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Instillation of Intraperitoneal Bupivacaine (0.25%) to Achieve Post-OperativeAnalgesia Following Laparoscopic Cholecystectomy: A Prospective Longitudinal study

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Abstract

Background and Aim:*Laparoscopic cholecystectomy conducted under general anaesthesia. Pain intensity remains high in initial hours. In search of analgesic technique which has minimal side effects this study was conducted to observe the effectiveness of intraperitoneal instillation of Bupivacaine (0.25%) on post-operative pain following laparoscopic cholecystectomy.*

Methods*: This prospective longitudinal study conducted in 50 patients aged 18-60 years of ASA I-II to assess the effectiveness of post-operative analgesia with 0.25% 40 ml bupivacaine in laparoscopic cholecystectomy under general anaesthesia. Number of patients having VAS<3 at 3 hours, duration of analgesia, total number of rescue analgesic (IM Diclofenac) required in 24 hrs and incidence of any adverse events such as shoulder pain, post-operative nausea and vomiting, respiratory depression were noted.*

Results*: Effective analgesia was achieved in 40 (80%) patients (VAS < 3 at 3 hrs). Mean duration of analgesia was 5.924±0.76 hrs. Mean frequency of IM Diclofenac was 2.64±0.48. HR, SBP & DBP were comparable in post-operative period with respect to baseline (p>0.05). Nausea, vomiting & shoulder pain were experienced by 6 (12%), 8 (16%)& 3 (6%) patients respectively.*

Conclusion: *Intraperitoneal instillation of 0.25 % Bupivacaine 40 ml is proven to be an effective alternative for post-operative analgesia with stable hemodynamic and minimal adverse effects in laparoscopic cholecystectomy.*

Keywords*: Laparoscopic cholecystectomy, Intraperitoneal instillation, Bupivacaine, Post-operative analgesia*

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I. Introduction

Laparoscopic cholecystectomy has gained popularity since its introduction in 1989. It is now surgical technique of choice for cholelithiaisis due to less bleeding, smaller cosmetic incision, shorter duration of surgery& recovery and thus less hospital stay.[1,2]

Though laparoscopic cholecystectomy is definitely less painful but the magnitude of post-operative shoulder pain and abdominal pain in the early post-operative period is quite significant. As most of the laparoscopic surgeries are conducted on day-care basis, effective pain management plays a vital role in early discharge. Various modalities for post-operative pain relief such as intermittent intramuscular, intermittent/continuous intravenous injection of narcotics or NSAID'S, infiltration of wound butinstillation of intraperitoneal local anaesthetics seems to have better efficacy in various literatures.[3,4,5]

Many researchers used intraperitoneal Bupivacaine in different volume, different concentrations & different site with or without adjunct for postoperative pain relief in laparoscopic cholecystectomy and proved to be effectivewith minimal side effect.[2,6]Till date, conventional intravenous opioids, intramuscular/ intravenous NSAIDs and wound infiltration with local anaesthetics have been the standard modalities for post-operative pain relief following laparoscopic cholecystectomy in our institute. With their advantages & disadvantages to overcome pain following laparoscopic cholecystectomy therefore, aim of the prospective longitudinal observational study was to observe the effectiveness of intraperitoneal instillation of 0.25% 40 ml Bupivacaine for post-operative pain in laparoscopic cholecystectomy with primary objective ofproportion of the patients having effective analgesia (i.e. Visual Analogue Score < 3 at 3 hrs). Secondary were duration of analgesia, changes in hemodynamic variables, number of rescue analgesic required in first 24 hrs and any side effects like nausea, vomiting, respiratory depression & shoulder pain.

II. Material and Methods

Thisprospective, longitudinal observational study was conductedafter seeking approval from the Institutional Scientific and Ethics committee in 50 young adult patients who had undergone laparoscopic cholecystectomy under general anaesthesia.

Study Design: Prospective longitudinal observational study

Study Location: This was a tertiary care teaching hospital based study done in Department of Anaesthesiology, at Dr Bhim Rao Ambedkar Hospital, Raipur, Chhattisgarh

Study Duration: April 2018 to July 2019 (1year 3months)

Sample Size: 50 patients.

Sample Size calculation: The sample size was calculated using the data from Shukla U et al[7], that is time for first dose of rescue analgesia, after instillation 40 ml of 0.25% Bupivacaine. Taking standard deviation of 18, confidence level of 95% and desired precision of 5, a minimum of 50 study subjects were required as calculated by **Epitools software**. Sixty-three patients were enrolled for the study, out of which 50 patients meeting inclusion and exclusion criteria were analysed.

Inclusion Criteria:

1. Age between 18-60 yrs
2. Either sex,
3. Weight 45-85 kg &
4. ASA grades I-II

Exclusion Criteria:

1. Patient refusal
2. Need for bile duct exploration
3. Acute cholecystitis
4. Surgery related complication for example, bile spillage or conversion to open cholecystectomy
5. Severe systemic disease
6. Prolong analgesics ingestion

Procedure Methodology: All the patients had thorough pre anaesthetic evaluation, which comprised of a detailed history, a clinical examination and evaluation of the investigations. Afterwritten & informed consent for participation in the study, the patients were shifted to operation theatre and multipara monitor was attached. Baseline vitals (HR, SBP & DBP) were recorded while breathing room air. 18 G intravenous cannula was secured over dorsum of hand and IV ringer lactate was started at 5-6 ml/kg/hr infusion rate.

All the patients were premedicated with IV Glycopyrrolate 0.2 mg, IV Midazolam 0.03 mg/Kg and IV Pantoprazole 40 mg slowly. After pre-oxygenation with 100% oxygen (O_2) for 3 min, general anaesthesia was induced with IV Propofol 2.0–2.5 mg/kg followed by IV Succinylcholine 1.5 mg/kg to facilitate endotracheal intubation. Trachea was intubated with lubricated cuffed endotracheal tube of appropriate size. Anaesthesia was maintained with 60% N_2O in oxygen with 0.5–1% Isoflurane. Intermittent boluses of IV Atracurium was used to achieve muscle relaxation. Minute ventilation was set to maintain normocapnia (End tidal carbon-dioxide [$EtCO_2$] between 34 and 38 mm Hg). Nasogastric tube of appropriate size was inserted. During laparoscopy, intra-abdominal pressure was maintained in between 12-14 mm Hg. After removal of the gallbladder and haemostasis, residual blood and fluid were thoroughly suctioned. Then the surgeon instilled 40 ml of 0.25% Bupivacaine in the sub diaphragmatic suprahepatic surface of liver and gallbladder fossa. Patients was maintained in the right lateral Trendelenburg position for 10-15 min. After that Inj. Ondansetron 4 mg was given intravenously. Then anaesthesia was reversed with IV Neostigmine 50 µg /kg and IV Glycopyrrolate 10 µg/kg.

The degree of postoperative pain was assessed using the VAS at 15 min, 30 min, 1 hr, 2, 3, 4, 8 ,12 and 24 hrs post-operatively. At the same time intervals, hemodynamic variables like HR, SBP & DBP were also recorded. Those patients who had VAS $\geq$ 4 received a bolus of IM Diclofenac (75mg) as rescue analgesia. Duration of analgesia i.e. the time of instillation of intraperitoneal Bupivacaine to the time when VAS $\geq$ 4 was recorded. Total rescue analgesic requirement up to 24 hrs along with incidence of any adverse events such as shoulder pain, post-operative nausea and vomiting, respiratory depression and any ECG changes were recorded. PONV was treated with IV Ondansetron & shoulder pain was managed by reassurance and IV Pentazocine, if needed. Number of patients had VAS <3 at 3 hrs was counted and proportion of patient having effective analgesia was calculated.

Statistical analysis

Data were collected from all the patients and observations were analysed and compared using Epitools Software. The unpaired student t test was applied to compare the means of two independent samples. p-

value>0.05 was considered as not significant and p-value <0.05 and <0.001 was considered as significant and highly significant, respectively.

III. Results

In present study, maximum patients were adult female of ASA I with mean weight 58.38 ± 8.84 kg and height 165.82 ± 10.16 cm.(Table 1)

Table 1. Demographic profile

Mean Age (years)	36.56 ± 11.26
Male : Female	21 : 29
ASA I : ASA II	35 : 15
Mean Weight (Kg)	58.38 ± 8.84
Mean Height (cm)	165.82 ± 10.16

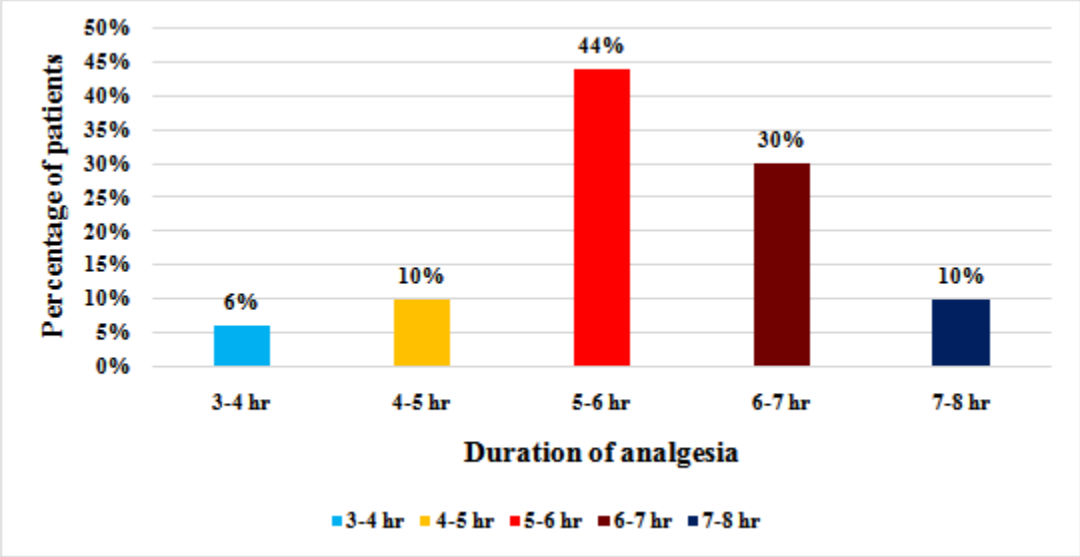
Effective analgesia (VAS <3 at 3 hrs) was observed in 40 (80%) patients had which was statistically significant (p< 0.001). Maximum number of the patients had VAS < 3 at various time interval throughout the study period except at 4th& 8th hr when VAS score was 3-4 in 45 (90%) and 29 (78%) patients; respectively. Baseline VAS i.e. VAS at pre-operative period was 0.54±0.49. Increase in VAS score was observed between the 4th hr and 8th hr which was 3.16±0.54 and 3.86±0.74, respectively. (Table 2)

Table 2. Trend of Visual Analogue Score

Time interval	Number of patients (%)			VAS (Mean ±SD)
	VAS <3	VAS = 3 - 4	VAS >4	
Baseline	50 (100 %)	0 (0%)	0 (0%)	0.54±0.49
Post-extubation				
15 min	50 (100%)	0 (0%)	0 (0%)	0.96±0.63
30 min	48 (96%)	2 (4%)	0 (0%)	1.56±0.53
1 hr	46 (92%)	4 (8%)	0 (0%)	1.58±0.87
2 hr	41 (82%)	9 (18%)	0 (0%)	1.62±0.62
3 hr	40 (80%)	6 (12%)	4 (8%)	1.80±0.70
4 hr	3 (6%)	45 (90%)	2 (4%)	3.16±0.54
8 hr	4 (8%)	39 (78%)	7 (14 %)	3.86±0.74
12 hr	40 (80%)	10 (20%)	0 (0%)	1.64±0.48
24 hr	46 (92%)	4 (8%)	0 (0%)	1.82± 0.55

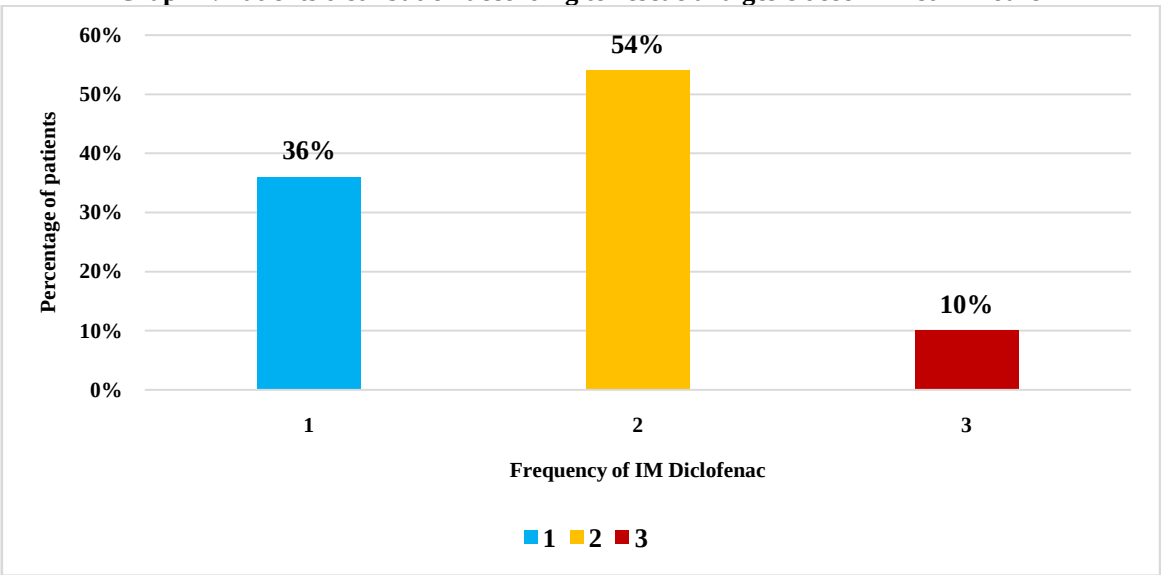
Mean duration of analgesia was 5.924±0.76 hrs. Maximum number of pts, i.e. 22 (44%) had duration of analgesia between 5-6 hrs followed by 6-7 hrs in 15 (30%) pts. Only three patients had duration of analgesia of 3-4 hrs. (Graph 1)

Graph 1. Patients distribution according to duration of analgesia



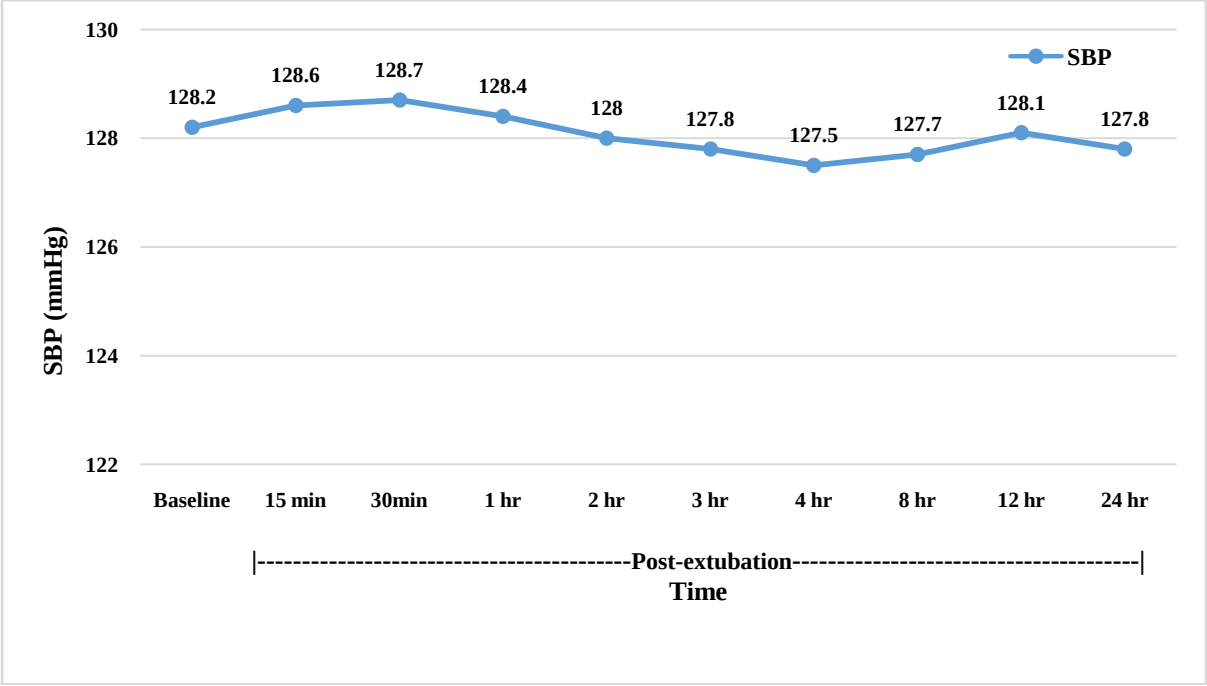
Mean frequency of rescue analgesic (IM Diclofenac) was 2.64±0.48.Maximum 27 (54%) pts needed 2 doses of IM Diclofenac and 18 (36%) pts required only single over 24 hours. (Graph 2)

Graph 2. Patients distribution according to rescue analgesic dose in first 24 hours

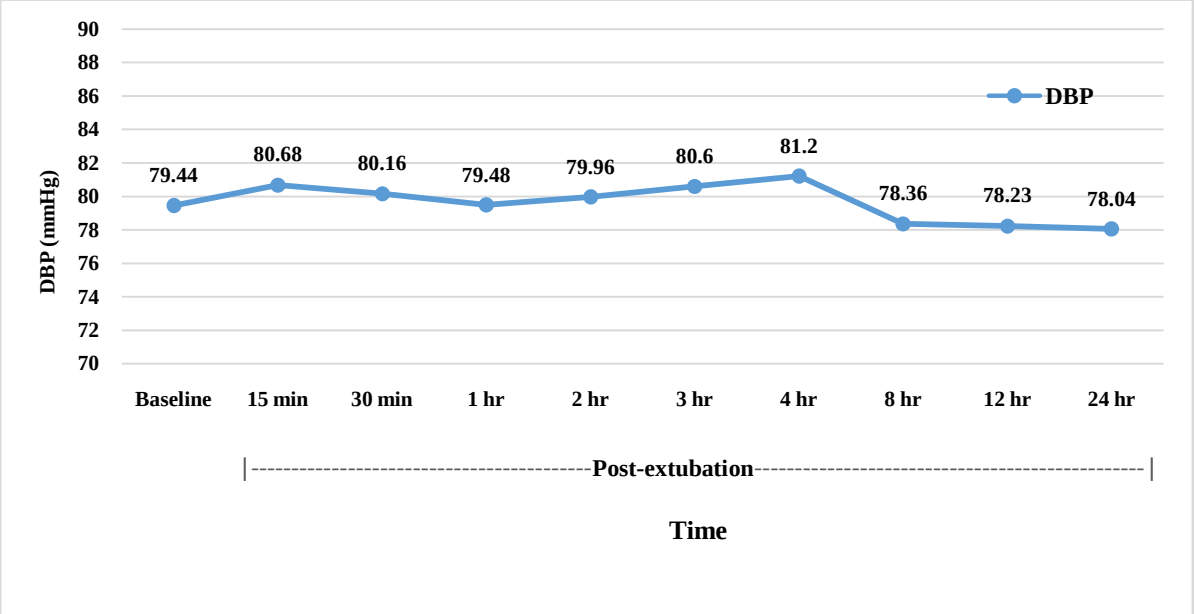


The changes in mean HR, SBP & DBP at all measured time intervals over 24 hrs follow-up time were statistically comparable. (Graph 3 & Graph 4)

Graph 3. Mean SBP (mmHg)



Graph 4. Mean DBP (mmHg)



In our study, 6 (12 %) pts had nausea, 8 (16%) pts had vomiting. Shoulder pain was experienced by 3 (6%) pts. None of the pts experienced respiratory depression or arrhythmias.

IV. Discussion

Laparoscopic cholecystectomy is widely used as treatment for symptomatic gall stone.[2,7,8]Extreme patient positioning & pneumo-peritoneum induce cardiopulmonary derangements & increase risk of aspiration makes general anaesthesia with endotracheal intubation a preferred technique for anaesthesia. As most of the laparoscopic surgeries are conducted on day-care basis, effective pain management strategy with minimal side effects plays a vital role in early discharge.[9]Though laparoscopic cholecystectomy is definitely less painful as compared to open procedure,but etiology and the nature of pain is different and requires a specific approach for pain management. The magnitude of post-operative shoulder pain and abdominal pain in the early post-operative period is quite significant. Pain intensity usually peaks during the initial post-operative hours and declines over time.[6]Post- operative pain after laparoscopic cholecystectomy are due to visceral, parietal and referred shoulder pain distinguishable from each other in the intensity, latency and duration. The stretching of the intra-abdominal cavity, peritonealinflammation and diaphragmatic irritation caused by gas insufflation, raised intraperitoneal pressure and residual carbon dioxide in the peritoneal cavity are most probable causes of early post-operative pain.[2,10,11,12]

In present study, intraperitoneal instillation of 40 ml 0.25% Bupivacaine provided effective postoperative analgesia i.e. VAS <3 at 3 hrsfollowing laparoscopy cholecystectomy in 40 (80%) patients with decrease 24-hour requirement of rescue analgesic.More number of female patients in this study could be because of high incidence of symptomatic gallstones in female.

Bhardwaj N et al[3]observed higher number of patient required rescue analgesic (IM Diclofenac) 20 ml intraperitoneal NS as compared to 20 ml of 0.5% intraperitoneal Bupivacaine with Adrenaline at 4th hour post-operatively. Khurana S et al[11]found that in 25 ml intraperitoneal NS group, rescue analgesic was given to 30 pts as compared to 15 pts of 25 ml of 0.25% intraperitoneal Bupivacaine group post-operatively and this difference was statistically significant. In 25 ml 0.25% intraperitoneal Bupivacaine-Buprenorphine group only 5 pts required rescue analgesic. Results in the study conducted by Bhardwaj N et al[3]& Khurana S et al[11]correlated well with our study which denotes effectiveness of intraperitoneal instillation of Bupivacaine for post-operative pain relief.

IM Diclofenac was used as rescue analgesic in our study because it is a routine practice in ourinstitute and it has additional anti-inflammatory property. In our study, mean number of doses of rescue analgesic were 2.64±0.48.Maximum 27 (54%) pts needed 2 doses of IM Diclofenac. (Graph 2) The lower frequency of requirement of rescue analgesics in the studies by Sulekha D[2]might be explained by higher volume of Bupivacaine and of Shukla U et al[7]might be explained by use of higher concentration ofBupivacaine (0.5%) that provide satisfactory analgesia for longer period postoperatively**.** Meena RK et al[8]follow up the pts till 12 hrs that results in lowernumber of rescue analgesic as compared to 24 hrs follow-up in our study. Variation in mean HR, SBP & DBP correlated well with various literatures.[8,13]

Inour study, mean duration of analgesia was 5.924±0.76 hrs. Maximum pts had duration of analgesia between 5-6hrs or more. Our result was comparable to resultof Das NT et al[9].They observed 7.93±1.44 hrs duration of analgesiawhich could be due to similar volume and concentration (0.25%, 35 ml) ofBupivacaine used. Shorter duration of analgesia (3.07±0.46hrs) in study by Khurana S et al[12]might be due to use of lower volume of Bupivacaine (25 ml).Jain S et al[6]observed longer duration of analgesia(19.35±8.64 hrs) that might be explained by use of higherconcentration of Bupivacaine (0.5%) & intraperitoneal irrigation of Bupivacaine during the surgery which might further contribute to post-operative analgesia. Longer duration of analgesia(7.11±2.08 hrs) was also observed by Sulekha D[2]that could be due to use of higher concentration of Bupivacaine (0.5%) as compared to 0.25% in our study.

In our study, nausea, vomiting and shoulder pain was observed in few patients which was not severe enough and managed successfully without medication with reassurance.Higher incidence of shoulder pain in studies by Bhardwaj N et al[3]& Jain S et al[6]might be attributed by incomplete evacuation of pneumo-peritoneaum. Higherincidence of nausea in studies by Sulekha D[2]&Jain Set al[6]might be dueto use of higher concentration of Bupivacaine (0.5%). Arrhythmia and hypotension instudy by Sharan R et al[13]were might be due to inclusion of patients of ASAgrade III.

Limitations & Future Scope:

Present study was an observational study conducted in very small sample size, used singlevolume and concentration.Interpretation of pain using VAS, surgical procedure and degree of tissue dissection were confounding factors that were not taken into consideration. In futuresame study could be conducted on large sample size, comparing different volume and concentration of local anaesthetic and considering various confounding factors to validate theresults.

V. Conclusion

Intraperitoneal instillation of 0.25% Bupivacaine 40 ml is an effectivealternative for post-operative analgesia with stable hemodynamic and minimal adverse effectsin patients undergoing laparoscopic cholecystectomy which provides 5.924±0.76 hrs of Postoperative analgesia.

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Conflicts of interest- There are no conflicts of interest.

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