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THE INFLUENCE OF BODY MASS INDEX ON SENSORIMOTOR, BLOCK DURING SPINAL ANAESTHESIA FOR UMBILICAL AND INFRAUMBILICAL SURGERIES IN A TERTIARY CARE HOSPITAL.

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ABSTRACT **BACKGROUND**: Regional anesthesia using local anaesthetics and opioids is the preferred anaesthetic technique for elective and emergency umbilical and infra umbilical surgeries in both non -obese and obese patients. The prevalence of obesity has increased 15% up to 20% and represents an important challenge for the anesthesiologist in drug-dosing and management. Our study compares response to same dose of intrathecal hyperbaric bupivacaine 0.5% 15 mg(3ml) with 25mcg(0.5ml) of fentanyl, in both non obese and obese patients aiming to observe the level of block attained. The time for sensorimotor block post spinal anesthesia was noted. **METHODOLOGY:** Study was carried out among 70 patients, willing to give consent and posted for umbilical and infraumbilical surgeries. Patients were divided into group obese (O) (BMI >30) and group non obese(NO) (BMI <30). Spinal anaesthesia was given with 3ml of 0.5% bupivacaine heavy (15mg) and 0.5ml (25mcg) fentanyl. Time for sensory motor block was studied. Complications, if any, were handled according to institutional protocol. **RESULTS:** Time for ascent of sensosry block(T6), as assessed by the cold swab test and motor blockade as assessed by the Bromage scale was faster in the obese group than the non obese group with a p value of <0.001. **CONCLUSION:** We conclude that sensory motor block was faster in onset and more profound in obese patients than non obese patients after similar dose spinal anaesthesia was administered.

KEYWORDS :

INTRODUCTION :

Body mass index (BMI) is an index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m2).1 In adults, a body mass index over 25 is considered overweight, and over 30 is obese.2 A survey carried out by Royal College of Anesthetists in 2011 and 2014 showed that in patients with a high BMI, there was an increased risk of complications during general anaesthesia. Complications include deep vein thrombosis, breathing problems, low oxygen levels, cardiovascular complications, complications with pain relief, more time to recover from anaesthesia. The safest anaesthetic technique may be a local anaesthetic, spinal block or epidural rather than a general anaesthesia.[3]

Spinal anaesthesia with bupivacaine is routinely used to provide anaesthesia for both elective and emergency umbilical and infra umbilical surgeries. This local anaesthetic, particularly when in combination with an opioid, provides good anaesthesia and is therefore in common use. The technique is associated with a significant incidence of hypotension resulting from sympathetic blockade [5,6,7].

Hypotension induced by spinal anesthesia remains an important adverse effect, with a reported incidence between 20% and 100%8,9. Morbidly obese patients have significant risk for anesthesia complications during umbilical and infra umbilical surgeries, and some studies found that a BMI ≥40 Kg/m2 was an independent factor for spinal hypotension10,11. Also, usage of high doses of local anesthetics is a risk factors associated with hypotension during spinal anesthesia.

The differences in spinal dose requirements for local anesthetics in different BMI patients may not be evident unless the BMI is in the extreme range.[12,13]

Our study compares response to same dose of intrathecal hyperbaric bupivacaine 0.5% 15 mg (3ml)with 25mcg of fentanyl, in both non obese and obese patients primarily aiming to observe the level of block attained ,changes in blood pressure and the requirement of vasopressors to maintain haemodynamics during first 30 minutes was also monitored.

AIMS AND OBJECTIVES

Aim: To study the effect of obesity on spinal anaesthesia.

Objective:

To determine the height of sensorimotor block after spinal anaesthesia in obese and non-obese patients while also noting the heamodynamic parameters and the vasopressor dose required to maintain heamodynamic stability in the first 30 minutes.

Materials and Methods:

Source of data:

Two groups of 35 patients each were recruited with widely differing body mass indices to examine the influence of body mass index (BMI) on the responses to a specific dose of spinal bupivacaine. One group comprised Patients with BMI < 30 kg/m2 (group NO) and the other group had a BMI of >30 kg/m2 (group O). Patients were weighed at the time of recruitment.

Inclusion criteria:

Patients aged between 18 to 65 years, posted for infraumbilical surgery, willing to give consent and whose BMI was <30kg/m2(group NO) and patients with BMI of >30kg.m2(group O) belonging to ASA I, II.

Exclusion criteria:

Patient refusal
Pregnant patients
Patients BMI <18
Patient height <150cm
Any contraindications to Spinal anaesthesia.

Sampling method:

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square was the test of significance. Continuous data was represented as mean and standard deviation.

Independent t test was the test of significance to identify the mean difference between two groups. p value <0.05 was considered as statistically significant.

Method of collection of data:

After ethical committee approval and obtaining written informed consent from the patients, the study was undertaken.

Study Protocol:

- Institutional ethical committee approval was obtained
- The study was explained to the patient in their own understandable language.

- A written informed consent was obtained
- All the patients were subjected to a detailed PAC where the BMI of the patient was noted.
- The patients were divided into group NO and group O based on their BMI
- On arrival to the OT, IV line was secured, monitors were connected.
- Under strict aseptic conditions, after identification of the L3 –L4 space, Lumbar puncture was carried out and intrathecal administration of 3ml 0.5% bupivacaine(H) with 25 micrograms of fentanyl was given and the time of administration of the drug was noted.
- The position of the OT table post spinal anaesthesia was kept horizontal.
- The level of sensory block achieved, was tested using a cold swab test in the mid clavicular line 2 minutes after the sub arachnoid injection. Subsequently the test was carried out at 2 minute interval till maximum sensory block height was achieved.
- The degree of motor block achieved was measured using the modified Bromage scoring system every 2minutes till maximum block was attained.
- Heart rate and blood pressure was recorded at 15-minute interval till the end of surgery.
- Hypotension was defined when there was more than 20% decrease in MAP or SBP<100mm hg
- Vasopressor requirement during the surgery was noted.
- Injection ephedrine was the vasopressor of choice in our study.
- Injection ephedrine 1cc=6mg was administered according to the vasopressor need.
- Post operatively, the patient was hemodynamically monitored and the time taken for the regression of spinal anaesthesia was recorded.
- The sensory modality was tested using the cold swab test and the motor component by using the modified Bromage scale.
- Any complications were noted and managed as per institutional protocol

Study Duration: 12- 18 months.

Sample Size:

Was estimated by using the difference in Mean Time to regression of block (touch) between Group N and Group O from the study T.C. Ngaka et. Al4. as 132.1 ± 30.1 min and 152.1 ± 26.6 min. Using these values at 95% Confidence limit and 80% power sample size of 32 was obtained in each group by using the below mentioned formula and Med calc sample size software. With 10% non-response sample size of 32 + 3.2 ≈ 35 cases was included in each group.

Type Of Study: Cross Sectional study, Hospital based study.

Statistical Analysis Method:

Data was entered into Microsoft excel data sheet and will be analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square was the test of significance. Continuous data was represented as mean and standard deviation. Independent t test was the test of significance to identify the mean difference between two groups. p value <0.05 was considered as statistically significant.

RESULTS

During the present study, a total of 70 patients undergoing umbilical and infra-umbilical surgeries were reviewed. The enrolled patients were divided into two groups (NO and O), each containing 35 patients based on their body mass index (BMI) values. The patients of group NO (non-obese) have BMI < 30 kg/m2 and those under group O (obese) have BMI >30 kg/m2.

There was no significant difference between the age, gender and ASA status between both the groups.

Table 1 : Comparison of weight and height between two groups.

Group	Non-Obesity Mean ±Sd	Obesity Mean ±Sd	P-Value
Weight(kg)	70.37±8.5	83.42±6.88	0.0001
Height(cm)	165.5±10.45	162.13±9.02	0.125
BMI(kg/m2)	25.72±2.31	31.75±1.43	0.0001

Table 2 : Comparison of sensory block between two groups.

Block /Group	Non-Obesity Mean ±Sd	Obesity Mean ±Sd	P-Value
Sensory Block	3.87±0.45	3.01±0.68	0.0001

The mean sensory block in group NO was 3.87±0.45 and that in group O was 3.01±0.68. The p value calculated was 0.0001 indicating a highly significant difference in the sensory block of patients categorized into two groups. The time at attain sensory block of T6 for patients in group O was higher compared with that in group NO.

Table 3: comparison of motor block between the two groups

Block /Group	Non-Obesity Mean ±Sd	Obesity Mean ±Sd	P-Value
Motor Block	3.06±0.54	2.54±0.51	0.0001

The mean motor block in group NO was 3.06±0.54 and that in group O was 2.54±0.51. The p value calculated was 0.0001 indicating a highly significant difference in the motor block of patients categorized into two groups. The time to attain motor block with Bromage 4 was faster in obese group as compared to the non obese group.

Intraop heamodynamic parameters were comparable between both the groups. However group O required larger dose of vasopressor, in the first thirty minutes to maintain heamodynamic stability.

The total duration of sensory block was noted to be significantly higher in the obese group than in the non obese group whereas no significant difference was noted in the motor block recovery time between both the groups.

DISCUSSION:

During regional anaesthesia many factors affect spread of local anaesthetics and extent of block. Patient weight may be a significant variable in predicting the extent of block and subsequently hypotension and the need for vasopressors in obese patients. The sensory block level in patients undergoing spinal anaesthesia can be influenced by numerous patient demographic factors including age, gender, height, weight, body-mass index (BMI), spinal anatomy, and lumbosacral cerebrospinal fluid (CSF) volume[1-6]

Obesity increases both fat and lean masses; the percentage of fat tissue increases more than the lean mass, affecting the apparent volume of distribution of anaesthetic drugs according to their lipid solubility7.

Drug dosing is generally based on the volume of distribution for the loading dose and on the clearance for maintenance. In the obese patient, the volume of distribution is increased if the drug is distributed both in lean and fat tissues whereas the anaesthetic drug clearance is usually normal or increased[7].

Morbid obesity alters drug dose requirement and time course of drug response. In addition, morbid obesity's impact on many organ systems decreases the margin of safety of anaesthetic drugs. Consequently, incorrect dosing will increase the rate of perioperative complications[14]

We conducted this study in Rajarajeswari medical college and hospital, Bangalore.

A total of 70 patients undergoing umbilical and infra-umbilical surgeries were recruited. The enrolled patients were divided into two groups (NO and O), each containing 35 patients based on their body mass index (BMI) values. The patients of group NO (non-obese) have BMI < 30 kg/m2 and those under group O (obese) have BMI >30 kg/m^2.

We did not find any significant difference in demographics between the two groups. By definition the obese(O) group had a higher average BMI than the non –obese(NO) group.

The mean sensory block (T6) assessed by cold touch sensation, in group NO was attained at 3.87±0.45minutes and that in group O was 3.01±0.68. Similarly, the mean motor block in group NO was 3.06±0.54 and that in group O was 2.54±0.51. The p value calculated was 0.0001 in both cases indicating a highly significant difference in the sensory and motor block of patients categorized into two groups. The block of patients in group O was higher compared with that in group NO.

There have been studies in the past which have studied the influence of

obesity on the spread of spinal anaesthetics15,16, but the results remains conflicting. The precise mechanism by which BMI affects the spread of a spinal block is unclear. However, cerebrospinal fluid (CSF) volume appears to be an important factor[17].

T.C. Ngaka et al4 studied the influence of body mass index on sensorimotor block and vasopressor requirement during spinal anaesthesia for elective cesarean delivery and concluded no difference in sensory block height as assessed by touch at the 5th and 25th minute between the obese and non obese group. Our study had comparable results. However, while their study included only parturients we did a study in all patients and excluded parturients.

T. Taivainen18 et al in their study, studied the influence of obesity on the spread of spinal analgesia after injection of plain 0.5% bupivacaine. They concluded that there was extensive cephalad spread of sensory block in patients with increased BMI compared with patients with normal BMI.

In our study the calculated p-value of 0.2046 for vasopressor requirement parameter indicates both the groups required vasopressors for the same number of times but the dose of vasopressor required in the obese group was higher with a calculated p-value of the vasopressor dose being 0.01 indicating a difference in the dose requirements in both the groups. Group O required a slightly high dose of vasopressors with a mean value of 8.25mg compared with group NO with a mean value of 5.25mg.

Time for regression of sensory block was significantly longer in the obese group compared to the non obese group with a p value of 0.022
There was no significant difference between the motor block regression in both the groups with a p value of 0.19

The above findings are similar to some studies. Details are as follows:
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Bamgbade OA et al19 concluded that there were greater odds of high block in those with BMI ≥50 kg/m^2.

- Ngaka TC et al4 postulated that only a minor increase in block height as assessed by temperature occurred in group O at 25 minutes. Vasopressor requirements during the first 30 minutes of SA were equivalent. Time for regression of SA block level was longer in the group O, which may be beneficial considering the longer surgical time. A dose of spinal bupivacaine 10 mg for single-shot SA should not be reduced in morbidly obese parturients.

- According to the results of the study conducted by Kim HJ17 et al, the time to first report of postoperative pain and time to first self-void were significantly longer in the O group. These results suggest that the duration of block with hyperbaric bupivacaine is prolonged in obese patients and obesity is independently associated with spinal anesthesia outcomes.

CONCLUSION: We conclude that obesity affects the spread of spinal anaesthetic in non parturient patients undergoing lumbar spinal anaesthesia. The sensory motor block was more profound and higher in the obese patients as compared to the non obese patients. Hemodynamic parameters were comparable. Vasopressor dose requirement was significantly higher in the obese group.

SUMMARY: We studied 70 patients undergoing lumbar spinal anaesthesia divided into two groups comprising 35 patients each with BMI >30kg/m2 in the obese group and <30kg/m2 in the non obese group. We wanted to observe whether there was any difference in sensorimotor block, hemodynamic parameters and dose of vasopressor among the two groups. Demographic parameters were comparable. BMI was higher in the obese group by definition.

We noted that sensory motor block was significantly higher in the obese group. Hemodynamic parameters were comparable. The total dose of vasopressor used was significantly higher in the obese group.

LIMITATIONS:
1) We did not include parturient patients who form a sizeable chunk of obese population. This was because dosing in parturient and non parturients cannot be compared.
2) We have used standard dose for all medications and not calculated as per body weight.

Further studies need to be done with different local anaesthetics and different baricities in a larger sample size in order to arrive at more meaningful conclusions.

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