Comparison of 3 doses of ropivacaine for epidural anesthesia in transurethral surgery

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ABSTRACT

الأهداف: فحص استخدام ثلاث جرعات مختلفة من عقار روبيفاسين على جودة التخدير وحركيات الدم لتخدير فوق الأم الجافية للجراحة عبر الإحليل.

الطريقة: أجريت هذه الدراسة في قسم علم التخدير – كلية الطب – جامعة إريكايس – تركيا، خلال الفترة ما بين مايو 2004م وحتى يونيو 2006م. شملت الدراسة 81 ذكراً في المجموعة الأولى– الثانية، تراوحت أعمارهم ما بين 60–80 عاماً. خضع جميع المرضى لعملية جراحية عبر الإحليل لاستئصال البروستات أو لاستئصال أورام المثانة. تم تقسيم المرضى عشوائياً إلى ثلاثة مجموعات وتلقوا عقار روبيفاسين على جرعات وتركيزات مختلفة. المجموعة الأولى (عدد=27) تلقت 15ml - 102.5mg
0.75% محلول إذابة، المجموعة الثانية (عدد=27) تلقت 10ml
75mg من 0.75% محلول إذابة، والمجموعة الثالثة (عدد=27) تلقت 10ml 50mg
0.5% من عقار روبيفاسين. تمت مقارنة نوعية التخدير وتغيرات حركات الدم.

النتائج: كان الجهاز التخديري أقل بشكل ملحوظ لدى المجموعة الثالثة من المجموعتين الأولى والثانية. بلغ مستوى تخدير الجهاز الحسي T6 أو أكثر لدى 55% المرضى في المجموعة الأولى، 35% في المجموعة الثانية، و 21% في المجموعة الثالثة. كانت فترة تخدير الجهاز الحسي أقل والوقت الذي تم تحقيق مستوى T10 كان أعلى لدى المجموعة الثالثة. تكرر حدوث انخفاض في ضغط الدم وبطء القلب بشكل أكثر لدى المجموعة الأولى.

خاتمة: يمكن الحصول على مستوى تخدير جيد بأغراض جانبية أقل عن طريق استخدام جرعات قليلة من عقار روبيفاسين.

Objectives: To investigate the use of 3 different doses of ropivacaine on the quality of anesthesia and hemodynamics in epidural anesthesia for transurethral surgery.

Methods: The current study was conducted in the Department of Anesthesiology, Medical Faculty of Erciyes University, Turkey, between May 2004 and June 2006. The study recruited 81 males of ASA I-II group, ages 60-80 years, undergoing transurethral resection of prostate or bladder tumors. Patients were randomly assigned to 3 groups receiving epidural ropivacaine in different doses and concentrations. Group I (n=27) received 15 ml (102.5mg) of 0.75% solution, group II (n=27) received 10ml (75mg) of 0.75% solution, and group III (n=27) received 10 ml (50mg) 0.5% ropivacaine. The quality of the blocks and the hemodynamic changes were compared.

Results: Motor block was significantly less in group III than in groups I and II. The sensory block level was T6 or more in 55% of patients in group I, 35% in group II, and 21% in group III. The duration of sensory block was less, and the time to achieve the T10 level was greater in group III. Hypotension and bradycardia were more frequent in group I.

Conclusion: Effective anesthesia with few side effects was obtained with low dose ropivacaine.

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In transurethral resection operations (TUR), regional anesthesia is widely used, as it is helpful in the early detection of complications, such as water intoxication and bladder perforation. Transurethral resection operations are routinely performed under spinal anesthesia. This technique can cause hypotension that is particularly undesirable in the elderly. Epidural anesthesia which allows block level and duration to be well controlled, may be more advantageous in cases where surgery is prolonged, or is converted to open surgery. The sensory block characteristics of ropivacaine,

which produce relatively less motor block, are similar to those of bupivacaine; as the dosage and concentration increase, so do the block depth and duration, but adverse effects such as hypotension and bradycardia occur more frequently.[1-3] This is especially more noticeable in elderly patients who frequently have other systemic disease and limited physiological reserves.[4,5] Ropivacaine has been used in varying concentrations in patients undergoing orthopedic, urological, or gynecological operations. However, the sensory block level in many patients is undesirably high, and hypotension was frequently observed.[6-8] Simon et al[9] found that in patients aged 60 or above, the level of analgesia and the intensity of motor block was increased, and hypotension and bradycardia occurred more frequently. Hypotension after regional anesthesia is often treated with vasopressors and intravenous fluids, a controversial regime for the elderly population with coronary disease,[10] as vasopressors can cause coronary artery spasm and arrhythmia. The literature contains limited information about the epidural use of ropivacaine for TUR, and mostly refers to relatively high doses.[7,8] We hypothesized that using smaller doses in patients aged 60 or above can reduce the incidence of hypotension and bradycardia but still give effective analgesia. Our study was designed to compare 3 relatively low doses of ropivacaine in TUR surgery with respect to block characteristics and cardiovascular stability, in order to determine the most suitable dose.

Methods. After obtaining approval from the Hospital Ethics Committee and written informed consent, 81 males, ASA groups I-III, aged 60-80, undergoing transurethral prostate or bladder tumor resection, were included in the study. The current study was conducted in the Department of Anesthesiology, Medical Faculty of Erciyes University, Turkey, between May 2004 and June 2006. Exclusion criteria included bleeding disorders, infection at the puncture site, morbid obesity, a history of uncontrolled hypertension, diabetes, allergy to study drug, and dementia. Intramuscular injection midazolam 0.04 mg/kg was given approximately 30 minutes before the operation. Patients were randomly assigned into 3 groups (n=27) to receive epidural ropivacaine, 15 ml of 0.75% (102.5 mg) for group I, 10 ml of 0.75% (75 mg) for group II, or 10 ml of 0.5% (50 mg) for group III. With the patients in the sitting position, sites suitable for anesthesia were cleaned, and locally infiltrated with 2% lidocaine. The epidural space was identified with the 'loss of resistance' to saline technique using a 17- gauge Tuohy epidural needle, from the midline L3-4, or L4-5 intervertebral space. For the test dose, we used 2 ml of 2 % lidocaine and waited for 2 minutes to confirm the absence of intrathecal injection. An epidural catheter was inserted, after ropivacaine was injected over one minute in which the patients were put into supine position. The level of sensory block was established by pinprick using a 25-gauge needle in the axillary line by a blinded anesthetist. Motor block was assessed on the modified Bromage scale: 0=able to straight leg raise (full flexion of knees and feet), 1=inability to raise leg (able to flex ankles), 2=inability to flex knees (able to flex ankles), 3= inability to flex ankles. When the sensory block reached the T10 dermatomal level, patients were put into the lithotomy position, and surgery was started. At the end of the surgery, a urinary catheter was inserted and the time was noted as the operative time. Onset time, in other words, the time from the administration of the agent until the emergence of the signs of blocks, the maximum degree of motor block, and the highest dermatome levels reached (maintained for 30 minutes) were determined by testing every 5 minutes, and checked in the postoperative period every 10 minutes until complete recovery from motor and sensory blocks. The periods between the onset and complete recovery of motor and sensory blocks were recorded as the block duration. Since maintenance fluid was given to all our study patients, fluids were not given prior to epidural block. Saline 0.9% was administered intravenously to all patients during surgery at 3 ml/kg/hr. Hypotension was defined as a decrease in mean arterial blood pressure (MAP) >20% of the pre-anesthetic value, or a systolic blood pressure <90 mm Hg. Hypotension was treated by administering ephedrine (5 mg) intravenously, and crystalloids. Bradycardia (<50 beats/minute) was treated with 0.5 mg of intravenous atropine. Side effects including nausea, vomiting, and shivering were recorded. If the patient complained of pain during surgery, the level of sensory block was assessed and extra ropivacaine was given via the epidural catheter. Patients were monitored with electrocardiogram pulse oximeter, and non-invasive measurement of arterial blood pressure (Datex Engstrom AS/3 Anaesthesia Monitor, Helsinki, Finland). After operation, they were asked to rate their satisfaction with the anesthetic procedure on a 5-point score (0-poor, 1-fair, 2-adequate, 3-good, 4-excellent). To calculate sample size, we used data from the previously mentioned study[9] as a criterion in which hypotension occurred in 73% during ropivacaine epidural anesthesia, in patients aged 61 years or more. We considered it important that this incidence be divided in 2, thus, 27 patients in each group would be sufficient for 80% power with α=0.05, and β=0.20.

Statistical analyses were performed using one-way analysis of variance for parametric data. Chi-square or Fisher's exact test was used for sensory block levels and motor block degree and frequency data. A *p*-value less than 0.05 was considered statistically significant.

Table 1 - Patient characteristics.

Variable	Group I (n=27)	Group II (n=27)	Group III (n=27)
Age, years	67.28 ± 5.6	68.50 ± 7.4	68.64 ± 7.14
Weight, kg	76.0 ± 10.21	77.78 ± 8.6	74.60 ± 11.83
Height, cm	171.85 ± 4.73	170.75 ± 4.81	171.32 ± 5.96
Operative time, minutes	37.28 ± 9.53	42.42 ± 14.33	35.72 ± 12.26

Values are expressed as means ± SD

Table 2 - Degree of motor block in the groups (N=27).

Degree of motor block (Bromage scale)	Group I n (%)	Group II n (%)	Group III n (%)
Degree 0	3 (10)	4 (15)	16 (59)*
Degree 1	16 (60)	12 (44)	9 (33)
Degree 2	8 (30)	11 (41)	2 (8)*
Degree 3	0 (0)	0 (0)	0 (0)

Chi-square= 21.33, p=0.0063.
Bonferroni corrections were made, p<0.016 was considered statistically significant. Group I versus Group II: χ^2 =9.003, p=0.108.
Group I versus Group III: χ^2 =15.93, p=0.007.
*Group II versus Group III, χ^2 =17.73, p=0.0033.

Table 3 - Level of sensory block in groups.

Sensory block	Group I (n=27)	Group II (n=27)	Group III (n=27)	*P* value
T2-3	3 (11)	0 (0)	0 (0)	0.103
T4-5	6 (22)	4 (15)	3 (11)	0.649
T6-7	5 (19)	5 (19)	3 (11)	0.801
T8-9	13 (48)	12 (44)	11 (41)	0.960
T10	0 (0)*	6 (22)*	10 (37)*	0.002

Data are presented as patients' number and (%)
Indicates statistically significant difference of the Group I compared with Group 2 and 3, Group I versus Group II, p=0.023
Group I versus Group III, p=0.001*, Group I versus Group III, p=0.372

Results. There were no significant differences between groups with regard to age, weight, height, and duration of surgery (**Table 1**). Groups I and II had similar incident of motor block, but fewer patients developed hypotension in group III, and had lesser degrees of block (**Table 2**). There was no difference between groups with respect to onset time and duration of motor block in those patients who developed it. While sensory block reached T6 and above in 55% of cases in group I, the incidence was 35% in group II, and 21% in group III (**Table 3**). Onset time for sensory block was less in group I, and duration was less in group III than in the other groups, also, the time taken to reach the T10 dermatomal level was considerably prolonged (p=0.0001) (**Table 4**). The incidence of hypotension and bradycardia was greater in group I (**Table 5**). There were no significant differences between the groups with respect to satisfaction score (3.2 in group I, 3.3 in group II, and 3.1 in group III). One patient in group III required epidural supplementation because of inadequate block.

Discussion. Adequate intraoperative analgesia was obtained in all patients except one in group III. Reduced dose of ropivacaine (50 mg) provided an adequate block for TUR in elderly patients. It gave better hemodynamic stability and fewer adverse effects than other groups. Hemodynamic stability was also reflected in the minimal need for vasopressor support of blood pressure. Previous studies show the degree and duration of motor block increasing with 1% ropivacaine,[1,11] but we did not use this concentration in our study, as we regard it as unsuitable for the short duration of TUR surgery. Finucane et al[2] produced epidural block using 25 ml ropivacaine in various concentrations. They found that the duration and depth of the motor block increased significantly with concentration, but the level of the sensory block was less affected. In our study, diminishing the dose strongly affected motor block. While there were no differences in motor and

Table 4 - Variables for motor and sensory block.

Variables	Group I (n=27)	Group II (n=27)	Group III (n=27)	*P* value
Onset time of motor block (min)	11.66 ± 4.29	18.50 ± 13.79	18.37 ± 7.61	0.000
Duration of motor block (min)	95.83 ± 36.97	91.66 ± 29.76	87.11 ± 49.45	0.336
Onset time of sensory block (min)	3.71 ± 1.43*	6.92 ± 3.34	7.52 ± 1.71	0.000
Time to achieving T_{10} dermatome (min)	17.35 ± 3.62	18.64 ± 5.85	24.20 ± 8.68*	0.000
Duration of sensory block	172.00 ± 42.47	164.71 ± 39.09	126.20 ± 46.85*	0.000

One-way analysis of variance were used. Data are expressed as mean±SD. *Indicates statistically significant difference.
Onset time: Group I versus Group II, p=0.000*, Group I versus Group III, p=0.000*, Group II versus Group III, p=0.335

sensory block characteristics between our groups I and II, there were notably fewer patients with motor block in group III. In this group, the dosage was less than in Finucane et al's[2] study, the onset of sensory block was more prolonged and the duration was less. On the other hand, Finucane et al[2] found that the smaller the dose, the shorter the duration of sensory block, but that the onset of sensory block was not greatly affected. However, they used greater doses of ropivacaine than in our study. Katz et al[12] reports that neither onset, nor duration of motor and sensory block differs significantly between different concentrations, despite much higher dermatome levels being reached in those patients who received 20 ml of 1.0% ropivacaine. However, the number of cases in their study was quite small, leaving open the possibility of type II error. Cederholm et al[8] reported that, with 20 ml of 0.5% or 0.75% solutions in TUR, analgesia starts rapidly, and the T10 dermatome level is quickly reached. However, their patients were placed in the lithotomy position for surgery, approximately 30-40 minutes after injection of the main dose. In our study, the onset time for sensory block was short, but the time for analgesia to achieve T10 dermatome level was greater than in the previous study, however, it was still possible to start surgery in less than 30 minutes in our group III. Cederholm et al[8] also reported that the sensory block level increased considerably (C8 and C4), but in our study, it reached as high as T2-3 in only 2 cases in group I. In only one case in our study group treated with 10 ml of 0.5 ml ropivacaine, did we supplement the dose via the epidural catheter because of satisfactory spread. Brockway et al[11] on the other hand, reported that analgesia was unsatisfactory in 8 of the 22 cases they treated with 15 ml of 0.5% ropivacaine, and switched to general anesthesia in 3 of these cases. Wood et al[13] reported ineffectual block in 4 of the 22 cases of abdominal gynecological operations in which 20 ml of 1.0% ropivacaine was used. The discrepancy in the findings may be related with the fact that the studies were conducted in various surgical operations on younger patients, and with differing epidural techniques. In contrast to our study, Cederholm et al's,[8] and Brockway et al's[11] studies were performed using catheters. Yun et al[14] reported that there is no difference between medication via epidural bolus injection and via epidural catheter, although there is a possibility for the catheter to be inserted intravenously in 3-5% of cases.[15]

We observed that the incidence of hypotension decreased as the dose was reduced, it was 3.5% in patients receiving 50 mg ropivacaine. In earlier studies, Simon et al[9] observed hypotension in 73%, Wood et al[13] in 86%, and Cederholm et al[8] in 40-70%, rather large incidences compared to our study, and probably explained by the ropivacaine dosage. Interestingly, in these earlier studies, the intensity of the motor block and the level of sensory block increased with dosage, but there was no relationship between the dose of ropivacaine and the incidence of hypotension in those studies. Thus, we can say that the dose response effect is only seen with low doses, as in our study. Regarding the incidence of shivering, only one previous study comparing epidural bupivacaine and ropivacaine[13] suggested that shivering was more likely with ropivacaine. Using ropivacaine in lower concentrations and volumes, Peduto et al[16] reported an incidence of 5.5%, which is similar to our finding. In a study of the factors predisposing to hypothermia, shivering correlated best with high spinal block, and advanced age.[17] Again, despite a high median age, we believe that our low incidence of shivering may be ascribed to lower dermatomal levels associated with the use of lesser doses of ropivacaine.

There is no study comparing spinal and epidural anesthesia with ropivacaine. Spinal anesthesia is associated with a risk of severe and prolonged hypotension, due to the rapid extension of the sympathetic block. Hemodynamic consequences are of greater importance in elderly patients with impaired physiological compensatory mechanisms. A decreased dose of local anesthetic reduces the severity and incidence of hypotension after spinal block.[18,19] However, it increases the risk of anesthesia failure in the form of inadequate blocks.[20] Epidural anesthesia may be more advantageous in elderly patients.

In conclusion, we obtained effective anesthesia with minimal adverse effects, using low dose ropivacaine. The incidence of hypotension was especially low with the 50 mg dose ropivacaine.

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