

## Postoperative Analgesic Efficacy of Intraperitoneal Ropivacaine in Patients Undergoing Laparoscopic Cholecystectomy

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**Abstract: Background-** Laparoscopic cholecystectomy is one of the most commonly performed day care surgeries. Although the patients complain of less pain than the open procedures, yet the emanating visceral pain causes significant discomfort. Multimodal analgesics have been tried to alleviate this pain by various routes. Intraperitoneal administration of local anaesthetics is one such modality. Ropivacaine when used intraperitoneally provides profound and prolonged analgesia. **Aim-** The aim of this study was to evaluate the analgesic efficacy of intraperitoneally administered Ropivacaine in patients undergoing laparoscopic cholecystectomy. **Materials and methods-** Patients were randomly allocated into two groups: Group C (control group n= 50) which received 40 ml of 0.9% saline and Group R (Ropivacaine group n= 50) which received 2mg/kg of Ropivacaine made to a total of 40 ml volume. Postoperative assessment of pain was done using visual analogue scale (VAS) and at VAS>3 intravenous tramadol 1mg/kg was administered. Time to first request of analgesia, total number of rescue analgesics in 24 hours at VAS>3, the incidence and severity of postoperative shoulder pain as well as adverse effects if any were noted. **Results-** Both the groups control group (group C) and the Ropivacaine group (group R) were comparable with regards to demographic profile and total duration of surgery. Ropivacaine provided prolonged duration of analgesia ( $19.68 \pm 2.48$  hours) compared to the control group ( $6.72 \pm 4.13$  hours), the results being statistically highly significant ( $P < 0.001$ ). Mean number of rescue analgesics in 24 hours at VAS> 3 were higher in the control group ( $1.9 \pm 0.54$ ) than the Ropivacaine group ( $0.82 \pm 0.39$ ), the difference being statistically significant ( $P < 0.05$ ). The incidence of shoulder pain albeit small, was comparable in both the groups and severity ranged from VAS 2-4. Incidence of nausea and vomiting was 10% and 20% respectively in the control group and Ropivacaine group. No other side effects were observed. **Conclusion-** Intraperitoneal instillation of Ropivacaine provides an effective and protracted analgesia in patients undergoing laparoscopic cholecystectomy.

**Keywords-** Laparoscopic cholecystectomy, Postoperative analgesia, Ropivacaine, Intraperitoneal.

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### I. Introduction

Pain following laparoscopic procedures albeit subtle than open procedures may significantly alter early patient recovery and hospital discharge. It is multifactorial in origin: abdominal wall visceral pain and referred shoulder pain being the common incriminating factors.<sup>1</sup> First 24 hours are the most crucial when the visceral pain predominates. Peritoneal distension during insufflation, traumatic shearing of blood vessels and nerves and subsequent purvey of inflammatory mediators are all triggering factors.<sup>2</sup> Multimodal analgesics have been tried to alleviate pain following laparoscopic cholecystectomy. Over the years intraoperative use of local anesthetics during laparoscopy for postoperative pain relief has gained interest. They act by reversible blockade of generation and propagation of action potential in nerves and other excitable tissue, at the level of sodium channels.<sup>3,4,5</sup> Ropivacaine, a long acting amide, released in 1996, when given intraperitoneally initiates its action in 15-20 minutes and reduces postoperative visceral and shoulder pain following laparoscopic cholecystectomy.<sup>6</sup> The aim of the present study was therefore to evaluate the postoperative analgesic efficacy of Ropivacaine given intraperitoneally in patients undergoing laparoscopic cholecystectomy.

### II. Materials and methods

The present study was a randomized, prospective, double blind study which included 100 patients of ASA-I and ASA-II physical status of either sex between the age groups of 20-60 years undergoing elective laparoscopic cholecystectomy. Before enrolment for the study, patients were informed about the aims, methods and anticipated benefits as well as hazards of the study. The study was initiated after obtaining informed written

consent from the patients as well as approval from the hospital ethics committee. Unwilling patients, those with history of acute cholecystitis or allergy to amide local anesthetics and those with previous abdominal surgery were excluded from the study. Patients in whom the laparoscopic procedure was converted to open cholecystectomy due to any reason were also not included in this study.

Pre-anaesthetic evaluation was done a day prior to surgery and included a detailed history and general physical and systemic examination. Basic demographic parameters like age, sex and weight were noted as also the baseline values of pulse, blood pressure and respiratory rate. Investigations comprising of electrocardiogram, X-ray chest, complete blood counts, renal function tests, serum electrolytes, blood sugar and liver function tests were noted. Patients were kept overnight fasting and tablet alprazolam 0.25 mg was given at bed time and tablet pantoprazole 40 mg was given early in the morning with a sip of water. Using sealed envelope technique patients were randomly allocated into two groups: Group C (control group n= 50) which received 40 ml of 0.9% saline and Group R (Ropivacaine group n= 50) which received 2mg/kg of Ropivacaine made to a total of 40 ml volume.

In the operation theatre after obtaining an intravenous access, ECG, pulse oximeter and non-invasive blood pressure monitors were attached. Injection glycopyrrolate 0.2mg, injection tramadol 2mg/kg and injection ondansetron 0.1mg/kg were given intravenously. After preoxygenating the patient with 100% oxygen, induction was carried out with injection Propofol 2mg/kg intravenous and tracheal intubation facilitated with oral cuffed endotracheal tube after giving intravenous vecuronium 0.1mg/kg. Intermittent positive pressure ventilation was then done with oxygen, nitrous oxide, isoflurane and top ups of injection vecuronium. End tidal carbon dioxide monitor was attached and normocapnia maintained (35-40 mmHg). Intravenous diclofenac 75mg was given in all the patients post intubation. The intra-abdominal pressure was maintained around 10-12 mmHg in all the patients. After the removal of gall bladder, intraperitoneal instillation of the 40 ml of the prepared solution was done under both the domes of diaphragm and the patients were made to lie in the Trendelenburg position for 10-15 minutes until the closure. Reversal from general anesthesia was then carried out with injection neostigmine 0.05mg/kg and injection glycopyrrolate 0.01mg/kg intravenous followed by extubation. All the surgical procedures were done by the single surgeon.

Postoperative pain was assessed using visual analog scale (VAS), consisting of 10 cm scale representing varying intensity of pain from 0 cm (no pain) to 10 cm (worst imaginable pain). Tramadol, 1mg/kg intravenous was used as rescue analgesic if patient complained of postoperative pain (VAS > 3). Postoperative assessment of pain was done by a staff nurse who was blinded to the study. Following parameters were noted in both the groups:

- Time to first request of analgesia i.e time elapsed between extubation and first rescue analgesic dose.
- Total number of rescue analgesic doses (intravenous tramadol 1mg/kg) at VAS > 3 in first 24hrs.
- Incidence and severity of shoulder pain in 24 hrs. (VAS Score).
- Complications (cardiovascular, neurological, allergic, nausea and vomiting ) if any.

The data was analyzed using statistical software Microsoft excel and SPSS 22 for windows. The results were reported as mean  $\pm$  standard deviation for quantitative variables and percentage (%) for qualitative variables. Statistical significance among mean differences was obtained using student t-test and chi-square test and  $p < 0.05$  was deemed to be statistically significant.

### **III. Results**

Both the groups, the control group (group C) and the Ropivacaine group (group R) were comparable with regards to the demographic profile i.e age, weight and sex as well as the duration of surgery (**TABLE 1**). However, the mean duration between extubation and first analgesic dose was  $6.72 \pm 4.14$  hours in the control group (group C) and  $19.68 \pm 2.48$  hours in the Ropivacaine group (group R), the difference between them being statistically highly significant ( $p < 0.001$ ) (**TABLE 2**). Mean number of rescue analgesics at VAS > 3 in 24 hours were  $1.9 \pm 0.54$  in the control group (group C) and  $0.82 \pm 0.39$  in the Ropivacaine group (group R), the difference being statistically highly significant (**TABLE 3**). 10 (20%) patients in the control group (group C) and 5 (10%) patients in the Ropivacaine (group R) reported shoulder pain peaking after 18 hours and attaining a severity of 4 (2-4) in the visual analogue scale (VAS). Only 5 (10%) in the control group (group C) and 3 (6%) patients in the Ropivacaine group (group R) complained of postoperative nausea and vomiting and no other adverse effects were observed (**TABLE 4**).

**Table 1-** Demographic Profile Of Patients

DEMOGRAPHIC PROFILE	GROUP C	GROUP R	P VALUE
Age in years (mean± SD)	37.18± 4.42	37± 4.40	P=0.838
Weight in Kg (mean± SD)	63.68± 3.94	64.32± 3.89	P=0.415
Sex (Female: Male)	30: 20	30: 20	P>0.9
Duration of surgery (mean ± SD)	53.74± 7.25	55.7± 7.17	P=0.177

P> 0.05 non-significant SD-Standard Deviation

**Table 2-** Time Interval Between Extubation And First Analgesic Dose

TIME (IN HOURS)	GROUP C	GROUP R	P VALUE
Mean± SD	6.72± 4.14	19.68± 2.48	0.00000

P< 0.001 Highly significant

**Table 3-** Number Of Doses Of Intravenous Tramadol At Vas>3 In First 24 Hours Following Extubation

NO. OF DOSES IN 24hrs	GROUP C	GROUP R	P VALUE
Mean± SD	1.9±0.54	0.82± 0.39	0.00000

P< 0.001 Highly significant VAS- Visual Analogue Scale

**Table 4-** Assesment Of Shoulder Pain And Complications

	GROUP C (%)	GROUP R (%)	
<b>NO. OF PATIENTS WITH SHOULDER PAIN</b>	10 (20)	5 (10)	P>0.08
<b>TIME INTERVAL (IN hrs) AT WHICH PAIN OBSERVED</b>			
0-6			
6-12			
12-18			
18-24	10	5	
<b>VAS SCORE OF SHOULDER PAIN</b>			
0	40	35	
1	-	-	
2	2	3	
3	2	2	
4	4	-	
<b>COMPLICATIONS</b>			
<b>NAUSEA/ VOMITING</b>	5 (10)	3 (6)	P>0.23
<b>OTHERS</b>	-	-	

P>0.05 non-significant

#### IV. Discussion

The advent of laparoscopic procedures has transmogrified surgical procedures with benefits of less postoperative pain than the conventional procedures, cosmetically better scar, less bleeding, early discharge and reduced hospital expenditures. The pain in laparoscopic procedures is either somatic originating from the site of incision, visceral pain or referred pain due to pneumoperitoneum.<sup>7</sup> As the laparoscopic procedures are day care procedures, the amelioration of pain becomes all the more important. Various analgesic modalities have been tried to remediate this pain including parenteral NSAIDs, opioids and local infiltration. Local anaesthetics act by inhibiting visceral nociception as well as the release and action of prostaglandins and other noxious agents on the nociceptors.<sup>8</sup> The main benefit of local anaesthetics is that they provide adequate analgesic relief without deleterious effects of opioids. Bupivacaine has been the most widely used local anaesthetic and its efficacy via the intraperitoneal route has been well evaluated in various studies.<sup>9,10,11</sup>

Intraperitoneal route of Ropivacaine has been widely studied and inferred to provide adequate postoperative analgesia and reduced consumption of rescue analgesics without any deleterious effects.<sup>12,13,14</sup>

In our study the mean duration (in hours) between extubation and first analgesic dose was 6.72± 4.14 in the control group which received 40ml of 0.9% saline whereas it was 19.68± 2.48 in the Ropivacaine group which received 40 ml of Ropivacaine in adose of 2mg/kg, the difference between the two being statistically as

well as clinically significant. Instillation of normal saline intraperitoneally also proffers analgesic effects as demonstrated in certain studies.<sup>15,16</sup> However intraperitoneal instillation of local anaesthetic Ropivacaine prolongs the duration of postoperative analgesia as corroborated by various literary evidences. Das N et al in their study observed prolonged duration of analgesia and numeric rating scores (NRS) <5 upto 16 hours postoperatively compared to intraperitoneal instillation of bupivacaine or saline.<sup>17</sup> Kucuk et al concluded enhanced analgesic effects after intraperitoneal Ropivacaine instillation compared to that of bupivacaine or placebo.<sup>12</sup> The longer duration of analgesia with intraperitoneal instillation of Ropivacaine as seen in our study can be explained on the basis of the fact that the concentration and volume of Ropivacaine used in our study was more.<sup>18,19</sup> As the mean body weight in our study was 64 kg, the mean concentration of Ropivacaine used was 0.32%. Also the use of preemptive analgesic medication (intravenous tramadol and diclofenac in the present study) prolonged the duration of postoperative analgesia.<sup>20</sup>

Mean number of rescue analgesic tramadol at VAS> 3 in the first 24 hours following extubation were  $1.9 \pm 0.54$  in the control group and  $0.82 \pm 0.39$  in the Ropivacaine group, the results being statistically highly significant ( $P < 0.001$ ). Intraperitoneal instillation of Ropivacaine because of its better analgesic efficacy significantly lowers the rescue analgesic consumption.<sup>21</sup>

Shoulder pain was reported after 18 hours, incidence being 20% in the control group (group C) and 10% in the Ropivacaine group (group R), the differences being statistically nonsignificant ( $P > 0.05$ ). The severity ranged from VAS (visual analogue scale) 2-4. The formation of carbonic acid (a strong diaphragmatic irritant) from carbon dioxide on moist peritoneal surface during laparoscopic procedures accounts for referred pain to neck and shoulder.<sup>9,22</sup> However the reduced incidence and severity of shoulder pain in our study was attributable to lower rate and pressure of insufflation, instillation of the prepared solution in the head down position under both the hemidiaphragms, use of preemptive NSAIDs and opioids and better emptying of pneumoperitoneum.<sup>5,23,24,25</sup> Saline irrigation and suctioning at the end of procedure prior to drug instillation also dilutes this carbonic acid thereby allaying shoulder pain.<sup>15</sup>

Nausea and vomiting was the only adverse effect seen in our study, the incidence in the control group (group C) and Ropivacaine group (group R) being statistically nonsignificant. The reduced incidence of nausea vomiting could be due to prophylactic administration of ondansetron a potent antiemetic.

Ropivacaine because of its vasoconstricting features has negligible systemic absorption and consequent better safety profile.<sup>26</sup> The maximum recommended dose of Ropivacaine is 3mg/kg.<sup>27,28</sup> In the present study the dose of Ropivacaine used was 2mg/kg, lower than the recommended, therefore the plasma concentrations were not measured.

## V. Conclusion

Intraperitoneal instillation of Ropivacaine under both the domes of diaphragm at the end of surgery provides an excellent, effective, prolonged and profound analgesia in patients undergoing laparoscopic cholecystectomy. The ease of administration together with a favorable safety profile makes its use amenable to day care surgeries.

## References

- [1]. Joris J, Thiry E, Paris P, Weerts J, Lamy M. Pain after laparoscopic cholecystectomy: characteristics and effect of intraperitoneal bupivacaine. *Anesth Analg* 1995;81(2):379-384.
- [2]. Shivhare P, Dugg P, Singh H, Mittal S, Kumar A, Munghate A. A prospective randomized trial to study the effect of intraperitoneal instillation of ropivacaine in postoperative pain reduction in laparoscopic cholecystectomy. *J Minim Invasive Surg Sci* 2014;3(4):e18009.
- [3]. de Jong E, Field JA, Spinnler HE, Wijnberg JB, de Bont JA. Significant biogenesis of chlorinated aromatics by fungi in natural environments. *Appl Environ Microbiol.* 1994;60(1):264-70.
- [4]. T. Labaille, X. Mazoit, X. Paqueron, D. Franco and D. Benhamou. The Clinical Efficacy and Pharmacokinetics of Intraperitoneal Ropivacaine for Laparoscopic Cholecystectomy.
- [5]. *Anesthesia & Analgesia* 2002;94(1): 100-105.
- [6]. Boddy AP, Mehta S, Rhodes M. The effect of intraperitoneal local anesthesia in laparoscopic cholecystectomy: a systematic review and meta-analysis. *Anesth Analg* 2006;103:682-688.
- [7]. Labaille T, Mazoit JX, Paqueron X, Franco D, Benhamou D. The clinical efficacy and pharmacokinetics of intraperitoneal ropivacaine for laparoscopic cholecystectomy. *Anesth Analg* 2002; 94:100-105 Kim TH, Kang H, Park JS, Chang IT, Park SG. Intraperitoneal Ropivacaine instillation for postoperative pain relief after laparoscopic cholecystectomy. *J Korean Surg Soc* 2010; 79: 130-6.
- [8]. Liu SS, Hodgson PS. Local anaesthetics. In: Barash PG, Cullen BF, Stoelting RK, editors. *Clinical Anaesthesia*. 4th ed. Philadelphia, PA: Lippicott Williams & Wilkins; 2001. p. 449-69.
- [9]. Anand S, Bajwa SJS, Kapoor BB, Jitendera M, Gupta H. Comparative evaluation of intraperitoneal bupivacaine, magnesium sulphate and their combination for postoperative analgesia in patients undergoing laparoscopic cholecystectomy. *Niger J Surg Sci* 2014; 24: 42-8.
- [10]. Shukla U, Prabhakar T, Malhotra K, Srivastava D, Malhotra K. Intraperitoneal bupivacaine alone or with dexmedetomidine or tramadol for postoperative analgesia following laparoscopic cholecystectomy: A comparative evaluation. *Indian J Anaesth* 2015; 59(4): 234-239.

- [11]. Yadav A, Rajput SK, Katiyar S, Jain RK. A comparison of intraperitoneal bupivacaine –tramadol with bupivacaine-magnesium sulphate for pain relief after laparoscopic cholecystectomy: A prospective randomized study. *Indian J Anaesth.* 2016; 60(10):757-762.
- [12]. Kucuk C, Kadiogullari N, Canoler O, Savil S. A placebo –controlled comparison of bupivacaine and Ropivacaine instillation for preventing postoperative pain after laparoscopic cholecystectomy. *Surg Today* 2007; 37(5):396-400.
- [13]. Gupta A. Local Anaesthesia for pain relief after laparoscopic cholecystectomy- A systemic review. *Best Pract Res Clin Anaesthesiol* 2005; 19(2): 275-92.
- [14]. Goldstein A, Grimault P, Henique A, Keller M, Fortin A, Darai E. Preventing postoperative pain by local anaesthetic instillation after laparoscopic gynecologic surgery. A placebo controlled comparison of bupivacaine and Ropivacaine. *Anesth Analg* 2000; 91(2):403-7.
- [15]. Ahmed BH, Ahmed A, Tan D, Awad ZT, Al-Aali AY, Kilkenny J 3rd, Orlando FA, Al-Chalabi A, Crass R, Alrawi SJ. Post-laparoscopic cholecystectomy pain: effects of intraperitoneal local anesthetics on pain control--a randomized prospective double-blinded placebo-controlled trial. *Am Surg.* 2008; 74(3):201-9.
- [16]. Donatsky AM, Bjerrum F, Gögenur I. Intraperitoneal instillation of saline and local anesthesia for prevention of shoulder pain after laparoscopic cholecystectomy: a systematic review. *Surg Endosc.* 2013; 27(7):2283-92.
- [17]. Das NT, Deshpande C. Effects of intraperitoneal local anaesthetics bupivacaine and Ropivacaine versus placebo on postoperative pain after laparoscopic cholecystectomy: A randomized double blind study. *J Clin Diagn Res* 2017; 11(7):8-12.
- [18]. Maestroni U, Sortini D, Devito C, Pour Morad Kohan Brunaldi F, Anania Group, et al: A new method of preemptive analgesia in laparoscopic cholecystectomy. *Surg Endosc* 2002; 16: 1336 – 1340.
- [19]. Tsimoyiannis EC, Glantzounis G, Lekkas ET, Siakas P, Jabarin M, et al: Intraperitoneal normal saline and bupivacaine infusion for reduction of postoperative pain after laparoscopic cholecystectomy. *Surg Laparosc Endosc* 1998; 8: 416 – 420.
- [20]. Phinchantra P, Bunyavehchevin S, Suwajanakorn S, Wisawasukmongchol W. The preemptive analgesic effect of celecoxib for day-case diagnostic laparoscopy. *J Med Assoc Thai* 2004; 87: 283-8.
- [21]. Meena RK, Meena K, Loha S, Prakash S. A comparative study of intraperitoneal ropivacaine and bupivacaine for postoperative analgesia in laparoscopic cholecystectomy: a randomized controlled trial. *Anaesth Pain & Intensive Care* 2016;20(3):295-30
- [22]. Hadi MS, Zakaria HM, Almulhim AM, Alghamdi AM, Mowafi HA, Hussein AM. Gas or gas less laparoscopic cholecystectomy? *Kuwait Med J* 2002;34:292-5.
- [23]. Cunniffe MG, McAnena OJ, Dar MA, Calleary J, Flynn N. A prospective randomized trial of intraoperative bupivacaine irrigation for management of shoulder-tip pain following laparoscopy. *Am J Surg* 1998;176:258-61.
- [24]. Sarli L, Costi R, Sansebastiano G, Trivelli M, Roncoroni L. Prospective randomized trial of low-pressure pneumoperitoneum for reduction of shoulder-tip pain following laparoscopy. *Br JSurg* 2000;87:1161-5.
- [25]. Berberoglu M, Dilek ON, Ercan F, Kati I, Ozmen M. The effect of CO2 insufflation rate on the postlaparoscopic shoulder pain. *J Laparoendosc Adv Surg Tech A* 1998;8:273-7.
- [26]. Meissner W, Mescha S, Rothaug J, Zwacka S, Goeltermann A, et al: Quality improvement in postoperative pain management: results from the QUIPS project. *Dtsch Arztebl Int* 2008; 105: 865 – 870.
- [27]. Kayani M, Azad A. Maximum recommended dose of Ropivacaine. *BJA* 2013; 110(3):482.
- [28]. Berde C, Strichartz GR, Miller RD, Eriksson LI, Fleisher LA, Weiner-Kronish JP, Young WL. Local anesthetics, Miller's Anesthesia, 2010 7<sup>th</sup>edn Philadelphia Churchill Livingstone Elsevier pg.962.

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