e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2022; 14(5); 723-728

Original Research Article

Assessing the Peritoneal Fluid Sensitivity and Culture in Subjects with Perforation Peritonitis: A Clinical Cross-Sectional Study

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Received: 15-04-2022 / Revised: 13-05-2022 / Accepted: 30-05-2022
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Conflict of interest: Nil

Abstract

Introduction: One of the most frequently seen pathology by general surgeons is peritonitis. Mortality and morbidity with surgeries have drastically reduced owing to advancements in surgical techniques and antibiotics. The complications seen can be mild like an infection to severe life-threatening like SIRS (Systemic Inflammatory Response Syndrome) and septic shock. Good recovery is also seen in the use of antibiotics covering anaerobic, gram-negative, and gram-positive organisms. Treatment failure and antibiotic resistance can result from inappropriate antibiotic use.

Objectives: The present study was conducted to assess the peritoneal fluid's microbiologic pattern in culture and sensitivity to recognize antibiotic sensitivity patterns for routinely used organisms.

Methods: The present cross-sectional study included 48 subjects having perforation and peritonitis diagnosed on chest x-ray. Peritoneal fluid was isolated and antibiotic sensitivity was recognized along with the microorganism nature.

Results: The results of the study have shown that the duodenum was the most common site of perforation followed by stomach commonly seen secondary to peptic ulcer disease. Klebsiella was the most common microorganism isolated followed by E. coli, pseudomonas, and proteus. Cephalosporin sensitivity was seen in most of the organisms in the peritoneal fluid which was followed by macrolides and Fluoroquinolones

Conclusion: The present study concludes that following the sensitivity pattern, appropriate antibiotic use is vital to decrease mortality and morbidity in subjects of perforation by peritonitis to reduce antibiotic resistance.

Keywords: Antimicrobials, Culture, Microorganism, Perforation, Peritonitis, Peritoneal fluid

Introduction

One of the most frequently seen pathology by general surgeons is peritonitis. Peritonitis can be a traumatic perforation of the bowel or simple perforation of the duodenum or can be acute pancreatitis or appendicular perforation with further complication of the appendicular abscess. Peritonitis is associated with high mortality of nearly 20%. Management of peritonitis is still challenging for surgeons despite advancements in intensive care, surgical technologies, and antibiotic therapy. The reported incidence of complications due to peritonitis varies in acute abdominal emergencies, however, in subjects of age more than 60 years, more complications are seen. With the advancement in the medical field, life expectancy is significantly increased in population which in turn, has increased better surgical outcomes following surgery in elderly subjects. [1]

Accurate and timely diagnosis and adequate surgical exploration is an approach that saves the life of subjects with secondary peritonitis. Controlling peritonitis surgically is a vital factor assessing survival of subjects with peritonitis and should be considered before manage these subjects. Intensive care facilities can help control sepsis. However, the time-lapse between surgery and the onset of hollow viscous perforation is directly proportional to the mortality rates. [2]

Dangerous and life-threatening complications are associated with peritonitis due to the high contamination risk of the peritoneal cavity by organisms like enterococci, Proteus, Klebsiella, E. Coli, and Enterobacteriaceae. Life-threatening conditions like SIRS (Systemic Inflammatory Response Syndrome) can result either by secretion of endotoxins or direct action. Multiple organisms from the peritoneal cavity were first isolated in 1930 by Altheimer that explains the pathogenesis for intra-abdominal sepsis. Antibiotics use and advancements in the recent past have made the control of developing sepsis feasible in subjects with peritonitis. The antibiotics approach has decreased mortality and morbidity by reducing abscess formation in these subjects. [3]

Recently, management of peritonitis includes the use of appropriate antibiotics to reduce infection risk and correction of underlying etiology that helps in preventing the incidence of SIRS following treatment. To control sepsis, combined use of antibiotics that covers anaerobes, gram-negative, and gram-positive microbes. The problem associated with antibiotic use is their inappropriate use leading to the development of resistance which might result in treatment failure. [4]

The present study assessed the peritoneal fluid of subjects with peritonitis following hollow viscous perforation including the identification of involved organisms and their sensitivity pattern which might help in starting appropriate antibiotic therapy to improve outcomes in these subjects.

Materials and Methods

The present cross-sectional clinical study was conducted to assess the peritoneal fluid's microbiologic pattern in culture and sensitivity to recognize antibiotic sensitivity patterns for routinely used organisms. The study was conducted at after obtaining clearance from the concerned Ethical committee. The study population was comprised of the subjects who presented to the emergency

department of the institution for peritonitis secondary to perforation. The inclusion criteria for the study were subjects who were 18 years of age or more, confirmed diagnosis of peritonitis and perforation by X-ray chest, and subjects who were willing to participate in the study. The exclusion criteria were subjects having peritonitis secondary to trauma, primary peritonitis subjects, and subjects who were not willing to participate in the study.

The study included a total of 48 subjects from both genders who were evaluated preoperatively in the emergency unit with the peritonitis features. Following the recording of detailed history and physical examination, a chest X-ray of all the study subjects was taken to confirm the diagnosis. After the X-ray showed the evidence of pneumo-peritoneum and the subjects were following the inclusion criteria, the subjects were finally included in the study.

After final inclusion, routine investigations were done for all the subjects with electrocardiogram or echocardiogram was done whichever appropriate. After stabilization of the vitals, resuscitation was done with intravenous fluids. This was followed by emergency laparotomy after taking informed consent from all the subjects. During surgery, intra-abdominal access was made and the peritoneal fluid was collected which was analyzed for sensitivity and culture. After thorough lavage of the abdomen, closure was done following surgery.

Following surgery, antibiotics, antacids, analgesics, and intraoperative fluids were given to all the subjects. In antibiotics, metronidazole and cefotaxime were given. Culture reports were taken after using the diffusion method with cotrimoxazole, ceftriaxone, ciprofloxacin, amikacin, and ampicillin. Antibiotic therapy was then started based on the sensitivity pattern of microorganisms seen in the culture.

The collected data were subjected to the statistical evaluation using SPSS software version 21 (Chicago, IL, USA) and one-way ANOVA and t-test for results formulation. The data were expressed in percentage and number, and mean and standard deviation. The level of significance was kept at $p<0.05$.

Results

The present cross-sectional clinical study was conducted to assess the peritoneal fluid's microbiologic pattern in culture and sensitivity to recognize antibiotic sensitivity patterns for routinely used organisms. The study included a total of 48 subjects from both genders who were evaluated preoperatively in the emergency unit with the peritonitis features. The study subjects were within the age range of 21-58 years with the mean age of 36.21±4.22 years. The demographic characteristics of the study subjects are listed in Table 1. There were 10.41% (n=5) females and 89.58% (n=43) males in the present study. The majority of the study subjects were within the age range of 31-40 years with 39.58% (n=19) study subjects followed by 22.91% (n=11) study subjects in the age range of 21-30 years, >50 years with 18.75% (n=9) study subjects, and 16.66% (n=8) study subjects from the age of 41-50 years. Concerning the perforation site, maximum perforation was seen in 41.66% (n=20) subjects at duodenal site followed by gastric perforation in 35.41% (n=17) study subjects, ileac perforation at 12.5% (n=6) subjects, jejunum perforation at 4.16% (n=2) study subjects, and 6.25%

(n=3) subjects with colon perforation (Table 1).

Table 1: Demographic and disease characteristics of the study subjects

Characteristics	Percentage (%)	Number (n)
Mean age (years)	36.21±4.22	
Age Range (years)		
21-30	25	12
31-40	39.58	19
41-50	16.66	8
>50	18.75	9
Gender		
Females	10.41	5
Males	89.58	43
Perforation site		
Duodenum	41.66	20
Gastric	35.41	17
Ileac	12.5	6
Jejunum	4.16	2
Colon	6.25	3

On assessing the organisms isolated from the peritoneal fluid of the subjects in the present study, it was seen that no growth was seen in 12.5% (n=6) study subjects, pseudomonas, proteus, and klebsiella each in 2.08% (n=1) study subjects, klebsiella in 45.83% (n=22) study subjects, and E. coli in 35.41% (n=17) study subjects (Table 2).

Table 2: Organisms isolated from the peritoneal fluid in the study subjects

Organisms	Percentage (%)	Number (n)
No growth	12.5	6
Pseudomonas	2.08	1
Proteus	2.08	1
Klebsiella with E. coli	2.08	1
Klebsiella	45.83	22
E. coli	35.41	17

In perforations, In duodenum 3 klebsiella with E. coli, 1 of pseudomonas and proteus, 6 in klebsiella, and 9 in E. coli was seen. In gastric, 2 klebsiella with E. coli, 9 klebsiella, and 6 E. coli were seen, in ileum, 1 klebsiella with E. coli, 2 pseudomonas, 1 klebsiella, and 2 E. coli were seen. In jejunum, 1 pseudomonas and 1 klebsiella was seen, and in colon 1 klebsiella with E. coli, klebsiella, and E. coli was seen (Table 3).

Table 3: Distribution of organisms isolated from the peritoneal fluid at different sites in the study subjects

Perforation	Colon	Jejunum	Ileac	Gastric	Duodenum
Klebsiella with E. coli	1		1	2	3
Pseudomonas		1	2		1
Proteus					1
Klebsiella	1	1	1	9	6
E. coli	1		2	6	9

On assessing the sensitivity and culture, it was seen that for sensitivity pattern for E. coli showed that doe amikacin, cotrimoxazole, ceftriaxone, ciproflox, and ampicillin was seen in 12, 1, 13, 14, and 2 respectively, for klebsiella, it was 15, 2, 18, 13, and 1 respectively. For proteus, 1 was seen for ceftriaxone, and for pseudomonas, it was 1 for each amikacin, cotrimoxazole, ceftriaxone, and ciproflox respectively as shown in Table 4.

Table 4: Culture and sensitivity of organisms isolated from the peritoneal fluid in the study subjects

Antibiotic	Pseudomonas (n=4)	Proteus (n=1)	Klebsiella (n=18)	E. Coli (n=17)
Amikacin	1		15	12
Cotrimoxazole	1		2	1
Ceftriaxone	1	1	18	13
Ciproflox	1		13	14
Ampicillin			1	2

Discussion

The present cross-sectional clinical study was conducted to assess the peritoneal fluid's microbiologic pattern in culture and sensitivity to recognize antibiotic sensitivity patterns for routinely used organisms. The study included a total of 48 subjects from both genders who were evaluated preoperatively in the emergency unit with the peritonitis features. The study subjects were within the age range of 21-58 years with the mean age of 36.21±4.22 years. There were 10.41% (n=5) females and 89.58% (n=43) males in the present study. The majority of the study subjects were within the age range of 31-40 years with 39.58% (n=19) study subjects followed by 22.91% (n=11) study subjects in the age range of 21-30 years, >50 years with 18.75% (n=9) study subjects, and 16.66% (n=8) study subjects from the age of 41-50 years. Concerning the perforation site, maximum perforation was seen in 41.66% (n=20) subjects at duodenal site followed by gastric perforation in 35.41% (n=17) study subjects, ileac perforation at 12.5% (n=6) subjects, jejunum perforation at 4.16% (n=2) study subjects, and 6.25% (n=3) subjects with colon perforation. These findings were consistent with the results of Srivastava R et al [5] in 2018 and Weinstein RA et al [6] in 2001 where similar disease characteristics and demographics were assessed by the authors as in the present study.

The study also assessed organisms isolated from the peritoneal fluid of the subjects in the present study, it was seen that no growth was seen in 12.5% (n=6) study subjects, pseudomonas, proteus, and klebsiella each in 2.08% (n=1) study subjects, klebsiella in 45.83% (n=22) study subjects, and E. coli in 35.41% (n=17) study subjects. In perforations, no growth was seen in 2

subjects in the colon, 1 in the jejunum, 1 in the ileum, 16 in the gastric, and 20 in the duodenum. In duodenum 3 klebsiella with E. coli, 1 of pseudomonas and proteus, 6 in klebsiella, and 9 in E. coli was seen. In gastric, 2 klebsiella with E. coli, 9 klebsiella, and 5 E. coli were seen, in ileum, 1 klebsiella with E. coli, 2 pseudomonas, 1 klebsiella, and 2 E. coli were seen. In jejunum, 1 pseudomonas and 1 klebsiella was seen, and in colon 1 klebsiella with E. coli, klebsiella, and E. coli was seen. These results were in agreement with the studies of Rigberg D et al [7] in 2000 and Mutiibwa D et al [8] in 2013 where similar organisms were isolated from the peritoneal fluid and the comparison sites. [9]

On assessing the sensitivity and culture, it was seen that for sensitivity pattern for E. coli showed that doe amikacin, cotrimoxazole, ceftriaxone, ciproflox, and ampicillin was seen in 12, 1, 13, 14, and 2 respectively, for klebsiella, it was 15, 2, 18, 13, and 1 respectively. For proteus, 1 was seen for ceftriaxone, and for pseudomonas, it was 1 for each amikacin, cotrimoxazole, ceftriaxone, and ciproflox respectively. These results were similar to the results by the studies of Nishida K et al9 in 2000 and Strobel O et al [10] in 2011 where authors showed similar culture and sensitivity as in the present study. [11]

Conclusion

Within its limitations, the present study concludes that accurate use of antibiotics depending on the culture and sensitivity is vital in subjects with peritonitis and perforation to reduce mortality and morbidity and prevent the emergence of resistance. However, the present study had a few limitations including small sample size, cross-section nature, and geographical area biases. Hence, more longitudinal studies with a larger sample size and longer monitoring period will help reach a definitive conclusion.

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