FNG & Demiroğlu Bilim Tıp Dergisi 2019;5(2):72-80
doi: 10.5606/fng.btd.2019.013

Original Article / *Özgün Makale*

Comparison of lornoxicam and tramadol administrations for postoperative pain in lumbar disk surgery

Lomber disk cerrahisinde ameliyat sonrası ağrı tedavisi için lornoksikam ve tramadol uygulamalarının karşılaştırılması

Yasin Yener[1], K. Hakan Erkal[2]

[1]*Department of Anesthesiology and Reanimation, BAU Medical Park Goztepe Hospital, Istanbul, Turkey*
[2]*Department of Anesthesiology and Reanimation, Kartal Dr. Lutfi Kirdar Training and Research Hospital, Istanbul, Turkey*

ABSTRACT

Objectives: This study aims to compare the efficacy and side effects of lornoxicam, a nonsteroidal anti-inflammatory drug , and a weak opioid derivative, tramadol hydrochloride, for postoperative analgesia following lumbar discectomy operation.

Materials and methods: Fifty-six American Society of Anesthesiologists (ASA) physical status 1-2 patients were randomly allocated into three groups: Group 1 was administered 8 mg IV lornoxicam, Group 2 16 mg IV lornoxicam, and Group 3 100 mg IV tramadol. In order to evaluate efficacy of the drugs, Verbal Rating Scale (VRS), pain intensity difference (PID), pain relief (PAR), mean blood pressure values, and side effects that developed were documented at 15, 30, and 45 minutes, and 1, 2 ,3 ,4 ,6, 12, and 24 hours into treatment.

Results: Demographic data was similar among all groups. In patients who were administered 8 mg lornoxicam, the time until first demand for analgesia was significantly lower ($p<0.01$). Mean VRS values of these patients were higher compared to other groups ($p<0.05$). In the postoperative period nausea and vomiting was observed in 35% of the patients in the tramadol group.

Conclusion: It was observed that, in the treatment of postoperative pain, 8 mg lornoxicam was insufficient and that 16 mg lornoxicam was as effective as tramadol 100 mg, but had shorter duration of action. Side effects such as nausea, vomiting, sedation and bradycardia were more common in tramadol compared to lornoxicam.

Keywords: Lornoxicam, postoperative pain, tramadol.

ÖZ

Amaç: Bu çalışmada lomber diskektomi ameliyatı sonrası analjezi için non steroidal anti-enflamatuvar bir ilaç olan lornoksikam ile zayıf bir opioid türevi olan tramadol hidroklorürün etkinlik ve yan etkileri karşılaştırıldı.

Gereç ve yöntemler: Lomber diskektomi ameliyatı planlanan, Amerikan Anestezistler Derneği (ASA) 1 ve 2 grubundan 56 hasta randomize olarak üç gruba ayrıldı: Grup 1'e 8 mg IV lornoksikam, Grup 2'ye 16 mg IV lornoksikam ve Grup 3'e 100 mg IV tramadol verildi. İlaçların etkinliğini değerlendirmek için 15, 30. ve 45. dakikalarda ve 1, 2, 3, 4, 6, 12. ve 24. saatlerde; Sözel Değerlendirme Skalası (VRS), ağrı şiddeti değişimi (PID), saatlik ağrı azalması (PAR) değerleri ve gelişen yan etkiler kaydedildi.

Bulgular: Tüm grupların demografik verileri benzerdi. 8 mg lornoksikam uygulanan hastaların ilk analjeziğe gerek duyma süreleri anlamlı düşük idi ($p<0.01$). Bu hastaların ortalama VRS değerleri diğer gruplara kıyasla yüksek idi ($p<0.05$). Ameliyat sonrası dönemde, tramadol grubundaki hastaların %35'inde bulantı kusma şikayeti gözlendi.

Sonuç: Çalışmada, ameliyat sonrası ağrı tedavisinde 8 mg lornoksikamın yetersiz kaldığı, 16 mg lornoksikamın 100 mg tramadol kadar etkili olduğu, ancak etki süresinin daha kısa olduğu görüldü. Tramadolün bulantı, kusma, sedasyon ve bradikardi gibi yan etkileri lornoksikam ile kıyaslandığında daha yaygın idi.

Anahtar sözcükler: Lornoksikam, ameliyat sonrası ağrı, tramadol.

Received: May 21, 2019 ***Accepted:*** May 30, 2019 **Published online:** July 31, 2019

Correspondence: K. Hakan Erkal, MD. Kartal Dr. Lütfi Kırdar Eğitim ve Araştırma Hastanesi, Anesteziyoloji ve Reanimasyon Kliniği, 34890 Kartal, İstanbul, Turkey.
Tel: +90 505 - 578 19 33 e-mail: hakerkal@hotmail.com

Cite this article as:
Yener Y, Erkal KH. Comparison of lornoxicam and tramadol administrations for postoperative pain in lumbar disk surgery.
FNG & Demiroğlu Bilim Tıp Dergisi 2019;5(2):72-80.

Despite developments in pathophysiology and treatment of pain- new drugs and complex drug administration systems in practice- many cases are still condemned to insufficient treatment for postoperative pain. One study reported that 30-75% of patients experienced moderate to severe pain in the postoperative period.[1]

Postoperative pain is an acute type of pain that begins with surgical trauma and gradually decreases as tissue heals. Pain plays an important role in the development of stress response induced by surgery. Type and duration of surgery also affects the severity of the stress response.[2] Stress response is defined as a clinical entity determined by changes in endocrine function and release of mediators from hypermetabolism and energy reserves.

Treatment of postoperative pain is an important factor that contributes to accelerated postoperative recovery, shorter hospitalization period, and decreased treatment expenses.[3]

This study aims to compare a non-steroid anti-inflammatory (NSAID) drug, lornoxicam, and a weak opioid derivative, tramadol hydrochloride, in terms of efficacy and side effects in postoperative analgesia following lumbar discectomy operation.

MATERIALS AND METHODS

This study was conducted at the SBU Kartal Lütfi Kırdar Training and Research Hospital Anesthesiology and Reanimation service on 56 American Society of Anesthesiologists (ASA) class 1-2 patients (27 males, 29 females; mean age 46.8±12.4 years; range, 18-65 years) undergoing L1-S1 laminectomy and discectomy surgery.

Patients who developed intraoperative complications, with operation time longer than two hours (hrs), allergic to NSAIDs, coagulation disorders or blood dyscrasias, asthma, aspirin sensitivity, gastrointestinal system (GIS) disorders or pregnancy, renal failure, alcohol addiction, and respiratory illnesses were excluded from the study.

The study protocol received ethics approval from the SBU Kartal Lütfi Kırdar Training and Research Hospital Ethics Committee. Patients were informed and written consent was obtained from all patients. The study was conducted in accordance to the principles of the Helsinki Declaration.

Physical examination, vital signs, and laboratory results were evaluated in all patients. Hemoglobin, hematocrit, erythrocyte, leukocyte, platelet, coagulation parameters, electrolyte values, liver enzyme values, BUN, and creatinine values of the patients were assessed.

In patients who were not administered premedication, induction with fentanyl (1 µg/kg), propofol (1-2 mg/kg), and vecuronium bromide (0.1 mg/kg) was administered. Three minutes (mins) later, orotracheal intubation was performed. General anesthesia was sustained with 40/60% O_2-N_2O and sevoflurane (1-1.5%). Electrocardiography, non-invasive systolic-diastolic, mean arterial pressures, saturation (SpO2) values, end-tidal CO2 (EtCO2) values with capnography, and end tidal sevoflurane concentrations with infrared anesthetic gas monitor were standardly monitored throughout the operation.

Patients were randomly divided into three groups according to postoperative analgesia: Group 1 (IV 8 mg lornoxicam, n=19), Group 2 (IV 16 mg lornoxicam, n=17), and Group 3 (IV 100 mg tramadol, n=20). After analgesic drugs were injected at specified doses, expired sevoflurane concentrations were decreased to 0.5% and with the final skin suture, anesthetic gases were turned off and 6 Lt/min O_2 was administered.

In order to determine the efficacy of the drugs, five-point Verbal Rating Scale (VRS) (0- no pain, 1- mild, 2- moderate, 3- severe, 4- unbearable), pain intensity difference (PID), and pain relief (PAR) methods were assessed at 15, 30, and 45 mins, and at 1, 2, 3, 4, 6, 12, and 24 hrs in all patients. Pain intensity difference was defined as the pain intensity at the start of the study - pain intensity at each time of measurement. All side effects (nausea, vomiting, hypotension, bradycardia, dizziness) were documented.

Time until initial analgesic demand in patients with VRS ≥3 and additional need for analgesia were documented. Patients with severe nausea and vomiting symptoms were treated with 10 mg IV metoclopramide.

Statistical analysis

Data obtained from the study were analyzed with the IBM SPSS version 20.0 software

Table 1. Demographic data

Demographic characteristics	Group 1			Group 2			Group 3			*p*
	n	%	Mean±SD	n	%	Mean±SD	n	%	Mean±SD	
Age (year)			46.9±13.9			47.1±14.1			46.5±9.8	0.989
Weight (kg)			71.4±10.4			69.9±12.6			71.0±8.4	0.909
Gender										0.887
Female	9	47.4		9	52.9		11	55.0		
Male	10	52.6		8	47.1		9	45.0		
ASA										0.218
Class 1	16	84.2		13	76.5		12	60.0		
Class 2	3	15.8		4	23.5		8	40.0		

SD: Standard deviation.

(IBM Corp., Armonk, NY, USA). In the analysis of study data, along with descriptive statistical methods (mean, standard deviation), comparison of quantitative data was performed with One-Way ANOVA test in groups with normally distributed parameters, and Tukey HDS test was used to determine the group causing difference. Chi-square test was used to compare qualitative data. Results were assessed in a 95% confidence interval, and $p<0.05$ was considered significant.

RESULTS

There was no significant difference among the groups according to demographic data ($p>0.05$) (Table 1).

The time until initial analgesic demand was statistically significant in Group 1 compared to Group 2 and Group 3 ($p<0.01$) (Table 2). Verbal rating scale in the 15th min was significantly different among the groups ($p<0.01$). The 15th min VRS value was significantly higher in Group 1 compared to Groups 2 and 3 ($p<0.01$, $p<0.05$, respectively) (Table 3).

Mean VRS value at 30 mins of Group 1 was significantly higher compared to Group 2 and 3 ($p<0.01$), while there was no statistically significant difference between 30 min VRS values of Group 2 and 3 ($p<0.05$). Mean VRS value at 45 mins was significantly higher in Group 1 compared to Group 2 and Group 3 ($p<0.01$), while there was no statistically significant difference between 45 min VRS values of Group 2 and 3 ($p<0.05$). Mean VRS value at 1-hour (hr) was significantly higher in Group 1 compared to Group 2 and Group 3 ($p<0.01$), while there was no statistically significant difference between 1 hr VRS values of Group 2 and 3 ($p<0.05$).

Mean VRS value at 2 hrs was significantly higher in Group 1 compared to Group 2 and Group 3 ($p<0.01$), while there was no statistically significant difference between 2 hr VRS values of Group 2 and 3 ($p<0.05$). Mean VRS value at 4 hrs was significantly lower in Group 1 compared to Group 2 and Group 3 ($p<0.01$, $p<0.05$, respectively). Mean VRS value at 6 hrs was significantly higher in Group 1 compared to Group 2 and Group 3 ($p<0.01$, $p<0.05$, respectively), while there was no statistically significant difference between 6 hr VRS values of Group 2 and 3 ($p<0.05$). There was no statistically significant difference among the groups according to 12 hr and 24 hr VRS values ($p>0.05$).

In Group 1, changes in VRS values at 30 and 45 mins, 1, 3, and 4 hrs compared to the 15 min VRS value was not statistically significant ($p>0.05$).

Table 2. Time until first analgesic demand

	Group 1	Group 2	Group 3	
	Mean±SD	Mean±SD	Mean±SD	*p
Time until first analgesic demand	2.5±1.1	5.0±1.7	4.7±1.9	0.001

SD: Standard deviation; * $p<0.01$ highly significant.

Table 3. Verbal Rating Scale distribution according to groups

	Group 1	Group 2	Group 3	
	Mean±SD	Mean±SD	Mean±SD	*p*
At 15 min	2.6±0.6	1.5±0.5	2.1±0.7	0.001*
At 30 min	2.7±0.9	1.5±0.7	1.8±0.8†	0.001*
At 45 min	2.7±0.7	1.9±0.6	1.7±0.9†	0.001*
At 1 hr	2.9±0.8	2.1±0.9†	1.9±0.8	0.001*
At 2 hrs	3.3±1.0†	2.2±0.7‡	2.1±0.6	0.001*
At 3 hrs	2.8±0.9	2.6±0.8‡	2.4±0.9	0.393
At 4 hrs	2.4±0.9	3.1±0.8‡	3.0±0.9‡	0.014**
At 6 hrs	1.8±0.6‡	2.9±1.0‡	2.5±0.9‡	0.001*
At 12 hrs	1.8±0.6‡	1.9±0.6†	1.8±0.6†	0.572
At 24 hrs	1.8±0.6‡	1.4±0.6	1.6±0.7†	0.095

SD: Standard deviation; * $p<0.01$ is highly significant; ** $p<0.05$ is significant among groups; † When compared with baseline values within the group, $p<0.05$ was significant; ‡ When compared with baseline values within the group, $p<0.01$ was highly significant.

The increase in VRS at 2 hrs compared to the 15 min VRS value was statistically significant ($p<0.05$); the decrease in VRS value seen at 6, 12, and 24 hrs was highly significant ($p<0.01$).

In Group 2, changes in VRS values at 30 and 45 mins, and 24 hrs compared to the 15 min VRS value was not statistically significant ($p>0.05$). While the increase in VRS value seen at 1 hr and 12 hr compared to 15 min VRS was significantly significant, the increase in VRS value seen at 2, 3, 4, and 6 hrs was highly significant ($p<0.01$).

In Group 3, 1 hr, 2 hr, and 3 hr VRS changes were not significantly different compared to 15 min VRS ($p>0.05$). While decreased VRS seen at 30 min, 45 min, 12 hr, and 24 hr compared to 15 min VRS value was statistically significant ($p<0.05$), increased 4 hr and 6 hr VRS was highly significant ($p<0.01$).

Mean 15 min PAR value was significantly higher in Group 1 compared to Group 2 and Group 3 ($p<0.01$, $p<0.05$, respectively). Difference between 15 min PAR values of

Table 4. Pain relief comparison according to groups

	Group 1	Group 2	Group 3	
	Mean±SD	Mean±SD	Mean±SD	*p*
At 15 min	2.6±0.7	1.3±0.5	2.1±0.9	0.001*
At 30 min	2.4±0.7	1.4±0.7	1.8±0.6†	0.001*
At 45 min	2.4±0.6	1.7±0.5†	1.5±0.6‡	0.011*
At 1 hr	2.3±0.8	1.8±0.7†	1.6±0.6†	0.013**
At 2 hrs	2.8±0.8	2.1±0.8‡	1.7±0.7†	0.001*
At 3 hrs	2.5±0.8	2.1±0.9‡	2.0±0.7	0.203
At 4 hrs	2.4±0.9	2.4±1.0‡	2.3±0.9	0.892
At 6 hrs	1.7±0.7‡	2.4±0.7‡	2.1±0.8	0.016**
At 12 hrs	1.6±0.6‡	1.7±0.5†	1.5±0.5†	0.659
At 24 hrs	1.3±0.6‡	1.2±0.4	1.2±0.4‡	0.967

SD: Standard deviation; * $p<0.01$ is highly significant; ** $p<0.05$ is significant among groups; † When compared with baseline values within the group, $p<0.05$ was significant; ‡ When compared with baseline values within the group, $p<0.01$ was highly significant.

Group 2 and Group 3 was highly significant (p<0.01) (Table 4).

Mean 30 min PAR value in Group 1 compared to Group 2 and Group 3 was highly significant (p<0.01), while there was no statistically significant difference in 30 min PAR values between Group 2 and Group 3 (p>0.05). There was no statistical difference between the groups according to 45 min PAR values (p<0.01). While the difference of mean 45 min PAR value of Group 1 compared to Group 2 and Group 3 was highly significant (p>0.01), there was no statistically significant difference between Group 2 and Group 3 45 min PAR values (p>0.05).

Mean 1 hr PAR value was significantly higher in Group 1 compared to Group 2 and Group 3 (p<0.01), while there was no statistically significant difference between 2 hr VRS values of Group 2 and 3 (p<0.05, p<0.01, respectively). There was no statistically significant difference in 1 hr PAR values between Group 2 and Group 3 (p>0.05). There was a highly statistically significant difference between the groups according to 2 hr PAR values (p<0.01). Mean 2 hr PAR value of Group 1 was significantly higher than Group 2 and Group 3 (p<0.05, p<0.01, respectively). There was no significant difference between 2 hr PAR values of Group 2 and Group 3 (p>0.05).

There was no statistically significant difference among the groups according to 3 hr and 4 hr PAR values (p>0.05). While 6 hr PAR value of Group 1 was significantly lower compared to Group 2 (p>0.01), there was no statistically significant difference between Group 3 and Group 1 (p>0.05) or Group 2 (p>0.05) according to 6 hr PAR values.

There was no statistically significant difference between the groups according to 12 hr and 24 hr PAR values (p>0.05).

For Group 1, the changes in 30 min, 45 min, 1 hr, 2 hr, 3 hr, and 4 hr PAR values compared to 15 min PAR values were not statistically significant (p>0.05). In Group 2, the 30 min and 24 hr PAR changes compared to 15 min PAR values were not statistically significant (p>0.05). In Group 3, compared to 15 min PAR value, 3 hr, 4 hr, and 6 hr PAR changes were not statistically significant (p>0.05).

Mean 15 min PID score was significantly lower in Group 1 compared to Group 2 and Group 3 (p<0.01, p<0.05, respectively). There was no statistically significant difference between Group 1 and Group 3 according to 15 min PID values (p>0.05) (Table 5).

Mean 30 min PID score was significantly higher in Group 1 compared to Group 2 and Group 3 (p<0.01). There was no statistically significant difference between Group 2 and Group 3 according to 30 min PID scores (p>0.05). Mean

Table 5. Pain intensity difference comparison according to groups

	Group 1	Group 2	Group 3	
	Mean±SD	Mean±SD	Mean±SD	*p*
At 15 min	2.4±0.6	1.2±0.4	1.9±0.9	0.001*
At 30 min	2.3±0.9	1.4±0.6	1.6±0.5	0.001*
At 45 min	2.3±0.7	1.7±0.5†	1.6±0.6	0.001*
At 1 hr	2.1±0.7	1.8±0.8†	1.8±0.8	0.311
At 2 hrs	2.5±0.8	1.9±0.8†	1.6±0.6	0.003*
At 3 hrs	2.3±0.8	2.2±0.9‡	1.8±0.7	0.088
At 4 hrs	2.0±0.7	2.2±0.8‡	2.2±0.8	0.445
At 6 hrs	1.5±0.5‡	2.1±0.7‡	1.7±0.9	0.034**
At 12 hrs	1.4±0.5‡	1.6±0.2†	1.4±0.5†	0.509
At 24 hrs	1.4±0.5‡	1.2±0.6	1.1±0.3‡	0.132

SD: Standard deviation; * p<0.01 is highly significant; ** p<0.05 is significant among groups; † When compared with baseline values within the group, p <0.05 was significant; ‡ When compared with baseline values within the group, p<0.01 was highly significant.

Table 6. Distribution of side effects according to groups

	Group 1 (n=20)		Group 2 (n=19)		Group 3 (n=17)	
Side effects	n	%	n	%	n	%
Hypotension	1	5.3	-	-	1	5.0
Bradycardia	-	-	1	5.9	1	5.0
Nausea/vomiting	2	10.5	1	5.9	7	35.0
Itchiness	-	-	-	-	3	15.0
Dizziness	-	-	-	-	1	5.0

45 min PID score was significantly higher in Group 1 compared to Group 2 and Group 3 ($p<0.01$). There was no statistically significant difference between Group 2 and Group 3 according to 45 min PID scores ($p>0.05$).

There was no statistically significant difference between the groups according to 1 hr PID scores ($p>0.05$).

Mean 2 hr PID score was significantly higher in Group 1 compared to Group 3 ($p<0.01$). There was no statistically significant difference between Group 2 and Group 1 or Group 3 according to 2 hr mean PID scores ($p>0.05$ for both).

There was no statistically significant difference in 3 hr and 4 hr PID scores among the groups ($p>0.05$).

While mean 6 hr PID score was significantly lower in Group 1 compared to Group 2 ($p>0.01$), there was no statistically significant difference between Group 3 and Group 1 and Group 2.

There was no statistically significant difference in 12 hr and 24 hr PID scores among the groups ($p>0.05$).

In Group 1, changes in PID score at 30 min, 45 min, 1 hr, 2 hr, 3 hr, and 4 hr compared to initial 15 min score was not statistically significant ($p>0.05$). In Group 2, changes in PID score at 30 min, and 24 hr compared to initial 15 min score was not statistically significant ($p>0.05$). In Group 3, changes in PID score at 30 min, 45 min, 1 hr, 3 hr, 4 hr, and 6 hr compared to initial 15 min score was not statistically significant ($p>0.05$).

While one patient in each Group 1 and Group 3 developed hypotension, this was not observed in Group 2. While bradycardia was seen in one patient in Group 2 and Group 3 each, no bradycardia was seen in Group 1. Nausea/vomiting was observed in two patients (10.5%) in Group 1, one patient (5.9%) in Group 2, and seven patients (35%) in Group 3. No itching was observed in any of the patients in Groups 1 and 2, and three patients in Group 3 had itching. No patient in Group 1 and 2 had dizziness, while one patient in Group 3 had dizziness (Table 6).

DISCUSSION

Analgesia following successful operation prevents most of the negative effects of pain, therefore it is accepted that postoperative pain relief is necessary.[4]

While opioid use in postoperative pain treatment dates as far back as the initial stages of surgery, use of NSAIDs are relatively new. Among this drug group, newly developed lornoxicam holds separate importance in the treatment of postoperative pain. It was determined that lornoxicam was one of the best performing NSAIDs in many painful events and postoperative pain treatment compared to opioid group drugs.[5]

According to the time until first analgesic demand, the group with earliest demand was the 8 mg lornoxicam group (2.5 h), and the latest (5 h) was the 16 mg lornoxicam group. As for the 100 mg tramadol group, mean time until first analgesic demand was 4.7 hrs. Half-life of tramadol is reported as 5-16 hrs, while lornoxicam half-life is 3-5 hrs.[6] Results of our study were similar to the half-life values of the drugs. One study reported that time until first analgesic demand was 38 mins for 4 mg lornoxicam, and 100 mins for 8 mg lornoxicam.[7] In another study, time until first analgesic demand was 7 hrs for the 16 mg lornoxicam group and 5.5 hrs for the 100 mg tramadol group.[8]

Evaluations according to VRS showed that 16 mg lornoxicam values for the first 30 mins were highly significantly lower compared to the 8 mg lornoxicam group and significantly lower than the 100 mg tramadol group. Later evaluations showed that the tramadol group had lower VRS scores compared to the lornoxicam groups. According to these results, although lornoxicam and tramadol have similar duration of actions, analgesic effect of 16 mg lornoxicam was faster compared to tramadol, but that in later periods tramadol had higher efficacy and effective duration.

In the study, it was difficult to score PID and PAR values. Since patients were not fully awake at the start of evaluation, it was difficult to provide a clear comparison, however it could be interpreted that patients did not have prominent pain in the initial stages. Although patients were administered fentanyl in the preoperative induction period, it did not affect patient values due to duration of drug effect, and since fentanyl was administered in all three groups, it would cause equal effect. In one study, similarly, when patients attained desired consciousness, they indicated decreased pain at various levels.[9]

One study that aimed to demonstrate the analgesic potential of lornoxicam for treating moderate and severe postoperative pain[10] showed that 8 mg lornoxicam was as effective as 50 mg tramadol and had a better tolerance profile. Our study obtained similar results when 16 mg lornoxicam was compared with 100 mg tramadol.

Analgesic effects of lornoxicam and tramadol begin approximately 20 mins later;[11] drugs were administered to patients in the early period about 30 mins before the end of the operation. Rosenow et al.[12] compared lornoxicam and morphine in patients undergoing lumbar disc surgery; drugs were not initially administered bolus and only administered as PCA (patient-controlled analgesia) as infusion. In the aforementioned study, VRS, PID, PAR, and total pain relief (TOTPAR) values were followed and patients experienced moderate to severe pain in the postoperative first three hrs. Analgesic drugs were administered half an hour before the end of the operation, as a single dose bolus at initial incision, and postoperative pain scores were relatively lower in the first two hrs compared to the later scores in all three patient groups, and it was determined that patient comfort was better when waking up.[12]

Staunstrup et al.[13] compared 16 mg lornoxicam and 100 mg tramadol administration following anterior cruciate ligament arthroscopic reconstruction; patients were monitored for the first 8 hrs following operation and patients who were administered 16 mg lornoxicam had significantly less pain compared to patients administered 100 mg tramadol. In our study, patients who were administered 16 mg lornoxicam had less pain compared to the 100 mg tramadol group in the first hr, but it was later observed that the tramadol group had more effective analgesia.

Thientong et al.[14] conducted a study on 50 patients who underwent microsurgical lumbar discectomy in which they were randomly assigned to two groups; at the start of incision closure, one of the groups was administered 16 mg lornoxicam while the other was administered placebo and VRS scores of the patients were monitored in the first two hrs in the surveillance room. Analysis showed that 16 mg lornoxicam provided insufficient analgesia and was equivalent to placebo. Both groups had the same analgesic demand time and nausea/vomiting side effect profile. The aforementioned study was conducted with a method similar to our study but had different results. One study that compared perioperative and postoperative administration of lornoxicam found that perioperative administration improved quality of analgesia and reduced analgesia consumption.[15] These results suggest that analgesia administered in the final stages of surgical procedure contributes to eliminating pain in the following period. Therefore, in our study, we chose single dose administration in the early period.

Staunstrap et al.[13] reported that 8 hr surveillance was sufficient following initial dose. Tuzuner Oncul et al.[16] conducted a 24 hr study to monitor potential complications and observe patients who required additional doses. In our study, one patient of the 19 patients in Group 1 developed hypotension (5.3%), one patient of the 17 patients in Group 2 developed bradycardia (5.9%), and one patient of the 20 patients in Group 3 developed bradycardia (5%) while another developed hypotension (5%). Although these results were significant, they did not require

intervention. These rates are consistent with the literature.[16,17]

Among the top factors limiting the widespread use of opioids are negative effects on respiratory function and late awakening due to sedation.[18] One study observed that despite opioid binding to receptors and antagonization with naloxone, patients administered tramadol did not develop opioid side effects at therapeutic doses.[19]

In our results, Ramsey score values of the patients were not found significant at 15 mins, however the following scores until the second hour showed significantly high Ramsey scores in the tramadol group, while there was no difference in the lornoxicam groups. One study compared postoperative tramadol and morphine administration and evaluated cognitive functions and found that all of them at 15 mins and 50% of them at 30 mins were unsuccessful at the cognitive function test.[20] The results support the results of the tramadol group of our study, and in conclusion, although tramadol does not lead to as prominent respiratory depression and sedation as opioids, they have more of these side effects compared to NSAIDs.

Increased bleeding tendency is one of the foremost expected complications during treatment with non-steroidal anti-inflammatory drugs.[21] In our study, patients were monitored for bleeding and none of the patients developed symptoms of increased bleeding. This result is consistent with similar studies.[22,23] Nevertheless, patients with peptic ulcer or bleeding risk are advised caution and these patients were not included in our study.

One of the most common side effects of the opioid-like drug, tramadol, is nausea and vomiting. For this reason, antiemetic drugs are usually recommended and administered as slow infusion. In our study, we observed that 35% of tramadol group patients had nausea and vomiting complaints. This rate was 10% in the 8 mg lornoxicam group and 5% in the 16 mg lornoxicam group (Table 6). Mild nausea and vomiting was the most common side effect in the study. This side effect is expected in both tramadol and lornoxicam, however it is more frequent with tramadol use.[24] However, it should be noted that postoperative nausea and vomiting is associated with anesthetic gas residue and surgical intervention.[25,26]

In conclusion, drugs used in treating postoperative pain is desired to effectively eliminate pain, have few side effects, and should be easy to administer. In the study, it was observed that lornoxicam possessed all three of these qualities. While 16 mg lornoxicam was as effective as tramadol in eliminating pain, its side effects were more tolerable. We came to the conclusion that lornoxicam could be a new and effective option in treatment of postoperative pain alone or in combination with other drugs.

Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The authors received no financial support for the research and/or authorship of this article.

REFERENCES

1. Salerno A, Hermann R. Efficacy and safety of steroid use for postoperative pain relief. Update and review of the medical literature. J Bone Joint Surg [Am] 2006;88:1361-72.
2. Nimmo SM, Foo ITH, Paterson HM. Enhanced recovery after surgery: Pain management. J Surg Oncol 2017;116:583-91.
3. Lovich-Sapola J, Smith CE, Brandt CP. Postoperative pain control. Surg Clin North Am 2015;95:301-18.
4. Rawal N. Current issues in postoperative pain management. Eur J Anaesthesiol 2016;33:160-71.
5. Rawal N, Krøner K, Simin-Geertsen M, Hejl C, Likar R. Safety of lornoxicam in the treatment of postoperative pain: a post-marketing study of analgesic regimens containing lornoxicam compared with standard analgesic treatment in 3752 day-case surgery patients. Clin Drug Investig 2010;30:687-97.
6. Abdelhalim AA, Al Harethy S, Moustafa M. Lornoxicam versus tramadol for post-operative pain relief in patients undergoing ENT procedures. Saudi J Anaesth 2014;8:38-44.
7. Ilias W, Jansen M. Pain control after hysterectomy: an observer-blind, randomised trial of lornoxicam versus tramadol. Br J Clin Pract 1996;50:197-202.
8. Yücel A, Yazıcı A, Müderris T, Gül F. Comparison of lornoxicam and low-dose tramadol for management of post-thyroidectomy pain. Agri 2016;28:183-9.
9. Allen SC, Ravindran D. Perioperative use of nonsteroidal anti-inflammatory drugs: results of a UK regional audit. Clin Drug Investig 2009;29:703-11.
10. Cooper S, Hersh E, Smith B. Lornoxicam: Analgesic efficacy and safety of a new oxicam derivate. Advances in therapy 1996;13:67-77.

11. Sunshine A, Olson NZ, Zighelboim I, DeCastro A, Minn FL. Analgesic oral efficacy of tramadol hydrochloride in postoperative pain. Clin Pharmacol Ther 1992;51:740-6.
12. Rosenow DE, Albrechtsen M, Stolke D. A comparison of patient-controlled analgesia with lornoxicam versus morphine in patients undergoing lumbar disk surgery. Anesth Analg 1998;86:1045-50.
13. Staunstrup H, Ovesen J, Larsen UT, Elbaek K, Larsen U, Krøner K. Efficacy and tolerability of lornoxicam versus tramadol in postoperative pain. J Clin Pharmacol 1999;39:834-41.
14. Thienthong S, Jirarattanaphochai K, Krisanaprakornkit W, Simajareuk S, Tantanatewin W, Sathitkarnmanee A. Treatment of pain after spinal surgery in the recovery room by single dose lornoxicam: a randomized, double blind, placebo-controlled trial. J Med Assoc Thai 2004;87:650-5.
15. Trampitsch E, Pipam W, Moertl M, Sadjak A, Dorn C, Sittl R, et al. Preemptive randomized, double-blind study with lornoxicam in gynecological surgery. Schmerz 2003;17:4-10. [Abstract]
16. Tuzuner Oncul AM, Yazicioglu D, Alanoglu Z, Demiralp S, Ozturk A, Ucok C. Postoperative analgesia in impacted third molar surgery: the role of preoperative diclofenac sodium, paracetamol and lornoxicam. Med Princ Pract 2011;20:470-6.
17. Scott LJ, Perry CM. Tramadol: a review of its use in perioperative pain. Drugs 2000;60:139-76.
18. Coetzee JF, van Loggerenberg H. Tramadol or morphine administered during operation: a study of immediate postoperative effects after abdominal hysterectomy. Br J Anaesth 1998;81:737-41.
19. Serpell MG, Thomson MF. Comparison of piroxicam with placebo in the management of pain after total hip replacement. Br J Anaesth 1989;63:354-6.
20. Nikoda VV, Maiachkin RB, Bondarenko AV, Mikhailov IuE, Anosova NP. Use of lornoxicam for analgesia in the early postoperative period. Anesteziol Reanimatol 2001;6:47-50. [Abstract]
21. Akcali GE, Iskender A, Demiraran Y, Kayikci A, Yalcin GS, Cam K, et al. Randomized comparison of efficacy of paracetamol, lornoxicam, and tramadol representing three different groups of analgesics for pain control in extracorporeal shockwave lithotripsy. J Endourol 2010;24:615-20.
22. Korkmaz Dilmen O, Tunali Y, Cakmakkaya OS, Yentur E, Tutuncu AC, Tureci E, et al. Efficacy of intravenous paracetamol, metamizol and lornoxicam on postoperative pain and morphine consumption after lumbar disc surgery. Eur J Anaesthesiol 2010;27:428-32.
23. Ng KF, Yuen TS, Ng VM. A comparison of postoperative cognitive function and pain relief with fentanyl or tramadol patient-controlled analgesia. J Clin Anesth 2006;18:205-10.
24. Balfour JA, Fitton A, Barradell LB. Lornoxicam. A review of its pharmacology and therapeutic potential in the management of painful and inflammatory conditions. Drugs 1996;51:639-57.
25. Jarde O, Bomlard E. Parenteral versus oral route increases Paracetamol efficacy. Clin Drug Invest 1997;14:474-81.
26. Bravo L, Mico JA, Berrocoso E. Discovery and development of tramadol for the treatment of pain. Expert Opin Drug Discov 2017;12:1281-91.