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COMPARISON OF THE CLINICAL EFFECTS OF INTRATHECAL ROPIVACAINE AND BUPIVACAINE IN GERIATRIC PATIENTS UNDERGOING TRANSURETHRAL RESECTION*

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ABSTRACT

Purpose: This study was designed to compare the efficiency and safety of intrathecal ropivacaine with intrathecal bupivacaine for spinal anesthesia in geriatric patients undergoing transurethral resection.

Materials and Methods: Sixty patients, ASA I to III, over 65 years and scheduled for transurethral resection were randomized to receive an intrathecal injection of one of two local anesthetic solutions. Group R (n=30) received 3 mL of ropivacaine 7.5 mg mL-1 (22.5 mg) and Group B (n=30) received 3 mL of bupivacaine 5 mg mL-1 (15 mg). The onset time for sensorial blockade to T10, time to two segment regression of sensorial blockade, time to regression to T10 of sensorial blockade, offset time of motor blockade, hemodynamic parameters, postoperative analgesic requirement time, and side effects were recorded.

Results: The onset time for sensorial blockade at T10, time to two segment regression of sensorial blockade and time to regression to T10 of sensorial blockade were similar in Group R and Group B. The offset time of motor blockade did not differ between the two groups. The variations in mean arterial pressure (MAP), heart rate (HR), and peripheral oxygen saturation (SpO2) in the course of time were similar in the groups. When the side effects of the two groups were compared, bradycardia was found to be significantly lower in Group R than in Group B. No neurological problems were observed in any patients.

Conclusions: Intrathecal administration of either ropivacaine 22.5 mg or bupivacaine 15 mg was well tolerated and an adequate block for transurethral resection was achieved in geriatric patients. Intrathecal ropivacaine is as effective and safe as intrathecal bupivacaine in geriatric patients.

Key Words: Anesthetic Techniques, Intrathecal; Local Anesthetics, Ropivacaine; Local Anesthetics, Bupivacaine; Surgery, Transurethral Resection; Patient Population, Geriatric Patients.

TRANSÜRETRAL GİRİŞİM GEÇİRECEK YAŞLI OLGULARDA İNTRATEKAL ROPİVAKAİN VE BUPİVAKAİN'İN KLİNİK ETKİLERİNİN KARŞILAŞTIRILMASI

ÖZ

Amaç: Bu çalışma transuretral girişim yapılacak yaşlı olgularda intratekal ropivakain ile intratekal bupivakain'in spinal anestezide yeterlilik ve emniyetini karşılaştırmak üzere planlandı.

Materyal ve Metot: Trasuretral girişim geçirecek 65 yaş üstü ASA I ile III arası 60 olgu intratekal lokal anestezik uygulanmak üzere randomize olarak iki gruba ayrıldı. Grup R (n=30) 3 mL ropivakain 7,5 mg mL-1 (22,5 mg) ve Grup B (n=30) 3 mL bupivakain 5 mg mL-1 (15 mg) uygulandı. Duyusal bloğun T10'a ulaşma, iki segment gerileme ve T10'a gerileme zamanı, motor bloğun sonlanma zamanı, hemodinamik parametreler, postoperatif analjezik gereksinimi ve yan etkiler kaydedildi.

Bulgular: Duyusal bloğun T10'a ulaşma zamanı, iki segment gerileme ve T10'a gerileme zamanı, Grup R ve Grup B'de benzerdi. Motor bloğun sonlanma zamanı açısından iki grup arasında fark yoktu. Ortalama arteriel basınç (MAP), kalp hızı (HR) ve parsiyel oksijen saturasyonu (SpO2) iki grupta da zaman dilimlerinde benzerdi. İki grup yan etkiler açısından karşılaştırıldığında bradikardi insidansı Grup R'de Grup B'ye göre anlanlı derecede düşük bulundu. Hiçbir olguda nörolojik probleme rastlanmadı.

Sonuç: Transuretral girişim geçirecek yaşlı olgularda intratekal uygulanan 22,5 mg ropivakain ve 15 mg bupivakainin her ikisi de iyi tolere edildi ve yeterli blok sağlandı. Yaşlı olgularda intratekal ropivakain'in intratekal bupivakain kadar etkili ve emniyetli olduğu sonucuna varıldı.

Anahtar Kelimeler: Anestetik Teknikler, İntratekal; Anestetikler Lokal, Ropivakain; Anestetikler Lokal, Bupivakain; Cerrahi Transüretral Girişim; Olgu Grubu, Yaşlı Olgular.

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INTRODUCTION

In elderly patients, because of physiological reductions in organ function, altered redistribution kinetics, slow drug metabolism, and chronic disease, there may be delays in mental and psychomotor function following the administration of anesthetic drugs that require organ metabolism to terminate their activity. In an attempt to minimize mental and psychomotor depression, spinal anesthesia is often considered the 'anesthetic of choice' in the elderly patient undergoing lower abdominal and urological surgery. We designed the present study to compare the clinical effects of ropivacaine and bupivacaine in geriatric patients scheduled for transurethral resection surgery using spinal anesthesia.

Ropivacaine is a long-acting, S-enantiomer amide local anesthetic with a high pKa and low lipid solubility that blocks the nerve fibers involved in pain transmission (Aδ and C fibers) to a greater degree than those controlling motor function (A□ fibers) (1). The drug is less cardiotoxic than equal concentrations of racemic bupivacaine and has a significantly higher threshold for CNS toxicity than racemic bupivacaine in healthy volunteers (2).

Spinal anesthesia has been widely used for urologic operations because it permits early recognition of symptoms caused by overhydration, transurethral resection syndrome, and bladder perforation (3). Ropivacaine, a recently introduced amide local anesthetic agent similar to bupivacaine in chemical structure, has been studied for intrathecal use.

Limited data have been published on the intrathecal use of ropivacaine for urological surgery (4).

Ropivacaine appears to be less potent and induces less intense motor blockade than bupivacaine. This may be because ropivacaine is an L-isomer, whereas bupivacaine is a racemic mixture. Ropivacaine seems less toxic to the cardiovascular and central nervous systems (5,6), and, administered by the epidural route, is reported to be 20% less potent than bupivacaine at equal dosage (7). It may produce less motor blockade and is of shorter duration (7,8).

METHODS

The protocol was approved by the hospital ethics committee and informed consent was obtained from each patient during preoperative visits.

Sixty ASA physical status I-III elderly (>65 years old) patients scheduled for transurethral resection of the prostate (TURP) and removal of bladder tumors (TUR-tm) were studied in a double-blinded, randomized prospective manner. Patients who had contraindications to spinal anesthesia were excluded from the study. No preanesthetic medication was administered.

The patients were randomly assigned into two groups of 30 patients each to receive an intrathecal injection of either 22.5 mg of isobaric ropivacaine 0.75% (Naropin®, Astra, Australia) or 15 mg of isobaric bupivacaine 0.5% (Marcaine®, Astra, Sweden). Both the patient and the observer were blinded to the contents of the intrathecal injection.

On arrival in the anesthetic room, continuous monitoring with ECG, non-invasive arterial pressure, and pulse oximetry were performed. A peripheral intravenous catheter was inserted and an infusion of approximately 8 mL/kg of lactated Ringer's solution was administered 30 min prior to injection of the local anesthetic solution.

Heart rate (HR), mean arterial pressure (MAP), and peripheral oxygen saturation (SpO_2) were measured and recorded before intrathecal administration. A dural puncture was performed at the L_{2-3} or L_{3-4} interspace using a 26 gauge needle with a midline approach in the sitting position. The anesthetic solution was injected over a 15-20 s period. After the injection, patients were placed in the supine position for 5 min, and then placed in the lithotomy position. HR, MAP, SpO_2, and the level of sensorial anesthesia (by pin prick) were recorded at 2.5, 5, 7.5, 10, 15, 20, 25, 30, 45, 60, 75, 90, 105, and 120 min. The degree of motor blockade was evaluated at onset and the end of the operation by Bromage scale (a score of 1 was recorded when no motor effects occurred; a score of 2 corresponded to a decrease in muscle strength with the ability to flex the thigh, a score of 3 to the inability to flex the thigh despite muscle contractions, and a score of 4 to the complete paralysis of thigh flexion).

Patients were considered hypotensive when mean arterial blood pressure decreased >25% from the baseline value and ephedrine 5 mg intravenously was used to treat it. Bradycardia was defined as a decrease in heart rate <50 bpm and it was treated with intravenous atropine 0.5 mg.

When pain or discomfort occurred during surgery, maximum 2 mg of intravenous midazolam and/or intravenous fentanyl 50 µg was injected. When the level of sensorial anesthesia reached the T_{10} dermatome, the surgery was allowed to start. The two segment regression of sensorial blockade and regression of sensorial blockade to the T_{10} dermatome, and the mean duration of motor blockade were recorded. Time to the first feeling of pain and time to the fist request for analgesics were determined. For postoperative pain relief petidine HCl 0.5-1 mg/kg was injected intramuscularly.

Table 1: Patient characteristics, duration of surgery, and ASA classification (mean±Sd)(n).

	Group R (n=30)	**Group B (n=30)**
Age (year)	71.00 ± 6.53	73.00 ± 6.78
Height (cm)	167.70 ± 7.65	168.83 ± 6.41
Weight (kg)	71.60 ± 11.08	73.63 ± 13.20
BMI	25.43 ± 4.21	25.76 ± 4.07
ASA I - II - III (n)	3 - 18 - 9	2 - 16 – 12

Table 2: Operation and spinal anesthesia properties (mean ±□Sd)(n).

		Group R (n=30)	**Group B (n=30)**
Duration of operation (min)		76.03 ± 40.26	64.47 ± 35.21
Type of operation	TUR-P	19 (63.3%)	17 (56.7%)
	TUR-tm	11 (36.7%)	13 (43.3%)
Spinal interspace	L_2-L_3	11 (36.7%)	9 (30%)
	L_3-L_4	19 (63.3%)	21 (70%)
Number of puncture trials	1	28 (93.3%)	24 (80%)
	2	2 (6.7%)	4 (13.3%)
	3	-	2 (6.7%)

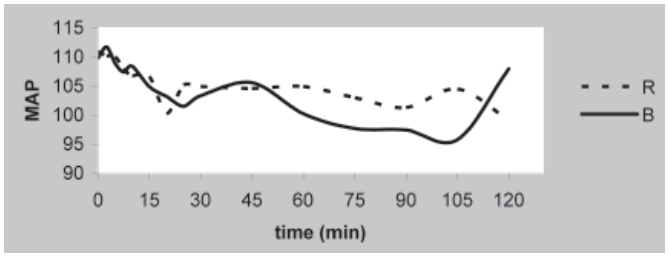

Figure 1: The mean arterial pressure (MAP) variations.

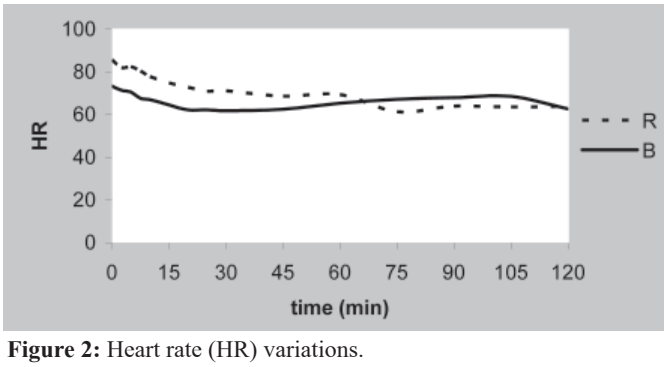

Figure 2: Heart rate (HR) variations.

Table 3: Characteristics of spinal anesthesia (mean±Sd) (n).

	Group R (n=30)	**Group B** (n=30)
The onset time for sensorial blockade at T_{10} (min)	4.57 ± 2.57	4.77 ± 2.56
Time to two segment regression sensorial blockade (min)	102.77 ± 43.08	101.33 ± 40.50
Time to regression to T_{10} of sensorial blockade (min)	119.50 ± 46.24	124.93 ± 37.44
Offset time of motor blockade (min)	253.73 ± 92.81	252.53 ± 74.04

Postoperatively, the patients were evaluated in terms of possible side effects, including headache, back pain, and transient neurological symptoms.

Statistical Analysis:

The results were presented as mean±standard deviation (mean±Sd). The statistical analysis was conducted with parametric and nonparametric methods. Parametric data were analyzed using Student's t-test and chi-square test, and nonparametric data using the Mann-Whitney U test and Fisher's exact test as appropriate. $P<0.05$ was considered significant.

RESULTS

Sixty patients were enrolled in this study. No statistical differences were detected between the groups with respect to age, weight, height, body mass index, or ASA classification (Table 1).

Duration of operation, type of operation, spinal interspace, and number of puncture trials are shown in Table 2.

Sensory and motor block properties are presented in Table 3. There were no differences between the groups in onset time to T_{10}. The time to regression of two dermatome was similar in the groups. The time to complete recovery from motor block did not differ significantly between the two groups.

Changes in MAP measurements were similar between the groups throughout the study (Figure 1). There were no statistically significant differences in ephedrine requirements between the two groups.

Changes in HR were similar between the groups (Figure 2); however, bradycardia was observed in 2 patients in Group R and in 8 patients in Group B ($P<0.05$). Other side effects (hypotension, noise and vomiting, pain, tremor, back pain) were similar in the groups. The mean time to first analgesic request was also similar in the groups (Group R = 279.26± 76.77 min; Group B = 307.71± 127.21 min).

DISCUSSION

The efficiency and safety of two isobaric solutions, ropivacaine 7.5 mg mL^{-1} and bupivacaine 5 mg mL^{-1}, were assessed, and these local anesthetics produced similar results in terms of time of onset and spread of analgesia.

Ropivacaine has been shown to be effective in providing intrathecal anesthesia for patients undergoing transurethral resection (2), total hip replacement, and lower abdominal or limb surgery (9-11).

In the studies by Van Kleef et al. (10) and Wahedi et al. (12), patients scheduled for orthopedic, gynecological, and urological surgery were randomized to receive 3 mL of isobaric ropivacaine of either 5 mg/mL or 7.5 mg/mL. These studies concluded that the spread of anesthesia was variable, the duration of analgesia and motor block were longer in the 22.5 mg group, and the intensity of motor block was lower in the 15 mg group. Therefore, we used ropivacaine 22.5 mg since motor block quality is better than that of bupivacaine 15 mg, and the equianalgesic dose of the two anesthetics was shown to be 3:2 (R:B) in previous studies (2,13). McNamee et al. (14) determined a more rapid postoperative recovery of sensorial and motor function with ropivacaine compared to bupivacaine in geriatric patients undergoing major orthopedic surgery. The reason for this different result arises from the 1:1 ratio of bupivacaine to ropivacaine, whilst it was 3:2 in our study.

Gautier et al. (13) estimated that the ropivacaine 12 mg was approximately equivalent to bupivacaine 8 mg. In our study, duration of sensory and motor block were similar since we used the local anesthetics at higher ratios, i.e. R:B = 3:2.

Malinovsky et al. (2) reported that, in patients undergoing transurethral resection of the prostate or bladder, patients were randomized to receive either 5 mL of isobaric bupivacaine 0.2% or 5 mL of isobaric ropivacaine 0.3%. The degree of motor block was similar, which is in accordance with our study, where a less potent anesthesia was seen with ropivacaine with respect to bupivacaine at the given doses.

Scott et al. (6) reported that ropivacaine caused less CNS symptoms and was at least 25% less toxic than bupivacaine in regard to the dose tolerated and cardiac depression that appeared at lower dosage on lower plasma concentration with bupivacaine compared to ropivacaine.

Two studies have linked intrathecal ropivacaine with an increased incidence of post-dural puncture headache (10) and low back pain (15). In our study, none of these complications were observed in any patients. Previous studies are in agreement with our findings (2, 9,13).

Van Kleef et al. (10) reported post-dural puncture headache when a Quinke needle was compared with a Whitacre needle.

In our study, no post-dural puncture headache was observed.

Ganapathy et al. (16) reported transient neurological symptoms in a patient scheduled to undergo elective knee arthroscopy via spinal anesthesia performed with low-dose (10 mg) intrathecal hyperbaric ropivacaine in the right lateral decubitus position. None of our patients showed neurological problems.

Khaw et al. (17) compared the effects of spinal anesthesia for elective cesarean delivery with plain and hyperbaric ropivacaine. Hyperbaric ropivacaine produced spinal anesthesia with faster onset and recovery, more extensive spread, and a greater success rate, compared with plain ropivacaine, but this was also associated with an increased incidence of hypotension. Since we performed this study in geriatric patients, most of which had coronary heart disease and hypertension, we used isobaric solution in order to provide hemodynamic stability.

Wahedi et al. (12) administered ropivacaine 15 mg and 22.5 mg intrathecally, and bradycardia, hypotension, and headache were observed in both groups at the same degrees. In the study by McNamee et al. (9), one group of patients received ropivacaine 0.75%, while the other group received ropivacaine 1% intrathecally. Bradycardia was found to be higher in the 1% ropivacaine group.

In our study when the side effects of the two groups were compared, bradycardia was found to be significantly lower in the ropivacaine group than in the bupivacaine group.

The postoperative analgesic request time was to be similar in the groups, similar to the findings reported by Ogun et al. (18) and Chung et al. (19).

In conclusion, intrathecal ropivacaine and bupivacaine were well tolerated and provided similar, effective anesthesia in geriatric patients undergoing transurethral resection of the bladder or prostate. In equivalent doses (R:B = 3:2), ropivacaine and bupivacaine produced similar sensory and motor block. We think that intrathecal ropivacaine is as effective and safe as intrathecal bupivacaine in geriatric patients undergoing transurethral resection.

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