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Research Article

Bupivacaine Irrigation at the Gall Bladder Bed for Postoperative Pain Relief after Laparoscopic Cholecystectomy

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Abstract:

Purpose: Gallbladder is highly innervated by parasympathetic and sympathetic nervous system through anterior and posterior hepatic plexus and the phrenic nerves. The aim of this study was to evaluate the effect of bupivacaine irrigated at the surgical bed on postoperative pain relief in laparoscopic cholecystectomy patients. and reducing analgesic consumption following laparoscopic cholecystectomy.

Methods: This randomized controlled prospective study included 150 patients undergoing elective laparoscopic cholecystectomy who were prospectively randomized into 2 groups. The placebo group (n=75) received 50cc normal saline in- stalled into the gallbladder bed after removal of the gall bladder. The bupivacaine group (n=75) received 20cc of 0.5% bupivacaine in at the same surgical site.

Pain was assessed at 1,2 ,6, 12, and 24 hours by using a visual analog scale (VAS).

Results: The postoperative visual analogue score within the first 24 hour for visceral pain at rest, during coughing, and movement was significantly lower in the infiltration group than the control group, but it was similar for somatic pain.

Time to first rescue analgesia was significantly longer in the infiltration than the control group. significant difference (P=.011) was observed in pain levels between both groups at 2, and 6 hours postoperatively. The average analgesic requirement was lower in the bupivacaine group.

Conclusions: In our study, the use of bupivacaine irrigated over the surgical bed was an effective method to decreased visceral pain intensity at rest, coughing, and movement with reduced analgesic consumption in the first postoperative 24 hours after laparoscopic cholecystectomy.

keywords: bupivacaine; irrigation; laparoscopic cholecystectomy; postoperative pain

Introduction:

Cholecystectomy is one of the most frequently per- formed abdominal surgeries [1]. Laparoscopic cholecystectomy is associated with minimal surgical trauma, good cosmetic surgical results, insignificant blood loss, reduced severity of postoperative pain and early discharge from hospital [2]. Inappropriate management of pain after laparoscopic cholecystectomy results in prolonged hospital stay and increased incidence of patient readmission after hospital discharge [3].

Postoperative pain following laparoscopic cholecystectomy manifests itself as somatic, visceral and shoulder tip pain.

Somatic pain is localized to incision sites for the insertion of surgical ports through abdominal wall. Visceral pain is a dull aching diffuse deep pain that is caused by surgical dissection, stretching and manipulation of tissues in the region of gallbladder bed and is perceived by the nociceptors of the visceral peritoneum that covers neighboring abdominal viscera [4].

Shoulder tip pain is a referred type of pain that is caused by residual car- bon dioxide and it usually occurs on the second postoperative day [5].

There is a strong evidence that intraperitoneal instillation of local anesthetics is associated with significant reduction of postoperative abdominal and shoulder pain and opioid consumption after laparoscopic gynecological [6] and gastric [7] procedures but this evidence is weak after laparoscopic cholecystectomy [8].

Visceral pain is more severe and predominant than somatic pain [9].

Surgical dissection of gallbladder from its bed in the inferior surface of the liver may cause injury and cauterization of Glisson's capsule (visceral peritoneum of the liver) resulting in increased intensity of postoperative abdominal pain and increased need for opioid analgesia after laparoscopic cholecystectomy [4].

The gallbladder is innervated by parasympathetic and sympathetic nervous system through three routes which are anterior hepatic plexus, posterior hepatic plexus and the phrenic nerves [10].

The aim of this study was to evaluate the use of the irrigation of a local anesthetic, such as bupivacaine, at the surgical bed for postoperative pain

reduction. Secondly, we tried to assess whether this analgesia method reduces the postoperative use of nonsteroidal anti-inflammatory drugs (NSAID).

Material and Methods

This randomized prospective study done in cooperation with the clinical pharmacology department university of benghazi the eligible patients were from 18 to 65 years old in both sex, undergoing elective laparoscopic cholecystectomy.
a written informed consent from each patient enrolled in the study were obtained. From October 2020 to august 2021 in aljalla university hospital and under supervision of surgical and clinical pharmacology departments, male and female patients were registered.
Exclusion criteria were pregnancy, open cholecystectomy, and acute cholecystitis. Patients undergoing chronic treatment with any analgesic or anti- inflammatory agents were also excluded. 150 patients undergoing elective laparoscopic cholecystectomy were prospectively randomized into 2 groups.
In the control or placebo group, 50cc of normal saline solution without bupivacaine was irrigated at the surgical bed after laparoscopic cholecystectomy.

The experimental group was irrigated with 20cc of bupivacaine 0.5% in normal saline solution prepared by a clinical pharmacology team.

Before surgery, all the patients underwent upper abdominal ultrasound, ECG, chest X-rays, a complete blood count, liver function test, and a coagulation profile.

All patients were referred to the operating room without premedication, and the induction was performed using atracurium or vecuronium, propofol, and fentanyl. A customized dose for each patient was used.
A standard operative method was used with a 3-trocar technique in all patients.
Pneumoperitoneum was achieved in every case with the use of a Veress needle through a periumbilical incision, and was maintained at 14mm Hg during the entire surgical procedure. After removal of the gallbladder, hemostasis was performed.
Pain was assessed using a visual analog scale (VAS) of 0 to10.
Assessment was carried out in the recovery room at 30 minutes and 60 minutes postoperatively. Measurement in the patients room was performed,2,6,12, and 24 hours after surgery the pain assessment is done by clinical pharmacology team.

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.
Administration of analgesics was correlated with the reading of VAS.

If the VAS score for visceral pain was >3 pts, incremental doses of (NSAID) like volterine 75mg IM, Timing of the initial administration of analgesics was also recorded. Different IV analgesics, such as nonsteroidal anti-inflammatory drugs (NSAID), were used to reduce the postoperative pain.

Evaluation of postoperative symptoms, such as nausea, vomiting, and fever, were also recorded at the hospital stay. Initiation of oral intake and ambulation were also recorded.

Statistical analysis was performed using a 2-tailed t test and chi-square analysis; significance was determined as P<.05.

Kaplan-Meier curves and Log Rank test were used to assess differences over time. The descriptive variables were analyzed either by chi-square analysis or Fisher's exact test, as appropriate. P<.05 was considered statically significant. VAS scores were analyzed using Mann Whitney U-test

Statistical analysis was performed with SPSS version 13.

Results

150 patients were included in this protocol; 110 were women and 40 were men ranging in age from 18 to 65 years. The average in the bupivacaine group was 37 years and in the control group 35 years. The result was insignificant for the age in both groups.

A significant difference occurred in the average pain levels at 1,2,6 hours postoperatively between the control and experimental groups (Table 1). No significant difference occurred between the 2 groups during the other time intervals.

VAS	Control group n-75	Infiltration group n-75	P
1HR	4(2-6)	1(0-2)	0.001
2HR	4(2-6)	1(0-2)	0.001
6HR	5(2-6)	1(0-3)	0.002
12HR	3(2-5)	2(1-3)	0.005
24HR	3(2-5)	2(1-3)	0.005

Table 1: Visual analogue score for visceral pain at rest during the first postoperative 24 hours.

The postoperative VAS scores for visceral pain at rest were significantly lower in the infiltration group than in the control group during the entire first postoperative 24 hours (Table I).

The VAS scores during cough and movement for somatic pain at 12 hours after surgery were similar in both control and infiltration groups while for visceral pain, they were significantly lower in the infiltration than in the control group. The incidence of shoulder pain was similar in both groups

Time to administration of the first rescue analgesia was significantly longer in the infiltration (12.45±2.46 hours) than the control (1.12±1.15 hours) group (p<0.0001) and the frequency of administering res¬cue analgesia was significantly lower in theinfiltrati¬on (0.60±0.35) than in the control (3.48±1.12) group (p<0.0001).

During the first postoperative 24 hours, the number and percentage of patients who required morphine for rescue analgesia was significantly smaller in the infiltration (3, 4.3%) than in the control (60, 80%) group.

Time to recovery of normal intestinal sounds, inci¬dence of nausea and vomiting and the state of patient satisfaction as regardsanalgesic regimen were similar in both infiltration and control groups.

Discussion

Laparoscopic cholecystectomy is one of the most frequently performed elective surgeries.

It is a short stay procedure, and therefore, adequate postoperative pain relief is of considerable importance, which makes itideal for patients.

The main findings of the current study have demons¬trated that the infiltration of gallbladder bed with bupivacaine during laparoscopic cholecystectomy is associated with effective control of visceral pain at rest, during coughing and movement, increased time to the administration of the first rescue analgesia and decreased analgesic consumption within the first postoperative 24 hours.

Pain following laparoscopic cholecystectomy is eit¬her somatic, visceral or both. Minimally invasive laparoscopic surgeries are associated with minimal somatic pain. Visceral pain after laparoscopic cho¬lecystectomy is more severe and predominant thansomatic pain [9].

Yi SQ et al. [10] studied the surgical anatomy of gall¬bladder innervation in human and they demonstra¬ted that the gallbladderand its bed in the liver are innervated by sympathetic and parasympathetic nervous system via anterior and posterior hepatic plexus, and phrenic nerve. Anterior and posterior hepatic plexuses pass through the hepatoduodenal ligament and contain branches arising from the hepatic branches of the vagus and celiac plexus. The nerves that innervate gallbladder pass along cystic duct and cystic arteries.

Another cause of the pain that originate from the gallbladder bed is injury and cauterization of Glisson's capsule (visceral peritoneum of the liver) during dis¬section of gallbladder from its bed in the inferior surface of the liver resulting in increasedintensity of postoperative abdominal pain and increased need for opioid analgesia after laparoscopic cholecystec-tomy [4].

Rehan AG et al. [12] found that infiltration of 0.25% bupivacaine at port sites, under the right hemidiaph¬ragm and gallbladderbed decreased the postopera¬tive pain within the first 24 hours and significantly reduced the analgesic requirements.

Choi GJ et al. [13] performed a meta-analysis to evalu¬ate the efficacy of intraperitoneal administration of local anesthetics forpostoperative pain after lapa¬roscopic cholecystectomy.

They obtained their data from Cochrane Library, EMBASE and MEDLINE and included 39 controlled randomized English studiesthat compared the analgesic effects of intraperitone¬ally instilled local anesthetic agents with placebo (or nothing) used in thecontrol group after laparoscopic cholecystectomy.

They concluded that intraperitone¬al intraperitone¬al instillation of local anesthetic had favorable effects on reduction of the intensity of postoperative abdo¬minal visceral and shoulder pain at rest.

Kang Jk et al. [14] evaluated the analgesic effects of intraperitoneal administration of lidocaine after laparoscopiccholecystectomy.

Their study was con¬ducted on 40 patients scheduled for elective laparos¬copic cholecystectomy who were randomly assigned into 2 groups.

One group received 200 mL normal saline containing 200 mg lidocaine and the other group received 200 mL normal saline thatwas instil¬led into the gallbladder bed and the under surface of right diaphragm.

They concluded that, the intraperi¬toneal instillation of lidocaine significantly reduces the severity of postoperative abdominal and shoul¬der pain for 24 hours.

Yang SY et al. [15] in their controlled randomized, double-blind placebo study evaluated the analgesic efficacy of intraperitoneal instillation or intravenous infusion of lidocaine when compared with placebo following laparoscopic cholecystectomy.

They conc¬luded that, intraperitoneal and intravenous lidocaine infusions were associated with significant reduction of postoperative pain severity and opioid require¬ments after laparoscopic cholecystectomy when compared with the controlplacebo group.

Kim TH et al. [16] administered ropivacaine into the peritoneal cavity immediately after pneumoperito¬neum in laparoscopic cholecystectomy and they found a significant reduction of postoperative pain score in the ropivacaine group when compared tothe placebo group.

The nociceptive pathway of visceral pain involves the nervous system that supplies the gut. Surgical mani¬pulation of the viscera as gallbladder and irritation of peritoneum activates the silent nociceptors with signals transmitted through afferent neurons in the vagus nerve causing unpleasant sensations and auto¬nomic reactions [17].

The antinociceptive effects of intraperitoneal administ¬ration of local anesthetics may be attributed to blocking of peritoneal nociceptors, its local anti-inflammatory action and/or its systemic absorption [18].

The peritoneum is the largest serous membrane in the body and its surface area is close to that of the skin. The concentrationof local anesthetics are detectable in the systemic circulation within 2 minu¬tes after their administration into the peritoneal cavity, reaching a peak systemic concentration after 10-30 minutes [19].

The postoperative visual analogue scores for somatic pain were comparable in both groups during the first postoperative 24hours.

They were less than 3 points up to the 4th hours, but increased severely after then.

The somatic pain was controlled in the first postoperative 4 hours by lidocaine infiltration aro¬und the sites of port entry intoabdominal wall in both groups.

The incidence of shoulder pain was similar in both groups. Donatsky AM et al. [23] collected the data of their meta-analysis from pubMed and Excerpta Medica Database (EMBASE) to evaluate the effect of intraperitoneal instillation of normal salinewith or without local anesthetic on the incidence and seve¬rity of shoulder pain after laparoscopic cholecystec¬tomy.

The study included only randomized clinical trials published in English. They reported that, the incidence and severity ofshoulder pain could be minimized by intraperitoneal instillation of both sali¬ne and local anesthetics.

Conclusion

This study demonstrates that irrigation with bupivacaine at the surgical bed in laparoscopic cholecystectomy will significantly lower the intensity of postoperative visceral pain, as well as analgesic consumption in the first post surgical hours.

Because of this, we can establish this protocol for use in laparoscopic cholecystectomies with the purpose of a faster return ofthe patient to his or her normal life, and thus, a shorter hospital stay.

Finally, bupivacaine at the dosage used were very safe and had no significant side effects. Therefore, we can reduce pain inpatients who undergo laparoscopic cholecystectomy in ambulatory centers. This practice can become permanent in these cases.

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