VOLUME - 15, ISSUE - 08, AUGUST - 2026 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

General Surgery

A STUDY ON MICROBIAL FLORA IN PERITONEAL FLUID AND POST OPERATIVE WOUND INFECTION/GAPING IN PERFORATIVE PERITONITIS

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ABSTRACT Perforative peritonitis is a life-threatening surgical emergency frequently associated with postoperative surgical site infections (SSIs). This prospective observational study evaluated the correlation between microorganisms isolated from intraoperative peritoneal fluid and postoperative wound infections in 80 patients undergoing emergency laparotomy for perforative peritonitis. Peritoneal fluid and wound swab cultures were analyzed and compared. Escherichia coli was the predominant organism isolated from peritoneal fluid (41.8%) and was also the most common pathogen in postoperative wound infections (31.4%). Among patients with identical isolates from both sites, E. coli accounted for 85.7% of cases, indicating a strong correlation between peritoneal contamination and subsequent wound infection. The findings suggest that routine intraoperative peritoneal fluid culture can predict postoperative wound pathogens and facilitate early culture-guided antibiotic therapy, thereby reducing surgical site infections and improving clinical outcomes in patients with perforative peritonitis.

KEYWORDS : Perforative peritonitis, peritoneal fluid culture, surgical site infection, postoperative wound infection, Escherichia coli, culture-guided antibiotic therapy.

INTRODUCTION

Surgical Site Infections: A Continuing Postoperative Challenge :

Surgical Site Infections (SSIs) continue to be one of the most prevalent complications following surgery, accounting for close to 40% of all hospital-acquired infections. These infections contribute to prolonged hospitalizations and increased healthcare expenses, posing significant burdens on patients, hospitals, and healthcare systems overall. Most SSIs develop within 5 to 6 days post-surgery, with about 90% manifesting within the first 30 days. The central aim of administering antibiotics before surgery is to maintain sufficient drug levels at the surgical site to prevent infection. These concentrations should be effective against anticipated pathogens and sustained throughout the time the wound is vulnerable to contamination, thereby preventing bacterial colonization during or after the operation. When antibiotic levels in tissue and bloodstream are not adequately maintained during surgery, the likelihood of infection rises sharply. Polk and Lopez-Mayor emphasized that optimal antibiotic concentrations should be achieved directly at the wound site rather than relying solely on systemic circulation. One method to attain this is through the direct application of antibiotics into the surgical incision before the procedure begins. Modern guidelines focus on ensuring high antibiotic concentrations in tissues most prone to infection, with consideration of the wound classification—whether clean, clean-contaminated, contaminated, or dirty. Clean surgical procedures typically have a 2% to 5% SSI rate, but this can climb to 20% in clean-contaminated cases.Although antibiotic prophylaxis isn't always required for clean surgeries, many surgeons still choose to use it as a precaution. However, with rising concerns about antibiotic resistance, it is crucial to use antimicrobial agents responsibly and only when clearly indicated.1,2

Perforative Peritonitis: A Common and Urgent Surgical Condition Perforative peritonitis, often caused by a perforation of a hollow organ, is a frequently encountered and critical condition in surgical practice. It refers to inflammation of the peritoneum—the membrane lining the abdominal cavity and its organs—caused by contamination from gastrointestinal contents, such as bacteria or gastric acid from a perforated ulcer. This condition may present in various ways, sometimes making it difficult to determine the exact source. The causes of gastrointestinal perforation vary by region; in tropical countries, upper GI tract perforations are more prevalent, while in Western nations, lower GI tract perforations are more common. The disease has been recognized since ancient times—Hippocrates described characteristic features of peritonitis as early as 400 BC. In 1727, Rawlenson offered a detailed clinical description of gastric ulcers and their progression to peritonitis. Despite advances in medical care, perforative peritonitis continues to have a high mortality and morbidity rate and typically requires emergency surgical treatment.9,10

Ileal Perforation in Developing Countries:

Ileal perforation is a significant surgical emergency in tropical regions, primarily due to the high prevalence of enteric fever and tuberculosis. It ranks as the fifth most common cause of acute abdominal emergencies in these settings. Even with modern advancements in anesthesia and critical care, the fatality rate remains considerable. Prompt surgical intervention, which often involves closure of the perforation and peritoneal lavage, is crucial for survival.3,4

Other Causes and Treatment Approaches Untreated appendicitis can lead to localized peritonitis, the formation of an appendicular mass, tissue necrosis, perforation, and eventually generalized peritonitis. McBurney first described appendicitis, also called "perityphlitis," in 1889. Immediate surgical exploration is essential in acute mesenteric ischemia if peritoneal signs are evident, while non-occlusive cases may be managed with intra-arterial vasodilators. Perforations associated with diverticular disease carry a high mortality risk. However, those due to malignancy or ischemia are also frequently encountered. Current surgical management of peritonitis may include simple closure with extensive lavage, bowel resection with or without anastomosis, and diversion procedures like Hartmann's operation in cases involving significant contamination, particularly in colonic perforations.5,6

Aim of The Study:

To identify whether bacteria found in peritoneal fluid and post operative wound infection/wound gaping in perforative

peritonitis were same or not.

OBJECTIVES:

1. Culture the peritoneal fluid in perforative peritonitis.
2. Culture the pus isolated from infected wound in postoperative cases of perforative peritonitis.
3. Compare the bacteria isolated from the peritoneal fluid and postoperative wound infection in perforative peritonitis.

PATIENTS AND METHODS

This is a hospital based Observational study which included 75 patients who underwent Laparotomy surgeries for perforative peritonitis in King George Hospital, Visakhapatnam, Andhra Pradesh, India from june 2023 to may 2024 for a period of 1 year satisfying all the inclusion criteria and the exclusion criteria mentioned below, started after obtaining the clearance from the Institutional Ethics Committee. Inclusion criteria: 1)All patients with age more than 18 years, of both the sexes who are undergoing laparotomies for perforative peritonitis in King George Hospital.

2) Patients with perforative peritonitis.
3) Patients with postoperative wound infection/gaping.
4) Patients who gave written consent after studying consent form.

Exclusion criteria:

1) Patients with major co-morbid illness.
2) Patients with peritonitis due to traumatic perforation.
3) Patients who were not given consent for surgery

Methodology

A prospective study of 75 patients with perforative peritonitis undergoing various emergency major general surgical procedures were done and intraoperatively peritoneal fluid and post operatively infected wound was sent for culture from 01.06.2023 to 01.05.2024 in KGH, Visakhapatnam. The statistical significance and the overall incidence of perioperative were analysed.

OBSERVATIONS AND RESULTS

Patients with perforative peritonitis were selected and culture of the peritoneal fluid found intraoperatively was sent to culture and then the patient was followed up post operatively.If wound infection occurs,pus was sent for culture and then see whether the micro organisms isolated from peritoneal fluid and postoperative wound infection were same or not.

TABLE – 1: Distribution according to Sex

	Male	Female	Total
Percentage	66%	34%	
Number	52	27	80

All the subjects belong to Low & middle socio-economic classes. Males constitute 66 percent of the study population and 34 percent of study population.

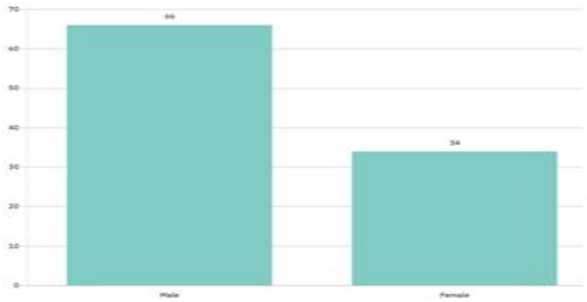


Figure – 1: Bar diagram representing Gender.

Table 2: Distribution according to age groups.

Age	Total	Percentage
18-30	7	8.8
31-40	13	16.3
41-50	8	10
51-60	19	23.8
>60	33	41.3

Among the 80 patients,prospective observational study in Post operative wound infection in perforative peritonitis patients,percentage of patients with age group 1830,31-40, 41-50,51-60, >60 are 8.8%,16.3%,10%,23.8%,41.3% respectively.

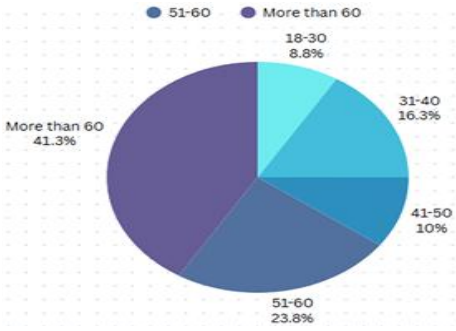
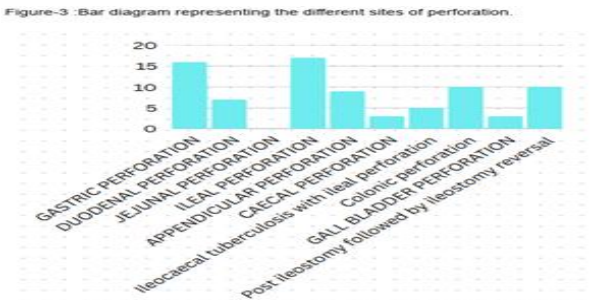


Figure -2 Pie chart representing age group distribution



Most common type of perforation as observed in the study group are gastric and ileal perforation.so the chance of bacterial isolated from the peritoneal fluid is commonly similar to the microbial flora found in the stomach and ileum like lactobacillus and helicobacter pylori , streptococcus and actinomyces .

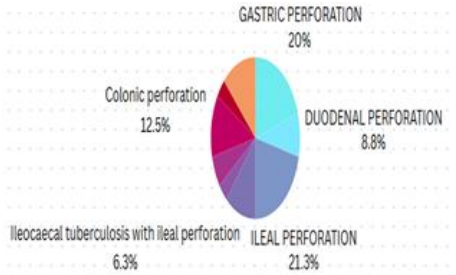


Figure -4 : pie chart representing the percentage of different sites of perforation of bowel.

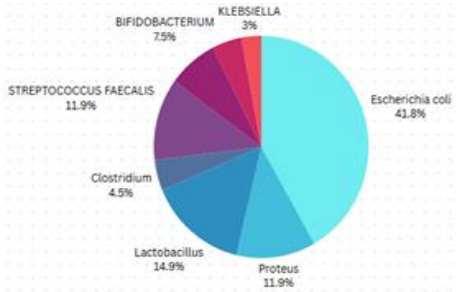


Figure-5 : Pie chart representing organisms isolated from peritoneal fluid

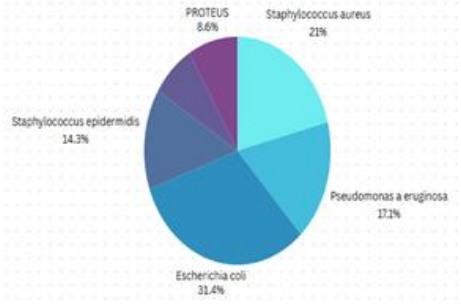


Figure-6: Pie chart representing organisms isolated from infected wound

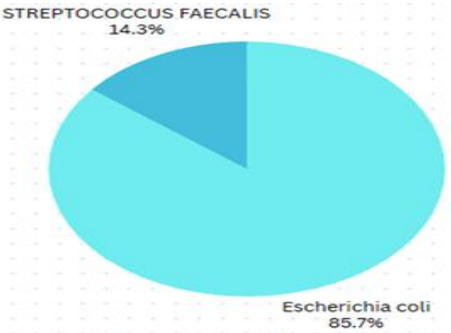


Figure -7: Pie chart representing organisms isolated same from both peritoneal fluid and wound infection

Table-6 : Representing no.of days of wound infection

Organism isolated	Maximum no.of days of wound infection
Staphylococcus aureus	10
Pseudomonas a eruginosa	20
Escherichia coli	10
Staphylococcus epidermidis	8
Streptococcus faecalis	25
PROTEUS	6

Investigations:

The investigations done to diagnose the acute abdominal emergency in this study are : 1. Plain x-ray abdomen (erect) 2. Ultrasound of the abdomen 3. CT scan of the abdomen. Among the 80 cases of perforative peritonitis, the primary investigation in those cases is plain x-ray of the abdomen in erect posture to look for pneumoperitoneum. Among those 80 cases of perforative peritonitis, 73 cases showed pneumoperitoneum on plain xray erect abdomen and the rest 7 cases had no pneumoperitoneum on xray Out of those 7 cases, 2 were caecal perforation due to malignant large bowel obstruction where the caecal perforation was noted intraoperatively, but ultrasound of the abdomen showed free fluid in the abdomen and the clinical signs of peritonitis lead to the clinical diagnosis of perforation peritonitis in those 2 cases. The other 5 cases that had no evidence of pneumoperitoneum are appendicular perforation. In these cases due to peritonitis features and due to evidence of free fluid in the abdomen a clinical diagnosis of perforation peritonitis was made and subsequently the intraoperative findings coincided with the clinical diagnosis. In the 73 cases of perforative peritonitis that showed pneumoperitoneum on plain xray, ultrasound was done to look for free fluid in the abdomen but it was not mandatory .Overall ultrasound has no much role in these cases. Ultrasound proved to be useful in cases that presented with obstruction where it showed the free fluid in the abdomen,the motility of the bowel and more importantly solid growths and bowel wall thickening that lead to suspicion of obstruction secondary to a malignant growth. Contrast enhanced CT scan was very useful in cases that presented with obstruction whose preoperative diagnosis was uncertain in the preliminary investigations like ultrasound of the abdomen. It showed growths, bowel wall thickening, pneumatosis intestinalis in case of bowel gangrene.

Surgery:

Among 80 patients,16 members presented with gastric perforation are treated with modified graham's patch repair. 7 members presented with duodenal perforation were treated with omental patch repair,17 members presented with ileal perforation treated with primary ileal repair/ resection of ileum and ileo-ileal anastamosis,9 members presented with appendicular perforation and treated with appendicectomy,3 members presented with caecal perforation and treated with primary closure of caecal perforation,5 members presented with ileo-caecal tuberculosis with distal ileal perforation and treated with ileocaecal complex resection and ileocolic anastamosis,10 members presented with colonic perforation and they were treated with primary repair,10 members presented with ileo-ileal anastmotic leak from the ileostomy reversal, 3 members presented with gallbladder perforation, and treated with cholecystectomy.

CONCLUSION

Incidences of perforative peritonitis,more common in low socio-economic status. After analysing this data, it can be said that a significant number of perforative peritonitis cases are identified in tertiary care facilities as emergencies. On the operating table, perforation was diagnosed at different parts of bowel. The elderly age group (>60years)is particularly more likely to get perforative peritonitis. When running an emergency department, this must be remembered. The surgeon faces an intriguing problem when dealing with abdominal emergencies, which is to correctly identify the underlying cause, address it, and bring relief to the patient.Perforative peritonitis are more likely to appear as an emergency in elderly individuals in their 7th decade and above, with the majority being male. The most common mode of presentation is pain in abdomen and abdominal distension.Most common organism isolated form peritoneal fluid in perforative peritonitis is Escherichia coli. Most common organism isolated from post operative wound infection in perforative peritonitis is staphylococcus aureus. Escherichia coli is the most common organism isolated as same from both peritoneal fluid and post operative wound infection in perforative peritonitis patients. This study offers valuable insights into the complex nature of perforative peritonitis, emphasizing the need for a comprehensive approach to its management. The male predominance observed in the study, along with the higher incidence in the elderly, aligns with previous reports highlighting key risk factors such as lifestyle choices and age-related comorbidities. These demographic factors play a significant role in the delayed presentation of the disease, which complicates timely intervention and increases the risk of postoperative infections. The findings also underscore the importance of understanding the anatomical site of perforation, as this has direct implications for the microbial flora present in both the peritoneal cavity and the surgical wounds. Gastric and ileal perforations, commonly associated with peptic ulcers and enteric fever, respectively, were found to harbor characteristic microbial populations, including Escherichia coli and Lactobacillus. These results support the hypothesis that the type of perforation informs the bacterial spectrum encountered, which is critical in guiding empirical antibiotic therapy. Furthermore, the isolation of Mycobacterium tuberculosis in a small subset of cases

highlights the importance of maintaining a high index of suspicion for tuberculosisrelated perforations in endemic areas. The microbiological profile of peritoneal fluid and postoperative wound infections revealed a predominance of E. coli, followed by other enteric pathogens and hospital-associated bacteria such as Pseudomonas aeruginosa. The significant presence of S. aureus and S. epidermidis points to the contribution of skin flora, emphasizing the role of infection control during the perioperative period. The prolonged duration of wound infections caused by Pseudomonas aeruginosa and Streptococcus faecalis underlines the need for vigilant monitoring and appropriate modification of antibiotic therapy based on culture results to prevent complications such as wound gaping and sepsis. Notably, the high concordance between organisms isolated from peritoneal fluid and wound infections further supports the notion that intraoperative contamination is a primary source of postoperative infections. This strengthens the case for systematic culture of peritoneal fluid during surgery as a valuable tool for tailoring antibiotic therapy. By targeting the specific pathogens present in the peritoneum, clinicians can reduce the risk of postoperative complications and improve patient outcomes. The study also highlights the variability in infection duration, with organisms like S. faecalis requiring prolonged treatment, possibly due to their virulence or resistance patterns. This further underscores the importance of individualizing treatment regimens, based on both the microbial profile and the clinical condition of the patient, rather than relying solely on empirical treatments. In conclusion, this study reinforces the importance of early, culture-directed therapy in the management of perforative peritonitis, as well as the need for effective infection control measures to prevent postoperative complications. The findings support the continued use of peritoneal fluid culture as a critical tool for guiding antibiotic therapy and minimizing the risk of postoperative infections. Further research into evolving resistance patterns and the role of emerging pathogens is crucial in refining treatment protocols and improving the management of this challenging condition, particularly in resource-limited settings.

LIMITATIONS OF THIS STUDY

The study will be done in a limited number of subjects and for a short period of time.The results may vary if done in a large number of subjects.

The burden of cost on the healthcare system and the patient is also not considered in the present study. For the ease of the study, the swabs for culture & sensitivity were sent only on specified days but not every day. Also, Laparoscopic and stoma cases were not included.

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