IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 19, Issue 7 Ser.10 (July. 2020), PP 22-28
www.iosrjournals.org

Cross Sectional Study of Peritoneal Fluid Culture and Antibiotic Sensitivity Pattern in Cases of Surgical Peritonitis in a Tertiary Hospital

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Abstract
This study was conducted to elucidate the spectrum of community acquired acute bacterial peritonitis, the role of microbiological culture in its management and other factors affecting its outcome.
This was a cross sectional study wherein we examined cases of secondary bacterial peritonitis admitted and operated at our institution from June 2015 to May 2016. The peritoneal fluid was sent for bacterial culture and sensitivity testing. Patients were followed up with relevant progress details till discharge or death.
I enrolled 113 patients in my study. The mean age of the study population was
42.4 years with a male : female ratio of 4.35:1. Gastroduodenal perforations formed the major site of perforation (53%), followed by small bowel (28.31%) and appendicular perforations (15.92%). Culture positivity rate was 42.4%. Klebsiella and E Coli species were the predominant isolates from peritoneal fluid. These main isolates were predominantly sensitive to amikacin and meropenem. Ceftriaxzone with amikacin and metronidazole was the first line of treatment used preoperatively in most of the patients, given its low cost and easier availability. Most of the patients responded well to empirical therapy and only 14% of patients had appropriate changes in postop period. This change of antibiotic too had no significant difference in terms of hospital stay, postop morbidity or outcome. The overall morbidity and mortality rates were 52% and 10.6%respectively.

Date of Submission: 08-07-2020 Date of Acceptance: 23-07-2020

I. Introduction

Intra-abdominal infections are commonly encountered in surgical practice and represent a major cause of morbidity and mortality. The most common aetiology is contamination of the peritoneal space by endogenous micro-flora secondary to loss of integrity of the gastrointestinal tract which results in secondary peritonitis. This is often acute and results in rapid, progressive and systemic illness with subsequent morbidity and mortality.[1]

Intra-abdominal infections (IAI) include many pathological conditions, ranging from uncomplicated appendicitis to faecal peritonitis and may be classified in to primary and secondary peritonitis.[2]Inappropriate antibiotic therapy of secondary peritonitis may result in poor patient outcomes. .

This study is aimed at determining the microbial causes of secondary peritonitis and their antibiotic sensitivity patterns among patients admitted in emergency ward of north Bengal medical college and hospital from june 2015 to may 2016 and its role in management of patients.

II. Aims And Objectives

general objective
To elucidate the microbiological spectrum of community aquired acute secondary surgical peritonitis
specific objectives

To select appropriate antibiotics as per the culture & sensitivity report to decrease morbidity and mortality.

III. Material And Method

- **Study Type and Design:** Cross sectional observational study
- **Study setting:** General surgery (both OPD and emergency) in North BengalMedical College & Hospital.
- **Study Period**: June 2015 to May 2016

- **Study Population:** Patients with surgical peritonitis attending OPD, IPD and emergency ward of all general surgical units of North Bengal Medical College & Hospital
- **Sample Size:** All patients attained in OPD, IPD and emergency of all general surgical units of North Bengal Medical College & Hospital from June 2015 to May 2016.

Inclusion Criteria

- All patients with features of surgical peritonitis undergoing emergency laparotomy after admission in emergency and indoor ward of surgery from june 2015 to may 2016.
- All patients giving conscent to participate in study**.**

Exclusion criteria

- patients admitted with deranged vital parameters and died before surgical intervention.
- Patients with penetrating abdominal injury.
- patients not giving conscent for study.

TOOLS AND TECHNIQUE

Patients were selected on the basis of clinical presentation of surgical peritonitis- abdominal distention, rigidity and guarding of abdomen, shifting of liver dullness, rebound tenderness and tachycardia. Minimal supportive serological and radiological investigations like haemogram, urea creatinine, LFT, X-ray abdomen erect posture and X-ray chest PA view was done.

Preoperative organ impairment was defined by following criteria:

I. Cardiovascular: heart rate >110 per minute after adequate resuscitation or requirement of inotropic support or electrocardiographic evidence of ischemia or infarct.

II. Hypotension: systolic blood pressure <100 mmHg.

III. Pulmonary impairment: clinical evidence of respiratory distress supported by chest X-ray findings or history of treatment for chronic obstructive pulmonary disease or pulmonary tuberculosis with reduction in exercise tolerance or PaO2 <65 mmHg or patient requiring mechanical ventilation.

IV. Renal failure: serum creatinine >2.0 mg/dl and serum urea >40 mg/dl with or without oliguria after adequate fluid resuscitation.

V. Liver disease: documented cirrhosis or a serum bilurubin level >2.0 mg/dl or previous episode of hepatic failure or encephalopathy.

VI. Diabetes mellitus: patient requiring insulin or oral hypoglycemic agents.

After resuscitation patients were taken up for exploratory laparotomy. The delay from time of diagnosis to surgery was noted. At laparotomy, intraoperative findings were noted in relation to site of origin, quantity and nature of peritoneal fluid and the surgical procedure carried out.

The peritoneal fluid was sent for bacterial culture and sensitivity by standard methods. Routine in-vitro antibiotic sensitivity testing was done with apgpropriate panel of antibiotics as per standard methods.

Immediate postoperative antibiotics were those given following surgery and before the availability of microbiology reports.

Patients were followed up noting relevant progress details including postoperative hemoglobin level, culture results, postoperative change of antibiotics, recovery stay, repeat laparotomy, wound infection and other morbidities till discharge or death.

Preoperative antibiotic therapy was considered adequate if the administered antibiotics covered all the organisms isolated while the rest were to be considered inadequate. Postoperative antibiotic change were considered appropriate if any of the changed antibiotics correlates with antibiogram results.

Outcome was documented in terms of mortality, morbidity, and hospital stay. Outcome parameters was correlated with factors including delay in pgresentation, co-morbid conditions, bacterial culture, antibiotic use and changes.

IV. Result And Discussion

113 patients of secondary bacterial peritonitis were included in my study. Data was collected preoperatively, intraoperatively and postoperatively and was analysed meticulously (table 1). Male female ratio was 3.34:1.

Age wise distribution of patiens is presented in table 2. Patients in extreme of ages (<13yr and >70 yr) were excluded from study.Gastroduodenal (53%) and small bowel perforations (28.3%) were the most common causes of peritonitis. Majority (75%) of the patients presented to us one to three days after the onset of

symptoms.Only 13 (11.5%) patients presented within 24 hours of t he onset and 6 patients (3%) presented with symptoms beyond 4 days.

Pain abdomen was a universal presenting symptom, followed by abdominal distension (71%) and vomiting (42%). Fever was present in 70 (62%) patients and 22 (20%) patients gave history of taking over-the-counter analgesics. Generalized abdominal tenderness was present in 93 (83%) patients while 20 (18%) patients presented with shock. Chest X-ray showed pneumoperitoneum in 90 patients which was noted in 94% of gastroduodenal perforations, 68% of small bowel perforations and in only 7% of appendicular perforations. 28.5% of patients had organ dysfunction at presentation. The most common being renal dysfunction (9%), followed by cardiovascular (4.2%) and pulmonary (3.6%) dysfunction**.**

Table 1: Etiology and gender distribution.

Site of perforation	Male	female	Total	Percentage(%)
gastroduodenal	51	9	60	53.09%
Small bowel	22	10	32	28.31%
appendicular	11	7	18	15.92%
Colorectal	2	-	2	1.76%
Others	1	-	1	0.88%
Total	87	26	113	

Peritoneal lavage, omental patch closure formed the mainstay of treatment of gastroduodenal perforations. Resection and anastomosis was the most common surgery done for small bowel perforations followed by ilistomy. Appendicectomy, lavage and drainage was done for appendicular perforation. Colorectal perforations were treated with resection, lavage and stoma. There was clinical evidence of failure of source control in 7 (6.19%) patients, of which 4(3.5%) underwent repeat laparotomy. Rest of the patients were either conservatively managed as per surgeon's discretion or were too sick to be taken up for repeat laparotomy.

Table 2: age distribution

	Gastroduodenal	Small bowel	Appendicular	colorectal	others	total
<20	**2**	**3**	**1**	**-**	**-**	**6**
20-29	**11**	**4**	**4**	**-**	**-**	**19**
30-39	**15**	**8**	**6**	**-**	**-**	**29**
40-49	**21**	**11**	**4**	**-**	**-**	**36**
50-59	**9**	**5**	**3**	**1**	**1**	**19**
60-70	**2**	**1**	**0**	**1**	**-**	**4**
Total	**60**	**32**	**18**	**2**	**1**	**113**

Table 3 result of peritoneal fluid c/s at primary surgery:

Organism	gastroduodenal	Small bowel	appendicular	colorectal	others	total
Klebsiella	**10**	**5**	**2**	**-**	**-**	**17**
E Coli	**6**	**6**	**2**	**1**	**-**	**15**
Enterococcus	**6**	**2**	**1**	**-**	**-**	**9**
Proteus	**3**	**1**	**-**	**-**	**-**	**4**
Acinetobacter	**1**	**1**	**-**	**-**	**-**	**2**
Candida	**1**	**-**	**-**	**-**	**-**	**1**
Total	**27**	**15**	**5**	**1**	**-**	**48**

A total of 48 (42.4%) patients had positive peritoneal fluid culture. Klebsiella (35.4%) was the dominant isolate in all perforation sites, followed by Escherichia Coli ,Streptococcus and Acinetobacter species. Candida alone was isolated in 1 case(table 3).Rest werefound to show no growth. Preop and over the counter antibiotic and delayed presentation to hospital may be one of the cause for negativity.

According to site of perforation 27(45%) patients of gastroduodenal perforation were found to be positive. 15(46.8%)patients of small bowel perforations were found to be positive. 5(27.7%) cases of appendicular perforation were positive. 1(50%) of colorectal perforation was positive(table 4).

Table 4: % positivity of peritoneal fluid

	gastroduodenal	Small bowel	appendicular	colorectal	others
Positive(%)	27(45%)	15(46.8)	5(27.7%)	1(50%)	-
Negative(%)	33(55%)	17(53.12%)	13(72.2%)	1(50%)	-

Majority (75%) of the patients presented to us one to three days after the onset of symptoms. Only 11% patients presented within 24 hours of the onset and 10 patients 3% presented with symptoms beyond 4 days. Percentage of positivity was greater in early operated cases than those who presented late. Injudicious use of antibiotics may be one of the reasons for it.

.Klebsiella(17) was the commonest organism isolated from peritoneal fluid followed closely by E Coli(15). Enterococcus(9) , Proteus(4) , acinetobacter(2) were other common organism isolated. Most of the organisms were sensitive to meropenem followed by amikacin.In vitro susceptibility testing of these isolates showed that Klebsiella isolates were mostly sensitive to meropenem (88.2%) followed by amikacin (76.4%), ampicillin (58.8%), ceftriaxzone(58.8%), pipracillin+tazobactum (58.8%), cefoperazone+sulbactum (58.8%). E coli species were sensitive to meropenem (86.6%), amikacin (86.6%), pipracillin+tazobactum (53.3%), cefoperazone+ sulbactum (46.6%) and ceftriazone (40%). Enterococcus were sensitive to amikacin and ampicillin. Similarly Proteus were sensitive to meropenem and amikacin.

Sensitivity profile for candida could not be obtained due to unavailability of appropriate media. Similarly sensitivity of enterococcus for meropenem could not be accessed.

Table 5: Antibiotic sensitivity profile of the common peritoneal fluid isolates.

Organism	(n)	Ampicillin (%)	Amikacin (%)	Meropenem (%)	Ceftriaxzone (%)	Pipracilli+tazobactum (%)	Cefoperazone+sulbactum (%)
Klebsiella	17	58.8%	76.4%	88.2%	41.1%	58.8%	58.8%
E Coli	15	13.3%	86.6%	86.6%	40%	53.3%	46.6%
Enterococcus	9	66.6%	77.7%	-	-	-	-
Proteus	4	-	75%	100%	-	-	-
Acinetobacter	2	-	-	-	-	-	-

Table 6: Antibiotic regimes instituted in 113 patients:

Antibiotic combination used	Number of patients who received preoperatively	Number of patients who received immediate postoperatively	Who continued to receive	Who were changed to new regimen
Ceftriaxzone + amikacin + metronidazole	82	70	60	10
Pipracillin + tazobactum + amikacin + metronidazole	28	40	36	4
Cefoperazone + sulbactum + amikacin + metr onidazole	1	1	1	-
Meropenem + amikacin + metronidazole	2	2	2	-

Ceftriazone + amikacin + metronidazole formed firstline combination of antibiotics used in laparotomy cases. 82 patients received this combination pre operatively, out of which 70 patients continued to use the combination and rest 12 were changed to higher antibiotic in immediate post op period based on intraop findings. Out of 70 patients 65 continued to use the same combination and 5 were changed appropriately after sensitivity report. Similarly pipracillin + tazobactum + amikacin + metronidazole were used in 28 patients preoperatively. This combination was used in 40 patients in immediate postoperative period. Out of these36 patients continued to receive and 4 were changed appropriately after sensitivity report. Meropenem + amikacin + metronidazole combination was used in 2 cases with septicemia with poor parameters. Only 14 (12.38%) patients had appropriate change of antibiotics.

Table 7: Antibiotic usage with reference to culture antibiogram in 47 patients:

Preoperative antibiotics	N
Inadequate (20)	
No change	6
Appropriate change	14
Adequate (27)	
No change	25
Appropriate change	2

Out of 47 positive cases 42.5 % had inappropriate antibiotics. 14 patients were changed on the basis of sensitivity report. Rest 27 had appropriate antibiotics and were continued. 2 cases of these had appropriate change due to wound complications. However there was no significant difference in hospital stay, repeat laparotomy rate, morbidity or mortality between these groups. Delay in hospital presentation may be one of the reason for it. Changing antibiotics at a later stage has less effect.

Table 8: Effect of postoperative changes in antimicrobial therapy in patients with positive culture.

Post op antibiotics	(n)	Mean hospital stay	Re laparotomy	Wound infection	Total morbidity	Death
Inadequate (20)						
No change	6	9.5	1	3	4	1
Appropriate change	14	10.7	2	6	8	2
Adequate (27)						
No change	25	10.4	2	6	8	3
Appropriate change	2	11.4	0	1	1	1
Patients with no growth	66	10.5	3	12	15	5

Table 9: Factors associated with mortality.

Parameters	Survivers (n =101)	Non survivers (n =12)
Median age(SD)	40	55
Female (%)	10 (9.9%)	4 (33.33%)
Mean delay in presentation (in days)	2.4	3.8
Mean delay in surgery (in hours)	7.4	8.6
Pre operative impairment (%)	15 (14.8%)	5 (41.6%)
Mean hemoglobin (%)	10.8	8.6
Culture positivity (%)	39 (38.6%)	8 (66.66%)
Repeat laparotomy	6	2
Failure at source control	10 (9.9%)	8 (66.66%)
Post op morbidity	45 (44%)	10 (83.3%)
Mean ICU stay (in days)	2.4	5.6
Mean hospital stay(in days)	9.8	12.6

Incidence of overall morbidity was 83.3% in non-survivors as compared to 44% in survivors ($p<0.001$). The mean total ICU (Intensive Care Unit) stay in non-survivors was 5.6 days compared to 2.4 days in survivors ($p<0.001$). The mortality rate was 10.6%. By univariate analysis, increasing age, female sex, delay in presentation, preoperative organ dysfunction, postoperative hemoglobin level, positive culture, failure of source control at surgery, prolonged ICU stay and presence of postoperative morbidity were found to be significantly associated with risk of mortality (Table 8).Multivariate analysis revealed only age >60 years, delay >3 days, and APACHE II score >15 were found to be independent predictors of mortality.

V. Discussion

This study aimed at studying the factors affecting outcome of community acquired acute bacterial peritonitis with special focus on routine peritoneal fluid culture and its relevance in antibiotic therapy. Secondary bacterial peritonitis due to gastrointestinal perforation is a common surgical emergency at tertiary care centers like NBMCH in India. Upper GI perforation formed major group unlike western studies where lower GI perforations form the major group.Gastrouodenal perforations (53.09%) due to peptic ulcers were the major cause of peritonitis in our study similar to most studies from the eastern hemisphere. . In the West and in developed countries, it is well known that large bowel perforations are more common. In our study, nonspecific perforations accounted for 52% of small bowel perforations with typhoid related perforations being reported in lesser numbers, compared to earlier eastern literature.[7,8,10]. Appendicular and colorectal perforation was the etiology in 17 % of our cases, similar to that noted by Khan[4] and Dorairajan .[10] . Also studies from the west have shown that around 15–20% cases are due to malignancy [38, 39] , this being in stark contrast to our study where malignancy was ascertained to be the cause of perforation peritonitis in only 3%of the cases. This shows that malignancy is not a common cause of perforation peritonitis in our setup as compared to our western counterparts.

In our study 47% patients presented after 48 hours of onset of acute symptoms. After a few days, peritonitis is no longer a localized problem and limits the surgeon's ability to securely eliminate the focus of infection. The mean delay in taking up surgery from the time of diagnosis was higher but not significantly so in non-survivors (8.6 vs. 7.4 hours), an observation which differs from published literature. 17.6% of patients had

preoperative organ dysfunction. There was relatively higher incidence of renal failure in our study which is different from other series where cardiovascular, pulmonary and malignant conditions comprised of the major co-morbid conditions.18 patients experienced a failure at source control, of which 8 (44.4%) underwent repeat laparotomy. Rest of the patients were managed either conservatively as per attending surgeon's discretion or were too sick to be taken up for repeat laparotomy. 66.66% of non-survivors failed at source control as compared to 9.9% survivors ($p<0.0001$).

The culture positivity rate of 42.4% in our study and was lower than other series. However, the spectrum of isolates matched with other series with klebsiella and E. coli being the dominant isolates. Only 22% received adequate preoperative antibiotics but the mean hospital stay, wound infection rates, overall morbidity rates and mortality rates were the same when compared with those receiving inadequate antibiotics. Only 12.3% had appropriate postoperative change of antibiotics, but this had no effect on morbidity or mortality. The absence of correlation between adapted antibiotic therapy and expected outcome in our study has been frequently reported in literature.[1,3] The most important reason could be the delay in presentation. Instituting appropriate antibiotics at later stages may be ineffective.

The pattern of various complications was consistent with the spectrum of morbidity reported in literature[7,12,13] except for the higher rate of wound infection. The mortality rate in our series was 10.6%. Other studies have reported 9% to 26% mortality, approaching 30% in severe intraabdominal infection. By multivariate analysis only age >60 years, delay >3 days were independently and significantly associated with increased risk of mortality. This shows that host related factors have a much greater impact on survival in patients with peritonitis. Some of the limitations of our study include non-availability of APACHE II scores for all patients and institution of higher antibiotics as per availability.

Unlike in south India, in our study of community acquired acute secondary bacterial peritonitis, gastroduodenal perforations comprised the major site of perforation (53.09%), followed by small bowel (28.3%) and appendicular perforations (15.92%). The spectrum of bacterial isolates from peritoneal fluid was consistent with previous reports, with Escherichia coli and Klebsiella as most common isolates. The mortality and morbidity rates are comparable in spite of lack of correlation with in-vitro bacteriological susceptibility reports in evaluable patients. Since the data is equivocal about potential benefit of postoperative change of antibiotics according to culture results, it may be prudent to adapt antibiotics as per culture results in patients who are critically ill or those unresponsive to empiric therapy. Analysis of factors influencing mortality shows dominance of host related factors over the type and source of infection with high risk population identified by age >60 years, delayed presentations >3 days.

VI. Conclusion

In our study 113 patients of secondary bacterial peritonitis operated in emergency OT of North Bengal Medical College & hospital during the defined period of 1 yr (June 2015 to May 2016) were included. On the basis of results of my study we conclude that :

- gastroduodenal perforations form the majority of the cases of secondary bacterial peritonitis operated in emergency.
- Klebsiella and E Coli form the majority of the isolates from peritoneal fluid culture of secondary bacterial peritonitis.
- Sensitivity profile for different isolates show high sensitivity for Amikacin and meropenem.

14 % cases required appropriate change in antibiotics in post-op course but no significant difference in outcome in terms of hospital stay, post-op morbidity and mortality rates were seen as frequently reported in literature.

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Dr Deepak Kumar Jha, et. al. "Cross Sectional Study of Peritoneal Fluid Culture and Antibiotic Sensitivity Pattern in Cases of Surgical Peritonitis in a Tertiary Hospital." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 19(7), 2020, pp. 22-28.