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Bacterial Analysis of Peritoneal Fluid in Patients with Perforation Peritonitis

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Abstract

Background: Generalised peritonitis continues to be one of the commonest surgical emergencies in India. Despite the availability of potent medications, incidence and prevalence of such cases remains high. This study aims to analyse the bacterial culture and drug sensitivity in perforation peritonitis patients. Materials and Methods: A cross sectional study is conducted between January 2021 to October 2022 diagnosed to have perforation peritonitis of both sexes aged 13 years and above who underwent exploratory laparotomy. A proforma especially designed for this study was used to record relevant information for each individual patient. Peritoneal fluid obtained intraoperatively sent for culture and sensitivity. Study of drug sensitivity pattern of the organisms cultured in perforation peritonitis patients were analysed. Data collected were analysed and results was interpreted accordingly. Results: This study shows that most common organism in gastric perforation is E coli followed by klebsiella. In case of duodenal perforation Klebsiella being more common followed by E coli and proteus and pseudomonas in each cases and no growth in 5 cases. In case of ileal perforation most commonly seen in duodenum followed by stomach. Most of the cases were due to peptic ulcer disease. Secondary peritonitis caused in these cases was most commonly due to E coli followed by klebsiella.

Keywords: Bacterial analysis, E. coli, Peritonitis, Peritoneal fluid

Introduction

Generalised peritonitis continues to be one of the commonest surgical emergencies in India. Despite many advances in perioperative care, antimicrobial therapy and intensive care support, patients with peritonitis still suffer high morbidity and mortality.^[1] Perforation peritonitis is the most frequent form of intra-abdominal infection. About 80% of cases of secondary peritonitis.^[2] These patients are among the most complex cases encountered in surgical practice.^[3] Peritonitis may be primary, secondary, or tertiary; and secondary peritonitis is the common form of intraperitoneal infection originating from bowel injuries, such as perforation, strangulation, or infection.^[4] Complicated intra-abdominal infections

(cIAIs) are defined as those extending beyond the original injury into the peritoneal space with associated abscess formation or peritonitis.^[5] The most important treatment for patients with secondary peritonitis attributable to hollow viscus perforation is removing the contamination source as soon as possible.[6-8] In addition. fluid resuscitation. electrolyte supplementation, and the administration of appropriate antibiotics are needed. During the initial stages, broad-spectrum antibiotics are selected empirically. Accordingly, knowledge of the microbial distribution is essential, because physicians must understand the regional distributions and characteristics of bacteria to ensure an optimal empirical choice of antibiotic. In this context, a

number of research studies have been performed on bacteria resistant to newly developed antimicrobial agents.^[9-10] Despite recent advances in diagnosis, antimicrobial therapy, and intensive care support, operative treatment remains the foundation of the management of patients with severe secondary peritonitis (SSP). This management is based on three fundamental principles: (1) Elimination of the source of infection; (2) reduction of bacterial contamination of the peritoneal cavity; and (3) prevention of persistent or recurrent intra-abdominal infection.^[11] The Mannheim Peritonitis index provide a novel and excellent platform as to predict the surgical outcome, mortality and morbidity in cases of hallow viscera perforations with peritonitis with all associated issues related to the conditions.^[12]

Despite the availability of potent medications, including proton pump inhibitors (PPIs) and appropriate antibiotics against the causative organisms, the incidence and prevalence of such cases remains high and results in a great economic burden upon the patient. Indeed, morbidity and mortality rates are higher among patients with various co-morbid factors or those presenting late to higher-level care centres. Diet and hygiene practices play a vital role in the causation of such cases.^[13]

In the study group of 80 patients, majority of the patients had duodenal perforation (40%). Highest survival rate was seen among duodenal perforation 32 of 32(100%) and the highest mortality was seen among patients with gastric, unknown and colonic perforations. The time of presentation of patients ranged from < 24 hours to 10 days. Most of the patients presented within 1-2 days. Mortality increased correspondingly with delay in presentation to the hospital. It was 25% for 1-2 days, 62.5% for 3-5 days and 12.5% for 6 to 10 days. Delayed presentation was usually seen in cases of peritonitis secondary to appendicular perforation which had better prognosis compared to other hollow viscus perforation presenting late.^[14]

On giving antibiotics empirically, 18 patients (25.71 %) were discharged within 8-10 days and 43 patients (61.43 %) were discharged within 11-15 days. After giving antibiotics according to culture and sensitivity, 19 patients (63.33 %) were discharged within 8-10 days. Thus, hospitalization days were reduced in

patients in whom antibiotics were given according to culture and sensitivity.^[15]

Finally, it is necessary to look into antibiotic sensitivity and culture done to help ascertain the efficiency of presently used antibiotics and to form antibiotic policy in peritonitis due to duodenal ulcer perforation.^[16] Nowadays inadvertent use of NSAIDS and analgesics available over the counter forms one of the most common risk factors. Abdominal pain and vomiting were the most common chief complaints and tenderness with guarding rigidity being the most commonly observed sign. Gas under diaphragm on X-ray standing abdomen is suggestive of hollow viscus perforation but, it is not obligatory. Surgery is the main modality of treatment. Wound infection is the most commonly observed post-operative complication.^[17]

Velappan et al^[18] and Rao et al^[19] study Pain in abdomen, vomiting, distension and Fever were the predominant symptoms. Pain abdomen was seen in all cases. Abdominal distension and guarding/rigidity are two common signs observed. Most common postoperative complication we observed is wound infection which is seen in 15% of the patient. 10 Chest infection is seen in 6.6% of the patients. This is probably due to chest physiotherapy, spirometry, early mobilization and use of nebulization.^[20]

This study aims to analyse the bacterial culture and drug sensitivity in perforation peritonitis patients.

Materials And Methods:

A cross sectional study is conducted at Department of Surgery, Regional Institute of Medical Sciences, Imphal, Manipur between January 2021 to October 2022 diagnosed to have perforation peritonitis of both sexes aged 13 years and above who underwent exploratory laparotomy. Exclusion criteria were Primary peritonitis patients, patients with traumatic bowel perforation, peritonitis patients with no identifiable perforation site on laparotomy. Sample size calculated as N =(4PQ)/ L^2 , where N = Sample Size, P = Prevalence of E coli in ileal perforation peritonitis taken as 10%⁶¹, Q= 100-P, L= Allowable error taken at 6%. Hence, sample size for the study was taken as 100 patients. Independent variables were age, sex, alcohol intake, smoking. Outcome variables were organisms isolated, drug sensitivity of bacterium isolated from peritoneal fluid and

intraoperative findings. A proforma especially designed for this study was used to record relevant information for each individual patient. Statistical analysis was performed using SPSS software 25 version (IBM). Age of the patient was expressed in mean, standard deviation and percentage. Other variables like gender, alcoholism, smoking history, organism isolated, drug sensitivity were expressed in percentage.

Ethical approval from the Research Ethical Board (REB), Regional Institute of Medical Sciences (RIMS), Imphal was obtained. Informed written consent were obtained from the patient and responsible attendant(s). Peritoneal fluid obtained intraoperatively sent for culture and sensitivity. Study of drug sensitivity pattern of the organisms cultured in perforation peritonitis patients, analysed in Department of Microbiology in RIMS. The study was self sponsored and there was no conflict of interest.

Results:

A total of 100 patients underwent exploratory laparotomy for perforation peritonitis where 81 were males and 19 were females. The sex distribution in this study shows perforation being more common in male (81%) than in females (19%). This study shows that the most common age group of presentation is about > 50 years (41%), followed by 31 to 40yrs (25%). There were 6 patients (6%) in the age group of 13 to 20yrs, 11 patients (11%) in 21 to 30yrs and 17 patients (17%) in 41 to 50yrs age group. The mean age of presentation was 49.6 yrs.

This study shows that the most common site of perforation being duodenal (52%) followed by gastric (38%), appendix perforation (7%) and ileal perforation in 3% of study population (*Table 1*).

In this study out of 100 cases the most common organism grown is e. coli (38%) followed by Klebsiella species (36%) and no growth in about 19%. In two cases of perforation there were growth of pseudomonas and mixed organisms each. Proteus species was isolated from three such perforation cases (*Table 2*).

This study shows that most common organism in gastric perforation is E coli followed by klebsiella. In case of duodenal perforation Klebsiella being more common followed by E coli and proteus and pseudomonas in each cases and no growth in 5 cases. In case of ileal perforation the common species being E coli followed by Klebsiella (*Table 3*).

This study shows that amikacin is sensitive in most cases of E. coli followed by ciprofloxacin and ceftriaxone. For klebsiella most cases are sensitive to ceftriaxone and ciprofloxacin. Both klebsiella and E coli were resistant to ampicillin and cotrimoxazole. Proteus and pseudomonas are less commonly found in peritoneal cavity, but if so they are sensitive to ceftriaxone and ciprofloxacin. But proteus found to be resistant to amikacin (*Table 4*).

SITE	NO OF CASES
GASTRIC	38
DUODENAL	52
ILEAL	3
APPENDIX	7

Table 1: Site of perforation in study population

Table 2: Frequency of cultured organism in study population

ORGANISM	FREQUENCY	PERCENTAGE
E. Coli	38	38%

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KLEBSIELLA	36	36%
K+E	2	2%
PROTEUS	3	3%
PSEUDOMONAS	2	2%
NO GROWTH	19	19%
	100	

Table 3: Organism according to site of perforation in a study population

	GASTRIC	DUODENAL	ILEUM	APPENDIX
E COLI	12	20	2	4
KLEBSIELLA	9	25	1	1
PROTEUS	1	1	-	1
PSEUDOMONAS	1	1	-	-
MIXED	1	-	-	1
NO GROWTH	14	5	-	-

Table 4: Sensitivity pattern of common antibiotics

ANTIBIOTIC	Е	Klebsiella(36)	Proteus(3)	Pseudomonas(2)	Mixed(2)
	Coli(38)				
AMPICILLIN	4	2	-	-	-
CIPROFLOXACIN	27	28	3	2	-
CEFTRIAXONE	18	35	3	2	1
COTRIMOXAZOLE	2	4	-	2	-
AMIKACIN	31	-	-	2	2

Discussion:

Secondary peritonitis caused by hollow viscus perforation is common. It has high mortality rate due to late presentation of patient to hospital. In our study secondary peritonitis due to perforation was common in males than females, which is in the ratio of 4:1. And this ratio is slightly higher in our study when compared to other standard literature. Most cases of perforation seen in case of males which is probably due to their irregular food habits, alcoholism and smoking.

In our study most of the cases of perforation were seen in the age group of >50yrs followed by 31 to 40yrs. The mean age of presentation is 49.6yrs of age. Most of the patients have previous history of peptic ulcer disease. There in is no exposure of drugs

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like steroids and NSAID's in long term as confirmed by history from the patient.

From our study, it has been noticed that the most common site of perforation is in first part of duodenum 52% followed by gastric in 38% of cases. Most are likely of peptic ulcer in origin. Only about 3 cases i.e 6% cases were due to ileal perforation and are of non typhoid in origin. In this study, peritoneal fluid culture sent for aerobic microbial culture shows monomicrobial growth in 79% cases, polymicrobial in 2% cases and no growth in 19% cases. Gram negative enteric bacilli were being common in the culture and this includes E coli and Klebsiella followed by proteus and pseudomonas. The most common organism grown were E coli 38% followed by Klebsiella in 36% of cases only 2% showed mixed growth of both E coli and Klebsiella. In about 19 cases i.e. 19% showed no growth in their culture. In our study, the sensitivity patterns of cultured organisms were analysed. It showed that organisms were sensitive in most cases to amikacin followed by ceftriaxone and ciprofloxacin. But these organisms high resistance to ampicillin showed and cotrimoxazole. E coli cultured in peritonitis in our study showed sensitivity to amikacin of about 81.5% followed by ciprofloxacin (71%) and ceftriaxone of about 47.3%. In case of Klebsiella, the sensitivity to amikacin is 100%, followed by ceftriaxone which is about 97% and ciprofloxacin 77.9%. Both E coli and Klebsiella showed high resistance to ampicillin and cotrimoxazole. Metronidazole in the treatment of anaerobic bacterial infection still holds good. Development of resistance to metronidazole among anaerobes is still very low and is confirmed in many studies. But development of resistance to aerobic bacteria is on the rise, due to inadvertent use of antibiotics. Due to this fact there has been confusion in selecting the empirical antibiotic therapy.

From this study, it concludes that drug that is most sensitive in most of cases of perforation peritonitis is amikacin followed by quinolones and cephalosporin group of drugs. Most of the cases showed resistance to ampicillin and cotrimoxazole group drugs.

Conclusion:

In this study, it is concluded that perforation most commonly seen in duodenum followed by stomach. Most of the cases were due to peptic ulcer disease. Secondary peritonitis caused in these cases was most commonly due to E coli followed by klebsiella and rarely by mixed, proteus and pseudomonas. Both Klebsiella and Escherichia coli were sensitive to macrolide group of drugs followed by quinolones and then cephalosporin antibiotics.

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