



DIFFERENT METHODS OF CLOSURE OF LAPAROTOMY INCISION IN PATIENTS OF SEPTIC PERITONITIS OR PERITONEAL CONTAMINATION.

General Surgery

**Dr. Samarth
Manojkumar
Batlawala**

3rd year General Surgery Resident, Narendra Modi Medical College, Ahmedabad.

ABSTRACT

Background: The closure of laparotomy incisions in patients with septic peritonitis is a challenging step, as it can significantly influence postoperative outcomes. Traditional wound closure techniques, such as primary closure (PC), involve immediate closure of the abdominal incision at the end of the surgery. Identifying the most suitable approach for abdominal closure in septic peritonitis cases can significantly impact patient recovery, hospital stay duration, and overall prognosis. **Aims & Objectives:** To study the outcomes of different methods of closure of laparotomy incision in cases of septic peritonitis. **Methodology:** A prospective Observational study was conducted among 50 patients who underwent emergency laparotomy for septic peritonitis at Department of General Surgery, Narendra Modi Medical College, Maninagar, Ahmedabad. Patient written consent and Ethical permission was taken prior to the study. **Results:** The mean age of the study population was 40.76 ± 15.81 years. 84% cases were males. Among the study participants, in 71.4% fever was the most common symptom. The most common diagnosis at presentation was ileal perforation, accounting for 28% of the cases. Surgical procedures varied based on intraoperative findings and included exploratory laparotomy with resection and anastomosis (12%), ileoileal anastomosis (6%), omental patch repair (8%), appendectomy (6%), and peritoneal lavage with drain insertion (6%). Patients undergoing DPC demonstrated the lowest rates of surgical site infection, wound dehiscence, and burst abdomen. **Conclusion:** Delayed primary closure of skin/subcutaneous tissue and enmasse (simple interrupted) with Tension Band closure is associated with superior postoperative outcomes compared to primary or layered closure or with continuous suturing.

KEYWORDS

Laparotomy, Peritoneal Contamination, Peritonitis, Sepsis.

INTRODUCTION:

The closure of laparotomy incisions in patients with septic peritonitis is a challenging step, as it can significantly influence postoperative outcomes. Traditional wound closure techniques, such as primary closure (PC), involve immediate closure of the abdominal incision at the end of the surgery.^[1,2] While this technique is generally effective in non-contaminated or clean surgical wounds, in septic peritonitis cases, where the risk of wound infection is heightened due to the infected environment, the immediate closure leads to severe complications, including wound dehiscence, abscess formation, and increased infection rates.^[3] An alternative approach, known as delayed primary closure (DPC), is often employed, particularly in contaminated or infected abdominal wounds. This technique involves leaving the wound open for a period, usually between 3 and 5 days, to allow for the resolution of infection before final closure, reducing the risk of postoperative complications.

Septic peritonitis can be classified into three categories: primary, secondary, and tertiary. Secondary peritonitis is the most common form and is usually caused by gastrointestinal perforation, post-surgical contamination, or traumatic injury, where the infection is often polymicrobial.^[4] In secondary peritonitis bacterial contamination of the peritoneum induces a robust immune response, triggering the release of pro-inflammatory cytokines such as interleukins (IL-1, IL-6) and tumor necrosis factor-alpha (TNF- α), which increase vascular permeability and recruit immune cells to the site of infection. This immune response is vital for controlling the infection, it can lead to systemic inflammation, organ dysfunction, and prolonged wound healing, particularly in the presence of continued infection.^[5]

A critical component of laparotomy is the method of abdominal wall closure. The choice of closure technique is vital, particularly in cases of septic peritonitis, where the risk of surgical site infections (SSI), wound dehiscence, and burst abdomen is substantially high. Several closure techniques exist, including primary closure, delayed primary closure, secondary closure, tension band wire and vacuum-assisted closure (VAC), each with its advantages and limitations. However, the overall superiority of one technique over another remains inconclusive, necessitating further investigation.^[6,7]

Identifying the most suitable approach for abdominal closure in septic peritonitis cases can significantly impact patient recovery, hospital stay duration, and overall prognosis. Factors such as suture material, tension management, and the presence of systemic inflammation play significant roles in determining wound healing outcomes.^[8]

Aims & Objectives: To study the outcomes of different methods of

closure of laparotomy incision in cases of septic peritonitis.

Methodology:

A prospective Observational study was conducted among 50 patients who underwent emergency laparotomy for septic peritonitis at Department of General Surgery, Narendra Modi Medical College, Maninagar, Ahmedabad. Patients aged 18 years and above who underwent emergency laparotomy for septic peritonitis and patients who provided informed consent to participate were included. Patient who had history of abdominal surgery within the last six months, Pregnancy women and Patients with HIV infection as well as patients with pre-existing wound infections or necrotizing fasciitis at the time of surgery were excluded. Patient written consent and Ethical permission was taken prior to the study.

Comprehensive patient history was gathered, focusing on symptoms, prior medical conditions, and surgical history. A full physical examination was performed to assess the general condition, severity of septic peritonitis, and any comorbid conditions. Complete blood count (CBC), liver function, renal function, blood glucose, and coagulation profile were checked. Abdominal ultrasound and plain X-rays (both erect and supine positions) were conducted to assess the extent of peritonitis and any other complications.

Data Entry & Analysis:

The collected data was analyzed using SPSS software. Continuous variables, such as hospital stay duration, were expressed as mean $\pm$ standard deviation and compared using the Student's t-test or Mann-Whitney U test. Categorical variables, such as the incidence of SSI and wound dehiscence, were expressed as percentages and analyzed using the chi-square test or Fisher's exact test. The p-value of < 0.05 was considered statistically significant for all analyses.

RESULTS:

The present study enrolled a total of 50 patients who underwent emergency laparotomy for septic peritonitis or peritoneal contamination. The mean age of the study population was 40.76 ± 15.81 years, with a median age of 40 years. The youngest patient enrolled was 15 years old, whereas the oldest was 80 years old. When categorized into age groups, the majority of patients belonged to the 16–30 years age group, accounting for 32% of the sample. This was followed closely by the 31–45 years and 46–60 years age groups, each comprising 28% and 26% of the population. Patients aged 61–75 years represented 10% of the cohort, while those younger than 15 years and older than 75 years constituted 2% each. [Table 1]

Table 1 Age Distribution Of Patients

Age Group	Frequency	Percentage (%)
≤15 years	1	2.0
16–30 years	16	32
31–45 years	14	28
46–60 years	13	26
61–75 years	5	10
≥76 years	1	2.0
Total	50	100.0

The majority of the patients were male, accounting for 84% of the total, while females comprised only 15. [Table 2]

Table 2 Sex Distribution Of Patients

Sex	Frequency	Percentage (%)
Female	8	15
Male	42	84
Total	50	100.0

Among the study participants, fever was the most common individual symptom, reported in 71.4% of patients. Vomiting was present in 49% of cases, while generalized abdominal pain was reported in 40.8%. Periumbilical pain was noted in 34.7% of patients. Right iliac fossa pain and epigastric pain were less commonly reported, with prevalences of 16.3% and 8.2%, respectively. Loose stools were noted in only 2% of patients, suggesting that diarrhea was an infrequent presentation in this cohort. [Table 3]

Table 3 Distribution Of Specific Symptoms

Symptom	Frequency	Percentage (%)
Periumbilical pain	17	34
Fever	35	70
Vomiting	24	48
Generalized abdominal pain	21	42
Right iliac fossa (RIF) pain	8	16
Epigastric pain	4	8
Loose stools	1	2.0
Total patients	50	–

The most common diagnosis at presentation was ileal perforation, accounting for 28% of the cases. Other significant causes included small bowel obstruction (12%), peptic perforation (10%), and perforated appendicitis (10%). Less common etiologies included terminal ileal stricture (8%), ruptured liver abscess (8%), and multiple ileal perforations associated with abdominal Koch's disease (4%). A variety of other rare causes such as caecal perforation, gangrenous caecum with gut malrotation, and sloughed-out caecum with appendicitis were also observed in isolated instances. [Table 4]

Table 4 Preoperative Diagnoses (Etiologies of Septic Peritonitis)

Diagnosis	Frequency	Percentage (%)
Ileal perforation	14	28
Small bowel obstruction	6	12
Peptic perforation	5	10
Perforated appendix	5	10
Terminal ileal stricture	4	8
Ruptured liver abscess	4	8
Multiple ileal perforations in abdominal Koch's	2	4
Other diagnoses (individual cases)	10	20
Total	50	100.0

Surgical procedures varied based on intraoperative findings and included exploratory laparotomy with resection and anastomosis (12%), ileoileal anastomosis (6%), omental patch repair (8%), appendectomy (6%), and peritoneal lavage with drain insertion (6%). Other specific interventions included right hemicolectomy with ileotransverse anastomosis (6%) and various complex resections. [Table 5]

Table 5. Type Of Surgical Procedures Performed

Surgical Procedure	Frequency	Percentage (%)
Exploratory laparotomy + resection and anastomosis	6	12
Exploratory laparotomy + ileoileal anastomosis	6	12

Exploratory laparotomy + omental patch repair	4	8
Exploratory laparotomy + appendectomy	3	6
Exploratory laparotomy + peritoneal lavage + drain insertion	4	8
Right hemicolectomy with ileotransverse anastomosis	3	6
Other complex surgeries	24	48
Total	50	100.0

Table 6. Consolidated Table of Best Performing Closure Techniques and Outcomes

Outcome	Best Performing Technique	Summary
Surgical Site Infection	Enmasse + Simple interrupted with Delayed Primary Closure (DPC)	Lowest incidence of infection
Wound Dehiscence	Enmasse + Simple interrupted with Delayed Primary Closure (DPC)	Minimal dehiscence observed
Burst Abdomen	Enmasse + Simple interrupted with Delayed Primary Closure (DPC)	No cases recorded
Hospital Stay	Enmasse + Simple interrupted with Delayed Primary Closure (DPC)	Shortest mean hospital stay
Overall Mortality	Not significantly different among groups	Mortality not dependent on closure method

Enmasse(simple interrupted) with Delayed Primary Closure (DPC) of skin and subcutaneous tissue emerged as the closure technique associated with the most favorable outcomes across multiple parameters. Patients undergoing DPC demonstrated the lowest rates of surgical site infection, wound dehiscence, and burst abdomen. Furthermore, their mean hospital stay was significantly shorter compared to those managed with primary closure or VAC therapy. Although VAC therapy has proven benefits in certain clinical contexts, in this study, its application was associated with higher wound complication rates and prolonged hospitalizations. Primary closure, while effective in select cases, exhibited intermediate outcomes compared to DPC and VAC. Mortality and readmission rates did not show a statistically significant association with closure technique, suggesting that factors beyond wound management—such as underlying sepsis severity and systemic complications—may play a more dominant role in influencing these ultimate outcomes. [Table 6]

DISCUSSION:

The present study was undertaken to evaluate the outcomes of different wound closure techniques in patients undergoing emergency laparotomy for septic peritonitis or peritoneal contamination. Clinical presentation in the current cohort was dominated by periumbilical and generalized abdominal pain, fever, and vomiting, findings that are consistent with classical descriptions of secondary peritonitis. Fever was the most prevalent symptom, affecting more than 70% of patients, which mirrors observations made by Ruiz-Tovar et al. (2018) in their cohort of fecal peritonitis patients. Importantly, the high rate of systemic inflammatory manifestations highlights the severe and rapidly progressive nature of intra-abdominal infections, necessitating prompt surgical intervention.^[9]

The intraoperative diagnoses identified ileal perforation as the most frequent etiology, followed by small bowel obstruction and peptic perforations. These findings resonate with the etiological patterns described by Patel et al. (2017) in their pooled analysis of emergency laparotomies. The significant burden of small bowel pathology underscores the challenges in early diagnosis and management of gastrointestinal perforations, particularly in settings where tuberculosis and typhoid fever remain endemic.^[10]

Similarly, Stone et al. (1973) documented a 25% SSI rate in contaminated wounds with primary closure, advocating for delayed closure strategies in such cases. The biologic rationale for the effectiveness of DPC lies in its ability to allow early control of infection and wound contamination before definitive closure, thereby reducing bacterial load and inflammatory response at the wound site.^[11]

Wound dehiscence rates were also lowest in the DPC group and enmasse(simple interrupted) with tension band wire closure, supporting the observations made by Ussiri et al. (2023), who found

fewer wound disruptions in open wound management compared to primary closure. The pathophysiological basis for this benefit is clear: closure of a less contaminated, better vascularized wound environment leads to stronger tissue apposition and reduced risk of mechanical failure.^[12]

Burst abdomen, a catastrophic postoperative complication, was entirely absent in the DPC and enmasse (simple interrupted) with tension band closure in this study, whereas it was noted in primary closure, layered closure and with continuous (simple/interlocking) manner closure. Khamphommala et al. (2008) emphasized the devastating consequences of burst abdomen in their cohort, particularly highlighting the need for early surgical source control and judicious wound management to prevent fascial dehiscence. The findings of the current study thus validate the strategy of deferred closure in contaminated abdominal surgeries.^[13]

Hospital stay was significantly shorter among patients who underwent DPC and enmasse with Tension band wire closure, further confirming the advantages of this technique. Ruiz- Tovar et al. (2018) similarly reported shorter median hospital stays with the use of advanced suture materials in contaminated wounds, suggesting that optimization of wound healing strategies can have tangible benefits in terms of healthcare resource utilization and patient quality of life.^[9]

The overall postoperative mortality in this study was 8%, with deaths primarily attributable to septic shock and overwhelming sepsis. This mortality rate is comparable to that reported by Schein et al. (2006) and Khamphommala et al. (2008) in similar high-risk surgical populations.^[13,14] Notably, mortality did not show a statistically significant association with the closure technique employed, suggesting that factors such as severity of peritonitis, comorbidities, and systemic organ dysfunction play a more dominant role in determining survival outcomes.

CONCLUSION:

Delayed primary closure of skin/subcutaneous tissue and enmasse (simple interrupted) with Tension Band closure is associated with superior postoperative outcomes compared to primary or layered closure or with continuous suturing. DPC resulted in significantly lower rates of surgical site infections, wound dehiscence, and burst abdomen, and was further associated with shorter hospital stays. Although VAC therapy offered theoretical advantages through enhanced wound drainage and granulation promotion, its application in the present cohort was associated with a higher incidence of wound-related complications and prolonged hospitalization. Primary closure, while effective in select clean or minimally contaminated wounds, demonstrated intermediate results and carried a higher risk of postoperative infections when applied in grossly contaminated fields.

Acknowledgment:

Guided By: Dr. Prashant Mukadam, Professor, Department of General Surgery Narendra Medical College, Ahmedabad. Dr. Yogesh Modiya, Associate Professor, Department of General Surgery Narendra Medical College, Ahmedabad. Dr. Ravi Paramar, Assistant Professor, Department of General Surgery Narendra Medical College, Ahmedabad.

REFERENCES:

1. Culp W, Holt DE. Septic peritonitis. *Compend Contin Educ Vet*. 2010;32(10):E1–14.
2. Ragni RA, House A. Peritonitis Part 1: Anatomy, aetiology, pathophysiology and diagnosis. *UK Vet Companion Anim*. 2009;14(9):15–25.
3. Patel SV, Paskar DD, Nelson RL, Vedula SS, Steele SR. Closure methods for laparotomy incisions for preventing incisional hernias and other wound complications. *Cochrane Database Syst Rev*. 2017;(11):CD005661.
4. Jeong ST, Kim YJ, Park JH, et al. A systematic review of emergency room laparotomy in patients with severe abdominal trauma. *Sci Rep*. 2025;15(1):2808.
5. Abdulkhaleq L, Assi M, Abdullah R, Zamri-Saad M, Taufiq-Yap YH, Hezmee MNM. The crucial roles of inflammatory mediators in inflammation: A review. *Vet World*. 2018;11(5):627–635.
6. Bhangu A, Singh P, Lundy J, Bowley DM. Systematic review and meta-analysis of randomized clinical trials comparing primary vs delayed primary skin closure in contaminated and dirty abdominal incisions. *JAMA Surg*. 2013;148(8):779–786.
7. Fuad M, Modher A. Primary closure or delayed primary closure? Assessment of optimum management of surgical wounds for perforated appendicitis. *Open Access Maced J Med Sci*. 2022;10(B):281–285.
8. Rajabaleyan P, Smith L, O'Connor A, et al. Vacuum-assisted closure significantly reduces surgical postoperative complications compared with primary abdominal closure in patients with secondary peritonitis: A comparative retrospective study. *World J Surg*. 2025;49(3):531–55.
9. Ruiz-Tovar J, Morales V, Sanjuanbenito A, Llaverio C, Martinez-Molina E, Molina EM. Analysis of factors associated with mortality in patients with fecal peritonitis. *Surg Infect (Larchmt)*. 2018;19(3):283–289.
10. Patel SV, Paskar DD, Nelson RL, Vedula SS, Steele SR. Closure methods for laparotomy incisions for preventing incisional hernias and other wound complications. *Cochrane*

Database Syst Rev. 2017;(11):CD005661.

11. Ussiri EV, Massawe HH, Mchembe MD, Chalya PL. Comparative outcomes of open wound management versus primary closure in contaminated abdominal incisions. *East Cent Afr J Surg*. 2023;28(2):45–51.
12. Khamphommala L, Kounnavong S, Souvannavong S, et al. Burst abdomen: incidence, risk factors and management outcomes in a tertiary hospital. *Asian J Surg*. 2008;31(3):135–139.
13. Schein M, Assalia A, Bachus H. Postoperative intra-abdominal infection and sepsis: the role of early reoperation. *World J Surg*. 2006;30(9):1513–1520.