RESEARCH ARTICLE

Correlation of Body Mass Index and Spread of Spinal Block in Herniorrhaphy Patients under Spinal Anesthesia

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Background: The level and time block in patients undergoing spinal anesthesia are affected by a variety of demographic factors (e.g., age, gender, height, weight, body mass index [BMI] and the amount of cerebrospinal fluid). Although the influence of BMI in spinal anesthesia is still a matter of controversy, the aim of this study was to determine the relationship between BMI and time of spinal block anesthesia in herniorrhaphy patients.

Methods: One hundred and eighty patients, who had undergone an inguinal herniorrhaphy operation, were divided into two groups—obese (BMI ≥30kg/m2) and non-obese (BMI<30kg/m2). Demographic characteristics, operation time, anesthesia time, time sensory and motor block and changes in hemodynamics were compared between the two groups. The evaluation of spinal block height was recorded with the help of a pin-prick test and Bromage Scale after the administration of bupivacaine.

Results: Body weight, height and BMI showed significant differences in the two groups and the time to reach sensory block T10 was significantly shorter in the group of obese patients. The time for recovery of sensory and motor block was longer in the obese group than in the non-obese group. Moreover, there were differences in the pattern of blood pressure of the two groups during surgery.

Conclusion: The results of this study showed a correlation between BMI and the time of spinal block anesthesia. Furthermore, the maximum motor and sensory block specified in obese patients happens faster and the analgesic duration could be prolonged in patients with a higher BMI.

Keywords: Body mass index; Bupivacaine; Spinal block; Herniorrhaphy

The level and time block in patients undergoing spinal anesthesia are affected by a variety of demographic factors such as age, gender, height, weight, body mass index [BMI] and the amount of cerebrospinal fluid (CSF) and body posture after injection. Obesity is an increasing public health concern worldwide. Studies have shown significant increases in the prevalence of obesity [1]. So anesthesia in obese patients usually represents a challenge and a significant problem, and adverse physiological effects can arise [2-3]. Previous studies showed obesity was associated with a significant impact on the cephalic spread of spinal block (SB) because of lower cerebrospinal fluid (CSF) [4-5]. The decreased volume of cerebrospinal fluid (CSF) in obese patients can affect the level and time of spinal block. Many studies have shown a decreased CSF volume due to increased intra-abdominal pressure, epidural fat, and extradural vein distention [6-7]. Therefore, the aim of the present study is to determine the effect of body mass (BMI) on the time of the spinal block in patients undergoing elective herniorrhaphy under spinal anesthesia by intrathecal hyperbaric bupivacaine among obese and non-obese patients.

Methods

The study was an observational research conducted by the Tabriz University of Medical Sciences and ran from July until December 2015 in the Emam Riza Hospital. Written informed consent was obtained from all patients, and then they were classified as ASA Physical Status I–II. Patients were divided in to two groups for comparison: obese group (BMI≥ 30kg/m2) (n= 90) and non abese group (BMI≤ 30kg/m2) (n= 90). Neuropathy disease, skin infection in location, allergy to bupivacaine, diabetes mellitus, or other contraindications for spinal anesthesia (e.g., hypovolemia, height ICP, circulatory shock, coagulopathy, sepsis) were excluded from study. We used standard monitoring in the operating room. All patients received before spinal anesthesia 8ml/kg of lactated Ringer's solution. And, then, a maintenance fluid of 4 ml/h was continually administered. Oxygen was given 5L/min by face mask during surgery. With the patient in the sitting position. Spinal puncture was injected intrathecally through a 25-gauge Quincke spinal needle at the L3-L4 interspace. After the injection, intrathecal hyperbaric bupivacaine success of spinal

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anesthesia was defined as a bilateral T10. Assessment of the maximum sensory block level by the anesthetist was the loss of sharp sensation to a pin-prick test. Motor block was determined according to a modified "Bromage Scale" (Bromage, 1965) [8-9]: 0 = ability to lift an extended knee at the hip;1= ability to flex the knee but not to lift extended; 2= ability to flex toes only; and 3= inability to move hip, knees, or toes. The data were analyzed using the SPSS 16.0. Descriptive statistics of the demographic data and constant variables were indicated as mean± standard deviation and chi-square test was performed for the determination of variable association. P-value< 0.05 was considered significant.

Results

We studied 180 patients (ASA I and II) undergoing herniorrhaphy surgery of the lower extremity under spinal anesthesia. Demographic and perioperative data were similar between the groups; except for body weight, height and BMI no significant differences were noted between the two groups (Table 1). There was no statistically significant difference in the operation duration and the duration of anesthesia between the groups. The characteristics of spinal anesthesia in the two groups are compared in (Table 2) and show that the time of the onset of the sensory block was similar in the two groups, whereas the time for sensory block to reach T10 was significantly shorter in the group of obese patients. Time to reach the maximum sensory block was significantly shorter in the obese group than in the non-obese group (p< 0.05). Time for recovery from the sensory and time for the onset of the motor block was significantly longer in the obese group than in non-obese (p< 0.05). The time to reach the maximum motor block was significantly shorter in the obese group. The time for the recovery of the motor block was significantly longer in the obese group (p< 0.05). We compared the effects of hemodynamic changes occurring in patients and the difference in HR between the groups was not statistically significant (Table 3).

Table 1- Patient characteristics

	Obese patients (n=90)	Normal weight patients (n= 90)	p
Age (years)	41.4±16	39.6±14	0.61
Weight (kg)	94.1±5	64±7±	0.00*
Height (cm)	171±3	166±5	0.003*
BMI (kg/m2)	32.1±1	22.9±1.6	0.00*
Duration of surgery(min)	65±18	64±27	0.98
Duration of anesthesia, (min)	83±21	81±25	0.73

*Extremely significant at the level of p<0.05

Table 2- Blockade characteristics.

	Obese patients (n= 90)	Normal weight patients (n= 90)	
Time to onset of sensory block(min)	1.00±0.00	1.00±0.00	0.00
Time to reach T10 level (min)	5.6±2.4	7.0±2.3	p≤0.05
Time to maximum sensory block (min)	11.8±2.1	15.7±2.0	p≤0.05
Time for recovery for sensory block (hour)	2.5±0.67	2.0±0.68	p≤0.05
Time to onset of motor block(min)	2.3±0.78	1.3±0.18	p≤0.00
Time to maximum motor block (min)	7.8±2.1	8.4±2	p≤0.23
Time for recovery for motor block (hour)	2.5±0.78	2.3±0.78	p≤0.25

Table 3- Hemodynamic data.

Group		Minutes after the lithotomy position			
	Base	2 min	10min	20min	30min
	Obese patients				
MAP	132.23±12.3	103.14±8.1	97.18±12.7	93±7.8	88±7.9
HR	86.12±12.1	81.12±5.1	75.64±13.2*	69.13±7.6*	64.66±12.3*
	Non-obese patients				
MAP	123.18±4.1	90±12.3	87±9.9	92±7.8	98±13.9
HR	95.06. ±14.5	87.14±12.4	82.24±7.1	80.23±5.8	78.91±9.21

*Extremely significant at the level of p<0.05

Discussion

Our data demonstrates that the average of variables such as BMI, weight, and height had normally significant differences between two groups and there was no significant difference among other variables such as age in the two groups. The required time for reaching the anesthetic level of T10 in obese patients was significantly faster than control group. The sensory block also occurred faster in the obese patients than control group. Taivainen et al. indicated that the faster occurrence of the sensory level in obese patients can be explained by the rapid transfer of local anesthetic in the adipose tissue, confirming the results of our study [10]. Despite of more adipose tissue in obese patients, other problems that may induce anesthesia and type of procedure, there was no statistical difference in the operation time, duration of anesthesia, and motor block in obese and non-obese patients. Leino KA et al. found no significant difference between the anesthesized surface in obese and non-obese patients in during the induction of local anesthesia, and the anesthetized surface of patients were identical [1]. In another study, by Ingrande J et al., it was demonstrated that injection and induction of local anesthesia required greater skills in case of obese patients but there was no difference in terms of anesthesia time and the duration of surgery; the results of our study also confirmed the above results [5]. In a study by Tanerciftci et al., the level and duration of the motor and sensory block by spinal anesthesia in non-obese patients was compared with obese patients, revealing interesting results. The sensory and motor block level had increased in obese patients, but block time had decreased. Of course, the results of this study were consistent with our study, suggesting the maximum anesthesia level and the given anesthesia level occur rapidly in obese patients. During spinal anesthesia, sympathetic blockade is the first event to occur that results in hemodynamic changes and affect the pharmacokinetics. Based on our results in the group of obese patients, the average of MAP and bradycardia decreased gradually, so that it was less than the previous one in each measurement. But, in the non-obese patient group, the mean MAP was first reduced, and then increased. The incidence of bradycardia in the present study was higher in obese patients than in the non-obese groups, while there was a significant association between and bradycardia during and at the end of surgery. A previous published work in W. MonBSc reported a reduction in the heart rate and hypotension as the common side effects of spinal anesthesia, and our findings confirmed that [11-12].

Conclusion

The results of this study showed a correlation between the BMI and the time of spinal block anesthesia. Furthermore, the maximum motor and sensory block specified in obese patients happen faster and the analgesic duration may be prolonged in patients with a higher BMI.

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