Evaluation of Ultrasound-Guided Adductor Canal Block With Two Different Concentration of Bupivacaine in Arthroscopic Knee Surgery, A Pilot Controlled Feasibility Study

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Abstract

Study Objective: The application of regional anesthesia techniques as a component of multimodal analgesia in knee arthroscopic surgeries increases the quality of postoperative analgesia. Adductor canal block (ACB) is an effective "motor sparing" analgesia technique used in knee surgeries. In this study, we aimed to evaluate the efficacy of two different concentrations of local anesthetic mixtures in terms of postoperative analgesia in patients undergoing knee arthroscopic intervention compared to each other and the control group. Design: Prospective, randomized, controlled, blinded Setting: Tertiary hospital Patients: A total of 60 patients (ASA I-II) were evaluated in three groups, with 20 in each group. Interventions: Standardized postoperative analgesia was planned for all groups. In addition, ultrasound guided ACB (same volume / two different concentrations of bupivacaine-0.25% vs 0.16%) was applied to the experimental groups. Measurements: Tramadol consumption, rescue analgesic requirement and Numeric Rating Scores (NRS). Main Results: Tramadol requirement in the first 24 hours was significantly higher in the control group (209.5±23.27 mg),($p<0.001$), and there was no difference between the experimental groups (63±42.06 mg vs 80.5±36.63 mg). Although the mean NRS score in the first three hours was higher in the control group than in both block groups, it was similar in all groups in the following measurements. Conclusion: In arthroscopic knee surgery, ACB interventions with 0.25% and 0.16% concentrations of bupivacaine were similar in terms of postoperative analgesic efficacy, and they increased the quality of multimodal analgesics more than the control group.

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Conclusion: In arthroscopic knee surgery, ACB interventions with 0.25% and 0.16% concentrations of bupivacaine were similar in terms of postoperative analgesic efficacy, and they increased the quality of multimodal analgesics more than the control group.

Keywords: Adductor canal block, Ultrasound guided regional anesthesia, Pain management, Knee arthroplasty, Lower extremity block, Bupivacaine concentration

1. Introduction:

Arthroscopic knee surgery methods are frequently preferred treatment procedures and this is because they are minimally invasive and therefore provide early recovery (1). As in many surgical branches, the number and variety of minimally invasive / arthroscopic interventions in knee surgery are increasing with technological progress, as an indirect result of this, enhanced recovery after surgery stands out as an issue that needs to be seriously addressed for anesthetists and surgeons (2–4). With the increase in ultrasound technology and availability; regional anesthesia techniques are used and encouraged as part of multimodal analgesia in many surgical procedures (5,6).

The use of adductor canal block (ACB) as a part of multimodal analgesia in arthroscopic knee surgeries is an increasingly common practice due to the prediction that it may cause lower quadriceps weakness compared to femoral nerve block in arthroscopic knee surgeries and the claim that it can provide similar effects with lower volume (7–9). Considering the clinical studies and case series in the literature, it is seen that the drug concentration is 0.25% or above in almost all of the single shot ACB applications under ultrasound guidance (in those using bupivacaine) (7,10–13).

In this study, in patients undergoing arthroscopic minimally invasive knee surgeries; We aimed to evaluate the effects of ACB on the intensity of pain measured at different time points in the postoperative period and the need for analgesia in the first 24 hours, by comparing the effectiveness of fixed volume with two different concentrations of local anesthetics between the control group and themselves.

2. Methodology

2.1. Study design

Local ethics committee approval (SBKEAH-KAEK: 2017/514/118/18) was obtained for this prospective, feasibility, randomized and single-blind study. Our study was designed and conducted in accordance with the ethical principles specified in the Helsinki Declaration. Patients were admitted to the study between 02.01.2018 and 01.07.2018. Written informed consent was obtained from all patients.

ASA I and II patients aged 18-60 years, scheduled for arthroscopic knee surgery (meniscectomy, synovectomy, and ACL repair), were included in the study. Our exclusion criteria were ASA III and above, chronic opioid or steroidal agent use, bleeding-coagulation disorder, diagnosis of neuropsychiatric disease that would affect the perception of pain, and regular use of antipsychotic-antidepressants or gabapentinoid. It was planned to be excluded from the study if the duration of the surgery was $<$60 minutes or$>$ 180 minutes.

2.2. Study and Control Groups

In this study, three groups, two experimental and one control group, were planned and randomization was done by closed envelope method. Standard perioperative and postoperative analgesia regimen was applied to the patients in the control group. In addition to this regimen in the experimental groups, unilateral ACB was applied before the induction of general anesthesia.

The experimental groups were named as ACB-0.25 and ACB-0.16 according to the local anesthetic concentration applied. The reason why these concentrations were chosen will be explained in detail in the discussion section. The design and process of the study are specified in the CONSORT diagram (Figure 1).

2.3. General anesthesia management:

The same general anesthesia induction and maintenance protocol was applied to all patients. Standard monitoring including pulse oximetry, electrocardiogram and non-invasive blood pressure arterial was applied when the patients were taken into the operation room.

After providing intravenous (i.v.) access, intravenous (i.v.) midazolam 0.03 mg kg^{-1} was administered for premedication.

Oxygen was given at 4 lt / min with Facemask. The patients were intubated after induction with propofol 2-3 mg kg^{-1}, fentanyl 1.5 μg kg^{-1} and rocuronium bromide 0.6 mg kg^{-1}. ACB was applied to the patients in the experimental groups before anesthesia induction. Maintenance of anesthesia was provided with 0.6-1 MAC sevoflurane and 0.08-0.2 mcg / kg / min remifentanil infusion. The dose of inhalation agent and remifentanil was adjusted according to the hemodynamic response of the patient.

2.4. Standart Analgesia Protocol

We have a standard perioperative and postoperative analgesia plan applied in our institute for arthroscopic knee surgeries. Our perioperative analgesia plan includes intravenous paracetamol 1 g and dexketoprofen 50 mg administrations at least 30 minutes before the end of surgery.

In the postoperative period, paracetamol 1 g continued every 8 hours. When the patients were taken to the recovery room, a patient control analgesia (PCA) device was connected. Our PCA procedure is basal infusion free, 10 mg bolus, and 20 minutes lock-out. Numeric rating scale (NRS) was used for pain monitoring of the patients. While NRS?4, fentanyl 25 mcg iv (in the recovery room) and diclofenac sodium 75 mg im (in service follow-up) were planned as rescue analgesics.

2.5. USG guided Blocks:

All blocks were made by the same practitioner (SGK). The patients were placed in the supine position, the knees were slightly flexed on the side of surgery. A high frequency linear ultrasound transducer was placed on the medial surface in the midline of the thigh in the transverse plane. By moving the transducer in the transverse plane, the femoral artery was detected in the adductor canal. The saphenous nerve located just lateral to the femoral artery was determined, a 22-gauge stimuplex needle was advanced from the lateral to medial direction using the in-plane technique, and 15 ml of bupivacaine (0.16% or 0.25%) was applied to encircle the saphenous nerve.

2.6. Evaluation of pain:

A numeric rating scale (NRS) was used for pain assessment. The NRS is a segmented numeric version of the visual analog scale (VAS) in which a respondent selects a whole number (0-10 integers) that best reflects the intensity of his / her pain. It is considered a unidimensional measure of pain intensity in adults. The 11-point numeric scale ranges from '0' representing one pain extreme ("no pain") to '10' representing the other pain extreme ("pain as bad as you can imagine" or "worst pain imaginable"). NRS pain score was evaluated at 30th minute and 1st, 2rd, 3th, 6th, 12th and 24th hours.

2.7. Outcome Measures

Primary Outcome was the amount of analgesic requirement in the first 24 hours postoperatively. The components of this analgesic requirement were determined as the amount of tramadol used with PCA and the number of rescue analgesic requirements. Secondary outcome was the NRS scores in 7 different time frames.

2.8. Sample size and Statistical analysis

We could not calculate the sample size from any previous study, since there was no study conducted with similar methodology. Therefore, We used a power of 0.90 and significance level of 0.05 to calculate a sample size of 18 patients for three groups when compared with ANOVA. Considering the dropouts, we determined the number of patients as 20 in each group.

Statistical Package for the Social Sciences version 16.0 statistical package program (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Descriptive statistics were expressed as mean ± SD. The univariate analysis compared in groups means using a two-sample, independent t -test assuming equal variances for continuous variables. For data without normal distribution, Mann–Whitney U-test was performed. Ratios were compared using the Chi-Square test. Categorical variables were compared using the Fisher's exact test. Continuous variables were tested for normality via the Shapiro–Wilk test. One-way ANOVA test was used to compare the mean of the groups, and the post-hoc Tukey test was used to determine where the difference between groups originated. Bonferroni correction was used because there are 7 different frames in NRS evaluations. Statistical significance was accepted as $p < 0.05$ except for NRS evaluations, and $p < 0.007$ in NRS.

3. Results

A total of 68 patients scheduled for arthroscopic knee surgery were evaluated. 4 patients refused to participate in the study, 3 patients were excluded due to antipsychotic use and 1 patient was excluded because of possible tramadol allergy history. Descriptive data such as age, gender, ASA class, body mass index, surgery type and duration and evaluations between groups are given in TABLE 1. There was no significant difference between the groups in terms of the distribution of descriptive data ($p > 0.05$).

All operations were completed uneventfully and there were no recorded postoperative complications. One time arterial puncture occurred during the block procedures, the procedure was continued and the case was included in the study. No complications such as quadriceps weakness, intramuscular hematoma, LAST etc. reported in the postoperative period were observed.

When the groups were compared in terms of fentanyl requirements in the recovery room, fentanyl requirement was observed in 7 patients in the control group, while fentanyl was required in 2 and 1 patients in the ACB-0.25 and ACB-0.16 groups, respectively, and the difference between the groups was statistically significant ($p < 0.05$). There was no difference between the groups in terms of rescue analgesic requirements in the first 12 hours and the second 12 hours ($p > 0.05$).

However, when the groups were compared, a statistical difference was found in terms of the tramadol requirements of the patients in the first 12 hours, the second 12 hours, and the first 24 hours ($p < 0.05$). The use of tramadol in both block groups was lower than the control group in all time periods ($p < 0.01$), and there was no statistically significant difference between the block groups ($p > 0.05$). Analgesic requirements for the first 24 hours are shown in Table 2, and tramadol requirements for 24 hours are shown in figure 2.

When the average pain scores of the groups were compared, a difference was determined between the groups at 30th minute, 1st hour, 2nd hour and 3rd hour ($p < 0.001$), while there was no difference at 6th, 12th and 24th hours. In the intergroup evaluation, it was determined that the pain score in the control group at 30th minute, 1st hour, 2nd hour and 3rd hour was higher than the block groups ($p < 0.001$), and there was no difference between the block groups in these times ($p > 0.05$) (Table 3) .

4. Discussion

In this study, we investigated the effectiveness of ACB in patients undergoing arthroscopic knee surgery. We determined that ACBs administered with two different concentrations of bupivacaine showed similar postoperative analgesic effects. And it was shown that both concentration groups had lower use of analgesics compared to the control group.

In arthroscopic knee surgeries, femoral nerve blocks and sometimes as well as obturator nerves and lateral femoral cutaneous nerve blocks were used for postoperative analgesia (14). Nowadays, femoral nerve blockage

has been abandoned due to complications such as quadriceps weakness that increase the duration of hospital stay, and distal blocks defined as adductor canal block, saphenous nerve block or subsartorial block have been started to be performed by seeking a more distal block that will provide adequate sensorial blockage and do not cause motor block (7,9,15,16). In this study, we will not discuss the efficiency of ACB, but will compare different concentrations in terms of postoperative analgesia efficiency. This study is not a superiority or non-inferiority study.

In most of the studies investigating the efficacy of ACB, we found that bupivacaine at a concentration of 0.5% was used (17–20), and a concentration of 0.25% was used in a very few (11,12,15,21–23).

Differently, in clinical studies conducted by Leung and Balaban, it was reported that a continuous infusion was performed with a 0.125% concentration of bupivacaine after a 0.25% bupivacaine bolus (24,25).

In our study, we compared 0.25% bupivacaine with 0.16% concentrations. Moura et al.(26) in their work; evaluated the effects of femoral nerve block with bupivacaine in different concentrations in arthroscopic meniscectomy surgery patients, and they reported EC50, which is the concentration that creates analgesic effect in 50% of the patients, and EC90, the concentration that creates analgesic effect in 90% of the patients, as 0.16% and 0.27%, respectively. While determining the methodology of our study, we determined our groups as ACB groups using bupivacaine at 0.16% and 0.25% concentrations, taking into account the findings of this study mentioned. While obtaining these concentrations, we obtained concentrations of 0.25% and 0.16% by diluting 0.5% commercial form of bupivacaine with saline. We determined the fixed volume we apply in ACB as 15 mL in line with anatomical studies (27–30). It should be kept in mind that in ACB performed with higher volumes, the local anesthetic agent may progress in the proximal direction as an overflow and cause quadriceps weakness.As a result of our study, we determined that 0.16% bupivacaine in ACB provides similar efficiency to 0.25% bupivacaine, but we do not recommend it because there is no data to support the use of concentrations less than 0.16% in single shot or as an initial bolus in continue technique (26).

Our study has some limitations. More homogenized randomized controlled trials that address patients undergoing a single arthroscopic knee surgery would be more appropriate. In addition, it is preferable to design a sham group instead of the control group. Although there is no postoperative motor weakness in the patients; we did not routinely perform knee joint motor examination of all patients.

5. Conclusion

Bupivacaine in concentrations of 0.16% and 0.25% in ACB applied in arthroscopic knee procedures exhibits similar properties in terms of postoperative pain scores and analgesia requirement. When added to multimodal analgesia, ACB increases the quality of analgesia at both concentrations compared to the control group.

References:

1. Steinwachs M, Cavalcanti N, Mauuva Venkatesh Reddy S, Werner C, Tschopp D, Choudur HN. Arthroscopic and open treatment of cartilage lesions with BST-CARGEL scaffold and microfracture: A cohort study of consecutive patients. Knee [Internet]. 2018 Dec 19; Available from: http://dx.doi.org/10.1016/j.knee.2018.11.015

2. Anand S, Singisetti K, Srikanth KN, Bamforth C, Asumu T, Buch K. Effect of Sodium Hyaluronate on Recovery after Arthroscopic Knee Surgery. J Knee Surg. 2016 Aug;29(6):502–9.

3. Ibrahim MS, Khan MA, Nizam I, Haddad FS. Peri-operative interventions producing better functional outcomes and enhanced recovery following total hip and knee arthroplasty: an evidence-based review. BMC Med. 2013 Feb 13;11:37.

4. Thienpont E. Faster recovery after minimally invasive surgery in total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc. 2013 Oct;21(10):2412–7.

5. Li D, Tan Z, Kang P, Shen B, Pei F. Effects of multi-site infiltration analgesia on pain management and

early rehabilitation compared with femoral nerve or adductor canal block for patients undergoing total knee arthroplasty: a prospective randomized controlled trial. Int Orthop. 2017;41(1):75–83.

6. Tak R, Gurava Reddy AV, Jhakotia K, Karumuri K, Sankineani SR. Continuous adductor canal block is superior to adductor canal block alone or adductor canal block combined with IPACK block (interspace between the popliteal artery and the posterior capsule of knee) in postoperative analgesia and ambulation following total knee arthroplasty: randomized control trial. Musculoskelet Surg [Internet]. 2020 Sep 27; Available from: http://dx.doi.org/10.1007/s12306-020-00682-8

7. Kwofie MK, Shastri UD, Gadsden JC, Sinha SK, Abrams JH, Xu D, et al. The effects of ultrasound-guided adductor canal block versus femoral nerve block on quadriceps strength and fall risk: a blinded, randomized trial of volunteers. Reg Anesth Pain Med. 2013 Jul;38(4):321–5.

8. Lee D-H, Lee MY, Kwack K-S, Yoon S-H. Effect of adductor canal block on medial compartment knee pain in patients with knee osteoarthritis: Retrospective comparative study. Medicine . 2017 Mar;96(12):e6374.

9. Abdallah FW, Whelan DB, Chan VW, Prasad GA, Endersby RV, Theodoropolous J, et al. Adductor canal block provides noninferior analgesia and superior quadriceps strength compared with femoral nerve block in anterior cruciate ligament reconstruction. Anesthesiology: The Journal of the American Society of Anesthesiologists. 2016;124(5):1053–64.

10. Gautier PE, Hadzic A, Lecoq J-P, Brichant JF, Kuroda MM, Vandepitte C. Distribution of Injectate and Sensory-Motor Blockade After Adductor Canal Block. Anesth Analg. 2016 Jan;122(1):279–82.

11. Henshaw DS, Jaffe JD, Reynolds JW, Dobson S, Russell GB, Weller RS. An Evaluation of Ultrasound-Guided Adductor Canal Blockade for Postoperative Analgesia After Medial Unicondylar Knee Arthroplasty. Anesth Analg. 2016 Apr;122(4):1192–201.

12. Nader A, Kendall MC, Manning DW, Beal M, Rahangdale R, Dekker R, et al. Single-Dose Adductor Canal Block With Local Infiltrative Analgesia Compared With Local Infiltrate Analgesia After Total Knee Arthroplasty: A Randomized, Double-Blind, Placebo-Controlled Trial. Reg Anesth Pain Med. 2016;41(6):678–84.

13. Gadsden JC, Sata S, Bullock WM, Kumar AH, Grant SA, Dooley JR. The relative analgesic value of a femoral nerve block versus adductor canal block following total knee arthroplasty: a randomized, controlled, double-blinded study. Korean J Anesthesiol. 2020 Oct;73(5):417–24.

14. Montes FR, Zarate E, Grueso R, Giraldo JC, Venegas MP, Gomez A, et al. Comparison of spinal anesthesia with combined sciatic-femoral nerve block for outpatient knee arthroscopy. J Clin Anesth. 2008 Sep;20(6):415–20.

15. Memtsoudis SG, Yoo D, Stundner O, Danninger T, Ma Y, Poultsides L, et al. Subsartorial adductor canal vs femoral nerve block for analgesia after total knee replacement. Int Orthop. 2015 Apr;39(4):673–80.

16. Gerner P, Danninger T. Faculty of 1000 evaluation for Continuous femoral nerve blocks: the impact of catheter tip location relative to the femoral nerve (anterior versus posterior) on quadriceps weakness and cutaneous sensory block [Internet]. F1000 - Post-publication peer review of the biomedical literature. 2013. Available from: http://dx.doi.org/10.3410/f.718015776.793477714

17. Kim DH, Lin Y, Goytizolo EA, Kahn RL, Maalouf DB, Manohar A, et al. Adductor canal block versus femoral nerve block for total knee arthroplasty: a prospective, randomized, controlled trial. Anesthesiology. 2014 Mar;120(3):540–50.

18. Grevstad U, Mathiesen O, Lind T, Dahl JB. Effect of adductor canal block on pain in patients with severe pain after total knee arthroplasty: a randomized study with individual patient analysis. Br J Anaesth. 2014 May;112(5):912–9.

19. Tong QJ, Lim YC, Tham HM. Comparing adductor canal block with local infiltration analgesia in total knee arthroplasty: A prospective, blinded and randomized clinical trial. J Clin Anesth. 2018 May;46:39–43.

20. Grosso MJ, Murtaugh T, Lakra A, Brown AR, Maniker RB, Cooper HJ, et al. Adductor Canal Block Compared with Periarticular Bupivacaine Injection for Total Knee Arthroplasty: A Prospective Randomized Trial. J Bone Joint Surg Am. 2018 Jul 5;100(13):1141–6.

21. Siriya P, Kwarmkanueng J. Analgesic Effects of Adding Dexamethasone to Bupivacaine in Adductor Canal Block for Postoperative Pain After Total Knee Arthroplasty: A Randomized Controlled Clinical Trial. Phichit Hospital Journal-waarsaar orng phyaabaal phicchitr. 2017;32(2):23–30.

22. Shah NA, Jain NP, Panchal KA. Adductor Canal Blockade Following Total Knee Arthroplasty-Continuous or Single Shot Technique? Role in Postoperative Analgesia, Ambulation Ability and Early Functional Recovery: A Randomized Controlled Trial. J Arthroplasty. 2015 Aug;30(8):1476–81.

23. Turner JD, Dobson SW, Henshaw DS, Edwards CJ, Weller RS, Reynolds JW, et al. Single-Injection Adductor Canal Block With Multiple Adjuvants Provides Equivalent Analgesia When Compared With Continuous Adductor Canal Blockade for Primary Total Knee Arthroplasty: A Double-Blinded, Randomized, Controlled, Equivalency Trial. J Arthroplasty [Internet]. 2018 May 24; Available from: http://dx.doi.org/10.1016/j.arth.2018.05.026

24. Leung P, Dickerson DM, Denduluri SK, Mohammed MK, Lu M, Anitescu M, et al. Postoperative continuous adductor canal block for total knee arthroplasty improves pain and functional recovery: A randomized controlled clinical trial. J Clin Anesth. 2018 Jun 8;49:46–52.

25. Balaban O, Aydın T, Demir L. Ultrasound-guided distal adductor canal catheter placement for continuous postoperative analgesia in lower leg surgery. Agri. 2018 Jul;30(3):150–1.

26. Moura ECR, de Oliveira Honda CA, Bringel RCT, Leal P da C, Filho G de JL, Sakata RK. Minimum Effective Concentration of Bupivacaine in Ultrasound-Guided Femoral Nerve Block after Arthroscopic Knee Meniscectomy: A Randomized, Double-Blind, Controlled Trial. Pain Physician. 2016 Jan;19(1):E79–86.

27. Grevstad U, Jæger P, Sørensen JK, Gottschau B, Ilfeld B, Ballegaard M, et al. The Effect of Local Anesthetic Volume Within the Adductor Canal on Quadriceps Femoris Function Evaluated by Electromyography: A Randomized, Observer- and Subject-Blinded, Placebo-Controlled Study in Volunteers. Anesth Analg. 2016 Aug;123(2):493–500.

28. Runge C, Moriggl B, Børglum J, Bendtsen TF. The Spread of Ultrasound-Guided Injectate From the Adductor Canal to the Genicular Branch of the Posterior Obturator Nerve and the Popliteal Plexus: A Cadaveric Study. Reg Anesth Pain Med. 2017;42(6):725–30.

29. Anagnostopoulou S, Anagnostis G, Saranteas T, Mavrogenis AF, Paraskeuopoulos T. Saphenous and Infrapatellar Nerves at the Adductor Canal: Anatomy and Implications in Regional Anesthesia. Orthopedics. 2016 Mar;39(2):e259–62.

30. Jæger P, Jenstrup MT, Lund J, Siersma V, Brøndum V, Hilsted KL, et al. Optimal volume of local anaesthetic for adductor canal block: using the continual reassessment method to estimate ED95. Br J Anaesth. 2015 Dec;115(6):920–6.

Legends of Tables ;

Table 1: Evaluation of the descriptive characteristics according to the groups

Groups	**Control (n=20)**	**ACB-0.25 (n=20)**	**ACB-0.16 (n=20)**	p
Female/male (n)	10/10	6/14	5/15	*0.212*
Age (year)	33±11.9	35.15±9.87	36.7±10.50	*0.547*
Weight (kg)	72.55±12.22	75.25±7.36	77.65±10.27	*0.290*
Height (cm)	169.8±8.97	172±5.54	172.25±6.54	*0.344*
BMI (kg/cm2)	25.08±2.97	25.54±2.99	26.13±2.59	*0.511*

Surgery duration (minute)	94.25±28.34	95±26.45	90.5±16.05	*0.820*
ASA I/II	10/10	11/9	5/15	*0.121*
Surgery (n)	9	10	9	*0.171*
Meniscectomy	7	6	7	
ACL repair	4	4	4	
Synovectomy				

Data are expressed as mean ± standard deviation or number. p values were italicized.

Table 2: Distribution of postoperative 24 hour analgesic requirement

Groups	**Control**	**ACB-0.25**	**ACB-0.16**	p
Patients requiring fentanyl in recovery room (n)	7	2	1	0.024
Rescue analgesic required patients in the first 12 hours (n)	5	2	2	*0.308*
Rescue analgesic required patients in the second 12 hours	3	1	2	*0.573*
Tramadol consumption in first 12 hours (mg)	156.5±21.58	46.5±31.33	65±34.4	<0.001
Tramadol consumption in 13-24 hours (mg)	53±25.36	16.5±28.7	15±21.15	<0.001
Tramadol consumption for 24 hours (mg)	209.5±23.27	63±42.06	80.5±36.63	<0.001

Data are expressed as mean ± standard deviation or number. p values were italicized and p values that are written in bold represent statistical significance.

Table 3: Evaluation of the NRS scores according to groups and time

Groups	**Control**	**ACB-0.25**	**ACB-0.16**	p
30. minute	3.5 (3-4)	1 (0-2)	1.5 (0-2)	<0.001
1. hour	3 (3-3)	1 (0-2)	1 (1-2)	<0.001
2. hour	3 (2-3)	1 (0-1)	1 (1-1)	<0.001
3. hour	3 (2-3)	1 (0-1)	1 (1-1)	<0.001
6. hour	2 (1-2)	1 (0.75-2)	1 (0.75-1.25)	*0.083*

12. hour	2 (1-2)	1 (1-2)	2 (1-2)	*0.363*
24. hour	1 (1-1)	1 (0-1.25)	1 (1-1.25)	*0.607*

Data are expressed as median (percentiles 25–75). p values were italicized and p values that are written in bold represent statistical significance.

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