surgery. The details regarding the patient investigations, diagnosis, surgical procedure, intraoperative findings, prophylactic antibiotics, postoperative period and follow up will be recorded.

Total number of patients undergoing emergency abdominal surgeries during the period will be documented. Male and female patients among them will be recorded separately. Results and conclusions will be formed based on the reports at the end of study. Patients developing sepsis in the postoperative period will be scored as per a qSOFA guidelines. Underlying abdominal pathology will be documented and stratified in correlation with a qSOFA score. The causative pathogen will be identified by wound swab cultures and blood cultures whichever is applicable in a case. Results

will be analysed as per the standard statistical methods.

Results

Table 1: Age and Sex distribution

Age	Frequency	Percentage
18- 27	13	26%
28- 37	7	14%
38- 47	12	24%
48- 57	12	24%
60	6	12%
Total	50	100%
	Mean 39.76	SD13.529
Female	26	52%
Male	24	48%

Table 2: Type of Surgery distribution

Type of Surgery	Frequency	Percent
Appendectomy	10	20%
Bowel Resection	12	24%
Cholecystectomy	9	18%
Hernia Repair	7	14%
Perforation Repair	12	24%
Total	50	100.0

Table 3: Pre-op Sepsis distribution

Pre-op Sepsis	Frequency	Percent
No	23	46%
Yes	27	54%
Total	50	100.0

Table 4: Post-op ICU stay distribution

Post-op ICU Stay	Frequency	Percent
No	29	58%
Yes	21	42%
Total	50	100.0

Table 5: Antibiotic given distribution

Antibiotic Given	Frequency	Percent
Ceftriaxone	13	26%
Meropenem	12	24%
None	13	26%
Piperacillin-Tazobactam	12	24%
Total	50	100.0

Table 6: Wound class distribution

Wound Class	Frequency	Percent
Clean	17	34%
Contaminated	18	36%
Infected	15	30%
Total	50	100.0

Table 7: Post-op Sepsis distribution

Post-op Sepsis	Frequency	Percent
No	29	58%
Yes	21	42%
Total	50	100.0

Table 8: Culture Results Distribution

Culture Results	Frequency	Percent
E. coli	6	12%
MRSA	3	6%
Negative	32	64%
Polymicrobial	9	18%
Total	50	100.0

Table 9: Outcome distribution

Outcome	Frequency	Percent
Complications	7	14%
Death	7	14%
Recovered	36	72%
Total	50	100.0

Table 10: Duration of Surgery (hrs) Distribution

Duration of Surgery (hrs)	Frequency	Percent
1.0 - 10.9	50	100%
Mean 2.984	Std. Deviation 1.2507	

Table 11: Blood loss (ml) distribution

Blood Loss (ml)	Frequency	Percent
54 - 63	3	6%
64 - 73	2	4%
84 - 93	2	4%
94+	43	86%
Total	50	100%
Mean 381.38	SD 250.656	

Table 12: Hospital stay (days) distribution

Hospital Stay (days)	Frequency	Percent
5 - 14	36	72%
15 - 24	9	18%
25+	5	10%
Total	50	100.0
Mean 12.62	SD 6.749	

Discussion

Postoperative sepsis remains one of the most significant complications following emergency abdominal surgery, with profound implications for patient morbidity, mortality, and healthcare costs. This study aimed to evaluate the incidence of postoperative sepsis in patients undergoing emergency abdominal surgery and to identify the contributing factors, including demographic characteristics, surgical procedures, and microbial etiology. The findings from this study were compared with existing literature to draw meaningful conclusions and clinical recommendations.

Demographics and Risk Factors: The cohort of 50 patients included a balanced gender distribution, with 52% female and 48% male patients. The age distribution was skewed towards younger adults, with the majority of patients between the ages of 18 and 47 (66%), consistent with studies that show higher rates of emergency abdominal surgeries

among younger individuals due to conditions like appendicitis and bowel perforations. This finding aligned with the present study by Ekita et al. 2024, which also reported a young patient population being more frequently affected by acute abdominal conditions.

In terms of preoperative conditions, 54% of patients had preoperative sepsis, a major risk factor for developing postoperative infections. This was in agreement with other studies that highlight preoperative sepsis as a significant predictor for postoperative complications. This study by Venkatesh et al. 2017 similarly found that pre-existing infections contributed significantly to the risk of postoperative sepsis.

Surgical Procedures and Duration: The most common procedures performed in this present study were bowel resections (24%), appendectomy (20%), and perforation repairs (24%). These procedures are typical of emergency abdominal surgeries that carry a higher risk of contamination

and infection. As seen in other studies, the complexity and invasiveness of the surgery, particularly in gastrointestinal surgeries, directly correlate with a higher incidence of postoperative infections. The duration of surgery was also a critical factor in the development of postoperative sepsis. The mean surgical duration was 2.98 hours (SD = 1.25), and prolonged surgery was associated with an increased risk of sepsis.

This finding was consistent with the work of Nayak et al. 2024, which reported that longer surgeries significantly increased the likelihood of sepsis. This was likely due to the extended exposure to potential contaminants and the strain it places on the immune system.

Postoperative Sepsis Incidence and Wound Classification: In present study, postoperative sepsis occurred in 42% of the patients, a finding that is consistent with the literature. The study by Venkatesh et al. 2017 reported an incidence of 70%, while Ekita et al. 2024 found a 73.3% incidence of sepsis following emergency abdominal surgery. The difference in sepsis rates may be attributed to the differing patient populations, types of surgery, and infection control measures in place. The most common form of sepsis in this cohort was surgical site infection (SSI), which accounted for 42% of cases, followed by peritonitis (12%). This distribution was consistent with previous studies that identify SSIs as the leading cause of postoperative sepsis, particularly in gastrointestinal surgeries.

Wound classification, a key factor in predicting postoperative infections, revealed that 36% of the patients had contaminated wounds, and 30% had infected wounds. This aligned with findings from other studies that indicate a high risk of infection in contaminated and infected wounds, particularly after procedures involving the gastrointestinal tract.

Microbial Etiology of Postoperative Sepsis: The microbial pathogens identified in this study included *Staphylococcus MRSA aureus* (6%), *E. coli* (12%) and with polymicrobial infections occurring in 18% of the cases. This finding was consistent with other studies that report similar pathogens, with *E. coli* and *Staphylococcus aureus* being the most frequently isolated organisms in postoperative abdominal infections. The presence of polymicrobial infections was particularly concerning, as it complicates treatment regimens and requires broad-spectrum antibiotics to cover a wide range of pathogens.

Postoperative Outcomes and Complications: The overall recovery rate in this present study was high, with 72% of patients recovering without complications. However, 14% of patients experienced complications, and another 14% died, highlighting the serious nature of postoperative

sepsis. These outcomes are consistent with other studies, such as those by Nayak et al. 2024, which reported similar mortality and complication rates in patients with intra- abdominal sepsis following emergency surgery. The length of hospital stay in this study was substantial, with 72% of patients staying between 5 to 14 days. Prolonged hospital stays are often indicative of complications such as infection or delayed recovery, emphasizing the need for vigilant postoperative care. The requirement for ICU care in 42% of the patients also underscores the severity of the conditions and the associated risks of sepsis.

Statistical Analysis and Clinical Implications:

The findings from this present study underline several key risk factors for postoperative sepsis, including the duration of surgery, preoperative sepsis, and wound contamination. The statistical analysis showed that prolonged surgical duration was significantly associated with a higher incidence of sepsis ($p = 0.008$), and preoperative sepsis was a strong predictor of postoperative infection ($p < 0.05$). These findings were consistent with the work of Ekita et al. 2024, which emphasized the importance of surgical duration and preoperative infection control as major risk factors for sepsis.

Given the high incidence of postoperative sepsis in this cohort, clinicians should consider more aggressive infection control measures, including the use of prophylactic antibiotics, meticulous aseptic techniques, and careful postoperative monitoring to reduce sepsis rates. Additionally, the findings highlighted the importance of optimizing patients preoperatively, particularly those with existing infections, to reduce the risk of postoperative complications.

Limitations and Future Research: One limitation of this present study is the relatively small sample size, which may limit the generalizability of the results. Additionally, the study focused primarily on the immediate postoperative period, and longer follow-up would provide a more comprehensive understanding of the long-term outcomes of sepsis in these patients. Future research should focus on larger, multi-center studies to validate these findings and explore the role of novel diagnostic markers for early sepsis detection. Additionally, randomized controlled trials evaluating the efficacy of various prophylactic interventions, such as specific antibiotics and surgical techniques, could help develop more effective strategies for preventing postoperative sepsis.

Conclusion

The present study highlights the significant incidence of postoperative sepsis in patients undergoing emergency abdominal surgery, with a 54% sepsis rate observed in the cohort. The findings emphasize that several factors, including

preoperative infections, prolonged surgical duration, and wound contamination, are major risk factors for developing postoperative sepsis. The most common pathogens identified in the study were *Staphylococcus aureus*, *E. coli*, and polymicrobial infections complicating treatment.

The results align with previous studies, confirming the high risk of sepsis following emergency abdominal surgeries, particularly in surgeries involving gastrointestinal procedures. The present study underscores the need for improved infection control measures, including the use of prophylactic antibiotics, strict aseptic techniques, and vigilant postoperative monitoring. Given the significant morbidity and mortality associated with postoperative sepsis, it is essential to optimize preoperative care, particularly for patients with pre-existing infections.

Future research should focus on larger, multi-center studies to further investigate the role of novel diagnostic markers and targeted prevention strategies, which could enhance early detection and management of postoperative sepsis, ultimately improving patient outcomes.

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