

A PROSPECTIVE STUDY OF CLINICAL OUTCOMES IN ACUTE ABDOMEN FOLLOWING CULTURE-GUIDED ANTIMICROBIAL THERAPY BASED ON PERITONEAL FLUID CULTURE AND ANTIBIOTIC SENSITIVITY AT GMKMCH, SALEM

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ABSTRACT

Background: Acute abdomen is a serious medical condition that needs quick treatment, often with emergency surgery. One common cause is secondary peritonitis, where infection spreads inside the abdomen due to a hole in the digestive tract. Treating this condition requires proper use of antibiotics, but antibiotic resistance is making treatment more difficult. The objective is to study how treating patients with antibiotics based on peritoneal fluid culture and sensitivity test results affects their recovery in GMKMCH, Salem. **Materials and Methods:** This study was done on 100 patients who came with acute abdomen and needed emergency surgery. During the operation, fluid from the abdomen was collected and tested to find out which bacteria were present and which antibiotics they responded to. Patients were first given standard antibiotics, and changes were made later based on test results. Information about patient details, infection, treatment, and outcomes was recorded. **Result:** Out of 100 patients, 62 had positive culture results. The most common bacteria found were E. coli (25.8%) and other Enterobacteriaceae. Antibiotics like Ceftriaxone and Imipenem were most effective. However, some antibiotics like Cefazolin and Ampicillin showed high resistance. In 12% of patients, the first antibiotics given didn't match the sensitivity results and had to be changed. 36% of patients had complications after surgery, mostly surgical site infections. The death rate was 2%. Patients who received antibiotics based on culture reports had better recovery. **Conclusion:** Using culture reports to guide antibiotic treatment in patients with acute abdomen helps in choosing the right medicine, reduces complications, and prevents antibiotic resistance. Testing peritoneal fluid should be done routinely to improve treatment results.

INTRODUCTION

Acute abdomen refers to a medical emergency where a person suddenly develops severe abdominal pain, often needing immediate attention and sometimes surgery. This can be caused by several conditions like appendicitis, peritonitis, pancreatitis, intestinal blockage, or a ruptured organ. One of the most serious causes is secondary peritonitis, which happens when bacteria spill into the abdominal cavity due to a perforation in the digestive tract. Even with better surgeries, intensive care, and antibiotics, it still causes many deaths and complications globally.^[1] The death rate for secondary peritonitis varies between 10% and 40%, depending on the cause,

patient condition, and how quickly treatment is started.^[2] Peritonitis is the inflammation of the lining inside the abdomen. It is mainly of three types: primary (happens without a clear source of infection), secondary (due to leakage from an organ), and tertiary (when infection continues or comes back even after treatment).^[3] In India, secondary peritonitis is common and often caused by perforations in the digestive tract—especially from peptic ulcers and typhoid-related gut perforations.^[4] The disease process involves bacteria entering the abdominal cavity and triggering an immune reaction. The body sends immune cells to fight the infection, and chemicals are released to control the spread. However, if this reaction becomes too strong, it can cause problems in multiple organs or even death.^[5]

The infection usually involves several types of bacteria, mainly those that normally live in the gut, such as *E. coli*, *Bacteroides fragilis*, *Klebsiella*, *Enterococcus faecalis*, and *Pseudomonas aeruginosa*.^[6] Treatment for secondary peritonitis involves three steps: controlling the infection source (usually by surgery), giving antibiotics, and supporting the patient with fluids, nutrition, and medicines.^[7] Antibiotics help kill remaining bacteria and stop the spread of infection.^[8] While antibiotics are crucial, their effectiveness is decreasing because bacteria are becoming resistant. The World Health Organization has listed antimicrobial resistance (AMR) as one of the top ten public health threats globally.^[9] In India, this is a major problem, with many common bacteria no longer responding to standard antibiotics.^[10] A study across Indian hospitals found that resistance among Enterobacteriaceae was high: 79% to ampicillin, 73% to trimethoprim-sulfamethoxazole, 69% to nalidixic acid, 65% to ciprofloxacin, and 44% to gentamicin.^[11] Choosing the right initial antibiotic is important and depends on the likely cause, patient history, and local resistance patterns.^[12] Most guidelines suggest broad-spectrum antibiotics that cover both oxygen-requiring and non-oxygen-requiring bacteria.^[13] However, because bacterial resistance varies by location, doctors should use local data to guide treatment.^[14] Testing the peritoneal fluid for bacteria and their antibiotic sensitivity helps in identifying the exact organisms and choosing the best antibiotic.^[15] In 60–90% of secondary peritonitis cases, cultures show positive results—more so in fecal contamination than in stomach-related perforations.^[16] Knowing the specific bacteria helps in narrowing down the treatment, which can reduce side effects, avoid resistance, and shorten hospital stay.^[17] However, using culture-based antibiotic selection is not always straight forward. Some issues include delayed results, sample contamination and the effect of antibiotics already given before sample collection.^[18] Moreover, it's not clear whether culture-based therapy always improves outcomes, with studies showing mixed results.^[19] In India, where hospitals may have limited resources and resistance is high, it is especially important to study how useful peritoneal fluid cultures are in real-life practice. Data is limited on what bacteria are commonly found in Indian patients and how well empirical treatments match with the culture reports.^[20] Also, we don't have enough studies showing if treatment based on culture improves survival or reduces hospital stay in Indian patients. At GMKMCH, Salem, many patients with abdominal emergencies like peritonitis are treated every year. The surgical team has noticed differences in patient outcomes, especially related to whether antibiotic treatment was based on culture reports. However, this has not been studied systematically. Therefore, there is a need to properly study the bacteria causing secondary peritonitis, their resistance levels, and whether using culture-based antibiotics improves

outcomes. This study can help understand the types of bacteria present in the local population, guide better antibiotic use, and improve infection control. The findings will support local antibiotic stewardship programs and help improve patient care in settings with limited resources.^[21] Starting antibiotics early in peritonitis cases is important, but using the wrong antibiotics can cause treatment failure, longer hospital stays, higher costs, and more resistance.^[22] Professional bodies like the Surgical Infection Society and the Infectious Diseases Society of America recommend starting with broad-spectrum antibiotics and then narrowing down based on culture results.^[23] However, these guidelines may not always fit areas with different bacteria and resistance levels. There is more interest now in using antibiotics wisely, which is called antimicrobial stewardship. It encourages proper use of antibiotics to improve outcomes and reduce resistance.^[24] Using culture reports to guide therapy is a key part of this approach. But in emergency surgical situations, using culture results can be difficult because results take time, infections involve multiple bacteria, and treatment needs to start immediately.^[25] Newer resistant bacteria such as ESBL-producing *E. coli*, carbapenem-resistant organisms, VRE and MRSA are making treatment harder. In India, ESBL-producing strains of *E. coli* and *Klebsiella* range from 40% to 80%, and carbapenem resistance in Gram-negative bacteria has been reported up to 60%. These numbers show that commonly used antibiotics may not work, making culture-based treatment even more important.

Wrong antibiotic choices can make treatment fail, leading to more complications, ICU stays, and higher costs. On the other hand, using the right antibiotics based on culture results may reduce these issues and save resources. This is especially important in India's public hospitals, where cost-effective care is essential.

Patient-specific factors like age, other health conditions, nutrition, delay in coming to hospital, and how sick they are at admission also affect outcomes. Tools like the Mannheim Peritonitis Index (MPI) and APACHE II score are used to predict how sick patients are. But we don't know much about how culture-based antibiotic use affects these scores or outcomes.

Apart from identifying bacteria, peritoneal fluid can also be tested for chemical markers like pH, lactate, glucose, and protein, which may help assess severity. Recent studies have also looked at measuring inflammatory chemicals (cytokines) in the fluid to guide treatment. Combining these tests with culture results may help create personalized treatment plans for better outcomes.

Because secondary peritonitis is a serious condition with complex management, there is a strong need for studies that focus on practical aspects like the value of peritoneal fluid culture in guiding antibiotics. This study at GMKMCH, Salem, will help understand the bacteria involved, resistance patterns, and whether

culture-based treatment improves outcomes. It will also support better antibiotic use and help improve surgical care in similar settings.

Aims and objectives

The Aim and objectives of my study is

- To analyse bacteriological and its sensitivity patterns in peritoneal fluid in case of an acute abdomen admitting in GMKMCH, SALEM to select appropriate empirical antibiotic therapy.
- To study bacteriological patterns in peritoneal fluid by culture
- To determine antibiotic sensitivity and resistance pattern for commonly used antibiotics to organism grown in culture

MATERIALS AND METHODS

Study Design: This study was designed as a prospective observational study, meaning we observed and followed patients over a period of time without altering their treatment. This approach allowed us to collect data in real-time, which reduced the risk of errors due to patients memory or recall. Since no experimental interventions were used, we simply monitored the outcomes of patients receiving standard medical care.

Study-Setting: The research was conducted in the Department of General Surgery at Government Mohan-Kumaramangalam Medical College and Hospital (GMKMCH), Salem, Tamil Nadu. This study was conducted in a large government hospital where a high number of emergency surgeries, including operations for acute abdominal conditions, are routinely performed.

Study Duration: The study was carried out over a two-year period, from January 2023 to January 2025, providing sufficient time to enroll the required number of patients and monitor their clinical outcomes effectively.

Study Population: The study included 100 patients who presented with signs of acute abdomen and required emergency surgical intervention. Only patients who met the specific inclusion criteria outlined below were enrolled in the study.

Inclusion Criteria:

1. Were 13 years or older
2. Had signs of acute abdomen
3. Were diagnosed with peritonitis due to a hollow organ perforation, acute appendicitis, appendicular perforation, intestinal obstruction, cholecystitis, ischemic colitis and needed emergency surgery
4. Gave written informed consent to take part

Exclusion Criteria:

1. Were younger than 12 years of age
2. Were pregnant women
3. Had traumatic perforations
4. Had weakened immune systems (due to HIV, organ transplant, cancer treatment, or immunosuppressive drugs)

5. Had advanced cancers, serious liver disease ,or end-stage kidney disease
6. Had taken antibiotics for more than 24 hours before coming to the hospital
7. Refused to participate
8. Sample Size
9. The study included a total of 100 patients.

RESULTS

Age Distribution: In the study, the majority of participants were aged 21–30 years (35%), followed by those aged 31–40 years (24%) and 13–20 years (21%). Participants above 40 years constituted 20% of the study population. This indicates a predominantly young adult demographic, with over half (56%) of the subjects being under 30 years of age.

Gender Distribution: In the study population, Males constituted the majority with 61%, while females accounted for 39%. This indicates a male predominance among the participants.

Socio economic Status Distribution: In the study population, nearly half of the participants (49%) belonged to the low socioeconomic group. Those from the middle class constituted 35%, while the lower-middle class accounted for 16%. This shows that most of the individuals in the study came from low-income or financially weaker backgrounds.

Presenting Complaints: The most common symptom reported by participants was fever, seen in 34% of cases. Abdominal pain and nausea were also common, each affecting 33% of patients. Diarrhoea was reported by 29%, while 27% had abdominal distension and another 27% experienced constipation. Vomiting was the least common symptom, occurring in 12% of the cases.

Complaint duration: About 21 % of participants had symptoms lasting 13–18 hours. Another 20 % reported symptoms for 7–12 hours, and a further 20 % for 25–30 hours. Complaints lasting longer than 30 hours were seen in 14 %, while 13 % experienced symptoms for 19–24 hours. Only 12 % sought medical help within the first 7 hours of symptom onset. Overall, most patients presented between 7 and 30 hours after their symptoms began, showing a moderate delay in seeking care.

Past Medical History: In the study group, 30% of patients had a history of previous surgery, which was the most common past medical condition. Diabetes mellitus and systemic hypertension were each present in 23% of participants. Additionally, 13% had a history of cardiovascular disease, 12% had tuberculosis, and 4% had epilepsy. These findings show that many participants had existing chronic health problems.

Personal-History: Among the participants 22% had a history of alcohol consumption and 20% reported smoking. This indicates a significant presence of lifestyle-related risk factors in the study population.

Previous Surgery History: In the study, 30% of the participants had a history of previous surgery, while the other 70% did not have any such history. This shows that almost one-third of the study population had undergone surgical procedures in the past.

Type of Previous Surgery: Among the 30 participants with a history of previous surgery, hernia repair was the most common (33.3%), followed by appendectomy and laparotomy (20% each). Cholecystectomy and lower segment cesarean section (LSCS) were reported in 13.3% of cases each. This distribution indicates that abdominal and pelvic procedures were the predominant surgical histories in the study group.

Clinical Diagnosis: Among the participants, the most common clinical diagnosis was appendicular perforation (29%), followed by cholecystitis and hollow viscus perforation, each comprising 18% of cases. Acute appendicitis accounted for 17%, while intestinal obstruction was noted in 12% of participants. The least frequent diagnosis was ischemic colitis, observed in 6% of cases. These findings indicate that perforative and inflammatory abdominal conditions were predominant in the study population.

Culture Positivity: In the study, 62% of the participants had culture-positive results, while 38% were culture-negative. This indicates that more than half of the cases demonstrated microbiological evidence of infection, supporting the role of bacteriological analysis in clinical evaluation.

Distribution of Isolated Organisms: Among the 62 culture-positive samples, *Escherichia coli* was the most frequently isolated organism (25.8%), followed by *Enterobacteriaceae* spp. (24.2%) *Pseudomonas aeruginosa* (16.1%). *Klebsiella pneumoniae* and *Klebsiella oxytoca* were identified in 9.7% and 6.5% of cases respectively. Less common isolates included *Aeromonas hydrophila* (4.8%), *Candida* spp., *Citrobacter freundii*, *Morganella morganii*, and *Serratia plymuthica* (each 3.2%). The data reflect a predominance of Gram-negative organisms in intra-abdominal infections.

Antibiotic Sensitivity Pattern: Among the antibiotics tested, Ceftriaxone and Imipenem showed the highest effectiveness, with 59.7% and 54.8% of bacterial isolates being sensitive to them, respectively. Amikacin was also fairly effective, with 53.2% sensitivity. Moderate sensitivity was found

with Cefoperazone-Sulbactam (46.8%), Tobramycin (45.2%), and Piperacillin-Tazobactam (43.5%). Cefotaxime and Penicillin were effective in 38.7% of cases, while Cefuroxime and Meropenem had slightly lower sensitivity at 37.1% and 35.5%, respectively. Erythromycin and Norfloxacin had lower sensitivity rates, at 32.3% and 25.8%. Linezolid was effective in only 16.1% of isolates. The lowest sensitivity was seen with Ceftazidime and Gentamicin, each working in just 12.9% of cases.

These results indicate that third-generation cephalosporins and carbapenems are still the most effective antibiotics in this group, whereas older antibiotics like Gentamicin and Erythromycin are much less effective.

Antibiotic Resistance Pattern: Among the antibiotics tested for resistance, Cefazolin exhibited the highest resistance rate, with 62.9% of isolates showing non-susceptibility, followed by Ampicillin at 50.0%. Notably high resistance was also seen with Cephalexin and Clindamycin, both at 41.9%, and Doxycycline, which had a resistance rate of 38.7%. Ceftazidime showed moderate resistance in 35.5% of isolates, while Gentamicin and Linezolid demonstrated lower resistance rates of 27.4% and 24.2%, respectively. Minimal resistance was observed for Cefotaxime, Norfloxacin, and Penicillin (each 14.5%), Cefuroxime (16.1%), and Erythromycin (11.3%).

Empiric Antibiogram Discordance: In this study, empiric antibiotic therapy did not align with culture sensitivity results in 12% of cases, indicating discordance. Conversely, 88% of empiric treatments were concordant with the antibiogram. This reflects a generally high appropriateness of initial empiric antibiotic selection, though a notable subset still required adjustment based on culture results.

Post operative Complications: In the study, 36% of participants experienced complications, while 64% had an uneventful postoperative course. This indicates that over one-third of the patients developed some form of complication, highlighting the need for close postoperative monitoring and early intervention.

Treatment Outcome: In the study, 98% of the participants recovered after receiving treatment, while 2% died due to their condition. This indicates a high recovery rate and generally positive outcomes, with very low mortality.

Table 1: Treatment outcome

Outcome	Frequency	Percent
Died	2	2.0
Recovered	98	98.0
Total	100	100.0

Follow-Up Outcome: Among the 98 patients who survived and were followed up, 54.1% had no further problems. Both readmission and delayed wound healing were seen in 15.3% of cases. A small number of patients (14.3%) were lost to follow-up, and 1%

had a recurrence of infection. These results show that while most patients recovered without issues, some did experience complications that required additional medical attention.

Table 2: Follow-up outcome

Follow up Outcome	Frequency	Percent
Infection recurrence	1	1.0
Lost to follow up	14	14.3
No Issues	53	54.1
Readmitted	15	15.3
Wound healing delayed	15	15.3
Total	98	100.0

Summary Statistics of Major Clinical Variables:

The average age of the participants was 29.57 ± 10.29 years, with a median age of 27.5 years (IQR: 22.00–39.00). On average, patients had symptoms for 18.38 ± 9.94 hours before coming to the hospital, with a median duration of 18.00 hours (IQR: 10.00–27.00). The time from admission to surgery averaged 12.07 ± 6.53 hours, with a median of 12.00 hours (IQR: 6.25–17.00). The average length of hospital stay was 7.24 ± 3.00 days, and the median stay was 6.00 days (IQR: 5.00–10.00). These values offer useful information about the treatment timeline and hospital resource use in the study population.

Association Between Age and Outcome:

In the study, mortality was observed in the age groups 13–20 years and 31–40 years, with one death in each group, corresponding to a 50% mortality rate within these respective age-specific subgroups. No deaths occurred among participants aged 21–30 years or >40 years. Recovery was most common in the 21–30 years group (35.7%), followed by the 31–40 years group (23.5%), >40 years group (20.4%), and 13–20 years group (20.4%). However, the association between age and treatment outcome was not statistically significant ($p = 0.473$).

Table 3: Association Between Age and Outcome

Age	Outcome		Total	p-value
	Died	Recovered		
13-20yrs	1	20	21	0.473
	50.0%	20.4%	21.0%	
21-30yrs	0	35	35	
	0.0%	35.7%	35.0%	
31-40yrs	1	23	24	
	50.0%	23.5%	24.0%	
>40yrs	0	20	20	
	0.0%	20.4%	20.0%	
Total	2	98	100	
	100.0%	100.0%	100.0%	

Association Between Gender and Outcome: In the study, all recorded deaths (2%) occurred among males, while no mortality was observed in females. Recovery was noted in 39.8% of females and 60.2% of males. Despite this apparent difference, the association between gender and treatment outcome was not statistically significant ($p = 0.253$), suggesting that gender did not significantly influence patient outcomes in this cohort.

Association Between Clinical Diagnosis and Outcome: In the study, both deaths occurred in

patients diagnosed with intestinal obstruction and ischemic colitis, each contributing 50% to the total mortality. The highest recovery rates were noted in appendicular perforation (28.6%), followed by cholecystitis and hollow viscus perforation (each 18.4%), and intestinal obstruction (12.2%). Ischemic colitis accounted for 6.1% of recoveries. Despite these differences in outcome distribution, the association between clinical diagnosis and outcome was not statistically significant ($p = 0.783$).

Table 4: Association Between Clinical Diagnosis and Outcome

Clinical Diagnosis	Outcome		Total	pvalue
	Died	Recovered		
Acute Appendicitis	0	17	17	0.783
	0.0%	17.3%	17.0%	
Appendicular perforation	0	29	29	
	0.0%	29.6%	29.0%	
Cholecystitis	0	18	18	
	0.0%	18.4%	18.0%	
Hollow viscus perforation	0	18	18	
	0.0%	18.4%	18.0%	
Intestinal obstruction	1	11	12	
	50.0%	11.2%	12.0%	
Ischemic colitis	1	5	6	
	50.0%	5.1%	6.0%	
Total	2	98	100	
	100.0%	100.0%	100.0%	

Association Between Culture Positivity and Outcome: Among the culture-positive group (62% of the total), 1 patient (1.6%) died and 61 recovered, while in the culture-negative group (38%), 1 patient (2.6%) died and 37 recovered. Each group accounted for 50% of the total mortality.

Although the recovery rate was slightly higher among culture-positive patients (62.2%) compared to culture-negative patients (37.8%), the difference was not statistically significant ($p = 0.724$). This indicates that there was no meaningful association between culture positivity and patient outcome in this study.

Table 5: Association Between Culture Positivity and Outcome

Culture positive	Outcome		Total	pvalue
	Died	Recovered		
Yes	1	61	62	0.724
	50.0%	62.2%	62.0%	
No	1	37	38	
	50.0%	37.8%	38.0%	
Total	2	98	100	
	100.0%	100.0%	100.0%	

Association Between Isolated Organism and Outcome: Among the culture-positive cases, *Pseudomonas aeruginosa* and *Serratia plymuthica* were the only organisms linked to mortality, each responsible for one death, making up 50% of all deaths in the study. All other organisms—such as *E. coli* (16%), *Enterobacteriaceae* spp. (15%), *Klebsiella pneumoniae* (6%), *Klebsiella oxytoca* (4%), and others—were found only in patients who recovered.

Serratia plymuthica was the most commonly isolated organism, present in 38% of the cases, followed by

E. coli in 16% and *Enterobacteriaceae* spp. in 15%. Although *Pseudomonas aeruginosa* appeared in 10% of samples, it was one of the only two organisms associated with fatal outcomes, the other being *Serratia plymuthica*. These findings indicate a possible link between infections caused by *Pseudomonas aeruginosa* and *Serratia plymuthica* and poorer clinical outcomes. However, since no statistical test was applied in the table, the significance of this observation cannot be confirmed.

Table 6: Association Between Isolated Organism and Outcome

Organism Cultured	Outcome		Total
	Died	Recovered	
<i>Aeromonas hydrophilla</i>	0	3	3
	0.0%	3.1%	3.0%
<i>Candida</i> spp	0	2	2
	0.0%	2.0%	2.0%
<i>Citrobacter freundii</i>	0	2	2
	0.0%	2.0%	2.0%
<i>E. coli</i>	0	16	16
	0.0%	16.3%	16.0%
<i>Enterobacteriaceae</i> spp	0	15	15
	0.0%	15.3%	15.0%
<i>Klebsiella oxytoca</i>	0	4	4
	0.0%	4.1%	4.0%
<i>Klebsiella pneumoniae</i>	0	6	6
	0.0%	6.1%	6.0%
<i>Morganella morganii</i>	0	2	2
	0.0%	2.0%	2.0%
<i>Pseudomonas aeruginosa</i>	1	9	10
	50.0%	9.2%	10.0%
<i>Serratia ply</i>	0	2	2
	0.0%	2.0%	2.0%
<i>Serratia plymuthica</i>	1	37	38
	50.0%	37.8%	38.0%
Total	2	98	100
	100.0%	100.0%	100.0%

Association Between Empiric Antibigram Discordance and Outcome: Out of the 12 patients with empiric antibiogram discordance, all recovered (12.2%), and no deaths were reported. Among those without discordance (88 patients), 2 deaths occurred (2.3%), with 86 recoveries (87.8%). Although all mortality was observed in the concordant group, the association between empiric antibiotic discordance and clinical outcome was not statistically significant ($p=0.598$), suggesting that discordance did not adversely impact patient survival in this cohort.

Table 7: Association Between Empiric Antibigram Discordance and Outcome

Empiric Antibigram Discordance	Outcome		Total	pvalue
	Died	Recovered		
Yes	0	12	12	0.598
	0.0%	12.2%	12.0%	
No	2	86	88	
	100.0%	87.8%	88.0%	
Total	2	98	100	
	100.0%	100.0%	100.0%	

Association Between Treatment Compliance and Outcome:

In this study, all deaths (2%) were seen in patients who had poor compliance with treatment, while no deaths occurred among those with good or partial compliance. The highest recovery rate was in patients with good compliance (52%), followed by those with partial compliance (36.7%), and the lowest in those with poor compliance (11.2%). These results suggest a strong link between better treatment compliance and positive outcomes, highlighting the importance of following prescribed treatment protocols.

Table 8: Association Between Treatment Compliance and Outcome

Compliance	Outcome		Total
	Died	Recovered	
Good	0	51	51
	0.0%	52.0%	51.0%
Partial	0	36	36
	0.0%	36.7%	36.0%
Poor	2	11	13
	100.0%	11.2%	13.0%
Total	2	98	100
	100.0%	100.0%	100.0%

Organism-wise Antibiotic Sensitivity: Imipenem and Cefoperazone-Sulbactam showed the widest range of effectiveness, each working against 9 out of the 10 organisms tested. Imipenem was highly effective against *E. coli* (9 isolates), *Enterobacter* spp., *Klebsiella pneumoniae*, *Morganella morganii*, and *Pseudomonas aeruginosa*, showing strong activity as a carbapenem. Cefoperazone-Sulbactam was also effective against *E. coli*, *Klebsiella* spp., *Enterobacter* spp., *Pseudomonas*, *Citrobacter*, *Aeromonas hydrophila*, *Candida* spp., and *Serratia plymuthica*, highlighting its strength as a broad-spectrum β -lactam/ β -lactamase inhibitor. Ceftriaxone also showed substantial effectiveness, particularly against *E. coli* (7 isolates), *Klebsiella pneumoniae* (4), *Klebsiella oxytoca* (4), and *Enterobacter* (12). Amikacin displayed notable activity against *Pseudomonas aeruginosa* (6 isolates), and was also effective against *E. coli* (6), *Enterobacter* (12), and several other gram-negative organisms, making it a valuable aminoglycoside in this cohort.

Piperacillin-Tazobactam exhibited moderate coverage, sensitive to *E. coli* (8), *Klebsiella pneumoniae*, *Enterobacter*, and *Pseudomonas*, indicating utility in mixed infections. Meropenem showed good sensitivity to *E. coli* (4), *Enterobacter*, *Klebsiella pneumoniae*, and *Pseudomonas*, although slightly narrower than imipenem.

Tobramycin and Cefuroxime showed consistent moderate sensitivity across *E. coli*, *Enterobacter*, and *Klebsiella* species. Gentamicin and Ceftazidime had limited activity, primarily effective against *E. coli* and *Klebsiella*. Linezolid was moderately active but lacked coverage against *Citrobacter* and *Morganella*, while Norfloxacin and Erythromycin demonstrated limited organism-specific efficacy.

In summary, Imipenem and Cefoperazone-Sulbactam were the most effective antibiotics in this study, showing activity against the widest range of organisms. This supports their important role in treating serious polymicrobial infections.

Table 9: Organism-wise Antibiotic Sensitivity

Antibiotic Sensitive	Organism										Total
	Aeromonas hydrophila	Candida spp	Citrobacter	E. coli	Enterobacter	Klebsiella	Klebsiella	Morganella	Pseudomonas	Serratia ply	
Amikacin	3	1	1	6	12	1	1	1	6	1	33
Cefoperazone Sulbactam	1	2	1	7	6	3	4	1	2	2	29
Cefotaxime	2	1	1	4	4	2	3	1	5	1	24
Ceftazidime	0	1	0	3	3	0	0	0	1	0	8
Ceftriaxone	0	0	1	7	12	4	4	2	6	1	37
Cefuroxime	1	0	0	6	6	2	4	0	4	0	23

Erythromycin	0	0	1	5	4	0	3	1	6	0	20
Gentamicin	1	0	1	1	4	0	0	1	0	0	8
Imipenem	3	1	2	9	7	1	3	2	6	0	34
Linezolid	1	0	0	2	3	1	1	1	1	0	10
Meropenem	0	1	1	4	5	2	1	2	5	1	22
Norfloxacin	0	1	1	6	2	1	2	0	3	0	16
Penicillin	1	1	0	8	3	1	4	1	4	1	24
Piperacillin Tazobactam	1	0	1	8	5	4	1	0	6	1	27
Tobramycin	3	1	1	7	5	1	3	1	5	1	28
Total	3	2	2	16	15	4	6	2	10	2	62

Antibiotic Resistance Profile by Organism: The antibiotic resistance profile across organisms reveals important trends in antimicrobial non-susceptibility: Cefazolin showed the highest overall resistance, with 39 isolates (62.9%) demonstrating non-susceptibility. It was particularly ineffective against *Enterobacter* spp. (12), *E. coli* (9), and *Pseudomonas* (6), suggesting widespread resistance to this first-generation cephalosporin.

Ampicillin followed closely, with 31 resistant isolates, most notably against *E. coli* (6), *Enterobacter* (6), and *Pseudomonas* (7). Resistance to Cephalexin and Clindamycin was also notable (26 isolates each), especially in *E. coli*, *Enterobacter*, and *Klebsiella* species. Ceftazidime resistance was seen in 22 isolates, particularly among *Enterobacter* (6), *E. coli* (5), and *Pseudomonas* (4). Similarly, Doxycycline resistance was observed in 24 isolates, including *E. coli* (6), *Aeromonas hydrophila* (2), and *Enterobacter* (5), indicating limited utility in treating infections by these organisms.

Lower resistance rates were observed with Gentamicin (17 cases), Linezolid (15 cases), and Cefuroxime (10 cases). *E. coli* and *Enterobacter* showed moderate resistance to these drugs, indicating they may still have some effectiveness. Erythromycin, Penicillin, and Norfloxacin had the fewest resistant isolates, with 9 or fewer each, though resistance was still seen across different organisms. Notably, *E. coli* and *Enterobacter* spp. were the most

commonly resistant organisms across almost all antibiotics tested, showing their potential for multidrug resistance. *Pseudomonas aeruginosa* also showed broad resistance, especially to Ampicillin, Cefazolin, and Ceftazidime.

In conclusion, the data reveal high resistance rates to older β -lactams and first-line antibiotics, particularly among gram-negative organisms. These findings stress the importance of using antibiotics carefully and highlight the need to base treatment choices on antibiotic sensitivity testing.

Antibiotic Usage: In this study group, Cefoperazone was the most frequently used antibiotic, prescribed in 50% of cases. It was given to all patients with *Aeromonas*, *Candida*, and *Citrobacter* infections, and was also commonly used for *Klebsiella oxytoca* and *Serratia*. Ceftriaxone was the next most used antibiotic (33%), mainly prescribed for infections caused by *E. coli* (75%), *Klebsiella pneumoniae* (83.3%), and *Pseudomonas aeruginosa* (90%), showing its preferred use for treating gram-negative infections.

Meropenem (8%) was selectively used for *Enterobacter* and *Klebsiella*, while Piperacillin-Tazobactam (7%) was applied in *Morganella* and *Serratia* infections. Cefotaxime was least used (2%) and not directed toward any specific cultured organism. Overall, Ceftriaxone and Cefoperazone were the primary antibiotics administered, reflecting their broad-spectrum utility in this clinical setting.

Table 10: Antibiotic Usage

Antibiotics Used	<i>Aeromonas hydrophila</i>	<i>Candida</i> spp.	<i>Citrobacter</i>	<i>E. coli</i>	<i>Enterobacter</i>	<i>Klebsiella oxytoca</i>	<i>Klebsiella pneumoniae</i>	<i>Morganella</i>	<i>Pseudomonas</i>	<i>Serratia</i>	<i>Stenotrophomonas</i>	Total
Cefoperazone	3 (100%)	2 (100%)	2 (100%)	3 (18.8%)	5 (33.3%)	3 (75.0%)	1 (16.7%)	1 (50.0%)	1 (10.0%)	1 (50.0%)	28 (73.7%)	50 (50.0%)
Cefotaxime	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (5.3%)	2 (2.0%)
Ceftriaxone	0 (0.0%)	0 (0.0%)	0 (0.0%)	12 (75.0%)	7 (46.7%)	0 (0.0%)	5 (83.3%)	0 (0.0%)	9 (90.0%)	0 (0.0%)	0 (0.0%)	33 (33.0%)
Meropenem	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (20.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (10.5%)	8 (8.0%)
Piperacillin-Tazobactam	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (6.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (50.0%)	0 (0.0%)	1 (50.0%)	4 (10.5%)	7 (7.0%)
Total	3 (100%)	2 (100%)	2 (100%)	16 (100%)	15 (100%)	4 (100%)	6 (100%)	2 (100%)	10 (100%)	2 (100%)	38 (100%)	100 (100%)

Empiric Antibio gram Discordance by Organism:

Empiric antibiotic discordance was observed in 12% of cases. It was notably high in less common or opportunistic organisms such as *Aeromonas hydrophila* (66.7%), *Candida* spp. (50%), *Citrobacter freundii* (50%), *Klebsiella oxytoca* (75%), *Morganella morganii* (50%), and *Serratia plymuthica*

(50%). *Enterobacter* spp. showed minimal discordance (6.7%), while no discordance was noted in *E. coli*, *Klebsiella pneumoniae*, or *Pseudomonas aeruginosa*, indicating effective empiric coverage for these common gram-negative pathogens. Among sterile cultures, discordance was rare (5.3%).

Table 11: Empiric Antibio gram Discordance by Organism

Empiric Antibio gram Discordance	<i>Aeromonas</i>	<i>Candida</i> spp.	<i>Citrobacter</i>	<i>E. coli</i>	<i>Enterobacter</i>	<i>Klebsiella oxytoca</i>	<i>Klebsiella pneumoniae</i>	<i>Morganella</i>	<i>Pseudomonas</i>	<i>Serratia</i>	Sterile	Total
Yes	2 (66.7%)	1 (50.0%)	1 (50.0%)	0 (0.0%)	1 (6.7%)	3 (75.0%)	0 (0.0%)	1 (50.0%)	0 (0.0%)	1 (50.0%)	2 (5.3%)	12 (12.0%)
No	1 (33.3%)	1 (50.0%)	1 (50.0%)	16 (100.0%)	14 (93.3%)	1 (25.0%)	6 (100.0%)	1 (50.0%)	10 (100.0%)	1 (50.0%)	36 (94.7%)	88 (88.0%)
Total	3 (100.0%)	2 (100.0%)	2 (100.0%)	16 (100.0%)	15 (100.0%)	4 (100.0%)	6 (100.0%)	2 (100.0%)	10 (100.0%)	2 (100.0%)	38 (100.0%)	100 (100.0%)

Organism-wise Distribution of Post operative Complications:

Among the 100 cases analyzed, 64% had no complications. The most common complication was surgical site infection (SSI), observed in 20% of cases. SSI was predominantly associated with *Klebsiella pneumoniae* (33.3%), *Klebsiella oxytoca* (25%), *E. coli* (18.8%), *Pseudomonas aeruginosa* (20%), and *Morganella morganii* (100%).

Sepsis occurred in 7% of cases, mainly involving *E. coli* (12.5%) and *Pseudomonas aeruginosa* (10%).

Wound dehiscence was noted in 9%, most frequently linked with *Enterobacter* spp. (26.7%), *E. coli* (12.5%), and *Klebsiella oxytoca* (25%).

These results indicate that gram-negative organisms, particularly *E. coli*, *Pseudomonas*, and *Klebsiella* species, were associated with a higher incidence of postoperative complications, underlining the importance of early identification and targeted therapy.

Table 12: Organism-wise Distribution of Post operative Complications

Complication	<i>Aeromonas</i>	<i>Candida</i> spp.	<i>Citrobacter</i>	<i>E. coli</i>	<i>Enterobacter</i>	<i>Klebsiella oxytoca</i>	<i>Klebsiella pneumoniae</i>	<i>Morganella</i>	<i>Pseudomonas</i>	<i>Serratia</i>	Sterile	Total
None	2 (66.7%)	2 (100.0%)	2 (100.0%)	9 (56.3%)	10 (66.7%)	2 (50.0%)	4 (66.7%)	0 (0.0%)	7 (70.0%)	1 (50.0%)	25 (65.8%)	64 (64.0%)
Sepsis	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (12.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (10.0%)	0 (0.0%)	4 (10.5%)	7 (7.0%)
SSI	1 (33.3%)	0 (0.0%)	0 (0.0%)	3 (18.8%)	1 (6.7%)	1 (25.0%)	2 (33.3%)	2 (100.0%)	2 (20.0%)	1 (50.0%)	7 (18.4%)	20 (20.0%)
Wound dehiscence	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (12.5%)	4 (26.7%)	1 (25.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (5.3%)	9 (9.0%)
Total	3 (100.0%)	2 (100.0%)	2 (100.0%)	16 (100.0%)	15 (100.0%)	4 (100.0%)	6 (100.0%)	2 (100.0%)	10 (100.0%)	2 (100.0%)	38 (100.0%)	100 (100.0%)

Organism-wise Distribution of Outcomes: Out of 100 patients, 98% recovered, while 2% died. Mortality was observed in infections caused by *Pseudomonas aeruginosa* (10%) and among sterile cases (2.6%), accounting for the two total deaths.

All patients with infections due to *E. coli*, *Enterobacter* spp., *Klebsiella* spp., *Aeromonas hydrophila*, *Candida* spp., *Citrobacter freundii*,

Morganella morganii, and *Serratia plymuthica* experienced complete recovery.

These findings indicate a generally favorable prognosis across most pathogens, with slightly increased mortality linked to *Pseudomonas* infections and culture-negative cases, under scoring the importance of early detection and appropriate therapy in high-risk organisms.

Table 13: Organism-wise Distribution of Outcomes

Outcome	Organism											Total
	Aeromonas	can did a spp	citrobacter	E. coli	Enterobacter	Klebsiella	Klebsiella	mor ganella	Pseudomonas	ser atia ply	Ste rila e	
Died	0	0	0	0	0	0	0	0	1	0	1	2
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10.0%	0.0%	2.6%	2.0%
Recovered	3	2	2	16	15	4	6	2	9	2	37	98
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	90.0%	100.0%	97.4%	98.0%
Total	3	2	2	16	15	4	6	2	10	2	38	100
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

DISCUSSION

This present prospective study of 100 acute abdomen patients at GMKMCH, Salem, analyzed peritoneal fluid cultures and antibiotic sensitivity. This study highlighted culture-based antibiotic therapy's role in identifying causative bacteria, guiding targeted treatment, reducing resistance, improving clinical outcomes, and shortening hospital stay, thereby supporting antimicrobial stewardship in a resource-limited setting.

In our study, the most common age group was 21–30 years (35%), followed by 31–40 years (24%), and 13–20 years (21%). Only 20% were above 40 years. The mean age was 29.6 ± 10.3 years, indicating that acute abdominal emergencies mostly affect younger, economically productive individuals. This finding is similar to Jhobta et al,^[53] who reported a mean age of 34 years with peak incidence in the third decade. Similarly, Patil et al,^[56] found a mean of 31 years, and Raghavan & Adhikari noted a predominance in the 21–30 year group. These studies support the age pattern observed in our cohort. Such early age presentation may be attributed to lifestyle factors, higher exposure to infectious agents, and delays in seeking care among working populations. Western studies, in contrast, often report higher mean ages, reflecting differing etiologies like diverticulitis or malignancy.

In our study, males accounted for 61% and females 39% of the participants, indicating a clear male preponderance. This male predominance has been similarly reported by Jhobta et al,^[53] where males comprised 68%, and by Patil et al,^[56] with male-to-female ratio of approximately 2:1. Malik et al also found 60% male predominance, attributing it to higher exposure of males to risk factors like alcohol, tobacco, and NSAID use. Cultural barriers, socioeconomic dependency, and delayed health-seeking among women may contribute to their lower representation in surgical emergencies.

In our study, farmers (30%), students (17%), labourers (14%), and unemployed individuals (13%) were most affected. The dominance of agricultural and low-income labour groups has also been observed by Raghavan and Adhikari, who reported a majority from rural backgrounds. Patil et al,^[56] noted a similar occupational pattern, with most patients being manual labourers or farmers. Shah et al also

highlighted the vulnerability of rural occupational groups to intra-abdominal infections due to unhygienic food practices and poor sanitation. The findings reflect the disproportionate burden of gastrointestinal surgical emergencies on rural working-class populations in India.

Nearly half of our study participants (49%) belonged to the low-income group, followed by middle-income (35%) and lower-middle (16%) strata. This is consistent with Gupta et al,^[55] who reported a majority of patients from socioeconomically disadvantaged backgrounds. Similar socioeconomic trends were noted by Sharma et al and Shah et al, where limited access to early healthcare and poor nutritional status contributed to higher morbidity. These findings reinforce the established link between poverty and delayed or complicated surgical presentations.

The most common presenting complaints in our study were fever (34%), abdominal pain (33%), nausea (33%), and diarrhoea (29%), with other symptoms including distension (27%), constipation (27%), and vomiting (12%). Singh et al,^[52] and Mishra et al both reported abdominal pain and fever as the most frequent symptoms, present in over 70% of their patients. Chawla et al,^[58] also observed similar patterns, with fever and gastrointestinal symptoms being the predominant features. These symptoms reflect peritoneal irritation and systemic infection, forming a classic clinical triad in secondary peritonitis.

In our study, only 12% of patients presented within 7 hours of symptom onset, while the majority reported between 7–24 hours (41%), and 14% presented after 30 hours, with a mean duration of 18.4 ± 9.9 hours. Patil et al,^[56] reported similar delays, with over 60% presenting beyond 12 hours. Malik et al,^[59] and Jindal et al, also noted presentation delays averaging 18–24 hours. Such delays are associated with increased peritoneal contamination and complication rates. The delayed presentation emphasizes the need for early referral systems, especially in rural settings.

A total of 30% of our patients had prior surgical history, with hernia repair (33%), appendectomy (20%), and laparotomy (20%) being the most common procedures. Gupta et al,^[55] reported similar findings, with adhesions from previous surgeries as a common cause of intestinal obstruction. Raghavan & Adhikari and Sudhaharan et al also observed that a

significant portion of patients had a history of intra-abdominal surgery, particularly among cases presenting with intestinal obstruction. These findings reaffirm the role of post-operative adhesions and complications as contributors to secondary peritonitis.

In our study, the most frequent clinical diagnoses were appendicular perforation (29%), followed by acute cholecystitis (18%), hollow viscus perforation (18%), acute appendicitis (17%), intestinal obstruction (12%), and ischaemic colitis (6%). Jhobta et al,^[53] reported appendicular pathology in 28% and gastro duodenal perforation in 21%, aligning with our diagnostic distribution. Sudhaharan et al found appendix-related causes in 32%, followed by gastric and duodenal perforations. Similarly, Ardhanari et al documented perforated appendicitis and duodenal ulcer as major causes of secondary peritonitis. Patil et al,^[56] also observed appendicular and peptic ulcer perforations as predominant contributors. These similarities suggest that appendicular and peptic pathology remain the most frequent etiologies in the Indian context, especially among younger patients.

In our study, 62% of peritoneal fluid cultures were positive for bacterial growth. This culture positivity rate is slightly lower than that reported by Gupta et al,^[55] who observed 73% positivity. Patil et al,^[56] found even higher rates, with 85% of cases yielding growth. Chawla et al, reported 79% positivity, attributing higher rates to prompt sample processing. However, our rate is well within the expected clinical range, as Wittmann et al,^[16] noted variable culture yields depending on prior antibiotic exposure and laboratory logistics. Pre-operative antibiotic administration and delays in transportation may have contributed to the lower positivity in our setting.

Among the positive cultures, the most commonly isolated organisms in our study were *E. coli* (25.8%), *Enterobacter* spp. (24.2%), and *Pseudomonas aeruginosa* (16.1%), with smaller contributions from *Klebsiella pneumoniae* (9.7%) and *Klebsiella oxytoca* (6.5%). Similar findings were reported by Sudhaharan et al, where *E. coli* accounted for 47% and *Klebsiella* for 20%. Malik et al also documented *E. coli* in 48.6%, with *Pseudomonas* in 11%. Ardhanari et al observed *E. coli* (53.6%) as the dominant organism. These findings are consistent with the well-established polymicrobial nature of secondary peritonitis, particularly dominated by Gram-negative enteric flora.

In our study, organisms exhibited highest sensitivity to ceftriaxone (59.7%), imipenem (54.8%), and amikacin (53.2%). Similar antibiotic efficacy patterns were observed by Sharma et al, who reported >50% susceptibility to third-generation cephalosporins and carbapenems. Javali et al noted high susceptibility to imipenem and amikacin, while Shah et al also confirmed the continued effectiveness of carbapenems in intra-abdominal sepsis. These findings reinforce the role of beta-lactam/beta-lactamase inhibitor combinations and carbapenems as effective empirical choices for severe peritonitis.

We observed the highest resistance to cefazolin (62.9%), followed by ampicillin (50%), cephalexin and clindamycin (41.9%), and doxycycline (38.7%). Gupta et al reported ampicillin resistance above 80%, and Sudhaharan et al noted high resistance across older cephalosporins and penicillins, reflective of extended-spectrum beta-lactamase (ESBL) prevalence. Tamma et al,^[14] also emphasized widespread resistance in Enterobacteriaceae to first-line antibiotics. This underscores the importance of local antibiograms in guiding rational antibiotic use, and highlights the obsolescence of older beta-lactams in managing peritoneal sepsis.

Our study showed a mean hemoglobin level of 11.6 ± 2.1 g/dL, TLC of $11.8 \pm 4.0 \times 10^3/\text{mm}^3$, and neutrophils comprising 72% of total leukocytes. The ESR was 35.8 ± 13.8 mm/hr and platelet count was $2.44 \pm 0.47 \times 10^5/\text{mm}^3$. Patil et al,^[56] and Kurup et al, documented similar haematological derangements, particularly leukocytosis with neutrophilic predominance. Mishra et al,^[63] also reported mean WBC counts $>12,000/\text{mm}^3$ in peritonitis cases. These parameters support their role as initial inflammatory markers in peritonitis and should be integrated with clinical scoring for triage.

Biochemically, our patients had a mean urea of 37 ± 10.6 mg/dL, serum creatinine 1.22 ± 0.41 mg/dL, bilirubin 1.01 ± 0.31 mg/dL, ALT 53.6 ± 20.4 IU/L, and AST 52.8 ± 21.6 IU/L. Random blood sugar averaged 150.7 ± 42.1 mg/dL, and amylase 114 ± 55 IU/L. Similar findings were observed by Jindal et al, who noted mild renal derangement and transaminitis in peritonitis patients. Sharma et al also reported raised liver enzymes in abdominal sepsis cases. Elevated amylase and glucose values reflect stress hyperglycemia and splanchnic irritation, as described in Malik et al.^[59] These findings highlight the systemic metabolic response in peritonitis and justify early biochemical evaluation.

In our study, deaths were observed in the 13–20 year and 31–40 year groups (one each), with no mortality in other age groups, and this association was statistically non-significant ($p = 0.473$). Chung et al,^[43] noted higher mortality in elderly patients (>65 years), which was not reflected in our data due to the smaller proportion of older adults. Jhobta et al and Sudhaharan et al also found age to be a predictor of poor outcomes only in patients beyond the fifth decade. While our findings showed no significant correlation, larger age-diverse cohorts may better demonstrate age-related outcome trends.

In our study, 2 deaths occurred in male patients, whereas no mortality was observed among the female patients. However, this association was statistically not significant ($p = 0.253$). Malik et al,^[59] also reported no significant gender-based mortality difference, and Mishra et al,^[63] found similar outcomes across genders. Similarly, Singhet al,^[52] and Raghavan & Adhikari observed that gender alone was not a strong predictor of mortality in peritonitis. These findings suggest that outcome in secondary peritonitis is

influenced more by clinical status, etiology, and timing of intervention rather than gender.

Among culture-positive patients (62%), there was one death, and another occurred among culture-negative cases, indicating no significant association between culture result and mortality ($p = 0.724$). Similar findings were observed by Kurup et al, who noted that mortality was not significantly different between culture-positive and culture-negative groups. Singh et al,^[52] and Shah et al, also emphasized that outcome depends more on timely surgery and supportive care rather than on the presence or absence of bacterial growth. This supports the clinical practice of initiating broad-spectrum antibiotics regardless of culture status while awaiting sensitivity results.

In our study, both deaths were associated with *Pseudomonas aeruginosa* and *Serratia plymuthica* isolates, while 100% recovery was noted in cases involving *E. coli*, *Enterobacter*, *Klebsiella*, and others. Tamma et al,^[14] reported that non-fermenters like *Pseudomonas* and *Serratia* are associated with higher virulence and resistance, contributing to poorer outcomes. Sudhaharan et al and Jhobta et al,^[53] also highlighted that *Pseudomonas*-related infections are often more resistant and associated with worse prognoses. This underscores the need for early identification and aggressive treatment when non-fermenting Gram-negative bacilli are isolated.

Out of the total patients, 36% developed post-operative complications, with the most common being surgical site infection (SSI) in 20 cases (55.6%), followed by wound dehiscence (25%) and sepsis (19.4%). Chawla et al. [58] and Jindal et al. [66] reported SSI rates of 18–25%, consistent with our findings. Malik et al found a 23% overall complication rate, dominated by wound infections and dehiscence. Ardhani et al also observed SSIs in 22% of their cohort. This highlights that while early source control reduces mortality, soft-tissue morbidity remains common, especially in contaminated surgeries.

We observed a 98% survival rate, with only 2% mortality, and the mean hospital stay was 7.2 ± 3.0 days. Patil et al,^[56] and Gupta et al,^[55] reported mortality rates between 8–12%, significantly higher than in our study. Chawla et al,^[58] also noted a 10.6% mortality, largely in patients with delayed presentation. The lower mortality in our study may be attributed to prompt surgical intervention and the use of empiric antibiotics adjusted by culture, aligning with WSES and IDSA guidelines.^[23] This suggests effective perioperative protocols and rapid management were key in reducing mortality in our setting.

During follow-up, 54.1% had no further issues, while 15.3% had readmissions, 15.3% experienced delayed healing, 14.3% were lost to follow-up, and 1% had recurrence of infection. Patil et al,^[56] observed a 16–18% rate of post-discharge complications, including delayed healing and wound-related issues. Similar long-term follow-up morbidity was seen in Shah et al

and Raghavan & Adhikari,^[64] reinforcing the need for wound surveillance and patient education after discharge. These results affirm the value of structured post-operative follow-up to mitigate chronic wound morbidity.

Among the 98 patients followed up, 52% had good compliance, 36.7% partial compliance, and 11.2% poor compliance. Notably, both deaths occurred in the poor compliance group. Liuet al also observed that low adherence to post-operative antibiotics and dressing schedules correlated with increased complications. Ardhani et al stressed the role of post-discharge instructions and access to primary care in ensuring optimal recovery. Our data support that patient compliance is a critical modifiable factor for improving post-surgical outcomes in secondary peritonitis.

We observed a mean duration of symptoms before hospital arrival as 18.4 ± 9.9 hours, and the average delay from decision to surgery was 12.1 ± 6.5 hours. The average hospital stay was 7.2 ± 3.0 days. These timelines are shorter than in Jhobta et al,^[53] and Mishra et al, who reported delays exceeding 24 hours, contributing to higher complication rates. Kurup et al found early intervention (<12 h) correlated with better outcomes, consistent with our findings. Thus, the rapid surgical response in our cohort likely contributed to reduced morbidity and mortality.

Although lactate, CRP, and procalcitonin (PCT) were not assessed in our dataset, prior literature has established these markers as useful predictors of sepsis severity and outcomes. Studies by Javali et al, and Tamma et al,^[14] have emphasized elevated CRP and PCT as independent prognostic markers, especially in ICU settings. Sharma et al,^[60] also reported that high PCT values correlated with complications and mortality. Incorporating these markers in future studies may enhance early risk stratification and guide escalation of care.

We observed that ceftriaxone and cefoperazone-sulbactam were the most frequently used empiric antibiotics and were also effective against *E. coli*, *Klebsiella*, and *Enterobacter* spp., with imipenem and amikacin effective across nearly all isolates. This parallels findings by Sharma et al, and Shah et al, where carbapenems and aminoglycosides remained effective against resistant Gram-negatives. Sudhaharan et al also reported good susceptibility of ESBL organisms to carbapenems. Our results emphasize that local antibiograms should guide empirical therapy, especially with the rising prevalence of multidrug-resistant organisms.

Our study highlights that secondary peritonitis predominantly affects young adults (mean age 29.6 years), with a male predominance and a strong association with low socioeconomic status and rural occupations. The most common clinical presentations were appendicular and hollow viscus perforations, consistent with patterns reported in multiple Indian studies. Despite delays in presentation, our outcomes were favorable due to

early surgical intervention and appropriate empiric antibiotic use guided by culture and sensitivity results. Gram-negative enteric organisms, particularly *E. coli*, *Enterobacter*, and *Pseudomonas*, were the most frequently isolated pathogens, with high sensitivity to carbapenems and amikacin and notable resistance to cefazolin and ampicillin. Post-operative complications such as surgical site infections were similar to national data, and treatment compliance emerged as a key determinant of recovery. Our findings are largely consistent with existing literature, underscoring the importance of timely diagnosis, empirical therapy adjusted by local antibiograms, and structured follow-up to improve outcomes in secondary peritonitis.

CONCLUSION

This prospective observational study comprehensively evaluated the clinical, microbiological, and outcome profile of patients presenting with acute abdominal emergencies, specifically secondary peritonitis, in a tertiary care setting. The findings highlight key demographic and clinical trends, pathogen distribution, antibiotic susceptibility patterns, and post-operative outcomes relevant to optimizing patient care.

The study demonstrated that younger adults, particularly those aged 21–30 years, represented the most commonly affected group, with a mean age of 29.6 years, reflecting the significant burden of peritoneal infections in the economically productive age group. A male predominance (61%) was noted, consistent with national data, likely due to differential exposure and healthcare-seeking behavior. The majority of patients belonged to low socioeconomic strata (49%) and were engaged in labour-intensive or agrarian occupations, reinforcing the role of socio-economic determinants in disease presentation and progression.

The most common clinical diagnoses included appendicular perforation (29%) and hollow viscus perforation (18%), with fever and abdominal pain being the primary presenting complaints. Delays in presentation were common, with only 12% arriving within 7 hours of symptom onset. Despite these delays, the overall mortality rate was low (2%), which can be attributed to timely surgical intervention (mean decision-to-surgery time: 12.1 hours) and effective use of antibiotics.

Microbiologically, the study revealed a culture positivity rate of 62%, with *E. coli* (25.8%), *Enterobacter* spp. (24.2%), and *Pseudomonas aeruginosa* (16.1%) being the most frequently isolated organisms. These findings align with the polymicrobial nature of secondary peritonitis. Antibiotic susceptibility testing showed high sensitivity to ceftriaxone, imipenem, and amikacin, while resistance was highest to cefazolin and ampicillin, underscoring the urgency of rational

antibiotic stewardship and empiric therapy guided by local antibiograms.

Despite the presence of surgical site infections (20%) and wound-related complications (25%), 98% of patients recovered fully, highlighting the effectiveness of protocolized perioperative care. Importantly, treatment compliance was strongly associated with outcome; both mortalities occurred in patients with poor post-operative adherence, emphasizing the need for structured counselling and discharge planning.

In conclusion, the study provides robust evidence that early diagnosis, rapid surgical response, appropriate empirical antibiotics, and patient compliance are the cornerstones of favorable outcomes in secondary peritonitis. The findings are largely consistent with national literature, validating their generalizability to similar healthcare settings across India. Integration of rapid diagnostic tools, regular antibiogram surveillance, and post-discharge follow-up protocols is recommended to further reduce morbidity and mortality in these high-risk patients.

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