

**Original Research Article** 

# CLINICAL STUDY OF CULTURE AND SENSITIVITY OF INTRAOPERATIVE PERITONEAL IRRIGATION FLUID FOR PREDICTION OF POSTOPERATIVE COMPLICATIONS IN ELECTIVE AND EMERGENCY ABDOMINAL SURGERIES

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# ABSTRACT

**Background:** Postoperative infections are among the most common complications following abdominal surgeries. Early identification of microbial flora within the peritoneal cavity may provide prognostic value and improve targeted antibiotic therapy. This study aims to evaluate the role of culture and sensitivity of intraoperative peritoneal irrigation fluid using the BACTEC method in predicting postoperative complications in patients undergoing elective and emergency abdominal surgeries. The findings are intended to guide more effective use of antibiotics and improve postoperative outcomes.

**Materials and Methods:** This observational study was conducted at KIMS and RF, Amalapuram, from December 2016 to October 2018. A total of 100 patients undergoing elective and emergency abdominal surgeries were enrolled and divided into two equal groups: cases (intraoperative peritoneal fluid sent for BACTEC culture and sensitivity testing) and controls (no culture performed). Postoperative complications were compared between the groups. Microbial profiles and antibiotic sensitivities were analyzed.

**Results:** In the case group (n=50), 80% had positive cultures, with Escherichia coli being the most prevalent organism (46%). Patients treated based on culture and sensitivity results had a significantly lower rate of complications compared to those receiving empirical antibiotics (p=0.0049). The control group showed a higher incidence of surgical site infections (26%) and major postoperative complications. Dirty wounds were associated with the highest complication rates in both groups.

**Conclusion:** Intraoperative culture and sensitivity testing of peritoneal irrigation fluid can help predict and potentially reduce postoperative complications in abdominal surgeries. The use of targeted antibiotics based on intraoperative culture reports significantly improves outcomes compared to empirical treatment alone.

**Keywords:** Peritoneal irrigation fluid, BACTEC, abdominal surgery, surgical site infection, intraoperative culture, postoperative complications, targeted antibiotics.

# **INTRODUCTION**

Postoperative complications, particularly surgical site infections (SSI), remain a significant cause of morbidity and extended hospital stay in patients undergoing abdominal surgeries. Despite advances in aseptic techniques and prophylactic antibiotic use, the incidence of SSIs continues to challenge surgical outcomes, especially in emergency procedures where contamination risk is higher.<sup>[1]</sup>

The peritoneal cavity, under normal physiological conditions, is a sterile environment. However, during

abdominal surgeries—especially in cases involving hollow viscus perforation, peritonitis, or bowel resection—there is a risk of microbial contamination. The endogenous gut flora, which consists predominantly of anaerobes and facultative anaerobes such as Escherichia coli, Klebsiella, Bacteroides, and Enterococcus species, may translocate into the peritoneal cavity, leading to sepsis and wound infections if not managed appropriately.<sup>[2]</sup>

Traditional empirical antibiotic therapy, though widely used, may not effectively cover the specific involved intra-abdominal pathogens in contamination, particularly in regions with high prevalence of resistant organisms like extendedspectrum beta-lactamase (ESBL)-producing Gramand negative bacilli methicillin-resistant Staphylococcus aureus (MRSA). In this context, intraoperative microbiological assessment of peritoneal irrigation fluid offers a promising strategy for early identification of potential pathogens, enabling targeted antibiotic therapy.<sup>[3]</sup>

BACTECTM culture systems (Becton Dickinson, USA) offer a reliable method for detecting microbial growth in peritoneal fluid. These systems utilize CO2 production as an indicator of microbial growth in peritoneal fluid. These systems utilize CO2 production as an indicator of bacterial metabolism and are capable of identifying organisms even in patients already on antibiotics, due to the resin-based medium that neutralizes antimicrobial agents. The subsequent use of automated systems such as VITEK® allows for precise identification and antibiotic susceptibility profiling.<sup>[4]</sup>

Several studies have attempted to establish the predictive value of intraoperative cultures in determining postoperative sepsis and wound complications.<sup>[5]</sup> However, the clinical utility of peritoneal irrigation fluid culture during surgery, particularly in resource-limited settings, remains underexplored.

# MATERIALS AND METHODS

This was a prospective observational study conducted in the Department of General Surgery at Konaseema Institute of Medical Sciences and Research Foundation (KIMS and RF), Amalapuram, Andhra Pradesh, India. The study was carried out over a twoyear period from December 2016 to October 2018.

**Study Population:** A total of 100 patients undergoing elective and emergency abdominal surgeries were included. These patients were divided into two equal groups (n=50 each):

- Case Group (n=50): Patients whose intraoperative peritoneal irrigation fluid was sent for microbial culture and antibiotic sensitivity using the BACTEC method.
- Control Group (n=50): Patients who underwent similar surgeries but without intraoperative peritoneal fluid culture.

The two groups were matched based on demographic and clinical parameters such as age, gender, diagnosis, and type of surgery (elective vs. emergency).

# **Inclusion Criteria**

All patients of age between 18 and 70 years of both genders undergoing laparotomy with acute appendicitis, intestinal obstruction, peritonitis, perforation peritonitis, intestinal resection and anastomosis, gangrenous bowel and acute cholecystitis

## **Exclusion** Criteria

Laparoscopic surgeries, Hernia, hydrocele, and nonabdominal surgeries (e.g., head and neck, thyroid), Patients with immunocompromised status (e.g., HIV, long-term steroids) Known malignancy with immunosuppressive treatment

In the case group, after achieving intra-abdominal exposure and hemostasis, the peritoneal cavity was irrigated with normal saline. A 10 ml sample of the peritoneal irrigation fluid was aspirated using sterile technique and sent immediately for microbiological culture using the BACTEC system.

The BACTEC culture bottles containing resin-based media were inoculated and incubated in the automated BACTEC FX machine. Positive cultures were further processed for organism identification and antibiotic sensitivity using the VITEK 2 automated identification system (bioMérieux, France).

The control group did not undergo intraoperative fluid culture, and postoperative antibiotic management was empirical based on standard hospital protocols.

**Postoperative Monitoring:** All patients were monitored for 30 days postoperatively for the development of complications as surgical site infection (SSI), wound dehiscence, sepsis, intraabdominal abscess, pneumonia and mortality. Complications were graded using the Southampton Wound Scoring System and ASEPSIS wound score. **Statistical Analysis:** Data were entered into Microsoft Excel and analyzed using SPSS version 22.0 (IBM Corp., Armonk, NY). Categorical variables were compared using the chi-square test. A p-value < 0.05 was considered statistically significant.

# RESULTS

A total of 100 patients were enrolled, with 50 patients in each group (case and control). The case group had 17 elective and 33 emergency surgeries, while the control group had 21 elective and 29 emergency surgeries. Age, gender, and distribution of surgical indications were comparable between the two groups. Microbial Profile in Case Group of the 50 patients in the case group, 40 (80%) showed positive microbial growth in intraoperative peritoneal fluid cultures.



20 18 16 s 14 12 0 10 10 Number 8 6 4 2 0 Clean Clean-Contaminated Dirty contaminated No. of Patients No. with Complications

Figure 1: Pie chart representing organism distribution in the case group



Table 1: Organisms isolated in the Case Group via BACTEC culture (n=50).				
Organism	Frequency	Percentage (%)		
Escherichia coli	23	46.0		
Klebsiella pneumoniae	4	8.0		
Pseudomonas aeruginosa	1	2.0		
Enterobacter cloacae	1	2.0		
Enterobacter aerogenes	1	2.0		
Staphylococcus lentus	1	2.0		
Pasteurella pneumotropica	1	2.0		
Acinetobacter baumannii	1	2.0		
Pseudomonas luteola	1	2.0		
Sphingomonas paucimobilis	1	2.0		
No growth (Sterile)	10	20.0		

Postoperative Complications: In case Group (n=50) total with complications are 6 cases (12%), Surgical site infection in 2 cases, Pneumonia, peritonitis, bile leak, pleural effusion four in each case.

Table 2: Complications in the case group by wound type.					
Wound Type	No. of Patients	No. with Complications	<b>Complication Rate (%)</b>		
Clean	0	0	0		
Clean- contaminated	18	1	5.5		
Contaminated	19	1	5.2		
Dirty	13	4	30.7		

In control Group (n=50) total with complications in 20 cases (40%) Surgical site infection in 13 cases, Death in 3 cases and Sepsis and respiratory complications in 4 cases.

Table 3: Complications in the Control Group by Wound Type					
Wound Type	No. of Patients	No. with Complications	<b>Complication Rate (%)</b>		
Clean	0	0	0		
Clean- contaminated	25	8	32.0		
Contaminated	13	5	38.4		
Dirty	12	5	41.6		









Table 4: Postoperative Complications by Antibiotic Strategy					
Antibiotic Approach	<b>Complications Present</b>	Complications Absent			
Culture- 6 44 50 guided (BACTEC- based)	6	44			
Empirical	18	32			

Patients receiving antibiotics based on culture reports had significantly fewer complications compared to those on empirical antibiotics.

# **DISCUSSION**

Postoperative complications, particularly surgical site infections (SSI), remain a formidable challenge in abdominal surgery. In this study, we observed that the culture and sensitivity analysis of intraoperative peritoneal irrigation fluid using the BACTEC system was an effective predictor of postoperative infectious complications. The culture-guided antibiotic approach significantly reduced the incidence of SSI and other morbidities compared to empirical antibiotic administration.<sup>[6]</sup>

In the case group, Escherichia coli was the most commonly isolated organism, consistent with the known endogenous colonic flora. The predominance of Gram-negative organisms (notably E. coli and K. pneumoniae) aligns with prior studies highlighting the role of Enterobacteriaceae in abdominal infections following perforation, peritonitis, and bowel surgery. The identification of rarer organisms such as Pasteurella pneumotropica, Pseudomonas luteola, and Sphingomonas paucimobilis further emphasizes the diversity and unpredictability of microbial contamination in open abdominal surgeries.<sup>[7,8]</sup>

A notable finding was that patients who received culture-guided antibiotics had a significantly lower rate of postoperative complications (12%) compared to those on empirical therapy (36%). This reinforces the utility of intraoperative microbiological assessment as a practical and cost- effective tool, particularly in high-risk procedures and emergency settings.

Claesson and Holmlund,<sup>[9]</sup> demonstrated that dipslide cultures of peritoneal irrigation fluid could predict up to 83.3% of postoperative infections, with a strong correlation between high colony- forming units (CFU) of Enterobacteriaceae and subsequent sepsis . Maite de Miguel-Palacio et al,<sup>[10]</sup> showed empirical antibiotic therapy appears to be of paramount importance, and patients will benefit from a wider empirical broad-spectrum antibiotic therapy securing coverage of ESBL and Enterococcus spp.

Our findings corroborate this result, as patients with positive cultures in our study were able to receive appropriately targeted antibiotics, thereby reducing complications. Similarly, Simchen et al,<sup>[11]</sup> emphasized host-related factors and wound contamination levels as primary determinants of postoperative SSI in colorectal surgeries. In our study, dirty wounds had the highest complication rates in both groups (30.7% in cases, 41.6% in controls), further validating this association.

The BACTEC system is advantageous in several respects. It uses a resin-based medium to neutralize any antibiotics present in the sample, allowing accurate culture even in pre-treated patients.<sup>[12]</sup> It also supports the identification of fastidious organisms and enhances early diagnosis by detecting CO2 produced by metabolizing bacteria. The use of VITEK 2 for identification and sensitivity profiling ensures precision in guiding postoperative antibiotic therapy.<sup>[13,14]</sup>

#### Strengths of the Study

- Prospective, comparative design with standardized surgical techniques.
- Use of a robust microbiological system (BACTEC + VITEK).
- Evaluation of both elective and emergency surgical scenarios.
- Focus on real-world clinical outcomes, including SSI, pneumonia, sepsis, and mortality.

#### Limitations

- Single-center design limits generalizability.
- Small sample size (n=100) may not capture the full microbial spectrum.
- Postoperative follow-up limited to 30 days; longterm complications like incisional hernias were not assessed.
- Antibiotic stewardship and resistance patterns were not longitudinally analyzed.

# **Future Directions**

- Larger, multicenter studies could validate and generalize these findings.
- Molecular diagnostics (e.g., PCR) may offer faster and broader pathogen detection.
- Cost-effectiveness analyses could support routine implementation in high- risk surgeries.
- Studies incorporating antibiotic resistance profiling and local antibiograms are warranted.

## **CONCLUSION**

The culture and sensitivity analysis of intraoperative peritoneal irrigation fluid using the BACTEC system provides valuable prognostic information in abdominal surgeries. The ability to identify specific microbial flora and guide postoperative antibiotic therapy significantly reduces the risk of surgical site infections and related complications. This approach is especially beneficial in emergency and contaminated surgeries, where empirical antibiotics may fail to offer adequate coverage.

Routine use of intraoperative peritoneal fluid cultures should be considered in high-risk cases to facilitate early, targeted interventions. This strategy can improve surgical outcomes, shorten hospital stays, and contribute to better antibiotic stewardship in clinical practice.

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