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Paravertebral Block and Opioid Requirement in Laparoscopic Cholecystectomy

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Abstract

Background: Conventional cholecystectomy has been unchallenged supremacy as treatment of choice for cholelithiasis for more than 100 years but its preference in the surgical fraternity is slowly and steadily decreasing after the invent of minimally invasive surgery like mini-cholecystectomy and laparoscopic cholecystectomy (LC). We conducted a study on requirement of analgesic intra-operatively in elective laparoscopic cholecystectomy, with or without para-vertebral block.

Methods: This study was conducted in Department of Anesthesiology of Mahatma Gandhi Medical College & Hospital, Jaipur after due permission from the institutional ethics committee, review board and written informed consents from the patients were obtained. Bilateral PVB was given in Group B patients.

Results: Significantly less consumption of fentanyl intra-operatively in PVB group (113.60±21.29) was noted as compared to only GA group (169.45±25.91) ($p<0.001$).

Conclusion: We concluded from this study that paravertebral block prior to GA reduces the opioid requirement intra-operatively in laparoscopic Cholecystectomy. Ultrasound guided technique made paravertebral block more safe and precise . The use of ultrasound reduces the time of the procedure as well as prevents complications like hematoma, pneumothorax as well as ensuring more complete block effect.

Keywords: Paravertebral block, hematoma, pneumothorax.

Introduction

Conventional cholecystectomy has been unchallenged supremacy as treatment of choice for cholelithiasis for more than 100 years but its preference in the surgical fraternity is slowly and steadily decreasing after the invent of minimally invasive surgery like mini-cholecystectomy and laparoscopic

cholecystectomy(LC)[1, 2]. A National Institutes of Health (NIH) consensus statement in 1992 stated that LC provides a safe and effective treatment for most patients with symptomatic gallstones and has become the treatment of choice for many patients. It is the commonest laparoscopic operation performed worldwide and is the second most commonly performed operation in gastrointestinal (GI) surgery after appendectomy[3]. Laparoscopic cholecystectomy provides a safe and effective treatment for patients with gallstones because it reduces postoperative pain with almost invisible scar, short hospital stays and early return to work.[4]

The development of ultrasonography (USG) has enabled better visualisation of PVB space, pleura, lungs and the real time visualisation of the needle . The use of ultrasound guidance for performance of peripheral nerve blocks increases the success rate, reduces block performance time, improves quality of block, reduces the local anesthetic doses needed and reduces the chances ofcomplications.

Paravertebral block (PVB) is one of modality for providing long lasting unilateral or bilateral anesthesia, hemodynamic stability, early ambulation and prolonged pain relief.

Bupivacaine has emerged as the most commonly used drug for local anesthesia. However, since it has undesirable effects such as hypotension, bradycardia, prolonged duration of motor paralysis, cardiovascular system (CVS) toxicity and central nervous system (CNS) toxicity, there led to the identification of long-acting pure S-enantiomer of bupivacaine. Ropivacaine is nearly identical to bupivacaine in onset, quality and duration of sensory block, but it produces lesser duration of motor blockade, has a better safety profile. It is very helpful for short duration surgeries as well as for early ambulation[5].

Material And Methods

This study was conducted in Department of Anesthesiology of Mahatma Gandhi Medical College & Hospital, Jaipur. Due permission from the institutional ethics committee, review board and written informed consent from the patient was obtained.

Study Design:- Hospital-based, Prospective, Randomized, Comparative interventional study.

Study Period:- January 2019 to June 2020.

Sample Size:- A total 200 patients included in study divided in two groups.

Ethical Clearance: The study protocol for the procedure was approved by institutional ethical committee Mahatma Gandhi medical College and Hospital, Jaipur and written informed consent from all the patients.

Sampling Technique: In this study randomization was done by chit and box method.

200 eligible cases had been allocated into two study groups. Randomization in our study was done by chit in box method. A total of 200 chits (100 per group) were made, each chit mentioning a particular study group. We asked all the patients to pick up a chit from the box. The patient was allocated to group mentioned on the chit.

GROUPA(n=100):Patients received GA with IV analgesic as per protocol.

GROUP B (n=100): Patients received paravertebral Block followed by GA.

Inclusion Criteria

- Patient with American Society of Anesthesiologist (ASA) Classes I/II.
- Patient aged 18-60years.

- Patients undergoing elective laparoscopic Cholecystectomy.
- Patient's giving written and informed consent.

Exclusion Criteria

- Patient with ASA CLASS III/ IV &V.
- Patient refusal.
- Allergy to study medications, infection at the site.
- Anatomic abnormalities, coagulation disorders
- Inability to comprehend or participate in pain scoring system.

Pre anesthetic check-up

A thorough pre-anesthetic check-up was done a day prior to surgery and explained about the anesthetic technique, perioperative course and VAS assessment.

In group A - All patients were pre-medicated with injection glycopyrrolate 0.2mg iv., inj. Midazolam 1 mg iv. and inj. fentanyl 2 microgram/kg body wt. iv.

Induction done with propofol 2 mg/kg iv. Followed by inj. rocuronium 0.8mg/ kg. iv. and intubation done with appropriate size of ETT after 90 seconds.

Maintenance - O_2 + Air + Vecuronium + Isoflurane + intermittent positive pressure respiration (IPPR)with tidal volume of 8ml/kg.

Injection fentanyl was given in incremental doses of 0.5 mcg/kg iv. on the basis of presence of any one of the following parameters-

- Rise in heart rate (HR) by more than 20% of the baseline values.
- Systolic BP rise by more than 20% of the baseline values.

Inj. Ondansetron 4mgiv. Was given half an hour before completion of surgery and reversal was done with Neostigmine 2.5mg with Glycopyrrolate0.5mg.

In group B- Patients received TPVB in sitting position at T7 level bilaterally with ropivacaine 0.5%, 10ml on each side followed by GA as per the protocol of Group A.

Results

The study was conducted among 200 adult patients undergone for laparoscopic cholecystectomy. Patients who received GA without PVB (Group A) had the mean age of 45.89 year with SD of 12.78 years and minimum age of patients was 18 years and maximum was 60 years. While patients who received PVB with GA (Group B) had the mean age of 44.52 year with SD of 12.83 years and minimum age of patients was 23 years and maximum was 60years.

Table 1: Distribution of patients according to Socio-demographic in both groups

Variable	Group A	Group B
Mean ± SD	42.89 ± 12.78	44.52 ± 12.83
Male : Female	35:65	34:66

In present study, 53.00% patients were belonging to 40-60 Yrs age group and 47.00% patients were belonging to 20-40 Years age group in group-A. 63.00% patients were belong to 40-60 Years age group and 37.00% patients were belonging to 20-40 Years age group in group-B. The age wise difference in both groups found statistically Insignificant. In present study, 65.00% patients were female and 35.00% patients were male in group-A and 66.00% patients were female and 34.00% patients were male group in group-B. The gender difference between both groups was statistically Insignificant.

Table 2: Comparison of HR (bpm) between two groups at different time intervals intra operatively

	Group A		Group B		Result (P value)
	Mean	SD	Mean	SD	
Baseline	79.86	2.33	77.72	1.71	p<0.001 (S)
5 min after block	80.44	2.98	77.74	1.35	p<0.001 (S)
10 min after block	80.98	3.81	78.22	1.20	p<0.001 (S)
At the time of intubation	85.70	1.78	83.18	1.10	p<0.001 (S)
1 min after intubation	87.69	1.67	83.38	1.38	p<0.001 (S)
3 min after intubation	88.12	2.65	82.72	1.41	p<0.001 (S)
5 min after intubation	89.02	3.23	83.40	1.38	p<0.001 (S)
10 min after intubation	90.16	5.27	81.64	1.94	p<0.001 (S)
15 min after intubation	90.33	5.28	80.26	2.66	p<0.001 (S)
30 min after intubation	89.24	4.38	79.38	2.00	p<0.001 (S)
1 hr after intubation	88.58	4.38	79.24	2.37	p<0.001 (S)
At the end of surgery	87.70	3.47	77.66	1.93	p<0.001 (S)

S=significant ; NS = Non significant

In present study, the mean heart rate was significantly higher in group A as compare to group B where patients received the block at all the point of time during the surgery.

Figure 1:- HR(bpm) of two groups at different time interval intraoperatively

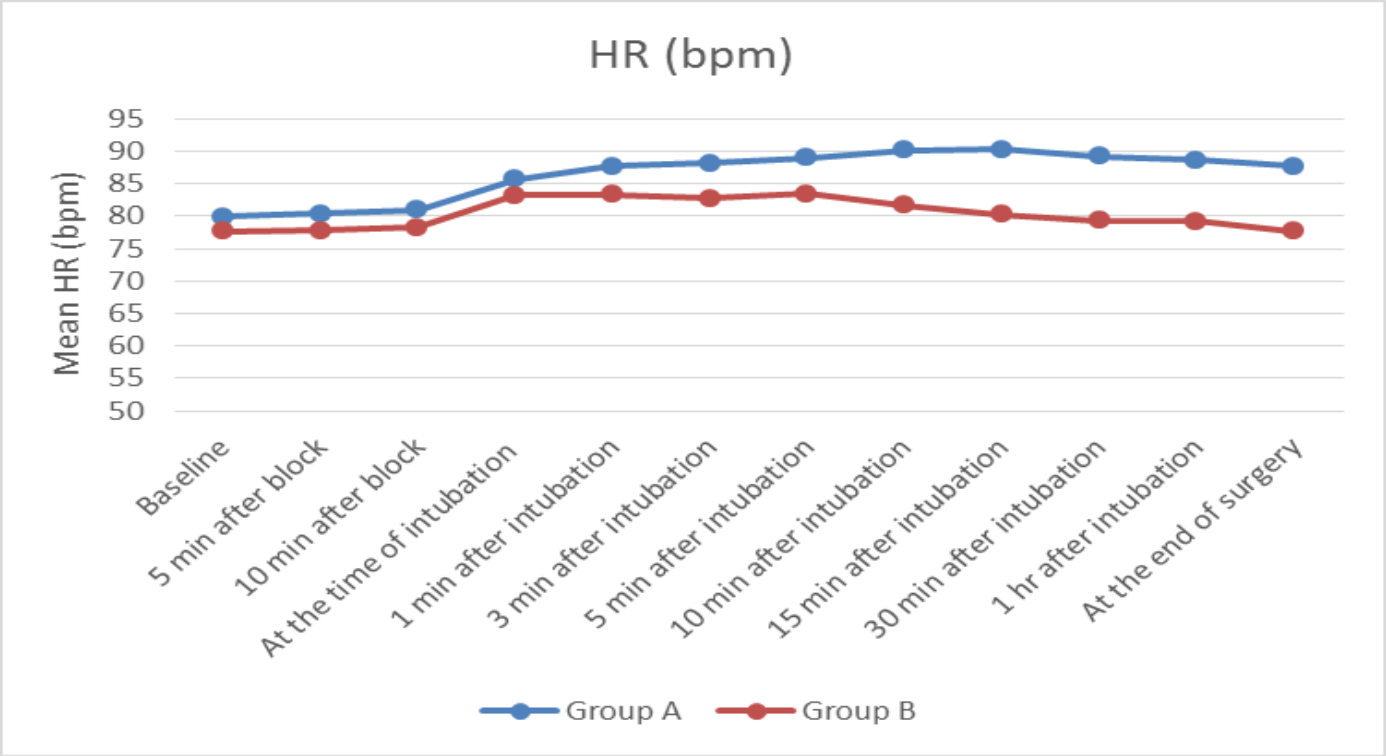


Table 3: Comparison of SBP (mmHg) between two groups at different time intervals intraoperatively

	Group A		Group B		Result (P value)
	Mean	SD	Mean	SD	
Baseline	123.76	8.58	123.43	9.09	0.792 (NS)
5 min after block	128.15	7.43	121.90	7.45	p<0.001 (S)
10 min after block	129.98	9.73	118.75	6.64	p<0.001 (S)
At the time of intubation	121.06	5.74	118.36	6.18	0.001 (S)
1 min after intubation	134.53	5.34	132.10	4.93	0.0009 (S)
3 min after intubation	130.90	3.96	128.87	4.16	0.0005 (S)
5 min after intubation	128.52	3.60	126.38	4.31	0.0001 (S)
10 min after intubation	138.59	4.08	132.03	3.43	p<0.001 (S)
15 min after intubation	142.06	3.45	138.24	3.95	p<0.001 (S)
30 min after intubation	144.66	3.94	143.75	5.17	0.163 (NS)
1 hr after intubation	138.10	2.56	136.77	3.39	0.001 (S)
At the end of surgery	132.62	4.84	128.74	5.56	p<0.001 (S)

S=significant ; NS = Non significant

In present study, the mean systolic blood pressure was significantly higher in group A as compare to group B. It was highly significant immediately after intubation. At base line and 30 min. after intubation in mean systolic blood pressure, there was no significant difference in systolic BP between the groups, while there was significantly higher systolic blood pressure was there one hour after intubation and at the end of surgery.

Figure 2:Trends in SBP of both Groups at different time intervals intra-operatively

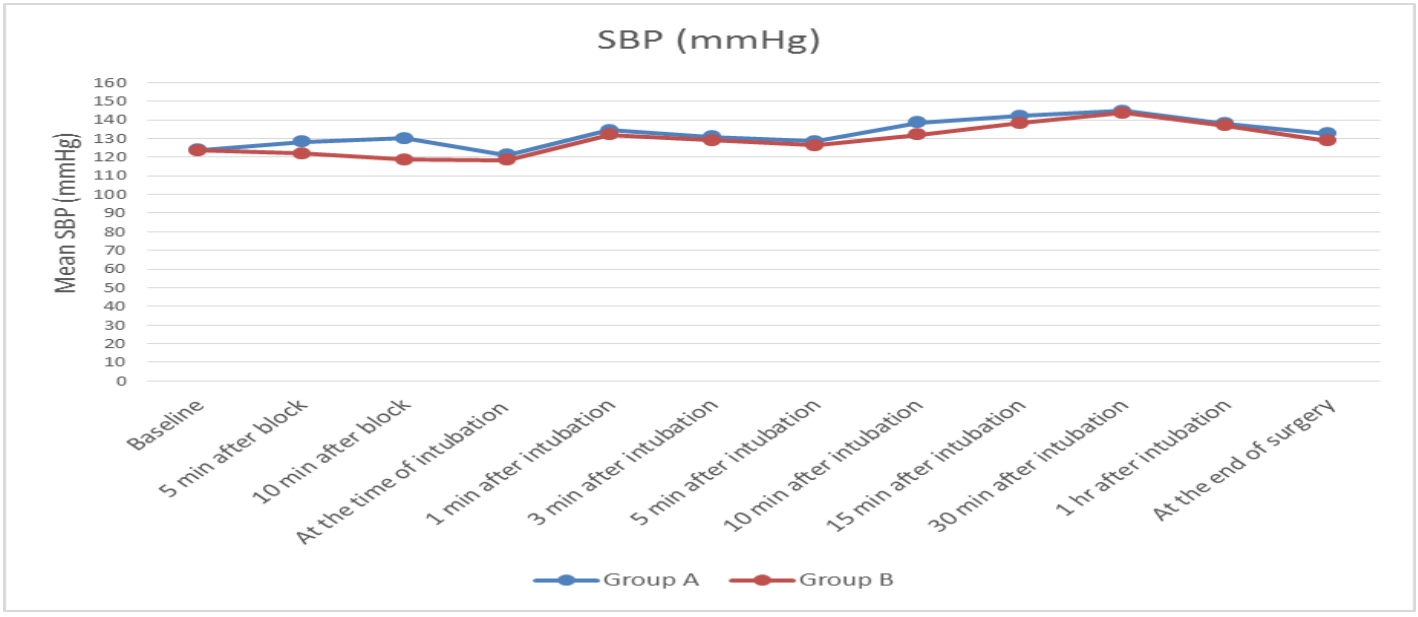


Table 4: Comparison of DBP (mmHg)) between two groups at different time intervals intraoperatively

	Group A		Group B		Result (P value)
	Mean	SD	Mean	SD	
Baseline	71.86	6.09	72.13	6.62	0.764 (NS)
5 min after block	70.52	3.96	69.66	5.64	0.213 (NS)
10 min after block	70.76	8.27	67.07	4.45	0.0001 (S)
At the time of intubation	67.87	4.05	65.92	4.09	0.0008 (S)
1 min after intubation	68.31	3.66	68.31	3.66	1.00 (NS)
3 min after intubation	67.96	3.75	66.45	3.26	0.002 (S)
5 min after intubation	76.33	2.90	64.48	3.12	p<0.001 (S)
10 min after intubation	69.25	2.51	69.25	2.51	1.00 (NS)
15 min after intubation	74.11	2.48	74.11	2.48	1.00 (NS)
30 min after intubation	81.83	3.20	81.83	3.20	1.00 (NS)
1 hr after intubation	78.28	0.70	78.28	0.70	1.00 (NS)
At the end of surgery	78.32	0.68	78.26	0.68	0.549 (NS)

S=significant; NS = Non significant

In present study, there was no significant difference in mean diastolic blood pressure between group A and group B at base line and 5 min after block. It was significantly higher at the time of intubation and 5 mins. After intubation, at all other points of time no significant difference was observed till end of surgery.

Figure 3 : Trends in DBP of both Groups at different time intervals intra-operatively

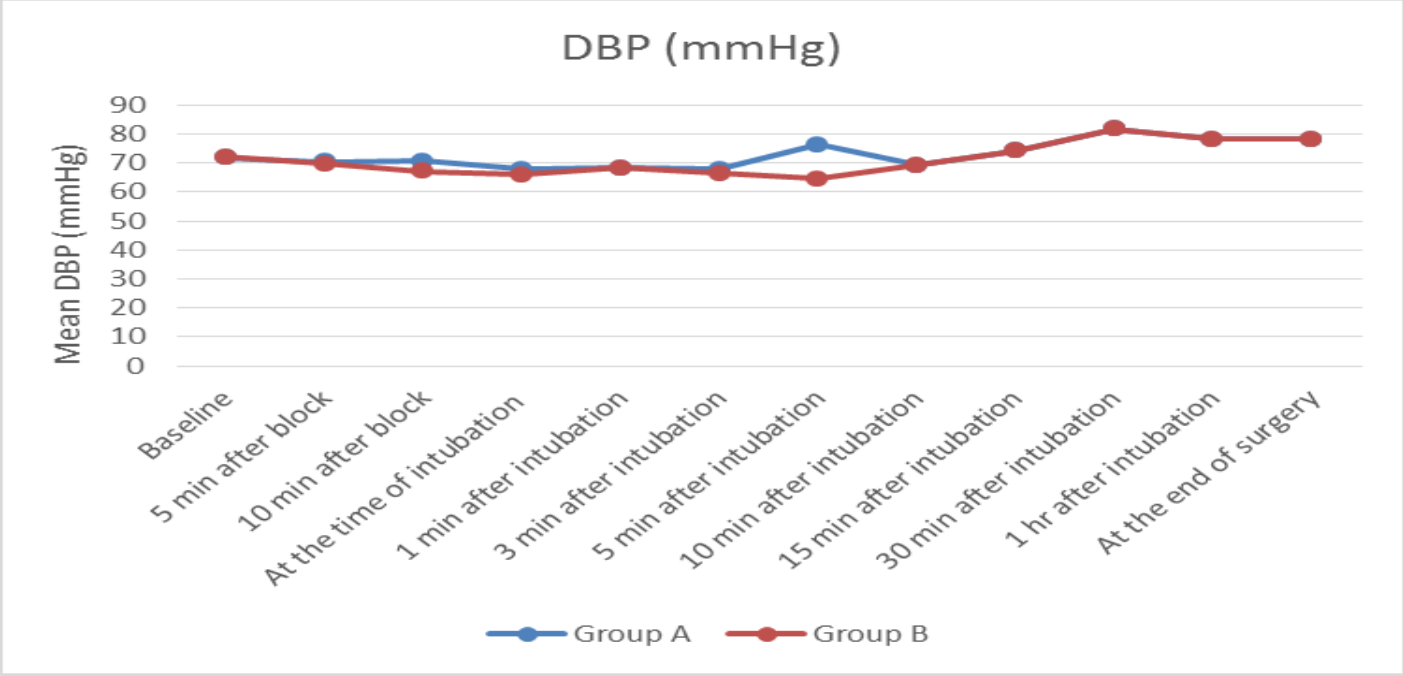


Table 5: Comparison of MAP (mmHg) between two groups at different time intervals intra operatively

	Group A		Group B		Result (P value)
	Mean	SD	Mean	SD	
Baseline	89.16	6.35	89.23	6.96	0.940 (NS)
5 min after block	89.73	3.18	87.07	5.77	p<0.001 (S)
10 min after block	90.50	6.05	84.30	4.64	p<0.001 (S)
At the time of intubation	85.60	4.10	83.40	4.26	0.0002 (S)
1 min after intubation	90.38	3.55	89.57	3.23	0.092 (NS)
3 min after intubation	88.94	3.23	87.26	2.85	0.0001 (S)
5 min after intubation	93.73	2.38	85.11	2.71	p<0.001 (S)
10 min after intubation	92.36	2.22	90.18	2.10	p<0.001 (S)
15 min after intubation	96.76	2.24	95.49	2.39	0.0001 (S)
30 min after intubation	102.77	2.67	102.47	299	0.449 (NS)
1 hr after intubation	98.22	0.99	97.78	1.22	0.005 (S)
At the end of surgery	96.42	1.64	95.09	1.92	p<0.001 (S)

S=significant ; NS = Non significant

In present study, the mean arterial pressure was significantly higher in group A as compare to group B from 5 min after block to at the end of surgery except baseline and 30 min. after intubation.

At base line and 30 min. after intubation in mean arterial blood pressure, there was no significant difference in MAP between the groups, while there was significantly higher mean blood pressure was there one hour after intubation and at the end of surgery.

Figure 4: Trends in MAP of both Groups at different time intervals intra-operatively

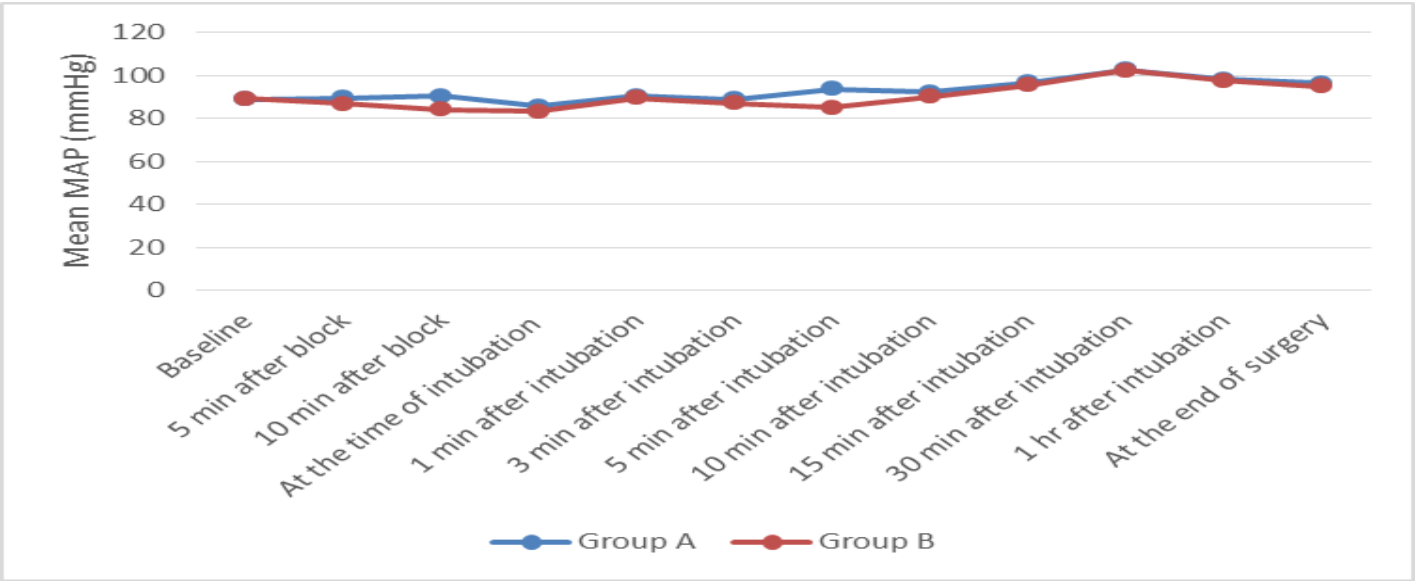
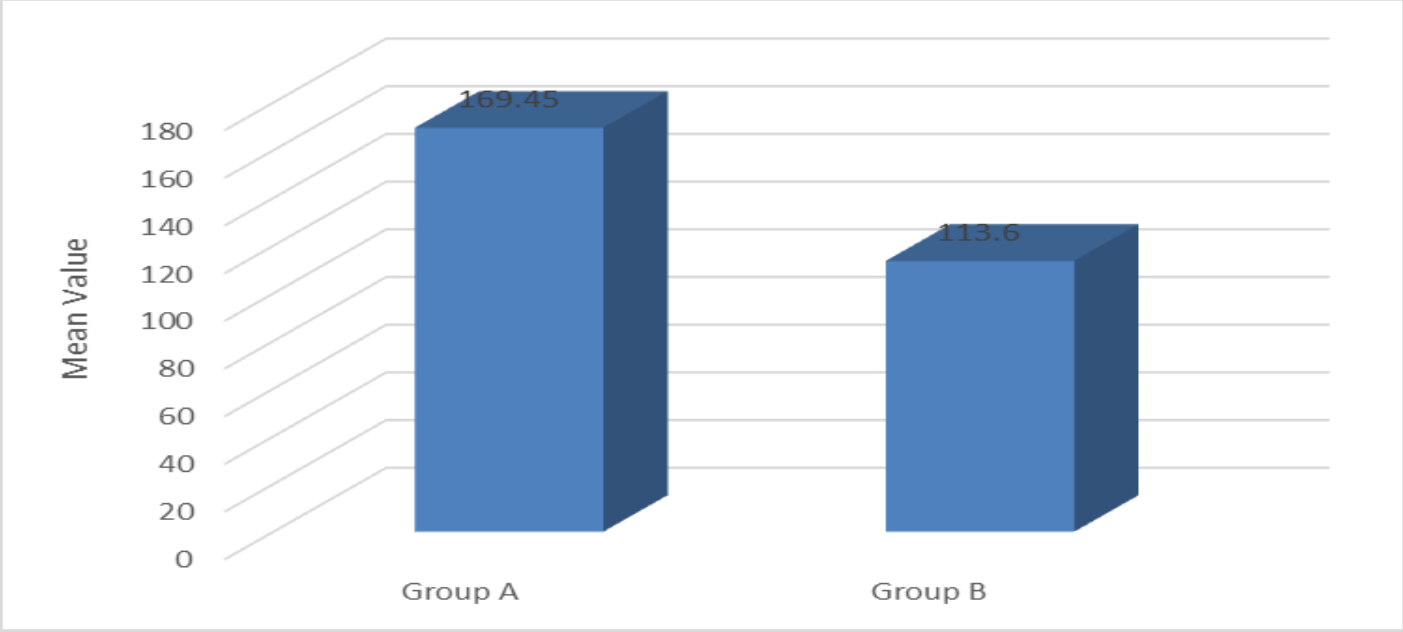


Table 6: Comparison of Total amount of Fentanyl(in micrograms) used intra- operatively in micrograms between two groups

	Group A		Group B	
	Mean	SD	Mean	SD
Mean Total amount of analgesic	169.45	25.91	113.60	21.29
Median	175		100	
Result (P value)	p<0.001			

Figure 5: Comparison of Total amount of Fentanyl (in micrograms) used intra-operatively between two groups



In present study, mean total amount of analgesic(fentanyl) required intra- operatively in group-A was 169.45±25.91 and in group-B was 113.60±21.29. There was significant difference in opioid requirement during surgery between Group A and Group B.

Discussion

The present study was a Hospital-based interventional study conducted among adults aged 18 to 60 years undergone for laparoscopic cholecystectomy at Mahatma Gandhi Medical College & Hospital, Jaipur.

The study aimed to investigate the effectiveness of paravertebral block at bilateral T_7 level in reducing intra-operative opioid requirement. Local anaesthetic used for bilateral paravertebral block was ropivacaine 0.5% in a dose of 10ml each side. By following the convenient sampling method, a total of 200 study participants were included.

Paravertebral block has been used as a sole anesthetic technique for various procedures like breast surgery, herniorrhaphy etc. with the help of USG machine paravertebral block was easy to perform and there was no complication like pleural puncture etc.

In our study, both groups were comparable with respect to age, gender and weight of the patients and no significant difference was found between the two groups (p-value >0.05) and this helped us to alleviate confounding factors like age and gender which would indirectly have an effect on drug distribution, metabolism and excretion. Weight among the two

groups in our study was not statistically significant, which had helped us to alleviate a point of controversy as obesity as well as cachexia has clinically significant effect on the action of the drug. In current study, bilateral PVB was given at T_7 level with 0.5% ropivacaine 10ml each side under USG guidance in patients undergoing laparoscopic cholecystectomy. We observed that intra-operative opioid requirement during surgery was less in PVB group compared to control group(p value<0.001). Study conducted by Fentie DY et al[6], in 2017 to check the efficacy of single injection unilateral thoracic paravertebral block for pain relief after open cholecystectomy. They used bupivacaine 0.5%, 15-20 ml for TPVB at T_7 level using landmark technique. They found that intra-operative morphine requirement(0-2 mg) was less in PVB group, while in Control group morphine requirement (2-4 mg) was comparatively high.

We also found that intra-operative fentanyl requirement (mean 113.60mcg) was less in patients who received bilateral Paravertebral block as compared to the patients who received only general anesthesia (mean 169.45mcg) (p<0.001) for laparoscopic cholecystectomy.

Abdellah AS et al[7] also reported that the mean dose of intraoperative fentanyl was significantly higher in GA group (24±32.25) compared with UG-TPVB (2.5±11.20).

Analgesia consumption was significantly lower intra operatively in patients who received pre-operative PVB in the study conducted by Naja et al[8] as compared to those who received PVB post operatively.

A study was conducted by Aydin et al[9], in 2018, to compare the effectiveness of unilateral preoperative and postoperative ultrasound-guided PVB at T_7 level with 0.5% bupivacaine 20 ml in patients undergoing LC. The authors found that after pre-operative unilateral PVB patients had significantly lower opioid requirements during surgery compared to the control

Agarwal et. Al[10] also had similar findings, PVB group in their study required 54% (p< 0.001) less intra operative fentanyl as compared to control group which is similar to our study.

Conclusion

We concluded from this study that paravertebral block prior to GA is more efficient than only GA. Ultrasound guided technique made paravertebral block more safe and precise. The use of ultrasound reduces the time of the procedure as well as prevents complications like hematoma, pneumothorax as well as ensuring more complete block effect.

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