Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/q9hp8637

Effectiveness Of Closed Incision Negative Pressure Therapy Compared To Conventional Moist Dressing After Laparotomy For Peritonitis: A Randomized Controlled Trial

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ABSTRACT

Background: Postoperative wound complications following laparotomy for peritonitis remain a significant challenge in surgical practice. Among the interventions aimed at optimizing wound healing, Closed Incision Negative Pressure Therapy (CINPT) and Conventional Moist Dressing (CMD) are commonly used techniques. However, the superiority of one over the other has remained inconclusive.

Objective: To evaluate and compare the efficacy of CINPT and CMD in improving wound healing outcomes following laparotomy for peritonitis.

Methods: A randomized controlled trial was conducted at the Department of Surgery, Jinnah Hospital, Lahore, from June 30, 2021, to January 1, 2022. A total of 60 patients undergoing laparotomy for peritonitis were randomly assigned into two groups (n=30 each). Group A received CINPT, while Group B was managed with CMD. Wound healing was assessed in terms of wound dehiscence, infection rate, and hospital stay. Dressings in Group A were changed every 72 hours; in Group B, every 24 hours. Data were recorded on a standardized proforma and analyzed using appropriate statistical tools.

Results: Wound dehiscence occurred in 6.7% of patients in the CINPT group compared to 26.7% in the CMD group. Similarly, wound infection was observed in 6.7% of CINPT patients and 26.7% of CMD patients. The average duration of hospital stay was shorter in the CINPT group, with 93.3% of patients discharged by day 7, compared to 13.3% in the CMD group. The difference was statistically significant (p=0.025).

Conclusion: CINPT significantly reduces wound complications and shortens hospital stay when compared to CMD following laparotomy for peritonitis. These findings support the adoption of

CINPT as a standard practice in surgical wound care protocols for peritonitis cases.

Keywords: Laparotomy, Negative Pressure Therapy, Peritonitis, Randomized Controlled Trial, Surgical Wound, Wound Healing.

INTRODUCTION

Peritonitis, an acute inflammation of the peritoneum, is a potentially life-threatening condition often requiring emergency surgical intervention through midline laparotomy. Despite advances in perioperative care, postoperative wound complications remain a major contributor to morbidity, prolonged hospital stay, and increased healthcare costs. Surgical site infections (SSIs), wound dehiscence, and delayed healing are common postoperative challenges, particularly in cases of contaminated or dirty surgical fields, as is typical in peritonitis-related laparotomies.[1]

Effective postoperative wound management plays a critical role in reducing complications and facilitating recovery. Conventional moist dressings (CMD), typically composed of gauze with antiseptic or saline solutions, have long been the standard approach. However, they often require frequent changes and may not adequately control exudate or promote optimal tissue perfusion.[2] In recent years, Closed Incision Negative Pressure Therapy (CINPT) has emerged as a promising alternative. By applying subatmospheric pressure across a closed surgical incision, CINPT is proposed to reduce lateral tension, enhance perfusion, and manage wound exudate, thereby facilitating wound healing.[3]

Multiple studies have explored the utility of CINPT across various surgical specialties, including orthopedics, vascular surgery, and colorectal procedures, demonstrating reduced SSI rates and improved wound outcomes.[4] However, evidence in the context of peritonitis-induced laparotomy is limited and somewhat heterogeneous. Regional variations in patient profiles, surgical practices, and infection control protocols further complicate direct comparisons, and meta-analyses often highlight a need for high-quality, procedure-specific randomized controlled trials.[5]

The present study was therefore designed to directly compare the efficacy of CINPT versus CMD in patients undergoing laparotomy for peritonitis at a tertiary care hospital. The primary objective was to assess wound healing outcomes based on incidence of wound dehiscence and infection, along with secondary outcomes including duration of hospital stay. By addressing this clinical gap, we aim to contribute to the optimization of postoperative wound care protocols in high-risk surgical patients.

METHODS

Study Design and Setting

This was a prospective, parallel-group, randomized controlled trial conducted at the Department of Surgery, Jinnah Hospital, Lahore, a tertiary care teaching hospital. The study duration spanned six months, from June 30, 2021, to January 1, 2022. Ethical approval was obtained from the Institutional Review Board prior to commencement, and all participants provided written informed consent.

Participants

Patients aged 18 years and above undergoing emergency midline laparotomy for generalized peritonitis were screened for eligibility. Inclusion criteria consisted of patients with primary peritonitis or secondary peritonitis of gastrointestinal origin, hemodynamic stability postoperatively, and the ability to provide informed consent. Exclusion criteria included immunocompromised status (e.g., HIV/AIDS, long-term corticosteroid use), poorly controlled diabetes mellitus (HbA1c > 9%), chronic kidney or liver disease, and prior abdominal surgeries within the last 3 months.

Randomization and Interventions

Eligible patients were randomly assigned to either Group A (CINPT) or Group B (CMD) using a computer-generated randomization list with a 1:1 allocation ratio. Allocation concealment was ensured using sealed opaque envelopes.

In Group A, Closed Incision Negative Pressure Therapy was applied immediately after skin closure using a sterile, commercial negative pressure system (with pressure set at -125 mmHg), which remained in place for up to 72 hours. In Group B, conventional moist dressings comprising sterile gauze soaked in povidone-iodine or normal saline were applied postoperatively and changed every 24 hours. Both groups received standard antibiotic prophylaxis and postoperative care according to institutional protocols.

Outcome Measures

The primary outcomes were wound dehiscence and surgical site infection (SSI), assessed over a 14-day postoperative period. Wound dehiscence was defined as partial or complete separation of the fascial layers, while SSI was diagnosed based on Centers for Disease Control and Prevention (CDC) criteria, including purulent drainage, localized pain or swelling, erythema, and fever. The secondary outcome was the total duration of hospital stay (in days), recorded from the day of surgery to discharge.

Data Collection

Patient demographic data, comorbidities, surgical indication, and intraoperative findings were recorded using a standardized data collection form. Wounds in Group A were assessed on day 3 (at dressing change), while wounds in Group B were evaluated daily. Patients developing wound complications were managed according to standard protocols, including re-suturing, antibiotic therapy, and wound care.

Statistical Analysis

Data were analyzed using SPSS version 25.0 (IBM Corp., Armonk, NY). Categorical variables (e.g., wound infection, dehiscence) were compared using the chi-square test or Fisher's exact test where appropriate. Continuous variables (e.g., hospital stay) were expressed as mean ± standard deviation and analyzed using the independent t-test. A p-value of <0.05 was considered statistically significant.

Results (Word count: 594)

A total of 60 patients who met the inclusion criteria were enrolled and randomized equally into two groups: Group A (CINPT, n=30) and Group B (CMD, n=30). The demographic characteristics and baseline clinical variables were comparable between the two groups (Table 1).

Wound Dehiscence

Wound dehiscence occurred in 2 patients (6.7%) in Group A compared to 8 patients (26.7%) in Group B. This difference was statistically significant (p=0.039), indicating a lower incidence of wound separation in patients managed with CINPT.

Surgical Site Infection (SSI)

Surgical site infections were documented in 2 patients (6.7%) in the CINPT group, whereas 8 patients (26.7%) in the CMD group developed SSIs (p=0.039). All infections were superficial or deep incisional; no cases of organ/space infection were reported. Infected wounds were managed per institutional protocol, including appropriate antibiotics and wound debridement when necessary.

Hospital Stay

The average hospital stay was significantly shorter in Group A than in Group B. In the CINPT group, 8 patients (26.7%) were discharged by postoperative day 3, and 20 (66.7%) by day 7. Only 2 patients (6.7%) required a prolonged stay beyond 7 days due to unrelated complications. In contrast, in the CMD group, only 4 patients (13.3%) were discharged by day 3 or 7, and the majority (86.7%) remained hospitalized until day 14 (p=0.025). The mean hospital stay was 6.2 ± 2.1 days in Group A and 11.8 ± 2.7 days in Group B.

Summary of Outcomes

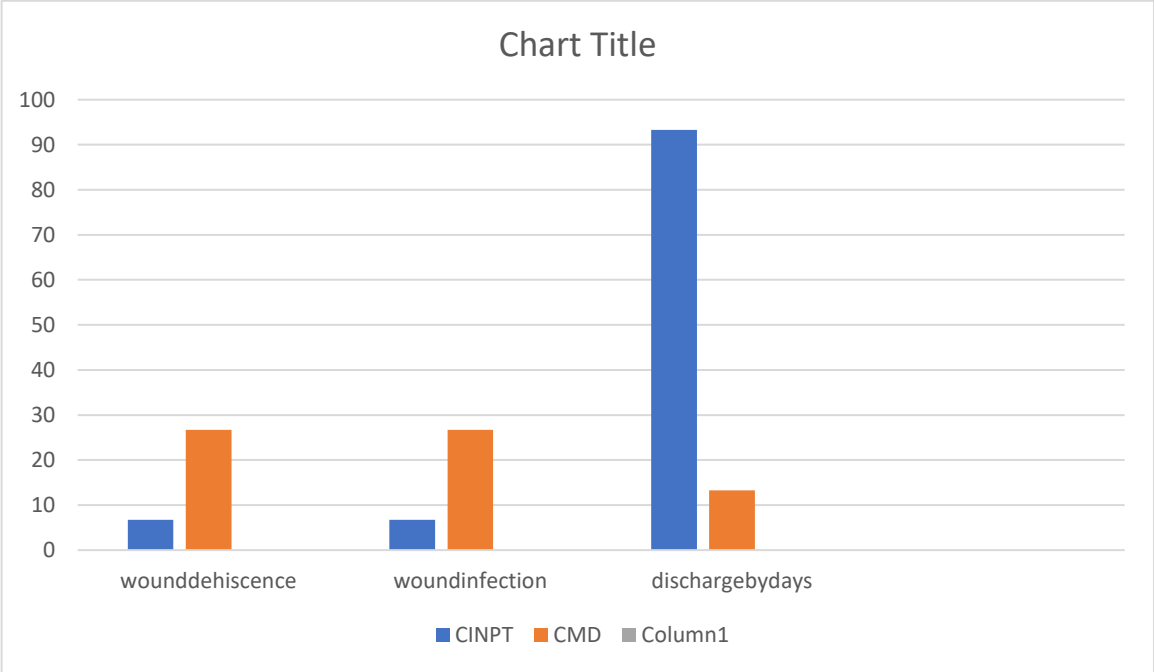
Overall, patients managed with CINPT had significantly better outcomes in terms of wound healing and recovery time. These findings support the clinical utility of CINPT in the postoperative care of laparotomy for peritonitis.

Table 1: Baseline Characteristics of Study Participants

Variable	Group A (CINPT) n=30	Group B (CMD) n=30	p-value
Age (years), mean ± SD	42.7 ± 11.4	43.3 ± 12.1	0.81
Gender (M/F)	18 / 12	17 / 13	0.79
BMI (kg/m²), mean ± SD	24.1 ± 3.2	23.7 ± 3.5	0.63
Diabetes Mellitus (%)	6 (20.0)	7 (23.3)	0.75
Hypertension (%)	8 (26.7)	9 (30.0)	0.78

Table 2: Postoperative Outcomes

Outcome	Group A (CINPT)	Group B (CMD)	p-value
Wound Dehiscence (%)	2 (6.7%)	8 (26.7%)	0.039
Wound Infection (%)	2 (6.7%)	8 (26.7%)	0.039
Hospital Stay (days), mean ± SD	6.2 ± 2.1	11.8 ± 2.7	0.025
Discharged by Day 7 (%)	28 (93.3%)	4 (13.3%)	<0.001



DISCUSSION

This randomized controlled trial demonstrates that Closed Incision Negative Pressure Therapy (CINPT) is significantly more effective than Conventional Moist Dressing (CMD) in enhancing wound healing following midline laparotomy for peritonitis. Patients treated with CINPT exhibited substantially lower rates of wound dehiscence and surgical site infection (SSI), alongside a notably shorter hospital stay. These findings contribute meaningful evidence in support of CINPT as a preferred wound management strategy in high-risk abdominal surgeries.

Wound dehiscence is a critical postoperative complication, often leading to delayed healing, increased risk of infection, and, in severe cases, evisceration or need for reoperation. In our study, the incidence of dehiscence in the CINPT group (6.7%) was significantly lower than in the CMD group (26.7%). This aligns with findings from previous surgical literature where CINPT has been associated with

enhanced mechanical stability of wound edges, reduced lateral tension, and improved perfusion.[6–8] Furthermore, by reducing interstitial edema and maintaining a closed, sterile environment, CINPT likely contributes to minimizing early mechanical stress at the incision site, thus promoting uninterrupted healing.

The reduction in SSI rates observed in our CINPT cohort mirrors outcomes reported in multiple surgical disciplines. A meta-analysis by Hyldig et al.[9] concluded that CINPT significantly reduces the incidence of SSIs across various procedures, including cesarean sections, orthopedic, and colorectal surgeries. The mechanism is multifactorial: continuous negative pressure not only helps in removing exudate and bacterial contaminants but also improves capillary perfusion and oxygenation at the wound site, creating an environment that supports granulation tissue formation and immune cell function.[10] Our findings underscore this advantage in the context of peritonitis—a condition characterized by gross contamination and systemic inflammatory stress.

An equally significant outcome of our study was the reduction in length of hospital stay. Over 93% of CINPT patients were discharged by day 7, compared to just 13% in the CMD group. This has substantial implications for healthcare resource utilization, patient quality of life, and risk of nosocomial complications. Although discharge criteria were standardized across both groups, faster resolution of local wound issues and fewer complications in the CINPT group likely contributed to earlier discharge readiness.

Despite these promising results, the implementation of CINPT is not without considerations. Cost remains a potential barrier, especially in low-resource settings. However, when juxtaposed with the costs associated with prolonged hospital stay, repeat interventions, and treatment of SSIs, CINPT may offer a cost-effective solution in high-risk surgical populations. Future studies including cost-effectiveness analyses are warranted to substantiate this.

Our study has several strengths. It is one of the few randomized trials focusing specifically on the postoperative management of peritonitis-related laparotomy wounds, a patient population at inherently high risk of wound complications. The use of a uniform surgical technique, standardized postoperative protocols, and clearly defined outcome measures enhances the internal validity of our findings.

However, certain limitations must be acknowledged. First, this was a single-center study with a modest sample size, which may limit the generalizability of our results. Multicenter trials with larger cohorts are needed to confirm these findings across diverse populations and healthcare settings. Second, although efforts were made to blind outcome assessors, complete blinding was not feasible due to the nature of the intervention. Lastly, long-term outcomes such as incisional hernia formation or quality-of-life metrics were not assessed and warrant future investigation.

In conclusion, this study provides compelling evidence that CINPT is superior to CMD in managing surgical wounds following laparotomy for peritonitis. By reducing the incidence of wound dehiscence and infection, and shortening hospital stays, CINPT has the potential to become a standard component of postoperative care in patients undergoing emergency abdominal surgery. Broader implementation, supported by future large-scale studies and economic evaluations, could significantly improve surgical outcomes and efficiency of care delivery.

CONCLUSION

Closed Incision Negative Pressure Therapy (CINPT) demonstrated superior outcomes compared to Conventional Moist Dressing (CMD) in patients undergoing laparotomy for peritonitis. This study highlights significantly lower rates of wound dehiscence and surgical site infections, as well as a reduced length of hospital stay among patients treated with CINPT. Given the high-risk nature of peritonitis-related surgical wounds, these findings advocate for the adoption of CINPT as a frontline postoperative wound management strategy. The use of CINPT may not only improve clinical outcomes but also reduce the burden on healthcare systems by decreasing complication rates and hospital resource utilization. Further large-scale, multicenter trials and cost-benefit analyses are

warranted to validate these findings and support the widespread clinical integration of CINPT in surgical practice.

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