e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(1); 872-878

Original Research Article

Randomized Controlled Prospective Postoperative Assessment of Analgesic Efficacy of the Pulmonary Recruitment Manoeuvre Compared to Intraperitoneal Hydrocortisone in Laparoscopic Gynaecological Surgeries

Amish Kumar[1], Rishi kant[2], Rajesh Verma[3]

[1]Senior Resident, Department of Anesthesia and Critical Care, Patna Medical College and Hospital, Patna, Bihar, India.

[2]Junior Resident, Department of Anesthesia and Critical Care, Patna Medical College and Hospital, Patna, Bihar, India

[3]Associate Professor, Department of Anesthesia and Critical Care, Patna Medical College and Hospital, Patna, Bihar, India

Received: 05-10-2022 / Revised: 25-11-2022 / Accepted: 02-12-2022

Corresponding author: Dr Rishi kant

Conflict of interest: Nil

Aim: To investigate the hypothesis that PRM is superior to intraperitoneal hydrocortisone for postoperative pain reduction in patients who have undergone laparoscopic gynaecological surgery.

Methodology: A prospective, randomized, controlled study was conducted in Department of Anesthesia and critical care, Patna Medical college and hospital, Patna, Bihar, India for one year. Female patients of American Society of Anesthesiologists (ASA) physical status I and II, aged between 20 and 45 years, scheduled for diagnostic laparoscopic gynaecological surgeries done as a part of infertility management were enrolled to participate in this study. The day before surgery, all patients had pre-anesthesia check-up with routine and subjective investigation as per requirement. The visual analogue score (VAS) was explained to the patients (where 0 = no pain and 10 = worst imaginable pain). A written valid informed consent was obtained from the patients. By the end of the operation, using a computer-generated randomization schedule, patients were randomly assigned into three equal groups i.e. Hydrocortisone group, pulmonary recruitment group, and control group. Vital measurements, (blood pressure and heart rate) were also recorded hourly for the first 24 h. The primary outcome was the first 24 h total analgesic consumption.

Results: There was no statistically significant difference between the three groups in demographic details. In addition, the VAS scores gradually decreased from group A to D, although a statistically significant difference was only found at 6 hours postoperatively (P=0.03). There were no complications related to the interventions. There was a statistically significant difference between both the hydrocortisone and the pulmonary recruitment groups in comparison with the control group as regards 24 h postoperative total analgesic consumption. Also, the first request for analgesia was less in both the hydrocortisone and the pulmonary recruitment groups as compared to the control group with a significant.

Conclusion: Our study demonstrates that performing a pulmonary recruitment maneuver at the completion of laparoscopic surgery significantly reduces pain after gynecologic laparoscopy. Both intraperitoneal hydrocortisone installation and the pulmonary recruitment maneuver could effectively reduce pain but intraperitoneal hydrocortisone might give a longer pain-free time following gynaecological laparoscopies.

Keywords: Intraperitoneal, hydrocortisone, Laparoscopy.

Introduction

Laparoscopic gynecological surgery is a minimally invasive approach that allows the surgeon to operate without making a large incision. A thin, lighted tube with a camera on the end, known as a laparoscope, is inserted into the abdomen through a small incision. The camera sends images of the inside of the body to a TV monitor in the operating room, allowing the surgeon to see and operate on the pelvic organs without having to use a long incision. Other small incisions may be made in the abdomen to insert very fine specialized surgical instruments. Laparoscopic surgeries are becoming more attractive because of early recovery [1].

Benefits of laparoscopic gynecological surgery can include less pain compared to open abdominal surgery, fewer complications, less scarring, shorter hospital stays, and faster recovery. Laparoscopic surgery can be used to treat a variety of gynecologic conditions that previously required large incisions, including endometriosis, fibroids, ovarian cysts, ectopic pregnancy, sterilization, pelvic problems such as urinary incontinence and pelvic support problems such as uterine prolapse. It can also be used for a variety of procedures, including a laparoscopic hysterectomy and a laparoscopically assisted vaginal hysterectomy.

Pain is one of the most common medical causes of delayed discharge after ambulatory surgery. Unfortunately, prevention and treatment of postoperative pain continues to be a major challenge [2]. Pain after laparoscopy is considered to arise from the incision site, the pneumoperitoneum, and the procedure site. Pneumoperitoneum can result in referred shoulder pain from the sub diaphragmatic region which might stay for twenty-four hours. Incisional pain is highest directly postoperative and subsides with time [3]. Passive exsufflation of carbon dioxide (CO2), intraperitoneal instillation of drugs like hydrocortisone [4] and the pulmonary recruitment manoeuvre (PRM) are some of the several methods that have been used to relieve laparoscopic postoperative pain.

The pulmonary recruitment manoeuvre will automatically wash away residual carbon dioxide (CO_2) after laparoscopic surgery, reduce phrenic nerve irritation, and consequently reduce post-laparoscopic shoulder and upper abdominal pain [5]. Although PRM and intraperitoneal hydrocortisone are reported to be effective, no head-to-head comparison of the two methods was done. Therefore, we designed this study to investigate the hypothesis that PRM is superior to intraperitoneal hydrocortisone for postoperative pain reduction in patients who have undergone laparoscopic gynaecological surgery.

Materials and Methods

A prospective, randomized, controlled study was conducted Department of Anesthesia and critical care, Patna Medical college and hospital, Patna, Bihar, India for one year. Female patients of American Society of Anesthesiologists (ASA) physical status I and II, aged between 20 and 45 years, scheduled for diagnostic laparoscopic gynaecological surgeries done as a part of infertility management were enrolled to participate in this study. Patients refusing to participate in the study, patients with a history of chronic pain, those with chronic respiratory disease, advanced renal, hepatic or cardiac diseases, and patients on opioids, tranquilizers, or steroids were excluded from the study. The day before surgery, all patients had pre-anesthesia

check-up with routine and subjective investigation as per requirement. The visual analogue score (VAS) was explained to the patients (where 0 = no pain and 10 = worst imaginable pain). A written valid informed consent was obtained from the patients.

In the pre-anaesthesia room 1 h before the procedure, a 20 gauge cannula was inserted peripherally and the patients were premedicated with intravenous (IV) midazolam 0.02 mg/kg, pantoprazole 40 mg, 10 mg metoclopramide before induction of general anaesthesia. After preoxygenation with 100% oxygen (O_2) for 3 min, anaesthesia was induced with IV propofol 2 mg/kg, 1 μg/kg of fentanyl followed by 0.5 mg/kg of atracurium to facilitate endotracheal intubation. Anaesthesia was maintained with isoflurane 1-1.5% in 100% O_2 and a state of muscle relaxation was maintained by IV atracurium 0.1 mg/kg every 30 min with volume-controlled mode of mechanical ventilation and adjusted parameters to keep end-tidal CO_2 between 35 and 40 mm Hg. All patients were continuously monitored by electrocardiogram (ECG), repeated non-invasive arterial blood pressure measurement every 5 min, and continuous end-tidal CO_2 and arterial oxygen saturation (SpO_2) by pulse oximetry. IV paracetamol 1g in 100 ml infusion over 15-20 min, was given 30 min before the end of surgery.

Laparoscopy was done using CO_2 as a distension medium. First, the Veress needle was introduced through the lower border of the umbilicus. A water test was done to confirm intraperitoneal placement. Then, the correct distension pressure was ensured when no dullness was felt over the lower border of the liver. The intraabdominal pressure was maintained between 12 to 14 mmHg. The patient was placed in the Trendelenburg position to provide optimum conditions for the laparoscopic view. A 10 mm laparoscopic trocar was introduced with 45 degrees towards the pelvis and a zero camera was introduced through the cannula trocar. The second puncture could be done through the right or left iliac fossae. By the end of the operation, using a computer-generated randomization schedule, patients were randomly assigned into three equal groups:

Group (A) (hydrocortisone group), in which patients received intraperitoneal 100mg hydrocortisone in 150 ml normal saline in addition to routine method to remove CO_2.

Group (B) (pulmonary recruitment group), in which CO2 was exsufflated by pulmonary recruitment maneuver performed manually using five positive pressure ventilation at a maximum pressure of 40 cmH_2O. The fifth positive pressure inflation was held by anaesthesiologist for approximately 5 s with the valves on the operative ports opened fully at end of surgery in addition to the routine method to remove CO_2.

Group (C) (control group), in which the routine method was performed by applying gentle abdominal pressure and removing CO2 by passive exsufflation through the port site at the end of the surgery.

Residual neuromuscular block was antagonized with IV atropine 0.01 mg/kg and neostigmine 0.05 mg/kg and extubation was done according to the extubation criteria. In the recovery room, patients were asked about post-operative shoulder and upper abdominal pain. Pain severity was assessed using the VAS. Pain with VAS score more than 3 was controlled using meperidine in increments of 20 mg every 20 min until the VAS is ≤ 3. Then, the patients were discharged to the ward according to the standard criteria.

In the ward, postoperative 24 h total analgesic consumption and time of first rescue analgesic request were recorded. Patients were also asked to fill a questionnaire at 1 and 24 hr postoperatively using the VAS of pain severity. Vital measurements, (blood pressure and heart rate) were also recorded hourly for the first

24 h. The primary outcome was the first 24 h total analgesic consumption. The secondary outcomes were the time for the first request of analgesia in minutes, pain score (VAS), mean arterial blood pressure, heart rate in the first 24 h postoperatively and the incidence of postoperative nausea, vomiting, or abdominal distension. Numerical data were presented as mean ± standard deviation or median (interquartile range). Categorical data were presented as frequency (percentage). Chi-square test was used to analyse categorical data.

Results

During the study period, 90 patients were enrolled. The study groups were comparable with respect to the demographic profile baseline values of haemodynamic variables and surgical duration; there was no statistically significant difference between the three groups.

Table 1: Demographic details and baseline hemodynamic variables data

Variables	Group A (Hydrocortisone)	Group B (Pulmonary recruitment)	Group C (Control)	P-value
Age (in years)	29.5+3.2	29.7+4.0	29.6+5.5	0.786
Weight (in Kg)	72.6+9.6	71.9+8.4	71.6+9.0	0.813
Duration of surgery (minutes)	50+6.2	56.4+8.4	53.6+7.8	0.920
Baseline HR (min)	73.3+7.1	73.2+8.2	73.0+7.6	0.976
Baseline MBP (mmHg)	74.6+6.2	73.8+5.8	74.0+6.0	0.845
ASA 1/2	19/11	17/13	22/8	0.425

There was a statistically significant difference between both the hydrocortisone and the pulmonary recruitment groups in comparison with the control group as regards 24 h postoperative total analgesic consumption (*P* value <0.001). Also, the first request for analgesia was less in both the hydrocortisone and the pulmonary recruitment groups as compared to the control group with a significant (*P* value <0.001). There was no significant difference as regards the total analgesic consumption between the two intervention groups.

Table 2: Postoperative total analgesic profile

Variables	Group A (Hydrocortisone)	Group B (Pulmonary recruitment)	Group C (Control)	P-value
Total analgesic consumption (mg)	20.9+14.6	28.4+12.8	54.3+20.6	<0.001
Time to first rescue analgesia (min)	45.5+8.6	43.4+9.2	31.6+9.6	<0.001

Regarding pain scores, the VAS was used. The abdominal and shoulder pain scores were significantly lower in both the hydrocortisone and the pulmonary recruitment groups as compared to the control group (*P* value <0.001). But there was no statistically significant difference between the two intervention groups in the

first 12 h postoperatively. VAS 24 showed a significant difference between the two intervention groups (*P* value <0.001).

Table 3: Mean VAS scores during first 24 hours.

VAS	Group A (Hydrocortisone)	Group B (Pulmonary recruitment)	Group C (Control)
1 hour	5.7	4.2	3.5
2 hours	4.9	3.6	2.9
4 hours	4.8	2.0	1.8
6 hours	4.2	2.3	2.4
12 hours	3.0	2.2	2.0
24 hours	2.8	3.0	1.2

Table 4: Postoperative nausea and vomiting in all the three groups.

PONV	Group						P-value
	Group A (Hydrocortisone)		Group B (Pulmonary recruitment)		Group C (Control)		
	Count	%	Count	%	Count	%	
Yes	13	43.3	14	46.7	17	56.7	0.315
No	17	56.7	16	53.3	13	43.3	

The patients in the three groups were similar regarding the frequency of postoperative nausea and vomiting. Mean arterial blood pressure was higher during the first 4 hour in the control group as compared to the hydrocortisone and the pulmonary recruitment groups with no significant difference after that.

Discussion

Although the pain following laparoscopic surgery is usually milder and easier to resolve than that after a laparotomy [6, 7], shoulder pain is a very common presentation that may cause even more discomfort than the pain at the incision site. The incidence of shoulder pain following laparoscopy ranges from 35% to 65% and the severity of pain varies [8, 9]. The pain intensity peaks during the first few hours after surgery and usually declines over the ensuing 2–3 days [10, 11]. Even though it remains unclear why a considerable number of patients experience shoulder pain after laparoscopy, peritoneal stretching and diaphragmatic irritation caused by CO2 gas seem to play a significant role in its mechanism [12, 13].

Thus, several trials have assessed the use of intraperitoneal local anesthetics with controversial results [14-16]. In 2008, Phelps et al [17] reported that a pulmonary recruitment maneuver that removed residual abdominal CO2 after laparoscopy reduced shoulder pain by more than half. The maneuver they used consisted of 5 manual pulmonary inflations with a peak pressure of 60 cm H2O. Although there were no adverse pulmonary effects, the risk of pneumothorax associated with high airway pressure remains questionable.

In the present study, both PRM and the intraperitoneal hydrocortisone installation significantly reduced the incidence and intensity of upper abdominal and shoulder pain after laparoscopic gynaecological surgeries without significant adverse effects; total analgesic requirements were less in the hydrocortisone and pulmonary recruitment groups during the first 24 h postoperatively as compared to the control group. However, the VAS score showed that the effect of intraperitoneal hydrocortisone is longer lasting.

Tsai H *et al* [18] compared the effect of intraperitoneal normal saline instillation and pulmonary recruitment for shoulder and upper abdominal pain using VAS score for 48 h and concluded that the effect of intraperitoneal normal saline instillation (INSI) was longer-lasting and more persistent than that of PRM. INSI had an additional buffer system. In contrast to PRM, the effect of INSI is long-lasting, continuous, and physiological until the normal saline is absorbed. Several studies investigated the use of intraperitoneal local anaesthetics and other drugs as a method to decrease postoperative shoulder pain. In the study done by Jain S *et al*., it was found that intraperitoneal instillation of high-volume local anaesthetic was effective in decreasing shoulder pain in a good number of patients because this volume covers effectively a larger area of sub-hepatic space together with the surrounding peritoneum [19].

Güngördük K *et al* [20] reported that the PRM effectively and safely reduced postoperative shoulder and upper abdominal pain levels in patients undergoing laparoscopic gynaecological oncologic surgery. Also, in accordance with the present study, Liu H *et al* [21] investigated the efficacy of combining local anaesthetic infiltration of ropivacaine with pulmonary recruitment manoeuvre on postoperative pain following diagnostic hysteroscopy and laparoscopy. [22] It was so effective that there were more patients without shoulder pain and fewer requiring tramadol. A study done by Khanna *et al* [5] investigated simple pulmonary recruitment maneuver to reduce pain after laparoscopic cholecystectomy and found that it is a simple and safe technique that can be implemented routinely after abdominal laparoscopy. The manoeuvre was different to ours, such that only two manual inflations to a maximum pressure of 60cm H_2O were done and each was held for 5 s.

Conclusion

Our study demonstrates that performing a pulmonary recruitment maneuver at the completion of laparoscopic surgery significantly reduces pain after gynecologic laparoscopy. Both intraperitoneal hydrocortisone installation and the pulmonary recruitment maneuver could effectively reduce pain but intraperitoneal hydrocortisone might give a longer pain-free time following gynaecological laparoscopies.

References

1. Johnson N, Barlow D, Lethaby A, Tavender E, Curr E, Garry R. Surgical approach to hysterectomy for benign gynecological disease Cochrane Database Syst Rev. 2006;2:CD003677.
2. Vadivelu N, Mitra S, Narayan D. Recent advances in postoperative pain management Yale J Biol Med. 2010;83:11–25
3. Mitra S, Khandelwal P, Roberts K, Kumar S, Vadivelu N. Pain relief in laparoscopic cholecystectomy-- A review of the current options Pain Pract. 2012;12:485–96.
4. Sarvestani AS, Amini S, Kalhor M, Roshanravan R, Mohammadi M, Lebaschi AH. Intraperitoneal hydrocortisone for pain relief after laparoscopic cholecystectomy Saudi J Anaesth. 2011;7:14–7.
5. Khanna A, Sezen E, Barlow A, Rayt H, Finch JG. Randomized clinical trial of a simple pulmonary recruitment maneuver to reduce pain after laparoscopy Br J Surg. 2011;1001290 – 4.
6. Grace PA, Quereshi A, Coleman J, Keane R, McEntee G, Broe P, et al. Reduced postoperative hospitalization after laparoscopic cholecystectomy. Br J Surg 1991;78:160-2.
7. Ortega AE, Hunter JG, Peters JH, Swanstrom LL, Schirmer B; Laparoscopic Appendectomy Study Group. A prospective, randomized comparison of laparoscopic appendectomy with open

appendectomy. Am J Surg 1995;169: 208-12.
8. Alexander JI. Pain after laparoscopy. Br J Anaesth 1997;79:369-78.
9. Cason CL, Seidel SL, Bushmiaer M. Recovery from laparoscopic cholecystectomy procedures. AORN J 1996;63:1099-103.
10. Ure BM, Troidl H, Spangenberger W, Dietrich A, Lefering R, Neugebauer E. Pain after laparoscopic cholecystectomy. Intensity and localization of pain and analysis of predictors in preoperative symptoms and intraoperative events. Surg Endosc 1994;8:90-6.
11. Lee DH, Song T, Kim KH, Lee KW. Incidence, natural course, and characteristics of postlaparoscopic shoulder pain. Surg Endosc 2010;32: 160-5.
12. Korell M, Schmaus F, Strowitzki T, Schneeweiss SG, Hepp H. Pain intensity following laparoscopy. Surg Laparosc Endosc 1996;6:375-9.
13. Song T, Kim KH, Lee KW. The intensity of postlaparoscopic shoulder pain is positively correlated with the amount of residual pneumoperitoneum. J Minim Invasive Gynecol 2010;24: 984-989.e1.
14. Labaille T, Mazoit JX, Paqueron X, Franco D, Benhamou D. The clinical efficacy and pharmacokinetics of intraperitoneal ropivacaine for laparoscopic cholecystectomy. Anesth Analg 2002;94:100-5.
15. Lee IO, Kim SH, Kong MH, Lee MK, Kim NS, Choi YS, et al. Pain after laparoscopic cholecystectomy: the effect and timing of incisional and intraperitoneal bupivacaine. Can J Anaesth 2001;48:545-50.
16. Narchi P, Benhamou D, Fernandez H. Intraperitoneal local anaesthetic for shoulder pain after day-case laparoscopy. Lancet 1991;338:1569-70.
17. Phelps P, Cakmakkaya OS, Apfel CC, Radke OC. A simple clinical maneuver to reduce laparoscopy-induced shoulder pain: a randomized controlled trial. Obstet Gynecol 2008;111:1155-60.
18. Tsai HW, Chen YJ, Ho CM, Hseu SS, Chao KC, Tsai SK, et al Maneuvers to decrease laparoscopy-induced shoulder and upper abdominal pain: A randomized controlled study Arch Surg. 2011;146:1360–6.
19. Jain S, Nazir N, Singh S, Sharma S. A prospective randomized controlled study for evaluation of high-volume low-concentration intraperitoneal bupivacaine for post-laparoscopic cholecystectomy analgesia Indian J Anaesth. 2010;62:109–14.
20. Güngördük K, Aşıcıoğlu O, Özdemir İA. Effect of the pulmonary recruitment maneuver on pain after laparoscopic gynecological oncologic surgery: A prospective randomized trial J Gynecol Oncol. 2010;29:e92
21. Liu H, Ma C, Zhang X, Yu C, Yang Y, Song X, et al Combined incisional ropivacaine infiltration and pulmonary recruitment maneuver for postoperative pain relief after diagnostic hysteroscopy and laparoscopy Chin Med J. 2011;127: 825–9.
22. Chola J. M., Belrhiti Z., Dieudonné M. M., Charles K. M., Herman T. K., Didier C. K., Mildred C. C., Faustin C. M., & Albert M. T. The Severe Maternal Morbidity in the Kisanga Health Zone in Lubumbashi, South of the Democratic Republic of Congo. Journal of Medical Research and Health Sciences. 2022; 5(1): 1647–1652.