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ORIGINAL RESEARCH

Comparative Analysis of Postoperative Analgesic Requirements Following Peritoneal Closure versus Non-Closure in Open Appendectomy

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ABSTRACT
Background: It is normal practice to suture each layer that is cut during surgery. The present study was conducted to assess analgesic requirement in non-closure and closure of peritoneum during open appendectomy.
Materials & Methods: 70 patients undergoing emergency or elective open appendectomywere divided into two groups of 35 each. Group I was closure (control) and group II was nonclosure (cases). On days 0, 1, and 2, post-operative pain was measured using the visual analogue scale (VAS). The need for analgesics was recorded.
Results: The mean age was 30.4± 6.1 years in group I and 29.2 ± 5.7 years in group II. There were 18 males and 17 females in group I and 20 males and 15 females in group II. The mean operative time was 39.5 ± 7.3 minutes in group I and 35.4 ± 6.8 minutes in group II. Wound infection was seen among 2 in group I and 3 in group II. The difference was non- significant (P> 0.05).VAS score on day 0 was 52.4±4.5 and 36.7±6.5, on day 1 was 41.2±1.4 and 39.2±2.9 and on day 2 was 35.6±5.4 and 29.4±1.6 in group I and group II respectively. The difference was significant (P< 0.05). Analgesic requirement such as non opoid analgesia (IM diclofenac on day 0 was 125.4±11.3 and 108.2±13.4, on day 1 was 101.2±14.2 and 69.1±10.3 and on day 2 was 46.6±6.2 and 23.5±7.4 in group I and group II respectively. Opoid analgesia (IV tramadol) requirement on day 0 was 150.2±12.2 and 65.4±9.2, on day 1 was 72.4±13.7 and 29.5±4.2 and on day 2 was 33.8±11.2 and 11.2±2.1 in group I and group II respectively. The difference was significant (P< 0.05).
Conclusion: Author recommended that leaving the peritoneum open during an appendectomy has a good impact on post-operative pain and that there is no short-term morbidity. Therefore, it is advised against closing the peritoneum during an appendectomy.
Keywords: Opoid analgesia, Peritoneum, Wound, Appendectomy

INTRODUCTION

It is normal practice to suture each layer that is cut during surgery. In fact, every surgeon is trained in this field and practices it. The worry that adhesions will increase once the peritoneum fails to seal has been refuted by numerous studies.[1] A significant amount of the experience with non-closure of the peritoneum in the literature is related to obstetric and gynecological surgery. There is ongoing discussion over the effects of post-operative discomfort.[2]

Despite the paucity of proof supporting its advantages, suturing the visceral and parietal peritoneum has historically been widely recognized.[3] In addition to aesthetic concerns; it is thought that adhesions can be avoided by closing the peritoneum. On the contrary, the opposing viewpoint is supported by theoretical analysis and animal trials.[4] Ischemia, necrosis, inflammation, and foreign body reactions to the suture material are common side effects of suture peritonization. Conversely, a clean incision of the peritoneal surface without suturing the cut edges results in faster peritoneal repair, which lowers the risk of ileus, improves wound healing, and causes less postoperative pain and fever.[5]

AIM & OBJECTIVES

Aim

To evaluate and compare the postoperative pain and analgesic requirements in patients undergoing open appendectomy with peritoneal closure versus those with non-closure of the peritoneum.

Objectives

1. To assess postoperative pain using the Visual Analogue Scale (VAS) on postoperative days 0, 1, and 2 in both peritoneal closure and non-closure groups.

2. To compare the requirement of non-opioid analgesia (intramuscular diclofenac) between the two groups over the first three postoperative days.
3. To compare the requirement of opioid analgesia (intravenous tramadol) between the two groups during the same period.
4. To evaluate the incidence of postoperative complications, including wound infection, in both groups.
5. To determine whether non-closure of the peritoneum results in reduced postoperative discomfort and analgesic need.

MATERIALS AND METHODS

Study Design

This study was designed as a **double-blind, randomized, prospective clinical trial** aimed at evaluating the impact of peritoneal closure versus non-closure on postoperative pain and analgesic requirement in patients undergoing open appendectomy.

Study Population

A total of 70 patients (both male and female) undergoing emergency or elective open appendectomy for ultrasonographically confirmed appendicitis were included. All participants provided written informed consent before enrollment.

Study Place

The study was conducted in the Department of General Surgery, Mata Gujri Memorial Medical College & Lions Seva Kendra Hospital (MGMMC), Kishanganj, Bihar, India.

Study Period

The study was conducted over a period of 24 months, from January 2009 to December 2010.

Ethical Considerations

The study protocol was approved by the Institutional Ethical Committee prior to commencement. All participants gave written informed consent before inclusion in the study. Confidentiality and anonymity were maintained throughout the study.

Inclusion Criteria

- Patients of both genders aged ≥12 years.
- Diagnosed with acute appendicitis confirmed by ultrasonography.
- Undergoing emergency or elective open appendectomy.
- Operated under spinal anesthesia.
- Willing to give written informed consent.

Exclusion Criteria

- Patients below 12 years of age.
- Neurotic or psychiatric patients.
- Cases of complicated appendicitis (perforated, gangrenous, or with abscess).
- Patients operated under anesthesia other than spinal anesthesia.
- Intraoperative detection of additional pathology or those who underwent additional surgical procedures.
- Patients who developed wound infections during the study period.

Randomization and Blinding

Patients were randomized into two equal groups (n=35 each) using computer-generated random numbers. Allocation concealment was ensured using opaque sealed envelopes opened by the surgeon just prior to the procedure.

- **Group I (Control Group)**: Peritoneum closed.
- **Group II (Study Group)**: Peritoneum left open.

Both the patient and the postoperative observer recording pain scores were blinded to group allocation, maintaining a double-blind design.

Surgical Procedure

All patients underwent **open appendectomy** under spinal anesthesia using a **standard McBurney's incision**. After removal of the appendix:

- In **Group I**, the peritoneum was sutured closed.
- In **Group II**, the peritoneum was left unclosed.

The remaining abdominal layers were closed in routine fashion. The end of surgery was designated as "0 hour", and the day of surgery as "Day 0."

Postoperative Assessment and Analgesic Administration

- **Pain** was assessed using the **Visual Analogue Scale (VAS)** at:
  - Day 0 (immediate postoperative)
  - Day 1
  - Day 2
- **Analgesics** were administered when **VAS > 40 mm**.
- Analgesic requirement was recorded in terms of the number and timing of doses.
- Patients were also monitored for the development of wound infections and other postoperative complications.

Outcome Measures

- **Primary Outcome**: Postoperative pain score measured by VAS on days 0, 1, and 2.
- **Secondary Outcome**: Requirement and frequency of postoperative analgesics.

Statistical Analysis

- Qualitative variables were analyzed using Chi-square test.
- Quantitative variables were analyzed using Student's t-test, depending on the distribution of data.
- A p-value < 0.05 was considered statistically significant.
- Data analysis was performed using SPSS version 15.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

Table 1: Baseline Characteristics of Study Participants

Parameters	Group I (Closure) *n=35, (Mean ± SD)*	Group II (Non-closure) *n=35, (Mean ± SD)*	P value
Age (years)	30.4 ± 6.1	29.2 ± 5.7	0.87
Gender (M:F)	18:17	20:15	0.24
Operative time (mins)	39.5 ± 7.3	35.4 ± 6.8	0.71
Wound infection (n)	2	3	0.93

The baseline characteristics of the study participants in both Group I (peritoneal closure) and Group II (non-closure) are summarized in Table 1. The mean age of patients in Group I was 30.4 ± 6.1 years, while in Group II it was 29.2 ± 5.7 years, with no statistically significant difference between the groups (p = 0.87), indicating age-matched groups. The gender distribution was also comparable, with 18 males and 17 females in Group I and 20 males and 15 females in Group II (p = 0.24), showing no significant gender bias between groups.

The mean operative time in the closure group was 39.5 ± 7.3 minutes, slightly longer than the 35.4 ± 6.8 minutes observed in the non-closure group; however, this difference was not statistically significant (p = 0.71), suggesting that peritoneal closure did not notably prolong the surgical procedure. Regarding postoperative wound infection, 2 cases were reported in Group I and 3 in Group II, with no significant difference between the groups (p = 0.93).

Table 2: Visual analogue scale score

VAS score	Group I, *n=35*	Group II, *n=35*	P value
Day 0	52.4±4.5	36.7±6.5	0.04
Day 1	41.2±1.4	39.2±2.9	0.05
Day 2	35.6±5.4	29.4±1.6	0.01

Table 2 shows that VAS score on day 0 was 52.4±4.5 and 36.7±6.5, on day 1 was 41.2±1.4 and 39.2±2.9 and on day 2 was 35.6±5.4 and 29.4±1.6 in group I and group II respectively. The difference was significant (P< 0.05).

Table 3: Comparison of analgesic requirement

Analgesic	Day	Group I, *n=35*	Group II, *n=35*	P value
Non Opoid analgesia (IM diclofenac	Day 0	125.4±11.3	108.2±13.4	0.05
	Day 1	101.2±14.2	69.1±10.3	0.01
	Day 2	46.6±6.2	23.5±7.4	0.01
Opoid analgesia (IV	Day 0	150.2±12.2	65.4±9.2	0.01

tramadol)	Day 1	72.4±13.7	29.5±4.2	0.02
	Day 2	33.8±11.2	11.2±2.1	0.03

Figure I: Comparison of anagesic requirement

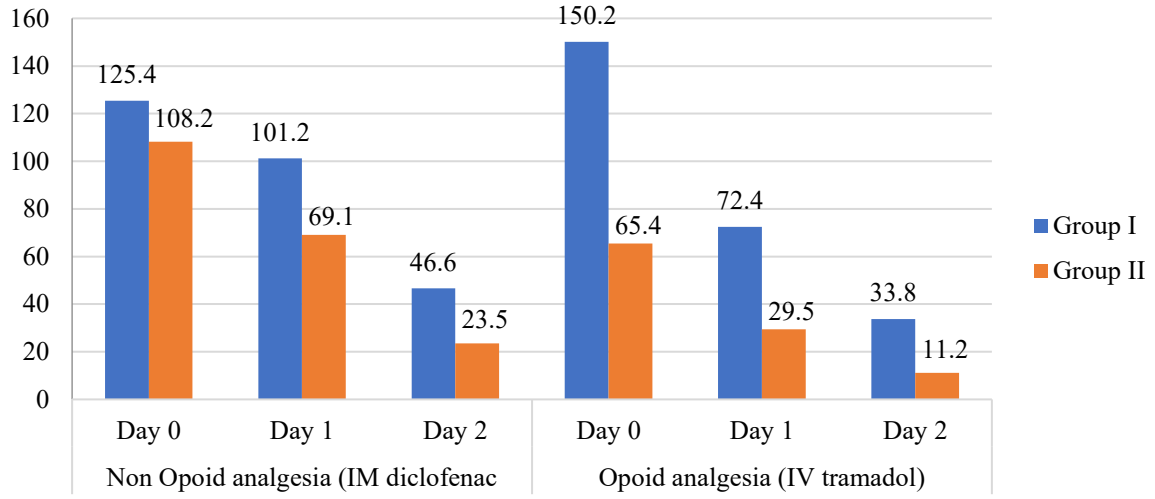

Table 3 and figure I, presents a comparison of postoperative analgesic requirements between Group I (peritoneal closure) and Group II (non-closure) over the first three postoperative days, using both non-opioid (intramuscular diclofenac) and opioid (intravenous tramadol) analgesics.

On **Day 0**, the mean requirement for non-opioid analgesia was higher in Group I (125.4 ± 11.3 mg) compared to Group II (108.2 ± 13.4 mg), with the difference approaching statistical significance ($p = 0.05$). A more pronounced difference was observed on **Day 1**, where Group I required 101.2 ± 14.2 mg, while Group II required only 69.1 ± 10.3 mg of diclofenac, which was statistically significant ($p = 0.01$). This trend continued on **Day 2**, with Group I requiring 46.6 ± 6.2 mg versus 23.5 ± 7.4 mg in Group II ($p = 0.01$), indicating a sustained lower analgesic need in the non-closure group.

Similarly, for **opioid analgesia**, a significantly higher requirement was observed in Group I across all three days. On **Day 0**, patients in the closure group required 150.2 ± 12.2 mg of IV tramadol compared to just 65.4 ± 9.2 mg in the non-closure group ($p = 0.01$). On **Day 1**, the requirement in Group I was 72.4 ± 13.7 mg, substantially greater than the 29.5 ± 4.2 mg needed in Group II ($p = 0.02$). By **Day 2**, although analgesic needs had decreased overall, the trend persisted, with Group I requiring 33.8 ± 11.2 mg versus 11.2 ± 2.1 mg in Group II ($p = 0.03$).

DISCUSSION

It has long been standard practice to close the peritoneum during a laparotomy. Numerous advantages of leaving the peritoneum open, including the absence of adverse consequences, are demonstrated by clinical and animal research.[6] The advantages include shorter operating times, fewer intra-abdominal adhesions, lower operational morbidity, and earlier hospital discharge.[7] The effect of peritoneal non-closure on post-operative pain is a topic of continuous debate. Some research found that post-operative discomfort decreased when the peritoneum was not closed, while other investigations found no such effect.[8,9]The present study was conducted to assess analgesic requirement in non-closure and closure of peritoneum during open appendectomy.

We found that the mean age was 30.4± 6.1 years in group I and 29.2± 5.7 years in group II. There were 18 males and 17 females in group I and 20 males and 15 females in group II. The mean operative time was 39.5 ± 7.3 minutes in group I and 35.4 minutes in group II. Wound infection was seen among 2 in group I and 3 in group II. Weerawetwat W et al.[10]determined whether non-closure of visceral and parietal peritoneum at LSCS has advantages over peritoneal closure with regard to postoperative complication and adhesions. Three hundred and sixty full-term pregnant women undergoing first cesarean section were divided into 3 groups (N = 120). Group A: non-closure of both visceral and parietal peritoneum. Group B. non-closure of only visceral peritoneum. Group C: closure of both visceral and parietal peritoneum. Postoperative complications were compared. Adhesions

were evaluated in 65 patients returning for a second LSCS and compared for severity of adhesions. The three groups were compared using statistical analysis. There was no significant statistical difference between group A and C, group B and C for postoperative complications or number of adhesion formation. However, adhesions in the closure group were more severe.

We observed that VAS score on day 0 was 52.4±4.5 and 36.7±6.5, on day 1 was 41.2±1.4 and 39.2±2.9 and on day 2 was 35.6±5.4 and 29.4±1.6 in group I and group II respectively.

Demirel Y et al.[11] examined the differences in postoperative pain levels and analgesic requirements between women undergoing gynecological abdominal surgery who had their peritoneum closed and those who did not. There was no statistically significant difference between the two groups when comparing age, gravidity, parity, body mass index, type of operation, operative time, and length of hospital stay ($p>0.05$). When comparing postoperative pain with visual analogue scale (VAS) scores, the closure group experienced more pain than the nonclosure group ($p<0.05$).

We found that analgesic requirement such as non opoid analgesia (IM diclofenac on day 0 was 125.4±11.3 and 108.2±13.4, on day 1 was 101.2±14.2 and 69.1±10.3 and on day 2 was 46.6±6.2 and 23.5±7.4 in group I and group II respectively. Opoid analgesia (IV tramadol) requirement on day 0 was 150.2±12.2 and 65.4±9.2, on day 1 was 72.4±13.7 and 29.5±4.2 and on day 2 was 33.8±11.2 and 11.2±2.1 in group I and group II respectively.

On postoperative **day 0**, although the difference in non-opioid analgesic requirement was only marginally significant ($p = 0.05$), the requirement for opioid analgesics was markedly higher in the closure group ($p = 0.01$), indicating more intense early postoperative pain in this group. The analgesic needs remained significantly higher in the closure group on **days 1 and 2** for both classes of drugs, suggesting sustained pain over the initial postoperative period.

These findings are consistent with earlier studies that have emphasized the role of **peritoneal manipulation and suturing** in triggering a local inflammatory response, which contributes to increased postoperative pain. For instance, **Tulandi and Mettler (1995)** reported that leaving the peritoneum unclosed during abdominal surgeries resulted in reduced postoperative pain and faster recovery.[12] Similarly, **Dunn and Shute (1999)** emphasized that peritoneal closure may not offer a functional benefit and is associated with increased postoperative discomfort and adhesion formation.[13]

In a randomized study conducted by **Bamigboye and Hofmeyr (2003)**, non-closure of the peritoneum during cesarean section was associated with reduced postoperative analgesic requirements and quicker return of bowel function.[14]Though their study was in obstetric surgery, the pathophysiological mechanisms—such as reduced tissue handling and inflammation—are applicable to appendectomy as well. Furthermore, **Elkasabany et al. (2002)** also found significantly lower postoperative pain scores in patients undergoing lower abdominal surgery without peritoneal closure.[14] These studies support the findings of the current study and reinforce the rationale for adopting the non-closure technique in routine appendectomies to improve patient comfort and reduce the burden of postoperative pain management.

Rafique Zet al.[15] compared a standardized anesthetic and surgical procedure with the analgesic requirement in the post-operative period following closure or non-closure of the peritoneum at the cesarean delivery. The primary outcome measures were oral analgesia used during the first four days following surgery, postoperative pain measured by a visual analogue scale and a verbal rating scale, patient satisfaction measured by a verbal rating scale, and analgesic requirement measured by morphine usage via patient controlled analgesia pump during the first twenty-four hours following surgery. The non-closure group required significantly less morphine than the closure group during the first 24 hours (0.64 mg/kg of body weight vs. 0.82 mg/kg, $P = 0.04$), although both groups' pain levels at 24 hours were similar (43.5 in the closure group and 40.5 in the non-closure group).

LIMITATIONS OF THE STUDY

- **Small sample size** ($n = 70$), which may limit the generalizability of findings to a broader population.
- The study was **limited to a single centre**, which may introduce center-specific practices affecting outcomes.
- **Pain perception is subjective**, and while VAS is widely accepted, it still depends on patient self-reporting and may introduce variability.

- Only **short-term outcomes** (first 3 postoperative days) were evaluated; long-term complications such as adhesion formation or chronic pain were not assessed.
- The **use of only one surgical approach (McBurney's incision)** and one anaesthesia method (spinal anaesthesia) restricts applicability to other techniques or settings.

CONCLUSION

Authors found that non-closure of the peritoneum during open appendectomy is associated with significantly reduced postoperative pain and lower analgesic requirements, both non-opioid and opioid, over the initial three postoperative days. The incidence of wound infection and operative time did not significantly differ between the groups, supporting the safety and efficacy of the non-closure technique. Thus, non-closure of the peritoneum may be a favorable modification in open appendectomy to enhance patient comfort and recovery.

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