

Incidence of Shoulder Tip Pain in Patients with Laparoscopic Cholecystectomy

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Abstract

Background: Laparoscopic cholecystectomy (LC) is the gold standard procedure for the surgical treatment of gallbladder disease; it is associated with decrease in postoperative pain and early mobilization after surgery, but still associated with shoulder tip pain that lead to patient's distress and delayed discharge, so the provision of postoperative pain relief is of great importance. **Objectives:** To evaluate the effect of intraperitoneal installation of local anesthesia (bupivacaine) on reduction of the incidence of shoulder tip pain after LC and its effect on postoperative analgesia need, early mobilization, and time of hospitalization. **Materials and Methods:** An experimental double-blind randomized control trail study include 60 patients with elective laparoscopic cholecystectomy at the age between 18 and 60 years of both sex, randomly assigned to 30 patients in each group either Group A (not received bupivacaine) or Group B (intraperitoneal installation of bupivacaine), at the end of surgery after gallbladder resection, 20 ml of 0.5% bupivacaine in 500 ml normal saline irrigate intraperitoneally. Postoperatively, the patients were assessed for shoulder tip pain using visual analog scale, the number of analgesic doses required, and time of mobilization after surgery at 1hr, 4 hr, 8hr, and 12 hr postoperatively, and time of discharge was also recorded. These information were analyzed using SPSS version 22. **Results:** The visual analog scale was significantly higher in Group A compared to Group B at 1st, 4th, and 8th postoperative h ($P = 0.0001, 0.0001, 0.001$; $P < 0.05$), the total number of patients require rescue analgesia was higher in Group A than Group B, the mobilization after surgery in Group B earlier than Group A and shorter hospitalization in Group B than Group A. **Conclusion:** Intraperitoneal instillation of bupivacaine (20 ml of 0.5%) with normal saline will significantly lower the intensity of postoperative shoulder tip pain, as well as decrease analgesic consumption, time to mobilize after surgery and time of hospitalization.

Keywords: Bupivacaine, cholecystectomy, gallbladder, shoulder pain

INTRODUCTION

Gallbladder diseases are known to the people since more than 2000 years. The most common surgery of the biliary tract performed nowadays is cholecystectomy.^[1] Gallbladder disease is a major cause of surgical intervention hospital admission and economic burden and is caused by gallstones.^[2] First laparoscopic cholecystectomy (LC) was performed wayback in 1987 by Phillip Mauret and later established by Dubois and Perissat in 1990.^[3] LC has a revolution in the dealing with gallbladder disease. It is the gold standard way for treating patients with cholelithiasis. It replaced open cholecystectomy as the first choice of treatment for gallstones and inflammation of the gallbladder.^[4]

Laparoscopic choletechnique is more preferred than open surgery as it is minimally invasive technique and is associated with reduced surgical trauma, smaller and more cosmetic incision, decreased intraoperative bleeding, and is associated

usually with less postoperative complications and reduced hospitalization time.^[5]

For being a minimally invasive procedure, laparoscopy induces the wrong perception that it has no pain; however, pain is the primary complaint and the main reason for prolonged hospitalization and more time for mobilization postoperatively.^[6]

The causes of pain after LC is multifactorial, and one of the most acceptable interpretation is the peritoneal insufflation with CO₂ gas that cause irritation of the phrenic nerve which

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results in feeling of pain at shoulder tip of right side. Other attributable factors include sociocultural and individual factors.^[7]

Good pain control encourages early ambulation, which has a great role in decreasing the risk of deep vein thrombosis and pulmonary embolism, enhances patient's ability to take deep breaths to decrease the risk of pulmonary complications such as atelectasis and pneumonia; so, in general, it is effective in decreasing the complication and unnecessary investigations related to it.^[8]

A numbers of multimodal methods have been tried to decrease pain after surgery. These include parenteral analgesics such as nonsteroidal anti-inflammatory drugs, epidural opioids, and intercostal nerve blocks as well a use other method like peritoneal wash with normal saline or used forced gas evacuation and multiple other methods.^[9] It is also possible to use intraperitoneal instillation of local anesthetic, which cause blocking of visceral afferent signaling and then modifying visceral nociception and attenuate illness responses.^[10]

In our study, we used intraperitoneal installation of bupivacaine with normal saline in patients with laparoscopic cholecystectomy to evaluate its effectiveness on postoperative pain, need for postoperative analgesia, early mobilization, and hospitalization time.

The objectives of the study is to evaluate the role of intraperitoneal installation of local anesthesia (bupivacaine) with normal saline in reduction of the incidence of shoulder tip pain after LC and its effect on analgesia need after surgery, time required for mobilization, and period of hospitalization.

MATERIALS AND METHODS

An experimental prospective double-blind randomized control trail study was done at Al-Hilla Teaching Hospital and Al-Imam Alsadiq Hospital, over a period of 5 months from 1st of February 2019 to 1st of June 2019. Population of the study included patients who admitted for elective laparoscopy cholecystectomy at age between 18 and 60 years of both sex (male and female), who accept to give written informed consent and have willing to participate in the study, and there is no contraindication to using of local anesthesia (bupivacaine). Patients (with emergency cholecystectomy) who excluded from the study included patients who refused to give consent to participate in the study, those with conversion to open surgery, pregnant women, and those with history of cardiac problem. Patients then were randomly assigned to either Group A (patient not received bupivacaine) or Group B (patients who undergo intraperitoneal installation of bupivacaine) 30 patients in each group, and in all patients general anesthesia used with endotracheal intubation and operative method was done with a 4-trocar technique in all patients. Pneumoperitoneum was achieved in every case with the use of a veress needle and open through a periumbilical incision, and pneumoperitoneum pressure was maintained at range 11–14

mmHg during the entire surgical procedure. After gallbladder extraction, hemostasis was performed at the surgical bed and randomly, 30 patients from 60 patients received intraperitoneal installation of 20 ml of 0.5% bupivacaine in 500 ml normal saline irrigate the surgical bed, on the right subdiaphragmatic space and on the surface of the liver. After 5 min, suction was done and gas instruments and trocars were removed. Surgical drain were used. Adverse effects associated with the use of local anesthesia, such as allergic reactions and local tissue, cardiovascular, central nervous system, and systemic toxicity were not observed in our study with the use of local anesthesia. No patient from the entire study population had any complications, and no conversion to open surgery occur.

Postoperatively, the patients were assessed for shoulder tip pain using visual analog scale (VAS), the number of analgesic doses required, and time of mobilization after surgery. The patients were assessed at 1, 4, 8, and 12 h postoperatively. All the patients were allowed to receive analgesic medication as needed, and the requirement of these medications was recorded. VAS was explained to every patient. The number "0" was equivalent to no pain, and "10" was the worst pain they ever felt. Timing of administration of analgesics was recorded, and the time of discharge from hospital was also recorded.

Analysis of data was done utilizing SPSS (SPSS, IBM Company, Chicago, IL 60606, USA) version 22 computer software; $P = 0.05$ was considered as statistically significant.

Ethical aspects

Study protocol was displayed on the ethical committee in granted permission was taken, after explaining the objectives of the study to the patients with details about medication used; written informed consent was obtained to participate in the study.

RESULTS

In general, there is no significant difference between the two study groups regarding their sociodemographic characteristics as presented in Table 1.

Figure 1 shows that most of the operations are done for calculus cholecystitis and only 3 cases presented with acalculous cholecystitis and no polyp case.

Estimation of pain by the individual showed a very significant difference between the Group A and Group B according to VAS at all four estimation points (in the 1st h, after 4 h, 8 h, and 12 h) as presented in Table 2.

There was a very significant difference between the two study groups regarding the number of analgesia and time of its use at (4–8 h postoperative), (8–12 h postoperative) presented in Table 3.

Figure 2 shows that out of a total of 30 patients (in Group A), 5 patients required only paracetamol (blue color) and the remaining (25 patients) required rescue tramadol (red color),

Table 1: Demographic characteristics of the two study groups

Characteristics	Group	Group A	Group B	Total	<i>t</i> or χ^2	<i>P</i>
Age		42.6±11.53	42.8±10.96	60	-1.007	0.318
Gender	Male	10	9	19	0.07	0.781
	Female	20	21	41		
Education level	None or primary	9	9	18	0.0001	1.0
	Medium or high	21	21	42		
Residence	Urban	15	8	23	3.45	0.063
	Rural	15	22	37		

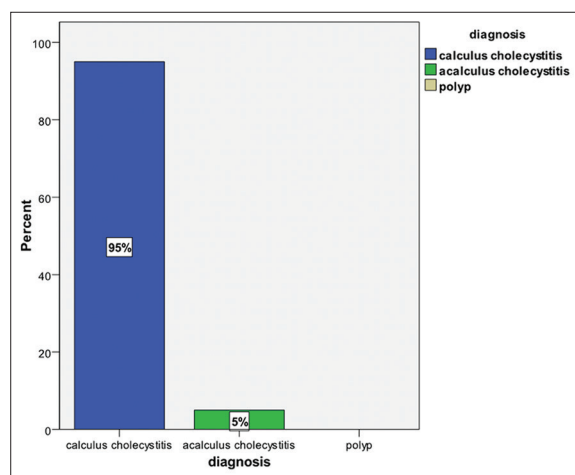
Table 2: Difference in the estimation of pain intensity according to visual analog scale score between the two groups

Group (h)	<i>n</i>	Mean±SD	<i>t</i>	<i>P</i>
Pain 1				
Group A	30	4.4667±0.899	16.597	0.0001*
Group B	30	0.8667±0.776		
Pain 4				
Group A	30	6.6667±1.093	16.804	0.0001*
Group B	30	2.2000±0.961		
Pain 8				
Group A	30	4.9333±1.080	7.306	0.001*
Group B	30	3.0333±0.927		
Pain 12				
Group A	30	3.1000±0.844	-2.028	0.047*
Group B	30	3.5667±0.935		

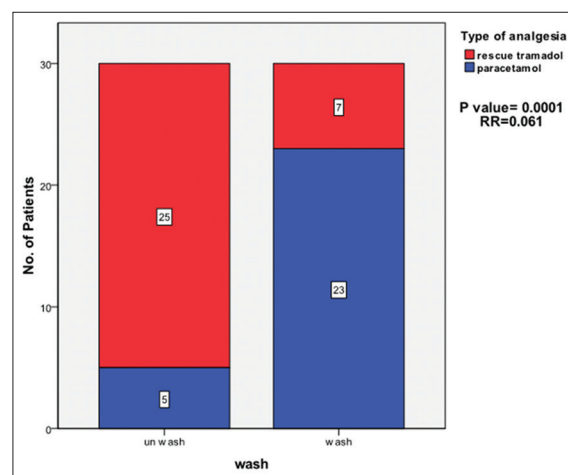
SD: Standard deviation

Table 3: Difference in the requirement of analgesia at the 1st 4 h, 4-8 h, and 8-12 h

Time of analgesia (h)	Use of analgesia	Group A	Group B	Total	χ^2	<i>P</i>
Analgesia at 4-8	Not used	6	29	35	36.27	0.0001
	Used	24	1	25		
Analgesia at 8-12	Not used	29	24	53	4.04	0.044
	Used	1	6	7		

**Figure 1: Distribution of the study group according to the cause of cholecystectomy**

while in Group B from a total of 30 patients, 23 patients required only paracetamol (blue color) and the remaining 7 patients required rescue tramadol (red color) and $P=0.0001$. This result

**Figure 2: Difference in type of analgesia required in the 1st 8 h between the two groups**

was highly significant to show that Group B required less rescue treatment due to the effect of bupivacaine use.

Table 4 shows there was a very significant difference between the two study groups regarding the mobilization at 1st 4 h, 4–8 h, and 8–12 h postoperative; in Group A from total 30 patients, mobilization within 4 h found in 11 patients, 14 patients within 4–8 h postoperative and remaining 5 patients after that, while in Group B from 30 patients, mobilization within 4 h occur in 17 patients, and remaining 13 patients within 4–8 h postoperative.

Time of hospitalization for two study groups in Figure 3 shows that in Group A (blue color), only two patients discharged early after 18 h while 20 patients from Group B (red color) discharge at that time also, while 19 patients in Group A and 2 patients from Group B discharged between 36 and 48 h.

DISCUSSION

Laparoscopy is an excellent means to minimize the trauma and agony of the patient following surgery. In LC, shoulder tip pain and visceral pain are more important causes of postoperative pain rather than parietal pain due to the smaller incisions of LC; so, there still remains some challenge to minimize the postoperative pain in the patients which usually reaches a maximum level within 6 h of the procedure and then gradually decreases.^[11,12]

In the study use intraperitoneal instillation of bupivacaine (local anesthesia) to evaluate its role for postoperative pain relief.

Regarding sociodemographic parameters, the two study groups are comparable and *P* value not significant for all sociodemographic characters which is of great benefit to such studies with comparison base, to avoid the effects of these factors on the result of the study.

Regarding causes of cholecystectomy and type of gallbladder disease, we found that 95% of patients involved in study

diagnosed as calculus cholecystitis and 5% as acalculous cholecystitis and no one of them with polyp or other causes; large sample size study carried out by Anderson confirmed this finding.^[13]

Ahmed and Diggory, in their retrospective cohort study, found that from total of 833 Laparoscopic cholecystectomy, 805 (96.7%) of them performed for calculous gallbladder disease with the remainder of 28 (3.3%) performed for a calculus cause. Of these 28 patients, 8 were performed for the presence of suspected gallbladder polyps.^[14]

The main step in our study evaluates the role of intraperitoneal instillation of bupivacaine on shoulder tip pain after laparoscopic cholecystectomy using VAS at 1, 4, 8, and 12 h postoperative. We found that at 1st h VAS in Group A was higher than in Group B, (*P* = 0.0001; highly significant). At 4 h postoperative, despite increase in VAS in Group B but VAS in Group A still higher and *P* value still significant. At 8 h postoperative *P* value decreased because VAS in Group A start to be lower as most patients required rescue analgesia then pain scale become lower because of analgesia effect and *P* value still significant. At 12 h postoperative, VAS in Group B became higher than Group A as duration of action of bupivacaine with maximum may reach to 9 h and also may be due to that the patients in Group A most of them had taken analgesia which result in decrease in VAS in Group A comparable with Group B.

So that mean intraperitoneal installation of bupivacaine has a significant role in decreasing shoulder tip pain after laparoscopic cholecystectomy special in first 8-h postoperative.

The result of study of Das and Deshpande^[15] was compatible with our results regarding shoulder tip pain. They did not observe any incidence of shoulder pain. In comparison with our result, VAS in Group B with mean of 3, so they explained in their study that this could have been due to meticulous absorption of gas at the end of surgery as well as suprahepatic surface instillation and maintenance of Trendelenburg position for at least 10 min in addition to the effect of local analgesia.^[15]

A meta-analysis study in 2015 by Choi *et al.* also showed that intraperitoneal instillation of local anesthetics significantly reduced incidence and severity of shoulder pain.^[16]

Feroi *et al.* studied the effect of using 0.5% bupivacaine, either infiltrated in trocars wounds or kept soaked in a regenerated oxidized cellulose sheet positioned in the gallbladder bed in comparison with control group (not using local anesthesia); they found that using bupivacaine can increase postoperative comfort.^[17]

Conflicting results have been reported by Zimmer *et al.*, stating that no significant differences in postoperative pain were noted in his study using 10 ml of bupivacaine, a possible explanation of the failed effect given by them was the small amount of local anesthetics used in his study.^[18]

A Randomized control trial study of Maharjan and Shrestha revealed that VAS scoreless when using 0.25% bupivacaine but

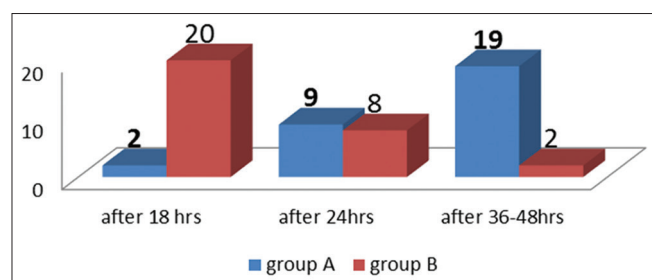


Figure 3: Time of hospitalization for two study groups

Table 4: Difference in the time required for mobilization between the study groups

Time of mobilization	Group A	Group B	Total	χ^2	<i>P</i>
Mobilization (h)					
Within 4	11	17	28	6.323	0.042
Within 4-8	14	13	27		
Within 8-12	5	0	5		
Total	30	30	60		

it was statistically not significant ($P > 0.05$). However, their result was different from the result of our study. This may be due to low concentration of bupivacaine which very important to produce its analgesic effect.^[19]

Regarding analgesia requirement, all patients in both groups received paracetamol vial in 1st h postoperative. At 4–8 h postoperative, it was found that in Group A from totally 30 patients, 24 required rescue analgesia and in Group B only 1 patient required rescue analgesia in which P value was highly significant since difference in analgesia need which was more in group A great than in group B.

At 8–12 hr in Group A, one patient required analgesia in the following hours while in Group B, 6 patients had taken rescue analgesia. So, from total number of patients who needed analgesia, results found that bupivacaine instillation was associated with less need for rescue analgesia.

Honca *et al.*, confirmed that in his study when he mention that total tramadol consumption was significantly lower in group that used bupivacaine than the placebo group.^[20]

Castillo-Garza *et al.* studied the effect of bupivacaine on analgesia requirement by patients and he demonstrates that irrigation with bupivacaine at the surgical bed in LC will decrease analgesic consumption in the first postsurgical hours and can establish this protocol for use in LCs with the purpose of a faster return of the patient to his or her normal life, and thus, a shorter hospital stay.^[21]

However, Pandove *et al.* did not agree with this result as he showed that intraperitoneal instillation of bupivacaine does not provide any advantage in terms of decreasing postoperative analgesic requirement.^[12]

Regarding early mobilization after surgery, we found in Group B that all patients mobilized with first 8 h postoperative while in Group A, about one-third in the first 4 h postoperative and in the remaining patients, mobilization delayed even to 12 h postoperative. This results mean that intraperitoneal installation of bupivacaine was associated with early mobilization after surgery.

Roberts *et al.*^[22] confirmed that intraperitoneal techniques of local anashesia during LC had decreased postoperative pain and enhanced early mobilization after surgery.

By comparing the time of hospitalization between Group A and B, results found that time of hospitalization with Group A was more than Group B. This result was compatible with Arshad *et al.* who showed the same finding that reduce postoperative hospital stay and time to mobilize after surgery.^[23]

The good results of our study may be related to the use of higher concentration and optimum volume of bupivacaine compared to other studies because its concentration is very important to produce its analgesic effect in association with normal saline; it works by dissolution of CO₂ gas in abdominal cavity and thorough removal of blood clots; debris and surgical smoke

from peritoneal cavity leads to decrease in postoperative pain including shoulder tip pain.

CONCLUSIONS

This study demonstrates that intraperitoneal irrigation with bupivacaine (20 ml of 0.5%) at the surgical bed in patients with LC will significantly lower the intensity of postoperative shoulder tip pain, as well as analgesic consumption, time to mobilize after surgery, and hospitalization time. It is easy to administer, with no adverse effects at the dose and concentration used in the study and will help in improving the postoperative recovery.

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Conflicts of interest

There are no conflicts of interest.

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