

EFFECTIVENESS OF INTRAPERITONEAL NORMAL SALINE INSTILLATION IN REDUCING SHOULDER TIP PAIN FOLLOWING LAPAROSCOPIC CHOLECYSTECTOMY

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Abstract

Background: Laparoscopic cholecystectomy is the preferred treatment for symptomatic cholelithiasis due to its advantages over open surgery, including reduced postoperative pain. However, postoperative pain, particularly shoulder tip pain, remains a significant concern, affecting recovery and patient satisfaction. This study aims to evaluate the effectiveness of various analgesic techniques in minimizing postoperative shoulder tip pain following laparoscopic cholecystectomy. By analyzing patient outcomes and pain management strategies, we hope to identify optimal approaches that enhance recovery and improve overall patient satisfaction. **Materials and Methods:** This prospective comparative study was conducted on 80 patients undergoing elective laparoscopic cholecystectomy, divided into two groups: the control group (no irrigation) and the normal saline group (intraperitoneal instillation of 1000 ml normal saline at 37°C). Pain was assessed using the Visual Analog Scale (VAS) at 6, 18, and 24 hours postoperatively. Analgesic demands within the first 24 hours were recorded. **Result:** The normal saline group demonstrated significantly lower shoulder tip pain scores at 6 hours ($P=0.031$) and 18 hours ($P=0.029$) compared to the control group, with no significant differences at 24 hours ($P=0.152$). Mean pain intensity was also significantly reduced at 6 hours ($P=0.002$) and 18 hours ($P=0.037$). Analgesia demand was significantly lower in the normal saline group during the first 6 hours ($P=0.014$) but showed no significant differences thereafter. **Conclusion:** Intraperitoneal instillation of normal saline effectively reduces early postoperative shoulder pain after laparoscopic cholecystectomy. This method is simple, safe, and can be incorporated into standard surgical practice to enhance patient outcomes.

INTRODUCTION

Laparoscopic cholecystectomy is considered the preferred method for treating symptomatic cholelithiasis and cholecystitis due to its several benefits compared to traditional open surgery. These include smaller incisions, less blood loss, shorter postoperative ileus, reduced hospital stays, faster recovery, and quicker return to daily activities and work.^[1] One of the most significant benefits of laparoscopic surgery is reduced postoperative pain compared to open surgery. However, postoperative pain remains a considerable concern, with patients frequently reporting back pain, discomfort at port sites, and referred shoulder pain.^[2] Shoulder pain is particularly prevalent, affecting 12% to 60% of

patients, peaking in the first few postoperative hours and subsiding after 2–3 days.^[3]

The etiology of postoperative pain after laparoscopic cholecystectomy is multifactorial. One significant cause is phrenic nerve irritation resulting from carbon dioxide insufflation into the peritoneal cavity during surgery, which creates an acidic milieu and peritoneal irritation.^[3] Pain may also be influenced by individual and sociocultural factors. Despite advancements in surgical techniques, effective pain management strategies remain a challenge.

Various approaches, including nonsteroidal anti-inflammatory drugs (NSAIDs), opioids, gas drainage, and intraperitoneal administration of saline or local anesthetics, have been employed to alleviate pain. While intraperitoneal instillation (IPI) of local anesthetics and saline has shown promise in reducing

pain, inconsistent outcomes and potential side effects highlight the need for further research.¹⁴ Therefore, this study aims to assess the effectiveness of intraperitoneal saline instillation in reducing postoperative shoulder pain after laparoscopic cholecystectomy.

MATERIALS AND METHODS

This prospective comparative study was conducted at the Department of General Surgery, Government Kanyakumari Medical College, to assess the effectiveness of normal saline irrigation in reducing postoperative pain among patients undergoing laparoscopic cholecystectomy. Adult patients aged 18–75 years, scheduled for elective laparoscopic cholecystectomy, were included in the study after providing informed consent.

Exclusion criteria included patients with a history of opioid, steroid, NSAID, or alcohol use, as well as those presenting with acute cholecystitis, gangrene, or empyema of the gallbladder. Additional exclusion factors included conversion to an open surgical procedure, gallbladder rupture or bile leakage at the surgical site, and bleeding at the surgical site causing peritoneal irritation.

The participants were randomly divided into two groups. The control group did not receive any intraperitoneal irrigation, while the normal saline group received 1000 mL of 0.9% NaCl at 37°C, which was infused into the surgical bed, the superior surface of the liver, and under the right hemidiaphragm.

All surgeries were performed by a single experienced surgeon using a standardized 4-trocar technique. Pneumoperitoneum was achieved through CO₂ insufflation via a periumbilical trocar, with the intra-abdominal pressure maintained at 14 mm Hg throughout the procedure. A nasogastric tube was inserted post-intubation and removed at the end of the surgery.

Postoperative pain was assessed using a Visual Analog Scale (VAS) at 6, 18, and 24 hours post-surgery, as well as one week after surgery. Additional data were collected on demographic information (age, gender, medical history, smoking status) and the number of analgesia demands during the first 24 hours postoperatively. This approach ensures consistency and reliability in evaluating the impact of

normal saline irrigation on postoperative pain management.

RESULTS

In [Table 1], total of 80 patients was enrolled in the study, with 40 participants in each group (control and normal saline groups). The mean age of participants was comparable between the two groups (44.61±11.15 years in the control group vs. 42.36±12.19 years in the normal saline group). The distribution of gender was similar, with 14 males and 26 females in the control group compared to 12 males and 28 females in the normal saline group. The prevalence of diabetes mellitus (DM) was slightly higher in the control group (9 vs. 7), whereas hypertension (HTN) was more frequent in the normal saline group (11 vs. 8). The mean duration of pneumoperitoneum was significantly longer in the normal saline group (55.29±13.58 minutes) compared to the control group (45.75±9.47 minutes). In [Table 2], the intensity of left shoulder tip pain was significantly lower in the normal saline group at 6 hours (1.8±2.6 vs. 3.1±1.9, P=0.031) and 18 hours postoperatively (1.7±1.9 vs. 2.8±1.9, P=0.029). However, at 24 hours, there was no significant difference between the groups (1.4±2.1 vs. 2.1±1.6, P=0.152). Similarly, right shoulder tip pain was significantly reduced in the normal saline group at 6 hours (1.9±1.9 vs. 3±2.1, P=0.038) and 18 hours (1.5±1.8 vs. 2.4±1.8, P=0.016), but no significant difference was observed at 24 hours (1.3±1.8 vs. 1.9±1.6, P=0.178).

When the mean pain intensity of both shoulders was considered, the normal saline group experienced significantly lower pain at 6 hours (1.4±2.3 vs. 3.2±2.1, P=0.002) and 18 hours (1.3±2.1 vs. 2.4±1.6, P=0.037). By 24 hours, the mean pain intensity difference between the groups was not statistically significant (1.7±2.0 vs. 1.9±1.5, P=0.663).

In [Table 3], the normal saline group demonstrated a significantly lower number of analgesia demands during the first 6 hours postoperatively (1.375±0.49 vs. 1.65±0.48, P=0.014). Between 6 and 18 hours, the difference in analgesia demand was not statistically significant (1.1±0.84 vs. 0.9±0.71, P=0.254). Similarly, no significant difference was observed between 18 and 24 hours (0.475±0.51 vs. 0.525±0.51, P=0.66).

Table 1: Demographic Characteristics of Study Participants.

Characteristics	Control group (n=40)	Normal saline group (n=40)
Age	44.61±11.15	42.36±12.19
Gender (M/F)	14/26	12/28
DM	9	7
HTN	8	11
Time of pneumoperitoneum (mins)	45.75±9.47	55.29±13.58

Table 2: Comparison of Shoulder Tip Pain among Study Participants

Group		Control group	Normal saline group	P value
Left shoulder tip pain	At 6 hour	3.1±1.9	1.8±2.6	0.031
	At 18 hour	2.8±1.9	1.7±1.9	0.029
	At 24 hour	2.1±1.6	1.4±2.1	0.152

Right shoulder tip pain	At 6 hour	3±2.1	1.9±1.9	0.038
	At 18 hour	2.4±1.8	1.5±1.8	0.016
	At 24 hour	1.9±1.6	1.3±1.8	0.178
Mean pain intensity of shoulders	At 6 hour	3.2±2.1	1.4±2.3	0.002
	At 18 hour	2.4±1.6	1.3±2.1	0.037
	At 24 hour	1.9±1.5	1.7±2.0	0.663

Table 3: Analgesia Demand among Study Participants

Number of analgesia demand over the 24 hours postoperatively	Control group	Normal saline group	P value
During the first 6 hour	1.65±0.48	1.375±0.49	0.014
Between 6 and 18 hour	0.9±0.71	1.1±0.84	0.254
Between 18 and 24 hour	0.525±0.51	0.475±0.51	0.66

DISCUSSION

Postoperative pain remains a significant challenge after laparoscopic cholecystectomy, with up to 80% of patients requiring analgesics.^[5] The intensity of pain typically peaks during the initial postoperative hours and gradually decreases over 48–72 hours.^[6] Evidence indicates that the primary source of this pain is peritoneal irritation rather than somatic factors such as the skin or abdominal wall. The acidic environment created by CO₂ insufflation during pneumoperitoneum is a major contributor, leading to peritoneal acidosis and irritation of the phrenic nerve, which are significant causes of postoperative shoulder pain.^[7–10] Novel approaches like three-port lap were tried.^[11] Both early and late cholecystectomy on pain characters had no impact.^[12] In our study, the normal saline group demonstrated a significant reduction in shoulder tip pain compared to the control group, particularly within the first 6 and 18 hours after surgery.^[11,12] These findings are consistent with previous studies showing that intraperitoneal saline washout effectively reduces residual CO₂ in the subdiaphragmatic region, thereby minimizing irritation and referred pain.^[13,14] The normal saline group also had a lower mean pain intensity of shoulders during the same time points compared to the control group. However, by 24 hours postoperatively, the difference in pain scores between the groups was not statistically significant. This suggests that the effects of normal saline irrigation are most pronounced in the early postoperative period.

Although the normal saline group required fewer analgesics within the first 6 hours compared to the control group, no significant differences were observed in analgesia demand between 6 and 24 hours postoperatively. This indicates that while saline irrigation reduces immediate postoperative pain, its impact on overall analgesic consumption over 24 hours is limited.^[15]

These findings highlight the utility of intraperitoneal normal saline irrigation as a simple and safe method to reduce early postoperative pain after laparoscopic cholecystectomy. However, additional studies incorporating longer follow-up periods and diverse patient populations are needed to confirm these results and optimize pain management strategies.^[16] Laparoscopy is often used to identify undiagnosed

abdominal pain, but pain after laparoscopy procedure remain a dilemma.^[17]

CONCLUSION

Intraperitoneal instillation of normal saline significantly reduces early postoperative shoulder tip pain following laparoscopic cholecystectomy, particularly within the first 6 and 18 hours. This technique offers a simple, cost-effective, and safe method to mitigate pain caused by residual carbon dioxide and diaphragmatic irritation. Although the effects on overall analgesic consumption beyond the immediate postoperative period were limited, the significant reduction in early pain intensity highlights its potential as a valuable adjunct for pain management.

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