

## Intraperitoneal instillation of Ropivacaine for postoperative analgesia in laparoscopic cholecystectomy

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### ABSTRACT

**Introduction:** Laparoscopic cholecystectomy is one of the most frequently performed elective surgical procedures. Post-operative pain has been reported to be seen in 35-63% of patients undergoing laparoscopic surgeries. Use of intraperitoneal ropivacaine has been widely advocated in various minimal access abdomino-pelvic surgeries with satisfactory results. Laparoscopic cholecystectomy is a common surgical procedure in our hospital and pain is complained by the patients time and again in the postoperative period especially in the first 24 hours.

**Method:** A cross sectional descriptive study was conducted in Nepal Medical College and Teaching Hospital among 129 patients. Patients(male/female) aged 18-65 years who were given ropivacaine intraperitoneally during laparoscopic cholecystectomy were included for the study. The post-operative analgesic effect of ropivacaine, a long-acting local anaesthetic agent was assessed.

**Result:** Total number of female cases was 87 (67.4%) and male cases was 42 (32.6%). One hundred and fifteen (89.1%) patients fell in American Society of Anesthesiologist(ASA) physical status classification I and remaining 14 (10.9%) in American Society of Anesthesiologist (ASA)physical status classification II. Normal Body Mass Index(BMI) was seen in 89 (69%) patients whereas 1 (0.8) patient was underweight and 39 (30.2) patients were overweight. Visual Analog Scale(VAS) more than 4 was seen mostly at 8 hours. Adverse effect in postoperative period was seen in 11 patients. Among which 4 (36.3%) patients had tachycardia and PONV was seen in 7 (63.6%) patients.

**Conclusion:** The instillation of bupivacaine and ropivacaine intraperitoneally was an effective method of postoperative pain relief in LC. It provided good analgesia in immediate postoperative period with ropivacaine, providing longer duration of analgesia

**Keywords:** Ropivacaine, intraperitoneal instillation, laparoscopic cholecystectomy, postoperative analgesia

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## INTRODUCTION

Laparoscopic cholecystectomy is one of the most frequently performed elective surgical procedures. It requires smaller incision with decreased postoperative pain and reduced length of hospital stay, as compared to open procedures.<sup>1</sup> Post-operative pain has been reported to be seen in 35-63% of patients undergoing laparoscopic surgery, mainly during the first post-operative hours.<sup>2,3</sup> Ropivacaine is a long-acting amide local anaesthetic agent which produces effects via reversible inhibition of sodium ion influx in nerve fibres.<sup>4</sup> Laparoscopic cholecystectomy is a common surgical procedure in our hospital and pain is complained by the patients time and again in the postoperative period especially in the first 24 hours. The purpose of this study was to evaluate the postoperative analgesic effect of ropivacaine in laparoscopic cholecystectomy by observing abdominal pain and requirement of rescue analgesic after intraperitoneal instillation of ropivacaine at completion of surgery.

## METHOD

This is a cross-sectional descriptive study among all patients who underwent laparoscopic cholecystectomy in Nepal Medical College and Teaching hospital within a time span of past 10 months (March 2020 to Jan 2021). Ethical approval was taken from the institutional review committee (Ref. no.: 037-076/077) of Nepal Medical College, Teaching Hospital. Data was collected using pre-designed proforma and analyzed in Statistical Package for the SPSS version 16. Point estimate at 95% Confidence Interval (CI) was calculated along with frequency and proportion for binary data.

### Inclusion criteria

- Age between 18-65 years, of either gender
- Weight 45-80 kg
- Elective laparoscopic cholecystectomy
- Those who can well understand components of VAS and follow the command

### Exclusion criteria

- Previous Abdominal surgery

- Contraindication to use of Local anesthetic agent in study as cardiac, respiratory, hepatic or renal co-morbidities

- Acute cholecystitis

- Conversion of procedure to open cholecystectomy

- Use of intra-abdominal drain at the end of the surgery

### Sample size

Target sample is obtained by the formula

Sampling frame: Patients undergoing cholecystectomy

Sampling unit: Patient undergoing laparoscopic cholecystectomy in unit

Sampling technique- Convenient sampling

$$\text{Number of cases} = \frac{Z^2 \times \sigma^2}{d^2}$$

Z=1.96 keeping the type I error of 5% and confidence interval of 95%

$\sigma$ = standard deviation of reference study<sup>9</sup> =0.82

d= (desirable error) i.e. 5% of mean of reference study<sup>9</sup> = 5% of 2.88 = 0.144

$$\begin{aligned} \text{Therefore, } n &= \frac{(1.96)^2 \times (0.82)^2}{(0.144)^2} \\ &= \frac{3.8416 \times 0.67}{0.02} \\ &= 128.69 \end{aligned}$$

Minimal sample size for this study will be 129.

## RESULT

The total number of cases enrolled was 129. None of the patients were excluded from the study. No conversion to open surgery was necessary for any patients and no intraoperative complications were recorded. All patients were comparable with regard to age, weight, height and surgical duration (Table 1). Total number of female cases was 87 (67.4%) and male cases was 42 (32.6%). One hundred and fifteen (89.1%) patients fell in ASA I and remaining 14 (10.9%) in ASA II. Normal BMI as compared with was seen in 89 (69%) patients whereas 1 (0.8) patient was underweight and 39 (30.2) patients were overweight.

**Table 1. General characteristics**

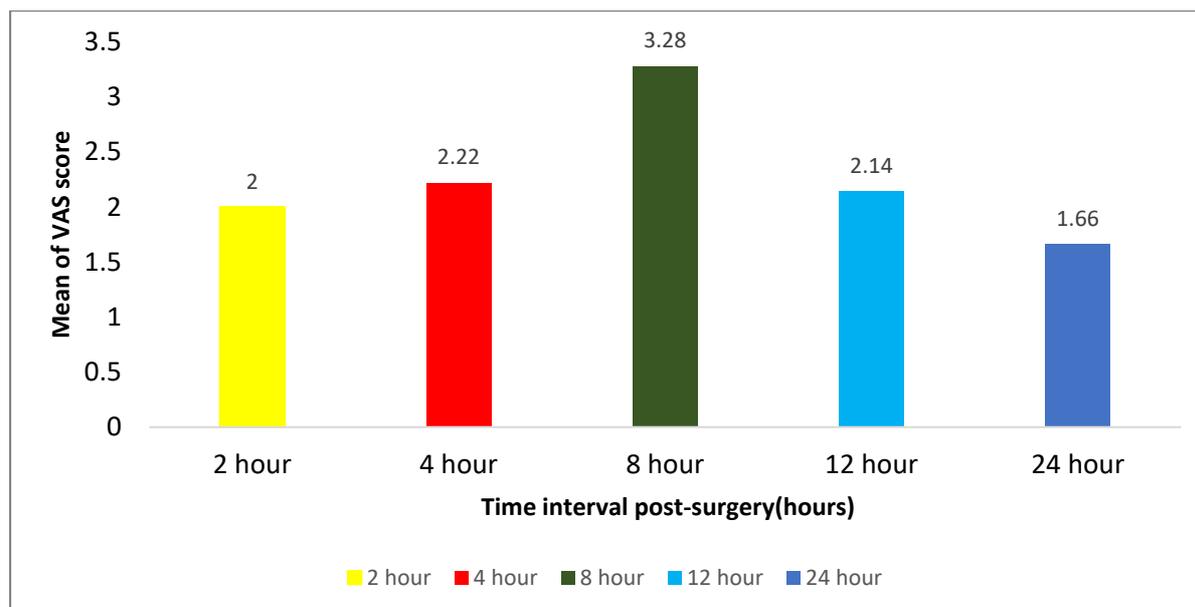
Variables	N (%)	Variables	N (%)
<b>Age</b>		<b>BMI</b>	
≤20	2 (1.6)	Underweight (<18.5kg/m <sup>2</sup> )	1 (0.8)
21-30	15 (11.6)	Normal (18.5-24.9kg/m <sup>2</sup> )	89 (69)
31-40	23 (17.8)	Overweight (>25kg/m <sup>2</sup> )	39 (30.2)
41-50	57 (44.2)	<b>ASA</b>	
51-60	26 (20.2)	I	115 (89.1)
>60	6 (4.7)	II	14 (10.9)
<b>Gender</b>			
Male	42 (32.6)		
Female	87 (67.4)		

**Table 2. Duration of surgery and anesthesia**

Procedure Duration	Mean $\pm$ SD
Duration of Surgery	81.43 $\pm$ 15.83
Duration of anaesthesia	90.65 $\pm$ 16.78

**Table 3. VAS score**

Time interval post-surgery(hours)	Mean (S.D) of VAS Pain Score
2	2 (0.15)
4	2.22 (0.61)
8	3.28 (1.44)
12	2.14 (0.63)
24	1.66 (0.577)

**Figure 1. Bar graph representing mean of VAS score****Table 4. Adverse effect (n=11)**

Adverse effect	N(%)
Tachycardia	4 (36.3)
PONV	7 (63.6)

**Table 5. Analgesia**

	Mean (SD) mins
Times of first analgesia	459.55 (47.97)
Number of rescue analgesia given	
	N (%)
0	95 (73.6)
1	23 (17.9)
2	11 (8.5)

## DISCUSSION

We observed the post-operative analgesic effect of ropivacaine in laparoscopic cholecystectomy by observing abdominal pain and requirement of rescue analgesic after intraperitoneal instillation of ropivacaine at completion of surgery. We found that, intraperitoneally instilled ropivacaine decreased the VAS pain score and total consumption of rescue analgesic in postoperative period after laparoscopic cholecystectomy.

Laparoscopic surgeries have gained popularity because of the advantage of having less intense postoperative pain as compared to open surgeries. However, laparoscopy is not a pain-free procedure and pain remains the most common complain reported by the patients in the post-operative period. So, management of the post-operative pain remains a major concern in laparoscopic surgery. Pain after laparoscopic cholecystectomy has three main components; parietal pain caused by incisional trauma at the port site<sup>5</sup>, visceral pain related to pneumoperitoneum-induced local and

systemic changes and the post-cholecystectomy wound within the liver<sup>6</sup> and shoulder tip pain that occurs due to diaphragmatic stretching with phrenic nerve neuropraxia.<sup>7-9</sup> Visceral pain is more intense than abdominal wall pain which is worst in the first 24 hours.<sup>10</sup> Several modalities have been suggested to relieve post-operative pain after laparoscopy.<sup>8</sup> These include intravenous opioids and non-opioid analgesics (NSAIDs), port site local anaesthetic infiltration, transverse abdominis plane block, intraperitoneal local anaesthetic instillation, intraperitoneal saline administration and low pressure pneumoperitoneum.<sup>11</sup>

Intraperitoneal local anaesthetic instillation is the most commonly used technique among various methods.<sup>12</sup> It potentially modifies visceral nociception and provides analgesia by blocking the visceral afferent signalling.<sup>1</sup> Local anaesthetic drug that has a longer duration of action and safe pharmacological profile should be used. Both bupivacaine and ropivacaine are widely used for intraperitoneal infiltration and the analgesic effects and duration of both the drugs are similar but ropivacaine has been preferred as it has a reduced risk of cardiac and systemic toxicity. Due to safer pharmacological characteristics, a larger and more potent dose can be safely administered.<sup>11</sup>

Ropivacaine causes reversible inhibition of sodium ion influx, and thereby blocks impulse conduction in nerve fibres. This action is potentiated by dose-dependent inhibition of potassium channels. Ropivacaine is less lipophilic than bupivacaine and is less likely to penetrate large myelinated motor fibres; therefore, it has selective action on the pain-transmitting A $\delta$  and C nerves rather than A $\beta$  fibres, which are involved in motor function.<sup>4</sup>

The efficacy of local anaesthetic infiltration has been demonstrated in numerous studies in laparoscopic cholecystectomy. Bhatia, et al.<sup>1</sup> compared intraperitoneal nebulization of ropivacaine with ropivacaine-fentanyl combination for pain control following laparoscopic cholecystectomy and concluded that ropivacaine nebulization of intraperitoneal cavity, with or without fentanyl, provides highly effective postoperative analgesia, with decreased incidence of shoulder pain. In a study done by DiPace, et al.<sup>3</sup>, they demonstrated that the combination of local infiltration and intraperitoneal instillation of ropivacaine is more effective for pain relief in children after laparoscopic surgery than the administration of ropivacaine only at the trocar sites.

In our study, we observed the duration of analgesia which was defined as time of intraperitoneal instillation of local anaesthetic to the demand for the first rescue analgesia and amount of analgesia required in the postoperative period. Our study showed that maximum intensity of pain seen was around 8 hours with mean time of first analgesia requirement was 459.55 minutes with standard deviation of 47.97 minutes. The long duration of analgesia after ropivacaine infiltration was comparable to the study done by Liu et al.<sup>6</sup> who suggested that infiltrating ropivacaine after surgery through the port site reduced pain intensity, the number of patients requiring postoperative analgesics, and hospital stay. In their study, administering local anaesthesia at the end of surgery offered a longer time delay to the need for analgesics, compared with patients who did not receive postoperative local anaesthesia. Furthermore, patients who received local anaesthesia at the end of surgery required significantly lower doses of analgesics than patients who did not receive local anaesthesia. Similarly, rescue analgesia was not needed in 95 (73.6%) patients in our study. Twenty-three (17.9%) patients required single rescue analgesia whereas 11 (8.5%) patients required rescue analgesia twice in 24 hours postoperatively. This is explained by the fact that pain intensity was less among patients who received local anaesthesia at the end of the surgery than among those who did not. Our findings are in accordance with Labaille, et al.<sup>13</sup> who also observed a substantial decrease in visceral pain in patients receiving ropivacaine immediately after trocar placement and at the end of surgery in the gall bladder bed. Ingelmo, et al.<sup>14</sup> found that postoperative pain was considerably minimized by preoperative nebulization of the peritoneal cavity with ropivacaine. Our research is also consistent with different authors; Gupta et al.<sup>15</sup>, Trikoupi, et al.<sup>16</sup>, Kucuk, et al.<sup>17</sup>, Memedov et al.<sup>18</sup>, Pavlidis, et al.<sup>19</sup>, Park, et al.<sup>20</sup>, who have discovered that intraperitoneal instillation of local anaesthesia reduces visceral pain during laparoscopic surgery. However, research performed by Bisgaard, et al. did not indicate any improvement in visceral pain after intraperitoneal instillation of ropivacaine.<sup>21</sup> It may be because the dosage used for intraperitoneal instillation has been decreased. Other trials using local anaesthetics have been performed, however there was no gain from intraperitoneal instillation of local anaesthesia to alleviate pain during laparoscopic cholecystectomy.

During the period of our study, complications of drug were not seen which revealed the safety of

the drug and procedure. This technique is simple, safe and without adverse effects. Ropivacaine is the drug of choice because of its higher efficacy and larger safety margin. As the pain is the most common and feared issue in postoperative period, its minimization with ropivacaine led to reduced use of analgesic agents and shortened the stay in PACU and hospital. These features resulted in less expenditure for the patients and also their return to normal activity rendered it cost-effective.

The limitation of our study was that we did not have a control or placebo group to which no local anaesthetic was administered. However, we believed that a control group was not necessary, because it is unethical to keep patients devoid of analgesics and previous studies have shown that 35-63% of patients complained of post-operative pain after laparoscopic surgeries.<sup>2</sup>

### CONCLUSION

Our result suggests that intraperitoneal instillation of ropivacaine into the hepato-diaphragmatic space, on gallbladder bed and close to hepatoduodenal ligament help in decreasing the post-operative pain after laparoscopic cholecystectomy.

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### Conflict of interest

None

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