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SENSORY AND MOTOR BLOCKADES IN OBESE PATIENTS UNDERGOING UROLOGICAL SURGERY IN THE LITHOTOMY POSITION LEVELS AND DURATION OF SPINAL ANESTHESIA

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Abstract: Obesity significantly influences the cephalic spread of a spinal block (SB) due to decreased cerebrospinal fluid (CSF) volume. SB distribution is also affected by tissue blood flow alongside CSF dynamics. Surgical positions and techniques can alter hemodynamics, prompting us to investigate these effects during transurethral prostate resection (TUR-P) and lithotomy position (LP) in obese versus non-obese individuals. Sixty patients undergoing TUR-P under spinal anesthesia were categorized into non-obese (BMI < 25 kg/m², Group N) and obese (BMI ≥ 30 kg/m², Group O) groups. SB levels were measured post-LP at 6 and 120 minutes, with peak SB levels compared between the groups. Hemodynamic parameters were also recorded after LP. Results indicated that peak and 6-minute SB levels were comparable across both groups, but 120-minute SB levels were significantly higher in Group O ($P < 0.05$). Blood pressure (BP) post-LP was notably higher in Group N ($P < 0.05$). LP and TUR-P procedures elevated BP in Group N more than in Group O. This hemodynamic increase likely enhances spinal cord blood flow, resulting in similar SB levels in non-obese patients as observed in obese patients. However, the duration of SB may be prolonged in obese patients.

Key words: Spinal Anesthesia, Obesity, Lithotomy Position, Transurethral Prostate Resection (TUR-P), Hemodynamic Changes, Sensory Block Levels, Motor Block Levels.

Introduction: Administering anesthesia to obese patients presents significant challenges. A reduced volume of cerebrospinal fluid (CSF) in obese individuals can lead to an increased cephalic spread of spinal anesthesia [1, 2]. Various surgical positions and techniques can alter hemodynamic parameters [3, 4, 5, 6-18]. In spinal anesthesia, the tissue concentration of local anesthetics is influenced not only by CSF but also by tissue blood flow [5]. Transurethral prostate resection (TUR-P), a common procedure for treating benign prostatic hyperplasia, is performed in the lithotomy position [6]. This position significantly raises systolic arterial pressure in the lower extremities due to the effect of autotransfusion [7]. Additionally, during TUR-P, fluid enters the system in relation to the volume of fluid used, the hydrostatic pressure of the solution, the number of open venous sinuses, irrigation time, absorption rate, and the

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amount of irrigation fluid [8]. These factors collectively influence the cardiovascular system.

Purpose of study: This study aims to investigate the impact of hemodynamic changes on the level and duration of spinal block during TUR-P in obese and non-obese individuals.

Material and methods: This study received approval from the Institutional Review Board of Medical School, and all participants provided informed consent. We included 60 male patients who underwent transurethral prostate resection (TUR-P) under spinal anesthesia, all with an American Society of Anesthesiologists (ASA) score of I or II, from the Urology Department. Participants were divided into two groups based on their body mass index (BMI): non-obese (BMI < 25 kg/m², Group N, n = 30) and obese (BMI ≥ 30 kg/m², Group O, n = 30). BMI was calculated by dividing the patient's weight by the square of their height in meters (kg/m²). Exclusion criteria included neurological disorders, spinal deformities, sensitivity to bupivacaine or other contraindications for spinal anesthesia, and skin infections at the injection site.

All patients received premedication with 0.03 mg/kg IV midazolam 30 minutes prior to anesthesia. In the operating room, continuous electrocardiography (ECG), cyclic noninvasive blood pressure (NIBP), and peripheral oxygen saturation (SpO2) were monitored. Patients received 10 mL/kg of lactated Ringer's solution before spinal anesthesia. A dural puncture was performed at the L3-4 interspace using a 25-gauge Quincke spinal needle in the sitting position, followed by the injection of 3 mL of 0.5% hyperbaric bupivacaine over 20 seconds. Patients were then placed in a supine position immediately after the spinal anesthesia and subsequently positioned in the lithotomy position.

The standard lithotomy position involved lifting both thighs 90 degrees towards the trunk, with lower legs supported on poles with ties. The operating table was kept horizontal. Oxygen was administered at 2L/min via nasal cannula during surgery. Analgesia was defined as the inability to sense pinprick. Successful spinal anesthesia was indicated by achieving a bilateral T10 sensory block to pinprick within 15 minutes of intrathecal drug administration. Motor block in the lower limbs was classified using the Bromage Scale【9】: 0 = ability to lift an extended knee at the hip; 1 = ability to flex the knee but not lift an extended leg; 2 = ability to flex toes only; 3 = inability to move hips, knees, or toes. Sensory and motor block assessments were recorded at 2, 4, 6, 10, 20, and 30 minutes after the lithotomy position and at 120 minutes post-intrathecal drug administration by an assistant. The sensory and motor block levels at 6 and 120 minutes, as well as the peak sensory and motor block levels, were compared between the groups. Patients' systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial blood pressure (MAP), heart rate (HR), and peripheral oxygen saturation

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(SpO2) were measured and recorded every five minutes for the first 30 minutes after the lithotomy position and then at ten-minute intervals until the end of surgery. Comparisons of SBP, HR, and SpO2 were made between the groups. Hypotension was defined as an SBP less than 70% of the baseline value or below 90 mmHg, and treated with repeated intravenous ephedrine boluses of 5 mg as needed. Bradycardia was defined as an HR less than 60 beats per minute, treated with atropine (0.5 mg) if necessary. Incidents of nausea and vomiting were documented and managed with intravenous metoclopramide.

Data analysis was performed using SPSS 16.0 for Windows (SPSS Inc., Chicago, IL, USA). Descriptive statistics for demographic data and continuous variables were presented as mean ± standard deviation. Data were analyzed using Student's t-test for normally distributed variables, and the chi-square test was used for categorical data analysis. Parametric repeated measures were evaluated using repeated measures ANOVA. A P-value of < 0.05 was considered statistically significant.

Results of study: No significant differences were observed between the two groups regarding age, height, surgery duration, or gender ratio. As anticipated, the groups differed significantly in weight and BMI.

Baseline hemodynamic parameters were comparable between the groups. Cardiovascular responses are detailed in Table 2. In both groups, systolic blood pressure (SBP) decreased from baseline values 5 minutes after the spinal block. However, SBP values measured at 10, 15, and 20 minutes post-lithotomy position were significantly higher in Group N compared to Group O ($P < 0.001$; $P < 0.001$; $P < 0.05$, respectively) (Figure 1). Heart rate (HR) values were similar between the groups.

Sensory and motor block levels are presented in 3. Peak sensory and motor block levels, as well as 6th-minute sensory and motor block levels, were similar between the groups. However, at the 120th minute, sensory and motor block levels were significantly higher in Group O compared to Group N ($P = 0.017$; $P = 0.008$, respectively). No significant differences in adverse effects were observed between the groups (4).

Comparative analysis showed no significant differences in SpO2 values between the two groups. No complications were reported in any of the patients.

Conclusion: Consequently, the lithotomy position and TUR-P significantly elevated systolic blood pressure in non-obese patients compared to their obese counterparts. This rise in hemodynamic parameters boosts spinal cord blood flow, potentially resulting in similar sensory and motor block levels between non-obese and obese patients. However, the increased blood flow also accelerates the clearance of local anesthetic, potentially necessitating earlier retreatment for spinal anesthesia in non-obese patients.

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