Section: Miscellaneous

Original Research Article

COMPARATIVE EVALUATION OF PULMONARY RECRUITMENT MANEUVER VERSUS INTRAPERITONEAL NORMAL SALINE INSTILLATION FOR REDUCING POST-LAPAROSCOPIC SHOULDER TIP PAIN: A DOUBLE-BLINDED RANDOMIZED CONTROLLED TRIAL

Aishwarya Kanade[1], Rakesh A. Hasabe[2]

[1]Department of Paediatric Anaesthesiology B J Wadia Children's Hospital, Mumbai, India.
[2]Associate Professor Department of Obstetrics & Gynaecology, BKL Walavalkar Rural Medical College, A/P-Kasarwadi, Chiplun, Ratnagiri, India.

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Corresponding Author:
Dr. Aishwarya Kanade,
Email: aishukanade31@gmail.com

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ABSTRACT

Background: Post-laparoscopic shoulder tip pain (STP) is a common and distressing complication following laparoscopic surgery. It is believed to result from diaphragmatic irritation caused by residual carbon dioxide within the peritoneal cavity. Various strategies such as pulmonary recruitment maneuver (PRM) and intraperitoneal normal saline instillation (INSI) have been proposed to reduce postoperative discomfort by facilitating removal of residual gas. **Materials and Methods:** A double-blinded randomized controlled trial including 90 patients undergoing elective laparoscopic surgery was conducted. Patients were randomly divided into two groups (45 each). Group A received intraperitoneal normal saline instillation (2 ml/kg) at the end of surgery, while Group B underwent pulmonary recruitment maneuver at 40 cm H_2O airway pressure for 5 seconds repeated five times. Postoperative shoulder tip pain was assessed at 2, 4, 6, 12, and 24 hours using a visual analog scale. Hemodynamic parameters and length of hospital stay were also recorded. **Results:** The mean age was 40.76 ±12.59 years in Group A and 42.27 ±12.08 years in Group B ($p > 0.05$). The incidence of postoperative shoulder tip pain was significantly lower in the intraperitoneal saline group compared to the pulmonary recruitment maneuver group (26.27% vs 57.78%). Mean hospital stay was 2.38 ±0.49 days in Group A and 2.58 ±0.50 days in Group B. Hemodynamic parameters were comparable between the groups. **Conclusion:** Intraperitoneal normal saline instillation significantly reduces the incidence of postoperative shoulder tip pain compared with pulmonary recruitment maneuver and may improve postoperative patient comfort.

INTRODUCTION

Laparoscopic surgery has become the preferred approach for many abdominal and gynecological procedures due to its advantages of reduced postoperative pain, shorter hospital stay, faster recovery, and improved cosmetic outcomes. Despite these benefits, postoperative shoulder tip pain remains a common complaint following laparoscopic procedures.

The pathophysiology of shoulder tip pain is largely attributed to diaphragmatic irritation caused by residual carbon dioxide within the peritoneal cavity after pneumoperitoneum. Carbon dioxide irritates the phrenic nerve endings in the diaphragm, leading to referred pain in the shoulder region.

Various techniques have been proposed to reduce residual pneumoperitoneum at the end of laparoscopic procedures. One such method is the pulmonary recruitment maneuver (PRM), which involves transient application of positive airway pressure to increase intra-abdominal pressure and facilitate evacuation of residual carbon dioxide through open trocar ports.

Another technique is intraperitoneal normal saline instillation (INSI), which helps displace residual carbon dioxide from the peritoneal cavity and may reduce irritation of the diaphragm.

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Although both methods are commonly used in clinical practice, evidence comparing their effectiveness remains limited. Therefore, the present study was conducted to compare the efficacy of pulmonary recruitment maneuver and intraperitoneal normal saline instillation in reducing postoperative shoulder tip pain following laparoscopic surgery.

MATERIALS AND METHODS

Study Design

This study was designed as a double-blinded randomized controlled trial conducted over a period of two years at a tertiary care hospital after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants.

Study Population

A total of 90 patients undergoing elective laparoscopic abdominal surgery under general anesthesia were included in the study.

Inclusion Criteria

- Age between 20 and 60 years
- ASA physical status Grade I or II
- Patients undergoing elective laparoscopic abdominal surgery

Exclusion Criteria

- History of chronic shoulder pain
- Severe cardiopulmonary disease
- Conversion to open surgery
- Patients unwilling to participate in the study

Randomization

Patients were randomly allocated into two equal groups using computer-generated random numbers:

Group A – Intraperitoneal Saline Instillation (INSI): Patients received intraperitoneal normal saline instillation (2 ml/kg) at the end of surgery before trocar removal.

Group B – Pulmonary Recruitment Maneuver (PRM):

Patients underwent pulmonary recruitment maneuver at 40 cm H_2O airway pressure for 5 seconds repeated five times before extubation.

Both patients and postoperative evaluators were blinded to group allocation.

Outcome Measures

Primary Outcome

- Incidence and severity of postoperative shoulder tip pain

Pain Assessment

Pain was evaluated using Visual Analog Scale (VAS) at the following postoperative intervals:

- 2 hours
- 4 hours
- 6 hours
- 12 hours
- 24 hours

Secondary Outcomes

- Hemodynamic parameters
- Requirement of postoperative analgesics
- Duration of hospital stay

Statistical Analysis

Data were analyzed using appropriate statistical methods. Continuous variables were expressed as mean ± standard deviation and compared using Student's t-test, while categorical variables were analyzed using the Chi-square test. A p value < 0.05 was considered statistically significant.

RESULTS

Demographic Characteristics

Both groups were comparable with respect to baseline demographic characteristics.

Table 1

Age (years)	Group A (N, %)	Group B (N, %)	p-value
20–30	11 (24.5%)	10 (22.2%)	>0.05
31–40	12 (26.8%)	11 (24.5%)	>0.05
41–50	8 (17.8%)	9 (20%)	>0.05
51–60	14 (30.9%)	15 (33.3%)	>0.05
Mean ± SD	40.76 ± 12.59	42.27 ± 12.08	>0.05

Table 2: Distribution of patients according to requirement of Rescue Analgesic

Rescue Analgesic	Group A (N)	Group A (%)	Group B (N)	Group B (%)	p Value
Required	6	13.30%	9	20.00%	p>0.05
No requirement	39	86.70%	36	80.00%	p>0.05
Total	45	100%	45	100%	p>0.05

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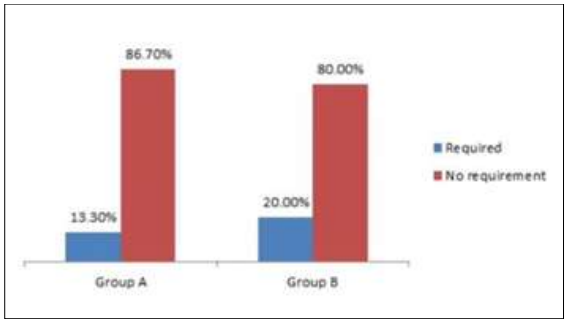

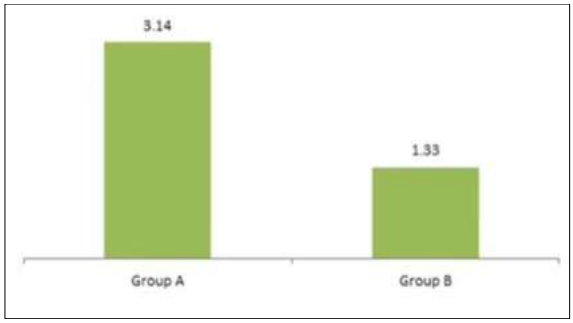

Table 3: Distribution of patients according to Time to first Analgesia Rescue

Time to First Analgesia Rescue (hours)	Group A (Mean)	Group A (SD)	Group B (Mean)	Group B (SD)	p Value
Duration	3.14	1.15	1.33	1.03	<0.05

Table 4: Distribution of patients according to outcome measures at 2,4,6,12&24 hours post-operatively

Patients with Shoulder Pain	Group A (N)	Group A (%)	Group B (N)	Group B (%)	P value
2 hrs.	4	8.89%	10	22.22%	<0.05
4 hrs.	5	11.11%	8	17.78%	<0.05
6 hrs.	2	4.44%	4	8.89%	<0.05
12 hrs.	1	2.22%	3	6.67%	<0.05
24 hrs.	0	0%	1	2.22%	<0.05
Total	12	26.27%	26	57.78%	<0.05

Table 5: Distribution of VAS score of patients

Changes from baseline in VAS Score	Group A (Mean)	Group A (SD)	Group B (Mean)	Group B (SD)	p Value
2 hours	1.27	0.66	1.56	1.2	>0.05
4 hours	0.63	0.04	1.15	0.72	<0.05
6 hours	0.39	0.03	1.07	0.63	<0.05
12 hours	0.21	0.02	0.78	0.42	<0.05
24 hours	0.13	0.02	0.45	0.24	<0.05

Table 6: Comparison of Side Effects in both groups

Side Effects	Group A (N)	Group A (%)	Group B (N)	Group B (%)	p Value
Vomiting	1	2.22%	3	6.67%	>0.05
Nausea	4	8.89%	3	6.67%	>0.05
Breathlessness	1	2.22%	2	4.44%	>0.05
Abdominal Distention	1	2.22%	0	0%	>0.05

Incidence of Shoulder Tip Pain

Parameter	Group A	Group B
Shoulder Tip Pain	26.27%	57.78%

The incidence of shoulder tip pain was significantly lower in the intraperitoneal saline group compared with the pulmonary recruitment maneuver group.

Hospital Stay

Parameter	Group A	Group B
Mean Hospital Stay	2.38 ± 0.49 days	2.58 ± 0.50 days

Hospital stay was slightly shorter in the INSI group, though the difference was not clinically significant.

Hemodynamic Parameters

Hemodynamic parameters including heart rate, blood pressure, and oxygen saturation remained stable and comparable in both groups throughout the postoperative period.

DISCUSSION

Post-laparoscopic shoulder tip pain is a well-recognized complication that significantly affects postoperative patient comfort. It is primarily caused by irritation of the diaphragm due to residual carbon dioxide trapped within the peritoneal cavity following pneumoperitoneum.

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The pulmonary recruitment maneuver attempts to expel residual gas by transiently increasing intrathoracic and intra-abdominal pressures, facilitating carbon dioxide evacuation through trocar ports.

In contrast, intraperitoneal saline instillation works through a different mechanism. Saline displaces residual carbon dioxide from the peritoneal cavity and may also reduce local inflammatory irritation of the diaphragm.

In the present study, the incidence of postoperative shoulder tip pain was significantly lower in patients receiving intraperitoneal saline instillation (26.27%) compared with pulmonary recruitment maneuver (57.78%). These findings support the hypothesis that saline instillation provides more effective removal or displacement of residual gas.

Additionally, hospital stay and hemodynamic parameters were comparable between both groups, indicating that both techniques are safe and feasible.

The results of this study are consistent with previous studies that have demonstrated the beneficial role of intraperitoneal saline instillation in reducing post-laparoscopic shoulder pain.

Limitations

- Single-center study
- Moderate sample size
- Subjective assessment of pain

Future multicenter studies with larger sample sizes are recommended to further validate these findings.

CONCLUSION

Intraperitoneal normal saline instillation is a simple, safe, and effective technique for reducing postoperative shoulder tip pain following laparoscopic surgery. Compared with pulmonary recruitment maneuver, it significantly decreases the incidence of postoperative discomfort and may enhance patient recovery and satisfaction.

Declarations

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Conflict of Interest: None declared

Ethical Approval: Obtained from Institutional Ethics Committee

Informed Consent: Obtained from all participants.

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