ORIGINAL RESEARCH

ClinicalStudy ofBacteriologicalPatterns andAntibiotic Sensitivity in Secondary Peritonitis

Naveen Banoth[1], Venkatesh A[2]

[1]Assistant Professor, Department of General Surgery, KMC/MGM Hospital, Warangal, Telangana, India
[2]Senior Resident, Department of General Surgery, ESIC Medical College, Sanath Nagar, Telangana, India.

ABSTRACT

Background:Intra-abdominal infections have been treated with various antibiotic regimens. These infections have been treated with single-agent and combination treatments. But no one therapy has been proven superior. The study's main goal is to examine the bacterial patterns in peritoneal fluid from surgical peritonitis patients and assess their antibiotic sensitivity and resistance.

Materials and Methods: It is a cross sectional observation research conducted in January 2020 to May 2021 which was conducted in JSS Hospital Mysuru. Analyzed data was in rates, proportions, and percentages. The sample includes 100 cases of secondary peritonitis caused by hollow viscus perforation, where preoperative peritoneal fluid samples were analysed for bacterial culture and sensitivity.

Results: Out of 100 samples, 50 had bacterial growth. The most common bacteria were E. coli. These were Acinobacter (6%), Candida (4%), Citrobacter (1%), Klebsiella (11%) and Serratia (2%). (4 percent). 77.5 percent of E. coli were sensitive to Ceftriaxone, 75% to Piperacillin-tazobactam, and 99.1 percent to Meropenem. In 40% of cases, E.coli was multidrug resistant. Most Klebsiellapneumoniae were responsive to ceftriaxone, piperacillin-tazobactam, and meropenem. Ciprofloxacin, Ceftriaxone, and Meropenem were all sensitive to Proteus mirabilis. 25.2 percent of cases were multidrug resistant bacteria.

Conclusion: The results of this investigation identify the organisms usually isolated from peritoneal fluid, their susceptibility and resistance to broad spectrum antibiotics. It shows the common gramme negative isolates and the current antibiotic resistance concern in these individuals. The most common microorganism found in gastrointestinal perforations is Escherichia coli. In most cases, numerous gramme negative bacilli develop polymicrobially. Antibiotic-resistant microorganisms, notably multidrug resistant Escherichia coli, are increasing in number. Third generation cephalosporins are becoming more resistant. In multidrug resistant organisms, Meropenem and Tigecycline seem to be the best options.

Keywords: Secondary Peritonitis, Peritoneal fluid, Culture and Sensitivity, Escherichia coli, multi drug resistance.

Corresponding Author: Dr. Naveen Banoth, Assistant Professor, Department of General Surgery, KMC/MGM Hospital, Warangal, Telangana, India.

INTRODUCTION

Surgical peritonitis is still one of the most common problems that surgeons face. It is still a major cause of morbidity and mortality, whether it is a duodenal perforation, a traumatic perforation, or a case of acute pancreatitis complicated with a pancreatic abscess.

Every surgeon faces a significant difficulty when it comes to managing intra-abdominal infections. We frequently see peritonitis cases as a result of a hollow viscous hole. Surgeons who treat this prevalent illness are fully aware of the horrible and deadly consequences that can occur as a result of perforations. These range from simple wound infections to the more serious septic shock or systemic inflammatory response syndrome.

Secondary peritonitis develops after the abdominal cavity has been contaminated by perforation or severe inflammation and infection of an intra-abdominal organ. A multimodality strategy is required for effective therapy, which comprises source management with reference to the sick organ, debridement of necrotic infected tissue and debris, and administration of antimicrobial drugs directed against aerobes and anaerobes. Because most patients' precise diagnosis cannot be determined until an exploratory laparotomy is performed, a broad spectrum antibiotic course is frequently used. It is employed a combination of agents or a single agent with broad-spectrum coverage. Effective source control and antibiotic therapy reduce morbidity and mortality rates to around 5% to 6%.[1]

Though surgery is the definitive treatment for gastrointestinal perforation, we start patients on intravenous antibiotic regimens that cover aerobic and anaerobic organisms prior to surgery. The antibiotic treatment's purpose is to eliminate infection in order to reduce postoperative problems.[2]

Several antibiotic regimens have been tried and tested to treat intra-abdominal infections. These infections have been treated with single-agent, broad-spectrum, and combination treatments. However, no single therapy has been found to be superior to another. Because the abdominal cavity contains a diverse range of microorganisms, infection of the abdominal cavity necessitates protection against both gram-positive and gram-negative bacteria, as well as anaerobes. Patients who have previously received antibiotic therapy or who have had a prolonged hospital stay are encouraged to have antipseudomonal coverage in addition to the standard medicine combination.[3]

The most serious issue that we all face with the widespread use of antibiotics is the development of antibiotic resistance, which results in a very high failure rate in the treatment of the condition. We are concerned that antibiotic therapy will become extremely limited, if not non-existent.

Antibiotics must be used correctly in individuals undergoing surgery. Mismanagement of strong antimicrobials leads to medication toxicity, super infections, ward colonisation by highly resistant bacteria, and excessive healthcare costs.[4,5]

To emphasise this issue, the current work focuses on acquiring peritoneal fluid cultures from surgical peritonitis patients. We hope to discover the bacteriological flora obtained by collecting peritoneal fluid samples prior to surgery. We also emphasise demonstrating whether or not resistant organisms have been isolated. This research could help us make peritoneal cultures essential in all cases of surgical peritonitis in the future.

Objectives of the present study

The objectives of the present study are as follows:

To study the bacteriological profile of peritoneal fluid, and culture andsensitivity of the same in secondary peritonitis due to surgical causes.

MATERIALS & METHODS

Patients diagnosed to have secondary peritonitis and beingconsidered for surgery from theperiod of January 2020 to May 2021 has been considered.

The study has been conducted in the Department of General Surgery, JSS Hospital, Mysuru. A total of 100 cases (n) were studied during this period.

All patients with acute abdominal pain, both traumatic and non-traumatic suspected for hollow viscus perforation, ages between 19 and 58 years were included in the study.
Patients were evaluated in a systematic manner, which included a detailed history taking, a thorough physical examination and required investigations.
Based on the history and clinical examination, provisional clinical diagnosis of hollow viscous perforation was suspected and confirmed using radiological investigations.

- **The routine investigations prescribed were:**
  - Complete blood count
  - Urine routine and microscopy
  - Serum electrolytes
  - Renal function test
  - Liver function test
  - HbsAg
  - HIV1, HIV2
- **Specific investigations:**
  - Erect Abdomen X ray
  - Erect chest X ray
  - Ultrasonography of the abdomen
  - Peritoneal fluid tap for culture and sensitivity
- **Patients excluded from the study were:**
  - Age less than 18 and more than 65 years.
  - Patients with comorbid conditions like diabetes mellitus, hypertension, anemia, cardiac disorders.
  - Any break in aseptic measures.
  - Patients referred from other medical facilities or patients who have taken treatment elsewhere prior to admission.

After taking all aseptic precautions a peritoneal aspirate through Ultrasound guidance was attempted before administering the first antibiotic dose.
The peritoneal aspirate was analyzed macroscopically for color, odor and consistency to point towards the location of the perforation and further analyzed in the lab for culture and antibiotic sensitivity patterns.

- **Purulent fluid:** This may vary from the offensive frank pus obtained from a perforated appendix or diverticulitis of the colon, to the thin turbid fluid.
- **Bile stained:** Bile stained fluid is seen in upper gastrointestinal perforations and biliary tree injuries.
- **Feculent aspirates:** These are encountered in distal small intestinal and colonic perforation cases.

- **Odor:**

A feculent smell is due to perforation of large intestine. Gastric and duodenal perforations are usually odorless unless thecollection gets infected secondarily.
In perforated gastric or duodenal ulcer, the fluid tends to be turbid or purulent with flecks of amorphous fibrinous material, whereas, in distal gastrointestinal perforations it usually granular.

Statistical Analysis:
The data was analyzed using rates, ratios proportions and percentages.

A total of 100 cases of secondary peritonitis admitted to the emergency surgical ward of JSS Hospital, Mysuru were studied.

Details regarding the age, sex, occupation, address, presenting symptoms, physical signs and the characteristics of the aspirated fluidwere studied and analyzed.

Vital signs were examined and a complete systemicexamination of the patients was done. The patients were put on nasogastric aspiration, IV fluids, analgesics and antacids. Patientswere catheterized depending on the need for thesame. Patients presenting in shock were resuscitated.

Routine blood investigations were sent in addition to erect abdomen X rays, erect chest X-ray and ultrasonography of the abdomen After confirmation of the diagnosis of hollow viscus perforation based on the presence of air under the diaphragm in the chest and erect abdomen X rays a peritoneal tap was done under ultrasound guidance.

One hour preoperatively a dose of antibiotic was given to the patients.

RESULTS

Age of incidence:

Ages between 35-44years were the most common in our present study. Out of 100cases 56 were from this age group. Next common age group was between 25- 34years, which constituted 24 cases, followed by 45-54years age group, which constituted 17 cases.

Table 1: Age of Incidence

Age Group (in years)	Number of cases
18 – 24	3
25-34	19
35-44	57
45-54	16
55-65	5

Sex Incidence:

Out of 100 cases studied, there were 89 male patients and 11 female patients. Inthis study males were affected more than the females.

Table 2: ?

Sex	Number of cases	Percentage
Male	89	89 %
Female	11	11 %

Causes of Secondary Peritonitis:

Out of 100 cases 83 were due to non-traumatic abdominal pathology and 21 caseswere caused by traumatic factor. Traumatic perforations take into consideration, both penetrating injuries and casesof blunt trauma to the abdomen.

Table 3: Causes of secondary peritonitis

Cause	Number of Cases
Traumatic	17
Non traumatic	83

Nature of peritoneal aspirate:

A lot of information can be gathered by gross examinationof the aspirated fluid. Most of the times, the physical characters of the aspirated fluid will give a probable clue to the location of the pathology.

In the present study of 100 cases, we could aspirate the characteristic fluid in 100cases. The most common type of fluid we aspirated was bile stained in 50 cases, as majority of the cases encountered were gastric in location. Purulent fluid was seen in 16 cases. Fecal stained fluid was seen in 31 of the cases.

Table 4: ?

Nature of peritoneal aspirate	Number of cases
Bile stained	16
Feculent	28
Purulent	15
Clear	41

As majority of the cases were gastric perforations, 40 cases had a clear fluid onaspiration, 20 a bile stained fluid and 31 cases yielded a feculent aspirate.

Table 5: Location of Perforation

Location of Perforation	Number of Cases
Gastric	49
Duodenum	7
Jejunum	5
Ileum	7
Appendix	11
Colon	8
Gall Bladder	4
Total	100

Microbiological profile of Perforation Cases:

Amongst the 100 cases of secondary peritonitis encountered, majority of the peritoneal samples were found to be sterile. 50 cases on incubationproduced a growth on the culture media.

Amongst the samples that yielded a growth of bacteria, the mostcommon microorganism isolated was Eschrichia coli, which was present in 35 ofthe cases, Klebsiella in 11 cases and Enterococcus in 9 cases.

Table 6: Microbiological profile in perforation cases

Microorganism isolated	Number of patients
Escherichia coli	35
Acinetobacter	6
Candida	4
Citrobacter	5
Klebsiella	11
Serratia	2
Enterococci	8
Streptococcus	2
Proteus	3
Sterile	50

Odor of aspirated fluid:
50 out of 100 cases were found to have an odorless peritoneal aspirate.

Table 7: ?

Odor of peritoneal aspirate	Number of cases
Odorless	45
Feculent	15
Purulent	10

Bacterial Spectrum in Gastric perforation cases:
Majority of the peritoneal aspirates in cases of gastric perforation were sterile. 10 out of the 50 cases of gastric perforation showed a positive culture. The most common organism isolated was Acinetobacter, which occurred in 4 cases out of 50.

Table 8: ?

Type of microorganism	Number of cases
Acinetobacter	4
Candida	3
E.coli	1
Citrobacter	2

Bacterial Spectrum in Duodenal perforations:
Escherichia coli was the most common bacteria isolated in cases of duodenalperforation.

Table 9: ?

Type of bacteria	Number of cases
Acinetobacter	1
Escherichia coli	3

Bacterial Spectrum in Jejunal perforation cases:
The most common organism identified was Escherichia coli, which accounted for3 out of the 4 cases.

Table 10: ?

Type of microorganism	Number of cases
Escherichia coli	3
Klebsiella	1
Enterococcus	2

Bacterial spectrum in ileal perforation cases:
Peritoneal aspirates from cases diagnosed to have a perforation in the ileum showed a predominant growth of Escherichia coli. Out of the 21 cases of ileumperforation 19 cases showed an isolate of Escherichia coli.

Table 11: ?

Bacteria isolated	Number of cases
Escherichia coli	17
Klebsiella	6

Serratia	2
Enterococcus	2

Bacterial spectrum in cases of colon perforation:
The most commonly isolated organism in cases of the perforated colon was Escherichia coli.

Table 12: ?

Type of bacteria	Number of cases
Escherichia coli	4
Klebsiella	2
Enterococcus	2

Bacterial spectrum in Appendix perforation cases:
Escherichia coli is the most commonly isolated organism in cases ofappendicular perforation.

Table 13: ?

Bacteria isolated	Number of cases
Escherichia coli	2
Klebsiella	1
Enterococcus	1

Antibiotic sensitivity patterns for Escherichia coli:
E.coli was isolated in 40 cases. Tigecycline was found to be sensitive in allcases. A rise has been seen in cases of multi drug resistant E.coli.

Table 14: Antibiotic sensitivity patterns for Escherichia coli.

Antibiotic	Sensitive (S)
Amikacin	28
Gentamicin	29
Cefotaxime	25
Ceftriaxone	30
Cefoperazone	25
Meropenem	32
Ciprofloxacin	20
Tetracycline	21
Tigecycline	35
Piperacillin-Tazobactam	30

Incidence of multidrug resistant bacteria:
Multi drug resistant bacteria were defined as those bacteria, which were found to be resistance to more than 3 antibiotics.
24 isolates were found to have multidrug resistant bacteria.

Table 15: ?

Peritoneal aspirate	Number of cases
Sterile	60
Multi drug resistant bacteria	24

ISSN 2515-8260 Volume 09, Issue 03, 2022

In our study of 100 cases of hollow viscous perforation, majority of the cases had a non-traumatic perforation. The most common perforation encountered was a gastric perforation, which accounted for 54% of the perforationsand 20% of the cases had a perforation in the ileum.

The peritoneal aspirate was analyzed for microorganisms. 60 cases yielded a sterile aspirate. The most common organism isolated was Escherichia coli. 40 of the cases on culture resulted in a growth of Escherichia coli, allowing us to conclude that it is the most common organism involved in hollow viscous perforation cases. 4 cases resulted in isolation of Candida species implying that arise is seen in cases of gastric perforation in regards to fungal growth.

In 75% of the cases of gastric perforation the aspirate was found tobe sterile. The most common organism isolated in cases of Gastric perforation was Acinetobacter.

Escherichia coli was the most common organism isolated from theperitoneal fluid aspirates, which was in 51% of jejunum perforation cases, 89% cases of Ileum perforation, 54% cases of Colon perforation and 43% cases of Appendix perforation. The total antibiotic sensitivity pattern was 81 percent for Amikacin, 80 percent for Gentamicin, 61 percent for Cefotaxim, 68 percent for Ceftriaxone, 69 percent for Cefoperazone, 74 percent for Piperacillin-tazobactam, 84 percent for Meropenem, and 92 percent for Tigecycline. The total antibiotic sensitivity pattern was 81 percent for Amikacin, 80 percent for Gentamicin, 61 percent for Cefotaxim, 68 percent for Ceftriaxone, 69 percent for Cefoperazone, 74 percent for Piperacillin-tazobactam, 84 percent for Meropenem, and 92 percent for Tigecycline.

Figure 1: Growth Of Escherichia Coli On Mac Conkey Agar

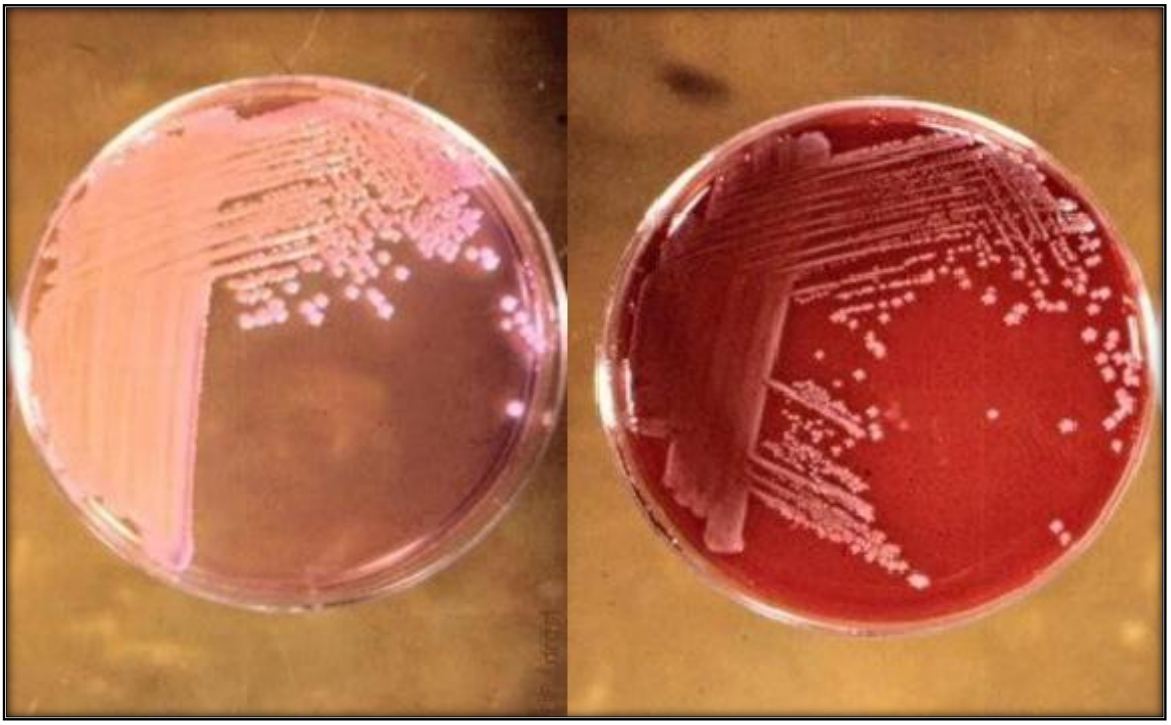

Figure 2: Growth OfKlebsiella On Mac Conkey And Chocolate Agar

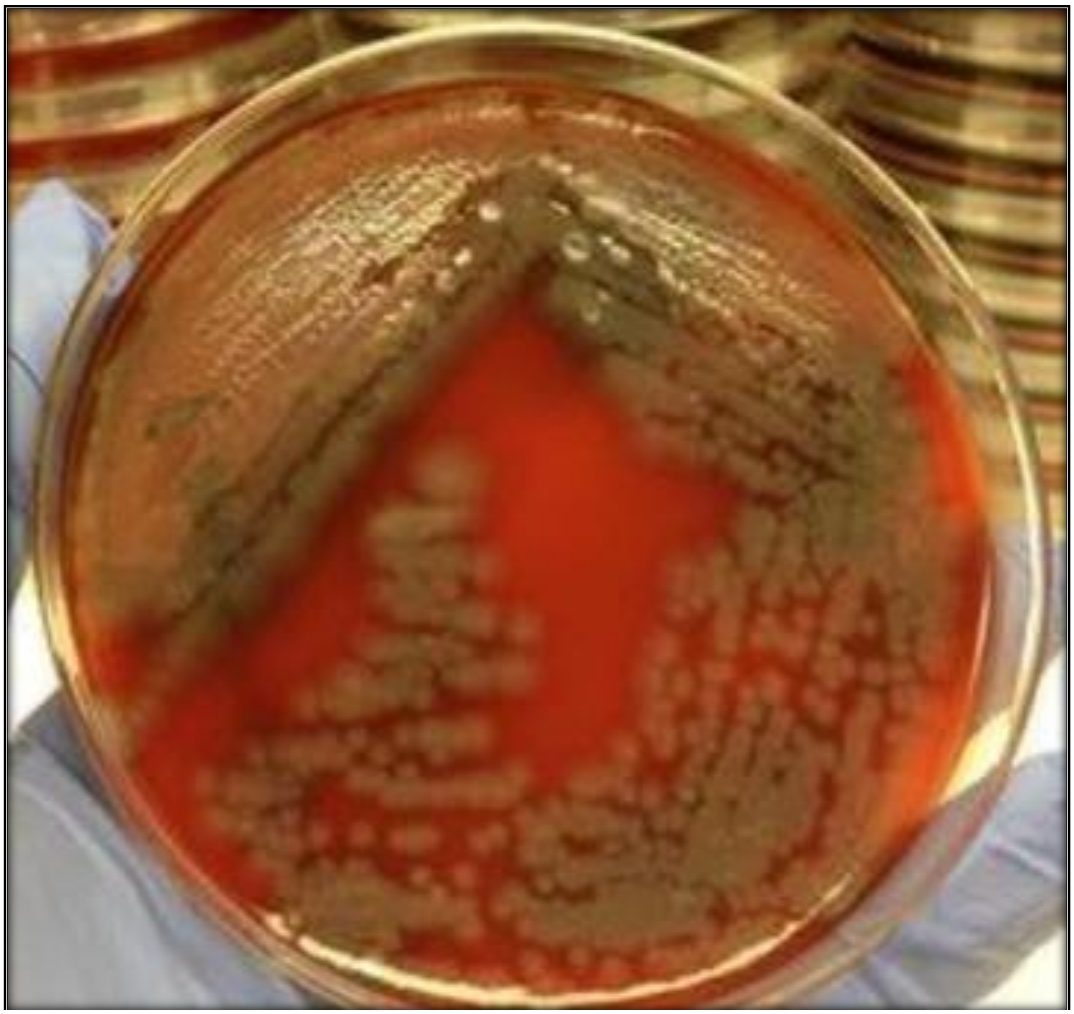

Figure 3: Growth Of Pseudomonas Species

Figure 4: Growth Of Proteus Species

Figure 5: Growth Of Candida In Sabourauds Agar

Figure 6: Candida Under The Microscope

DISCUSSION

Our sample study, which included 100 patients, was analyzed for bacterial culture and sensitivity based on the peritoneal fluid aspirated. A male to female ratio was found to be 8:1. The most common locationof the perforation was in the stomach, which accounted for 55% of the perforations. The perforation was located in the ileum in 22% of the cases.

The most common bacteria isolated from the peritoneal aspirates were Escherichia coli. It was found to be present in 38% of the cases, as53% of the cases yielded no growth. But among the cases that showed a bacterialgrowth Escherichia coli accounted for 86.7% of the cases. According to a study done in a tertiary hospital in New Caledonia, Escherichia coli accounted for 81%of the cases, showing that our data is following it.[4]

The second most common organism isolated was Klebsiella, which accounted for 12% of the cases. Candida was isolated in 5 of the cases which had a gastric perforation. Candida species are major constituents of the normal commensal flora of the gastrointestinal tract in humans. They causeinfections mostly in immunocompromised and severely ill patients, patients on steroid therapy and chemotherapy, diabetics, and HIV/AIDS patients, and veryrarely in healthy persons who indulge in habitual use of strong antacids.[5,6]

According to a study conducted the incidence of multidrugresistant bacteria was found to be 35.4% in male patients and 22.1% in female patients. The incidence of E. coli and P. vulgaris MDR isolates were higher in comparison to MDR isolates of Klebsiella spp., P. aeruginosa,P. mirabilis, Enterobacter spp., S. aureus, and E. faecalis.[7]

In our study multi drug resistant bacteria were seen in 24.9% of the cases similar to the study quoted above. Out of the 28 cases of MDR bacteria Escherichia coli accounted for 47% of the cases.

The results of this study ascertain the organisms commonly isolated from the peritoneal fluid as regards to solitary or multiple, type i.e gram negative or gram positive and its individual sensitivity and resistance patterns to broad spectrum antibiotics. It demonstrates the common gram negative organismsisolated and the current problem of antibiotic resistance in thesepatients. We would like to stress upon the fact that resistance to certain drugs like

cephalosporins and meropenem is on the rise. Hence peritoneal fluid cultures must be routinely performed in all cases of surgical peritonitis to facilitate early and definitive antibiotic therapy.

In conclusion, Escherichia coli is the commonest organism isolated from the peritoneal cavity in patients having surgical peritonitis. Third generation cephalosporins and Piperacillin-Tazobactam resistance is on the rise whereas Meropenem and Tigecycline remains a verysensitive drug against the gram negative enterobactericiae.

CONCLUSION

Among the microorganisms detected in cases of gastrointestinal perforation, Escherichia coli is the most frequently encountered. Several gramme negative bacilli are found in the majority of the cases, indicating a polymicrobialgrowth.There has been an increase in the prevalence of Candida in patients with gastric preforation in recent years. The patients were either HIV positive or above the age of 50, indicating that patients in a relatively immunocompromised state may be harbouring fungal organisms as the infective source of their illness. However, this can only be determined through the use of peritoneal aspirates or a biopsy of the perforation site.In most cases of gastrointestinal perforation, monotherapy is insufficient due to the ever- increasing resistance of bacteria to numerous antimicrobial drugs as well as the presence of more than one microorganism isolated from peritoneal aspirates, which makes it difficult to treat them effectively.In our research, we discovered a rising trend in resistance to third generation cephalosporins, as well as meropenem and other antibiotics. The majority of microorganisms have been discovered to be sensitive to Tigecycline, which can be employed as a last resort in the treatment of infections.It is suggested that patients be started on third generation cephalosporins in conjunction with metronidazole as soon as possible after diagnosis. In cases with gross contamination and a history of perforation lasting more than 3 days, it is advisable to add an aminoglycoside to the third generation antibiotic regimen in order to provide broader coverage.

REFERENCES

1. Schwatrz's Principles of Surgery, 10th Edition, chaper 6; 150
2. Crofts TJ, Park KG, Steele RJ. A randomized trial of nonoperative treatment for perforated peptic ulcer. N Engl J Med. 1989 Apr 13. 320(15):970-3.
3. Pavlidis TE. Cellular changes in association with defense mechanisms in intra-abdominal sepsis. Minerva Chir. 2003 Dec. 58(6):777-81.
4. Boueil A, Guégan H, et al., Peritoneal fluid culture and antibiotic treatment in patients with perforated appendicitis in a Pacific Island, AsianJ Surg., 2015 Oct;38(4):242-6.
5. D H Wittmann, M Schein, and R E Condon, Management of secondary peritonitis, Ann Surg. 1996 Jul; 224(1): 10–18.
6. Joseph.S.Solomkin, John E.Mazuski et al., Guidelines for the Selection of Anti-infective Agents for Complicated Intra-abdominal Infections, IDSA guidelines.
7. InêsLinhares, InêsLinhares et al., Incidence and Diversity of Antimicrobial Multidrug Resistance Profiles of Uropathogenic Bacteria, Biomed Research International, Volume 2015.