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Original Article

The Effect of Port-Site Local Anesthetic Application and Standard Analgesics on Postoperative Pain Management in Laparoscopic Cholecystectomy: A Prospective, Comparative Study

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ABSTRACT

Objective: We aimed to investigate the effects of bupivacaine applied to the port sites after laparoscopic cholecystectomy (LC) on postoperative pain (POP) intensity.

Methods: The study included 188 patients who underwent LC under elective conditions for symptomatic cholelithiasis. Patients: 93 patients who received bupivacaine instead of the port were divided into the bupivacaine group, and 95 patients who received postoperative analgesia with nonsteroidal anti-inflammatory/tramadol drugs were divided into the Standard Analgesia Group. Pain was measured by the Visual Analog Scale (VAS) in all patients at the 1st, 6th, 12th, and 24th h postoperatively. All analgesic drugs administered to the patients were recorded.

Results: There was no difference between the two groups in terms of demographic characteristics, duration of surgery, or hospitalization. The mean VAS score at 1st, 6th, 12th, and 24th h was 3.6, 4.4, 2.1, and 1.9 in the Bupivacaine Group, while it was 7.6, 6.9, 2.3, and 2.1 in the Standard Analgesia Group. A statistically significant ($p<0.001$) reduction in pain intensity was detected in the Bupivacaine Group compared to the patients in the Standard Analgesia Group at the 1st and 6th h. On the other hand, there was no difference in pain intensity at 12th and 24th h. There was a significant decrease in analgesic use in the bupivacaine group. No major complications or mortality were observed in any patient.

Conclusion: Local anesthetic (Bupivacaine) application to the port sites after LC provides a significant decrease in pain intensity in the first 6 h postoperatively. We also believe that fewer analgesic drugs will be used for POP in these patients.

INTRODUCTION

Laparoscopic cholecystectomy (LC) is a reliable and effective procedure for benign gallbladder diseases. It has become the gold standard of treatment for symptomatic gallstones. The laparoscopic method is associated with less postoperative pain (POP), early recovery, a better cosmetic outcome, decreased morbidity, and increased patient satisfaction compared to open cholecystectomy.[1,2] However, it is not completely painless. Despite being minimally invasive, most patients experience pain of varying intensities in the early postoperative period.[3] POP after LC is observed in three forms: visceral pain, parietal pain, and shoulder pain. POP increases with coughing and deep breathing and delays early mobilization of the patient.[4] Port site entry in the LC causes parietal pain. Minimizing port site entry pain still remains a clinical challenge. Pain peaks within 6 h after the intervention.[5] POP is the primary factor in early postoperative complications and has a direct impact on the quality of life for surgical patients.[6]

Different pain relief methods are applied for POP relief after LC, such as systemic opioids, intravenous or intramuscular nonsteroidal anti-inflammatory drugs (NSAIDs), intraperitoneal local anesthesia, epidural or intrathecal opioids, local anesthetic infiltration into the surgical site,[7] intraperitoneal saline, adequate removal of insufflation gas, heated gas, and low-pressure gas.[8] Each method has its own advantages and limitations. Having the longest half-life, bupivacaine is used as a local anesthetic. Bupivacaine

has a half-life of 2.5–3.5 h, and studies have shown that it can reduce pain for an average of 6 h. Bupivacaine has a wide safety margin and can be used safely at an upper limit of 2.5 mg/kg body weight.[9] NSAIDs are the standard of care for POP control. Tramadol is also the most commonly used opioid-group non-narcotic analgesic to address POP. NSAIDs reduce the need for narcotic analgesics.[10] Unfortunately, non-selective conventional NSAIDs have side effects such as increased upper gastrointestinal inflammation, bleeding, platelet dysfunction, and impaired renal function.[11,12]

The goal of this research was to assess the efficacy of long-acting local anesthetic (Bupivacaine) infiltrated into port sites for pain control after elective LC. Since pain is a subjective finding, it should be standardized with the Visual Analog Scale (VAS) in a comparative study.

MATERIALS AND METHODS

The study included 188 patients aged 18–80 years who underwent elective surgery for symptomatic cholelithiasis between December 2021 and December 2022 in our hospital. It was approved by our hospital's ethical committee (decision 2021/514/216/2, dated December 29, 2021). Preoperative clinical data, including age, gender, American Society of Anesthesiologists (ASA) score, and predisposing factors (endoscopic retrograde cholangiopancreaticography, acute cholecystitis attack, acute biliary pancreatitis, and patients on blood thinners in terms of bleeding risk), were determined. Patients were divided into 1, 2, and 3 groups according to their ASA score. Patients were split into two groups: the Bupivacaine Group (93 patients who received bupivacaine through the port site) and the Standard Analgesia Group (95 patients who received postoperative analgesia with nonsteroidal anti-inflammatory drugs or tramadol). Informed written consent regarding analgesia options was obtained from each patient. Patients with local anesthetic allergies, infection at the injection site, chronic pain syndromes, prolonged opioid medications, coagulopathy, and patients who took any analgesic 24 h before surgery were excluded from the study. Patients who did not understand pain scoring with VAS, had a body mass index of >35 kg/m2, had severe systemic disease, and underwent LC under emergency conditions were excluded from the study.

The study included patients with symptomatic cholelithiasis who underwent LC under elective conditions. Direct open cholecystectomies and cholecystectomies performed under emergency conditions were not included. LC was performed with standard two 10 mm and two 5 mm trocars under 12 mmHg pressure. Drains were placed in patients whose LC exceeded 1 h and who had predisposing factors for possible complications. Drains were removed through a 5 mm lateral port. After cholecystectomy, the gallbladder was removed through a 10 mm epigastric or umbilical port, as appropriate. All patients received cefazolin 1 g prophylaxis in the first 30 min preoperatively and analgesia with Tramadol before awakening. In patients in the Bupivacaine Group, a total of 20 cc of bupivacaine (diluted 1:1 with physiological saline solution) was injected into the port sites, under the skin, and along the incision depth after the trocars were removed. Local anesthetic was infiltrated into all layers before suturing the skin, especially at 10 mm trocar sites. No side effects were observed in any patient receiving bupivacaine. The patients in the Standard Analgesia Group received analgesia with the standard pain treatment of our clinic (NSAIDs [50 mg dexketoprofen and trometamol] intravenously [i.v.] and 100 mg Tramadol hydrochloride i.v. for patients with VAS greater than 7). In the Bupivacaine Group, additionally, NSAIDs (50 mg dexketoprofen and trometamol) were administered i.v. to patients with VAS greater than 3 and 100 mg Tramadol hydrochloride i.v. to patients with VAS greater than 7. All patients received tramadol hydrochloride at 8-h intervals if analgesia was required.

POP was assessed using the VAS, a 10-unit scale representing pain intensity ranging from 0 (no pain) to 10 (most severe pain). 1–3 were considered mild, 4–7 moderate, and >7 severe. Pain was evaluated at the 1st, 6th, 12th, and 24th h postoperatively. POP assessment included port access site, shoulder pain, and abdominal pain. In particular, the trocar entry site pain that the patients were suffering from was recorded. Pain intensity was measured with VAS at the 1st, 6th, 12th, and 24th h postoperatively for all patients. Analgesic drugs administered to all patients were recorded.

Statistical Analysis

SPSS 20.0 software was used for the statistical analysis of the data. The mean and standard deviation were calculated for quantitative variables. A bar graph was used to show the prevalence of pain sites. The statistical significance of the differences between the groups was evaluated using a one-way analysis of variance. $p<0.05$ was considered statistically significant.

RESULTS

The study was conducted on a total of 188 patients. The Bupivacaine Group and the Standard Analgesia Group were the two groups into which the patients were divided. Age, gender, body weight, length of hospital stay, and ASA score did not differ between the two groups. Although the mean operative time was longer in the Bupivacaine Group (48±2.71) than in the Standard Analgesia Group (46±3.01), it was not statistically significant (Table 1).

Pain intensity was evaluated using VAS at fixed time intervals at the 1st, 6th, 12th, and 24th h postoperative. The difference between the mean pain scores at the 1st and 6th postoperative hours was observed to be statistically significant ($p<0.001$). There was no significant difference at postoperative 12th and 24th h (Table 2 and Figure 1).

NSAIDs were administered as analgesics to all patients in the Standard Analgesia Group for the first 24 h after

Table 1. Demographic characteristics of patients

Patients characteristics	Bupivacaine group (n=93)	Standard analgesia group (n=95)	p-value
Mean Age (Years)	49±3.51	47±3.66	0.47
Mean Weight (Kg)	78.5±4.54	76±4.71	0.387
Sex Ratio (F:M)	76:17	79:16	
ASA (I,II,III)	5	7	ns
	67	70	
	21	18	
Time of operation (minutes)	48±2.71	46±3.01	ns
Number of NSAIDs doses administered in the first 24 h	93	190	
Number of Tramadol doses administered in the first 24 h	11	36	
Hospital stay (day)	1.1	1.2	ns

F:M: Female: Male; NSAIDs: Non-steroid anti-inflamatuar drug; ASA: American society of anesthesiologists; ns: Not significant.

Table 2. Mean VAS scores for bupivacaine groups and standard groups postoperatively

Postoperative assessment time (hours)	Bupivacaine group	Standard analgesia group	p-value
1. h	3.6±0.42	7.6±0.52	<0.001
6. h	4.4±0.24	6.9±0.41	<0.001
12. h	2.1±0.25	2.3±0.6	0.786
24. h	1.9±0.81	2.1±0.54	0.698

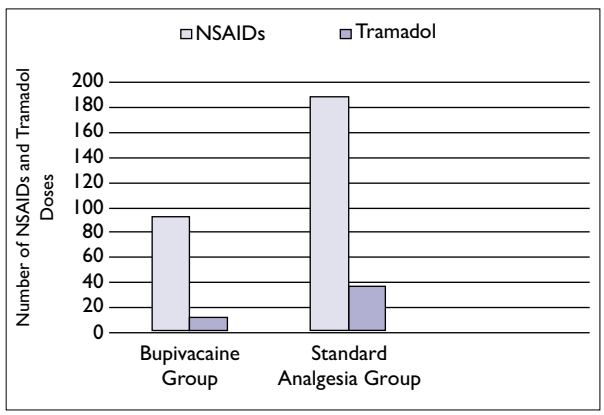

Figure 1. VAS graph in groups ıntervals over time.

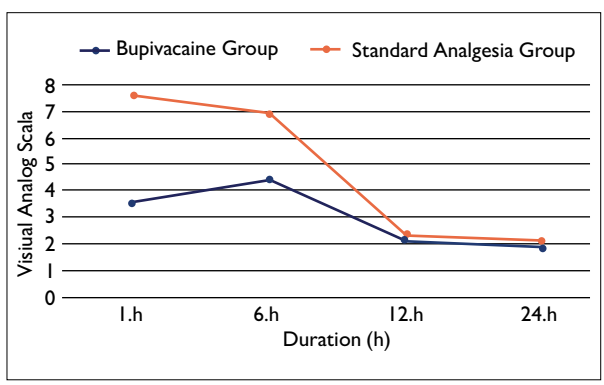

Figure 2. Number of doses of NSAIDs and tramadol administered in the first 24 h.

surgery to manage POP. However, in both the Standard Analgesia Group and the Bupivacaine Group, tramadol was added according to the analgesia needs of the patients. Since NSAIDs and tramadol were not routinely used in both groups, statistical data were not measured in this regard. The number of NSAIDs and tramadol doses administered in the first 24 h is detailed in Table 1 and Figure 2.

DISCUSSION

LC is considered the gold standard for symptomatic cholelithiasis. Although pain after LC is less severe and of shorter duration than that after open surgery, patients experience pain and discomfort of varying intensities. The port entry sites are usually the main source of pain after a laparoscopic procedure. Pain is also caused by the dissection area of the gallbladder bed and the trapping of the remaining carbon dioxide (CO_2) gas in the suprahepatic space. With reduced POP, early mobility, shorter hospitalizations, and early resumption of routine activities are ensured. This requires the use of effective painkillers. Bupivacaine infiltration into port sites has been shown to reduce severe pain occurring within the first 6-h after surgery and significantly reduce the need for narcotic analgesics. Previous studies have also revealed that local anesthetic infiltration at the incision site significantly reduces the need for analgesics and pain in the postoperative period.[13,14] While some studies have shown an analgesic effect in the early postoperative period (0–6 h),[15-17] other studies have reported a longer-lasting anesthetic effect (12–24 h).[18,19]

The anesthetic applied to the port sites should be applied to all layers and not only to the subcutaneous tissue. The anesthetic used to reduce the severity of POP depends on the depth of the port incision. In their study, Suragul et al.[20] emphasized full-layer application, especially at the trocar entry sites. In our study, the epigastric and umbilical trocar incisions were made to include all layers before suturing. Unfortunately, the POP-reducing property of long-acting local anesthetics after application to port sites does not show its effect on pain after intraperitoneal application to the gallbladder bed.[21]

Parietal-type pain is characterized by sudden onset, intense, and localized pain following LC.[13,14] This pain is caused by the incision made for the trocar entry (port site). Visceral pain after LC is blunt, diffuse, slowly progressive, not easy to localize, and felt in the midline. Some examples are factors such as contact of chemical irritants such as bile with internal organs, sudden stresses due to pressure changes, or changes in blood pressure. Reflected pain (shoulder pain) is pain that is felt in a different location than the stimulus site. It manifests itself as pain felt in the shoulder area due to stretching of the diaphragm muscle and irritation of the phrenic nerve with CO_2 gas or the effect of CO_2 gas remaining in the right subdiaphragmatic region.[22] Since the most common pain that patients suffer from is at the trocar ports, we specifically studied port site pain.

In the first 6 h postoperatively period, pain at the trocar entry sites was observed to be greater than at other pain sites. In their studies, Hussain et al.,[8] Nazir and Merdan[23] and Cantore et al.[24] have stated that long-acting local anesthetics applied especially to early port entry sites reduce pain. Accordingly, in our study, pain subsided in the first 6-h, and the need for analgesics decreased too. Moreover, in their study, Kotsovolis et al.[6] reported that long-acting local anesthetics applied to port sites reduced pain in the first 6 h postoperative. In our study, in parallel with current publications, there was a statistically significant decrease in POP according to VAS in the first 6-h and also a decrease in analgesic use.[25-27] There was no statistically significant difference in the pain scores between the two groups at the 12th and 24th h of the current study. In their study, Ali et al.[21] found that the need for analgesics decreased in the first 6-h, and they did not detect any statistically significant difference in VAS at the 12th and 24th h. In their study, Roy[5] found no statistically significant difference in pain with bupivacaine application at the port site before and after the incision. Again, Roy[5] stated that pain was less in the groups receiving bupivacaine. The study by Ke et al.[28] also reported conflicting results, indicating that the popular practice of infiltrating subcutaneous bupivacaine into the port sites did not provide any benefit in pain control after laparoscopy.

It has been suggested that local anesthetics applied at the port sites will reduce the need for analgesics and lead to a shorter hospitalization. Ali et al.[21] stated that the duration of hospitalization decreased in their study. The standard deviation was slightly higher in the infiltration group, according to Akbar et al.'[27] although the duration of hospitalization was not statistically significant. There was no statistically significant difference in hospitalization time between the two groups in our study.

When the studies on pain control with local anesthetic application at the port sites after LC are examined, ours is the study with the highest patient volume. Roy[5] studied 180 patients, Hussain et al.[8] 100, Akbar et al.[27] 84, Nazir and Merdan[23] 72, and Bhattarai et al.[25] 60. Our study was performed on 188 patients. In addition, the fact that our study was prospective and comparative is another advantage.

Conclusion

In conclusion, application of a long-acting local anesthetic (Bupivacaine) to port sites after LC provides a significant reduction in pain in the first 6-h postoperative period, and we believe that analgesics (NSAIDs, tramadol, etc.) will be used less in such patients to address POP. We also recommend a full-layer application of local anesthetic to the port sites.

Ethics Committee Approval

This study approved by the Kartal Dr. Lütfi Kırdar City Hospital Clinical Research Ethics Committee (Date: 29.12.2021, Decision No: 2021/514/216/2).

Informed Consent

Retrospective study.

Peer-review

Externally peer-reviewed.

Authorship Contributions

Concept: A.B., B.B.; Design: A.B., B.B.; Supervision: A.B., B.B.; Fundings: A.B., B.B.; Materials: A.B., B.B.; Data: A.B., B.B.; Analysis: A.B., B.B.; Literature search: A.B., B.B.; Writing: A.B., B.B.; Critical revision: A.B., B.B.

Conflict of Interest

None declared.

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Laparoskopik Kolesistektomide Port Yeri Lokal Anestezik Uygulaması ve Standart Analjeziklerin Postoperatif Ağrı Yönetimi Üzerine Etkileri: Prospektif, Karşılaştırmalı Bir Çalışma

Amaç: Laparoskopik kolesistektomi (LC) sonrası port yerlerine uygulanan bupivakainin postoperatif ağrı şiddeti üzerindeki etkilerini araştırmayı amaçladık.

Gereç ve Yöntem: Çalışmaya elektif şartlarda LC uygulanan 188 hasta alındı. Hastalar, port yerine bupivakain uygulanan 93 hasta bupivakain grubu ve postoperatif non-steroid antieflamatuvar/tramadol ilaçlar ile analjezi sağlanan 95 hasta standart analjezi grubu olarak ikiye ayrıldı. Bütün hastalar ameliyat sonrası 1., 6., 12. ve 24. saatte Visual Analog Skala (VAS) ile ağrı ölçümü yapıldı. Hastalara uygulanan bütün analjezik ilaçlar kayıt altına alındı.

Bulgular: Her iki grup arasında demografik özellikler, ameliyat ve hastanede yatış süreleri açısından fark yoktu. İlk 1., 6., 12. ve 24. saatte VAS skoru bupivakain grubunda ortalama 3.6, 4.4, 2.1 ve 1.9 iken, standart analjezi grubunda 7.6, 6.9, 2.3 ve 2.1 idi. Bupivakain grubunda 1. ve 6. saatte standart analjezi grubundaki hastalara göre ağrı şiddetinde istatistiksel olarak anlamlı derecede azalma saptandı ($p<0.001$). Buna karşılık 12. ve 24. saatlerde ağrı şiddetinde fark saptanmadı. Bupivakain grubunda analjezik kullanımında belirgin azalma görüldü. Hiçbir hastada majör komplikasyon ve mortalite görülmedi.

Sonuç: LC sonrası port yerlerine lokal anestezik (bupivakain) uygulaması postoperatif ilk 6 saatte ağrı şiddetinde belirgin azalma sağlamaktadır. Ayrıca bu hastalarda postoperatif ağrı için daha az analjezik ilaç kullanılacağına inanıyoruz.

Anahtar Sözcükler: Laparoskopik kolesistektomi; postoperatif ağrı; port-site anestezi; bupivakain; standart analjezi.