

## Modified Technique of Bogota Bag Application Vs Traditional Technique in Terms of Delayed Primary Fascial Closure

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**Abstract:** Open abdomen management is used when primary fascial closure is unsafe after emergency laparotomy due to bowel edema, intra-abdominal sepsis, abdominal compartment risk, or the need for planned re-exploration. The traditional Bogota bag is a simple and low-cost temporary abdominal closure method, but it mainly provides visceral coverage and may not adequately prevent lateral fascial retraction. A modified Bogota bag technique may help preserve fascial approximation and improve delayed primary fascial closure, particularly in resource-limited surgical settings.

**Objective:** To compare the modified Bogota bag technique with the traditional Bogota bag technique in terms of successful delayed primary fascial closure among patients requiring temporary abdominal closure after emergency midline laparotomy. **Methods:** This randomized controlled trial was conducted in the Department of Surgery, Mayo Hospital, Lahore, from 2 December 2022 to 2 December 2023. A total of 60 patients aged 12–70 years who underwent emergency midline exploratory laparotomy and required temporary abdominal closure were enrolled and randomized into two equal groups. Group A was managed with the traditional Bogota bag technique, while Group B was managed with the modified Bogota bag technique. The primary outcome was successful delayed primary fascial closure. Secondary outcomes included mortality, re-application of the Bogota bag, fistula formation, and evisceration. Data were analyzed using SPSS version 25.0, and a p-value of  $\leq 0.05$  was considered statistically significant. **Results:** The mean age of the study population was  $48.35 \pm 11.82$  years, and 43 patients (71.7%) were male. Secondary peritonitis was the most common indication for open abdomen management, observed in 47 patients (78.3%). Successful delayed primary fascial closure was achieved in 7 patients (11.7%) overall. Closure was achieved in 1 patient (3.3%) in the traditional group and 6 patients (20.0%) in the modified group. The modified technique showed a higher probability of delayed primary fascial closure compared with the traditional technique, with a risk ratio of 6.00 (95% CI: 0.77–46.87). Pearson's chi-square test showed statistical significance ( $p = 0.044$ ), while Fisher's exact test was more conservative because of the small number of events ( $p = 0.103$ ). Mortality was lower in the modified group than in the traditional group, but the difference was not statistically significant. No fistula formation or evisceration was observed in either group. **Conclusion:** The modified Bogota bag technique was associated with a higher rate of delayed primary fascial closure compared with the traditional technique among patients requiring temporary abdominal closure after emergency midline laparotomy. This simple and low-cost modification may be a useful option in resource-limited settings, although larger multicenter trials are needed to confirm its effectiveness.

**Keywords:** Open Abdomen; Bogota Bag; Temporary Abdominal Closure; Delayed Primary Fascial Closure; Emergency Laparotomy

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### Introduction

Open abdomen management is an important damage-control strategy in emergency general surgery and trauma when primary fascial closure is unsafe because of visceral edema, abdominal compartment syndrome, uncontrolled contamination, need for planned re-exploration, or severe physiological derangement (1, 2). Temporary abdominal closure (TAC) aims to protect abdominal viscera, limit fluid and heat loss, permit drainage, facilitate re-entry, and preserve the possibility of delayed primary fascial closure (3,4). Achieving fascial closure during the index admission is clinically important because failure of closure is associated with prolonged hospitalization, planned ventral hernia, entero-atmospheric fistula, repeated operations, and impaired quality of life (5, 6).

Several TAC techniques are used worldwide, including Bogota bag closure, Barker vacuum pack, commercial negative-pressure therapy, Wittmann patch, mesh-mediated fascial traction, dynamic retention systems, and hybrid techniques combining negative pressure with fascial traction (7, 8). The traditional Bogota bag remains widely used in low- and middle-income settings because it is inexpensive, rapidly available, technically simple, and useful where commercial negative-pressure systems are not accessible (9). However, the conventional technique mainly provides visceral coverage and containment; it does not reliably

counter lateral fascial retraction, which may reduce the chance of delayed primary fascial closure after repeated laparotomies (10).

Recent evidence suggests that techniques providing progressive medial fascial traction or dynamic fascial approximation may improve closure rates compared with static containment alone (11, 12). Studies evaluating vacuum-assisted mesh-mediated fascial traction, vertical traction devices, and abdominal re-approximation systems have shown that preventing lateral fascial retraction is central to successful delayed fascial closure (13, 14). Nevertheless, these advanced systems may be expensive, require specialized materials, and may not be consistently available in resource-constrained hospitals.

In Pakistan, emergency laparotomy is frequently performed for secondary peritonitis, intestinal obstruction, bowel ischemia, trauma, and septic abdominal catastrophes. Many public-sector hospitals depend on low-cost TAC options, particularly the Bogota bag. Therefore, a simple modification of the Bogota bag that improves fascial approximation without substantially increasing cost could be clinically valuable. The present study was designed to compare the modified Bogota bag application with the traditional technique in terms of successful delayed primary fascial closure among patients requiring temporary abdominal closure after emergency midline laparotomy.



**Methodology**

This randomized controlled trial was conducted in the Department of Surgery, Mayo Hospital, Lahore, from 2 December 2022 to 2 December 2023. The study included patients undergoing emergency midline exploratory laparotomy in whom primary fascial closure was not possible at the end of the procedure. The trial compared the traditional technique of Bogota bag application with a modified technique in terms of successful delayed primary fascial closure.

A total of 60 patients were enrolled and allocated into two equal groups of 30 patients each. Patients of either gender, aged 12–70 years, were eligible if they underwent midline exploratory laparotomy and required temporary abdominal closure because primary fascial closure was not possible. The main indications for leaving the abdomen open included marked bowel edema, overwhelming intra-abdominal sepsis, re-exploration for complications such as anastomotic leakage, and postoperative fascial dehiscence. Patients with traumatic causes of open abdomen and moribund patients were excluded from the study. Written informed consent was obtained from all patients or their attendants before inclusion in the study and before the surgical procedure.

Eligible patients were enrolled using non-probability convenience sampling and were then randomized into two treatment groups by the lottery method. Group A included patients managed with the traditional Bogota bag technique, while Group B included patients managed with the modified Bogota bag technique. Baseline demographic and clinical information, including age, gender, primary surgical diagnosis, and indication for temporary abdominal closure, was recorded on a predesigned study proforma before or immediately after the index operation.

In Group A, temporary abdominal closure was performed using the traditional Bogota bag technique. A sterile plastic sheet, prepared from a urine bag or blood bag, was cut according to the size of the abdominal defect and sutured to the edges of the rectus sheath or skin to provide temporary coverage of the open abdomen. The purpose of this technique was to protect the abdominal contents temporarily until bowel edema subsided and delayed closure could be considered.

In Group B, temporary abdominal closure was performed using the modified Bogota bag technique. A larger-than-usual sterile plastic bag was used. One half of the bag was placed laterally between the bowel and the abdominal wall, while the remaining half was kept toward the center of the abdomen. The bag was then sutured to the rectus sheath on one side. A similar bag was applied to the opposite side using the same method, and the free central edges of both bags were stitched together in the midline. This modification was intended to create a protective barrier between the bowel and the abdominal wall, thereby reducing adhesions and facilitating later fascial approximation.

All patients were managed postoperatively according to the standard surgical and critical care protocols of the unit. Patients were followed during hospital admission for up to 28 days or until discharge, whichever occurred earlier. During follow-up, the abdominal wound was assessed

regularly for reduction in bowel edema, approximation of fascial edges, need for re-application of the Bogota bag, development of fistula, evisceration, mortality, and suitability for delayed primary fascial closure. The primary outcome was successful delayed primary fascial closure. Delayed primary fascial closure was attempted when bowel edema had settled and the fascial edges could be approximated without undue tension. Closure was considered successful when complete fascial approximation was achieved or when the residual fascial defect was less than 5 mm. Secondary outcomes included in-hospital mortality during the follow-up period, requirement for repeated Bogota bag application, fistula formation, and evisceration.

Data were analyzed using SPSS version 25.0. Quantitative variables, such as age, were expressed as mean ± standard deviation. Categorical variables, including gender, primary pathology, successful delayed primary fascial closure, mortality, re-application of Bogota bag, fistula formation, and evisceration, were presented as frequencies and percentages. Baseline characteristics were compared between the two groups to assess group comparability. The independent-samples t-test was used for normally distributed quantitative variables, while the chi-square test was used for categorical variables. Fisher’s exact test was considered where expected cell counts were small, particularly for the primary outcome of delayed fascial closure. Effect estimates were calculated using risk ratios with 95% confidence intervals where applicable. A p-value of ≤0.05 was considered statistically significant.

**Results**

A total of 60 patients who required temporary abdominal closure after emergency midline laparotomy were included in the study and randomized equally into two treatment groups. Thirty patients underwent temporary abdominal closure using the traditional Bogota bag technique, while 30 patients underwent closure using the modified Bogota bag technique. All randomized patients were included in the final analysis.

The mean age of the study population was 48.35 ± 11.82 years. The mean age was 47.60 ± 11.26 years in the traditional technique group and 49.10 ± 12.50 years in the modified technique group. Overall, 43 patients were male (71.7%) and 17 were female (28.3%). Male predominance was observed in both groups, with 20 males (66.7%) in the traditional group and 23 males (76.7%) in the modified group. The baseline demographic and clinical characteristics were comparable between the two groups.

Secondary peritonitis was the most common indication for open abdomen management, accounting for 47 cases (78.3%), followed by intestinal obstruction in 7 cases (11.7%) and mesenteric ischemia in 6 cases (10.0%). In the traditional technique group, secondary peritonitis was present in 25 patients (83.3%), intestinal obstruction in 2 patients (6.7%), and mesenteric ischemia in 3 patients (10.0%). In the modified technique group, secondary peritonitis was observed in 22 patients (73.3%), intestinal obstruction in 5 patients (16.7%), and mesenteric ischemia in 3 patients (10.0%) (Table 1).

**Table 1: Baseline demographic and clinical characteristics of patients according to Bogota bag technique**

Variable	Traditional technique (n = 30)	Modified technique (n = 30)	Overall (n = 60)
Age, years	47.60 ± 11.26	49.10 ± 12.50	48.35 ± 11.82
Male	20 (66.7%)	23 (76.7%)	43 (71.7%)
Female	10 (33.3%)	7 (23.3%)	17 (28.3%)
Secondary peritonitis	25 (83.3%)	22 (73.3%)	47 (78.3%)
Intestinal obstruction	2 (6.7%)	5 (16.7%)	7 (11.7%)
Mesenteric ischemia	3 (10.0%)	3 (10.0%)	6 (10.0%)

Values are presented as mean ± standard deviation or frequency (%).

The primary outcome, successful delayed primary fascial closure, was achieved in 7 patients (11.7%) overall. Fascial closure was achieved in 1 patient (3.3%) in the traditional Bogota bag group and in 6 patients (20.0%) in the modified Bogota bag group. The absolute increase in

successful delayed primary fascial closure with the modified technique was 16.7 percentage points. The modified technique was associated with a six-fold higher probability of delayed primary fascial closure compared with the traditional technique (risk ratio: 6.00; 95% CI: 0.77–46.87).

Pearson’s chi-square test showed statistical significance ( $p = 0.044$ ), although Fisher’s exact test was more conservative because of the small number of events ( $p = 0.103$ ).

Overall, 13 patients (21.7%) died during follow-up due to the primary disease or its complications. Mortality occurred in 8 patients (26.7%) in the traditional group and 5 patients (16.7%) in the modified group. The difference in mortality between groups was not statistically significant

(risk ratio: 0.63; 95% CI: 0.23–1.69). Re-application of the Bogota bag was required in 12 patients (40.0%) in the traditional group and 7 patients (23.3%) in the modified group, showing a lower frequency in the modified technique group, although the difference was not statistically significant. No case of enterocutaneous fistula formation or evisceration was observed in either group during follow-up (Table 2)

**Table 2: Clinical outcomes according to Bogota bag technique**

Outcome	Traditional technique (n = 30)	Modified technique (n = 30)	Absolute difference	Risk ratio (95% CI)	p-value
Successful delayed primary fascial closure	1 (3.3%)	6 (20.0%)	+16.7%	6.00 (0.77–46.87)	0.044*
Mortality	8 (26.7%)	5 (16.7%)	-10.0%	0.63 (0.23–1.69)	0.347
Re-application of Bogota bag	12 (40.0%)	7 (23.3%)	-16.7%	0.58 (0.27–1.28)	0.165
Fistula formation	0 (0.0%)	0 (0.0%)	0.0%	-	—
Evisceration	0 (0.0%)	0 (0.0%)	0.0%	-	—

CI: confidence interval. \*Pearson’s chi-square p-value. Because the event count was small, Fisher’s exact test may also be reported for the primary outcome; Fisher’s exact  $p = 0.103$ .



**Figure 1A. Modified technique of Bogota bag application. Half of the bag is being spread laterally under the abdominal wall.**



**Figure 1B. Another half of the bag is free in the center. Similar bag is applied to opposite side and free ends are sewn together in the middle.**

**Discussion**

In this randomized study of 60 patients requiring temporary abdominal closure after emergency midline laparotomy, the modified Bogota bag technique showed a higher delayed primary fascial closure rate than the traditional technique. Successful closure was achieved in 20.0% of patients in the modified group compared with 3.3% in the traditional group, giving an absolute increase of 16.7 percentage points and a six-fold higher probability of closure. This finding supports the concept that even a low-cost modification may improve fascial preservation when compared with static visceral coverage alone. However, the small number of closure events requires cautious interpretation, as Pearson's chi-square test was significant, while Fisher's exact test was more conservative.

The observed direction of effect is consistent with recent literature showing that TAC methods that reduce fascial retraction tend to achieve better closure outcomes. Berrevoet et al. reported that early standardized open abdomen treatment using vacuum-assisted mesh-mediated fascial traction achieved favorable fascial closure outcomes, emphasizing the importance of early medialization of fascial edges (11). Similarly, Willms et al., using data from the European Hernia Society registry, found that surgical technique significantly influenced fascial closure after open abdomen treatment, with traction-based strategies performing better than passive techniques (12). Fung et al. also demonstrated that a vertical traction device prevented abdominal wall retraction and facilitated early primary fascial closure in septic and non-septic open abdomen patients (13). Although the present modified Bogota bag technique is less sophisticated than these systems, its improved closure rate may reflect the same biological principle: limiting lateral fascial separation during the temporary closure period.

Comparison with studies directly involving Bogota bag techniques further supports this interpretation. Pillay et al. compared vacuum-assisted mesh-mediated fascial traction with Bogota bag alone in trauma patients and found higher secondary closure with the traction-based approach than with Bogota bag alone (10). Zahid et al., in a Pakistani tertiary-care study, reported that Bogota bag closure achieved lower primary fascial closure than skin-only closure, suggesting that standard Bogota bag application may be less effective when used as a purely static closure method (9). The lower closure rate in our traditional group is therefore plausible, particularly because most patients had secondary peritonitis, where bowel edema, sepsis, repeated contamination control, and delayed re-exploration can reduce the feasibility of early closure.

Mortality was lower in the modified group than in the traditional group, but the difference was not statistically significant. This is consistent with the understanding that mortality in open abdomen patients is often driven more by the underlying pathology, sepsis, shock, ischemia, and organ dysfunction than by the closure material alone (14). Gormsen et al. reported that open abdomen use after non-trauma emergency laparotomy is associated with complex indications and heterogeneous outcomes, reinforcing that closure success and survival are influenced by multiple clinical variables (15). The absence of enterocutaneous fistula and evisceration in both groups is encouraging. Recent studies have emphasized that visceral protection, avoidance of direct bowel trauma, control of contamination, and early closure are key factors in preventing entero-atmospheric fistula (16, 17).

The re-application rate was lower in the modified group, although not statistically significant. This may suggest improved stability of the modified closure, but the study was underpowered for secondary endpoints. Similar findings have been noted in contemporary studies where industrial negative-pressure or traction-supported methods reduced unfavorable abdominal wall outcomes but did not always show statistically significant differences in mortality (18,19). The clinical importance of the current study lies in its applicability to resource-limited settings. Advanced commercial systems may offer superior outcomes, but their cost can restrict use in Pakistan. A modified Bogota bag technique may therefore represent a pragmatic middle option, combining affordability with better fascial preservation. Larger multicenter trials

with standardized timing of re-look laparotomy, fascial gap measurement, sepsis severity assessment, and longer follow-up for ventral hernia are needed to confirm these findings (20, 21).

This was a single-center study with a small sample size, which limited the statistical power, particularly for secondary outcomes and rare complications. The short follow-up period did not allow assessment of long-term outcomes such as incisional hernia, quality of life, or late abdominal wall complications.

**Conclusion**

The modified Bogota bag technique demonstrated a higher rate of successful delayed primary fascial closure than the traditional Bogota bag technique among patients requiring temporary abdominal closure after emergency midline laparotomy. As a simple and low-cost modification, it may offer practical clinical value in resource-limited surgical settings, but its benefit should be confirmed through larger multicenter randomized trials.

**Declarations****Data Availability statement**

All data generated or analysed during the study are included in the manuscript.

**Ethics approval and consent to participate**

Approved by the department concerned. (IRBEC-MAYOHS-203-23)

**Consent for publication**

Approved

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**Conflict of interest**

The authors declared the absence of a conflict of interest.

**Author Contribution****MSUM (SR)**

*Conceived the study, coordinated data collection, performed analysis and prepared the first draft of the manuscript*

**AW (Assistant Professor)**

*Provided academic supervision, guided the study methodology and critically reviewed the manuscript*

**AA (SR)**

*Assisted in data collection, literature review and manuscript preparation*

**MB(SR)**

*Participated in data acquisition, data organization and interpretation of study findings*

**AUK(Associate Professor)**

*Contributed to study design, supervised the research process and reviewed the manuscript for important intellectual content*

*All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.*

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