Original Research Article

A study on the ease of placement of spinal needle in relation to height, weight and BMI in a geriatric population of Eastern India

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ABSTRACT

Background: Spinal anaesthesia is the procedure of choice for infraumbilical surgery worldwide. This is usually very easy in young patients but fraught with difficulties in the elderly. Such difficulties may lead to pain, haematoma and infection, all of which pose a significant risk in the elderly. Hence it is imperative to study the common causes of such problems faced during introduction of the spinal needle for the same This will ensure a better management of the problem. The study was done to assess the impact of height, weight and BMI on the ease of introduction of spinal needle for anaesthesia in patients above 65 years of age.
Methods: A 500 patients above 65 years of age were selected for the study based on some well-defined inclusion and exclusion criteria. The time period for the study was 1 year. Their height, weight and BMI were then recorded. Then the number of redirections and level (s) required for successful placement of spinal needle were noted for each patient. ≤3 redirections and <1 levels were considered as easy placement of spinal needle. The latter were tabulated separately against the height, weight and BMI of each patient. Relevant statistical tests were also done to ascertain the significance of the findings.
Results: Patients with lesser height, weight and BMI took <3 redirections and <1 level for placement of spinal needle and these were statistically significant.
Conclusions: Spinal anaesthesia is relatively easy in elderly patients with lesser height, weight and BMI.

Keywords: BMI, Height, Spinal anaesthesia, Weight

INTRODUCTION

Aging is an irreversible and progressive physiological phenomenon characterized by degenerative changes in the structure and functional reserve of organs and tissues.[1]

Elderly patients (arbitrarily defined as being over 65 years of age) are vulnerable to the adverse effects of anaesthesia because of their reduced margin of safety. Morbidity and mortality increases with advancing age, with a steep increase after the age of 75 years.[2] The frequency of complications related to anaesthesia is 0.5% in patients >80 years old.[3]

Spinal anaesthesia is a form of regional anaesthesia involving injection of a local anaesthetic drug into the subarachnoid space. It is a blind landmark based technique that is very challenging in the geriatric age group. Successful spinal anaesthesia depends on the identification of the spinal subarachnoid space at the first attempt. Multiple attempts may lead to several serious

complications like increased risk of post-dural puncture headache, spinal haematoma, trauma to neural structures and permanent neurological damage. Hence easy identification of correct interspinous space for subarachnoid block is important. Predictors to assess the ease of spinal anaesthesia increase the chance of success with this blind technique and help in the prevention of multiple attempts thereby adding to the patients comfort.

The present study is an endeavour to find out the relation between some demographic factors (age, sex, body weight, height and BMI) and ease of insertion of spinal needle in a subarachnoid block. This study pertains to the specific demographic features found in the population served by a tertiary care medical college in a metropolitan region of West Bengal, India. Data regarding such population is very hard to come by in medical literature. This necessitated the present study in a manner that suits the problem.

METHODS

Patients above 65 years of age who were admitted for infraumbilical surgery with spinal anaesthesia in the Department(s) of Urosurgery, Orthopaedic Surgery, Gynaecologyand Obstetrics and General Surgery of R G Kar Medical College and Hospital, Kolkata were included in the study. Height and weight were recorded with. Data were collected from patients attending pre-anaesthetic check-up clinic, pre-operative room and surgical operation theatre. This is an observational and prospective type of study. All patients who met inclusion and exclusion criteria participated in the study.

The inclusion criteria were patients of all sexes above 65 years of age undergoing surgery with spinal anaesthesia and conforming to ASA physical grade I, II. The exclusion criteria were: patient refusal, contraindications to lumbar puncture, pregnancy, previous history of spinal surgery, deformed spinal skeleton, patients on anticoagulants and coagulopathy, infection at the site of puncture, patients with multiple co-morbidities, severe cardio-pulmonary disease, patients with serious CNS disorders and peripheral neuropathy, psychiatric disorders and blood volume deficits. Based on these the number of subjects selected for the study were 500.

Spinal anaesthesia was performed by an experienced anaesthesiologist. The procedure was done with patients in sitting posture and by midline approach only. All patients were informed about the procedure and the following laboratory investigations were conducted: complete blood count, blood for bleeding time and coagulation time, blood for urea and creatinine, chest X - ray PA view, ECG of all leads and echocardiography. Demographic details of the patient including age, sex, height, weight and BMI were recorded. Patients were enrolled from an Indian population. Study tools included the following: spinal needle (25/26 gauge), spirit, Povidone Iodine, transfusion set, IV fluids, IV cannula, disposable syringe and emergency drugs.

Two parameters were selected for defining the ease of placement of spinal puncture needle: attempt and redirection. Every withdrawal of the needle either out of the skin or to less than approximately 1 cm from the skin prior to advancing again was defined as an attempt. All new skin punctures were considered an attempt, whether at the initial spinal level or at a second level. Withdrawal of the needle beyond approximately 1 cm from the skin to change the direction of approach was regarded as a redirection. This was based on an earlier study looking at predictors for neuraxial access. ≤3 redirections and <1 levels were considered as easy placement of spinal needle.[4] A well designed proforma containing various parameters under study were used for data collection and the information gathered was computerised.

Lumbar puncture with 25/26 G spinal needle in all patients were done in sitting position under strict aseptic condition. All patients received IV Ringer Lactate injection intraoperatively after securing IV line with 18 G IV cannula. Patients were flexed anteriorly as far as possible, in order to separate vertebral spine maximally and expose the ligamentumflavum in interlaminar window. The level of L4 spine was identified by the intersection of the line joining the highest points of the iliac crests with the vertebral column.[5] L3 and L5 spinous processes were then identified by palpation above and below the L4 spine and marked. The anaesthesiologist determined the interspinous space level for lumbar puncture at the space between L3/L4 and L4/L5 vertebrae.

The success or failure was determined by the free flow of CSF. The number of patients corresponding to <3 and ≥3 redirections of needle were recorded. The minimum, maximum, mean, median and SD were then calculated. Finally, the p-value was obtained. A value of <0.0001 was considered significant. This was repeated with the level of needle placement: patients corresponding to <1 and >1 level (s) were recorded.

RESULTS

The mean height of patients requiring <3 redirections was greater than those requiring ≥3 redirections and this was significant. The former group with 380 patients and the latter group with 120 patients had a mean height of 1.5851 m and 1.5221 m respectively (Table 1). Patients with a mean weight of 55.8421kg underwent <3 redirections compared to those with a greater mean weight of 63.0917kg and this difference was significant (Table 2). Regarding BMI lesser (22.2582kg/m²) mean values were observed in patients with < 3 redirections as compared with those with greater BMI (27.2201 kg/m²). The difference was also significant (Table 3).

Data regarding level of placement of the needle followed a trend similar to that for redirections: the mean height of patients with a single level of needle placement was more than those with >1 level. The difference between the mean values (1.5726m and 1.5148m respectively) were not significant (Table 4). The mean weight for patients requiring >1 level of needle placement was greater (66.6522kg) than those requiring 1 level (57.1447kg). The difference in these values was significant (Table 5). The mean BMI (29.0704kg/m²) in patients requiring >1 level of needle placement was greater than those requiring a single level of needle placement (23.1780kg/m²). This difference was also significant (Table 6).

Table 1: Distribution of mean height (m) according to redirection of needle in interspinous space.

Redirections of needle	Number of patients	Minimum	Maximum	Mean	Median	SD	p-value
<3	380	1.4300	1.7300	1.5851	1.5800	0.0699	0.0001
≥3	120	1.4300	1.7300	1.5221	1.5100	0.0779	

Table 2: Distribution of mean weight (kg) according to redirection of needle in interspinous space.

Redirections of needle	Number of patients	Minimum	Maximum	Mean	Median	SD	p-value
<3	380	40.0000	71.0000	55.8421	57.0000	7.6079	<0.0001
≥3	120	41.0000	73.0000	63.0917	65.0000	8.4117	

Table 3: Distribution of mean weight (kg) according to redirection of needle in interspinous space.

Redirections of needle	Number of patients	Minimum	Maximum	Mean	Median	SD	p-value
<3	380	15.0597	27.9267	22.2582	22.3908	2.9951	<0.0001
≥3	120	18.3768	32.8814	27.2201	27.6450	3.0682	

Table 4: Distribution of mean height (m) according to interspinous space level needle placement.

Level of placement of needle	No. of patients	Minimum	Maximum	Mean	Median	SD	p-value
1	477	1.4300	1.7300	1.5726	1.5700	0.0773	0.0004
>1	23	1.4400	1.5500	1.5148	1.5200	0.0247	

Table 5: Distribution of mean weight (kg) according to interspinous space level needle placement.

Level of placement of needle	No. of patients	Minimum	Maximum	Mean	Median	SD	p-value
1	477	40.0000	73.0000	57.1447	58.0000	8.2900	<0.0001
>1	23	57.0000	73.0000	66.6522	66.0000	4.5388	

Table 6: Distribution of mean BMI according to in (kg/m2) interspinous space level needle placement.

Level of placement of needle	No. of patients	Minimum	Maximum	Mean	Median	SD	p-value
1	477	15.0597	32.8814	23.1780	23.3091	3.5204	<0.0001
>1	23	24.0344	32.4444	29.0704	29.3333	2.1799	

DISCUSSION

The present study has focussed on the difficulties encountered during spinal anaesthesia in the geriatric age group (> 65 years of age). The, height, weight and BMI were studied in relation to the ease of placement of needle in spinal anaesthesia. The present findings were studied in the light of similar studies done worldwide: Tessler MJ et al, observed a statistically greater frequency of more than one spinal needle use and requirement of more than one approach in the elderly.[6] According to de Oliveira Filho et al, anthropometric impediments to proper patient positioning were age >60 years, BMI >30kg/m², abnormal spinal anatomy and short, broad biotype (brevilineal, based on the xipho-costal angle >90°). Their report also highlighted that anatomical landmarks were poor with age >40 years, BMI >25kg/m², abnormal spinal anatomy and those with brevilineal biotype. The present study also revealed difficulty in patients with greater BMI as evidenced by >3 redirections and >1 level for spinal needle placement. de Oliveira Filho et al, did not find body weight or height to predict a successful outcome.[7] The latter is therefore contrary to the findings of the present study. The depth to the neuraxial space and BMI was shown to be a predictor of success, along with the practitioner's experience in a more recent study by Kim JH et al, Shankar H et al, could

not calculate BMI in all subjects due to missing height data in 119 subjects.[8,9] Chien et al, reported that age and gender were not associated with the first-level success or first attempt success.[10]

Ravi KK et al, found that as the weight of the patients increased, the depth of the epidural space also increased. They also found that body mass index was directly proportional to the distance from skin to the epidural space. The latter does not depend on the age or the sex of the patients. The weight of patients was also important.[11] The findings of the present study are in agreement with those of Kim JH et al and Ravi KK et al.[8,11] All studies shown that an increase in body weight and consequent BMI lead to lesser ease in placement of needle. Ružman T et al and Sprung J et al did not find any correlation between gender and body type with first puncture success.[12,14] Difficulties in performing the block were often associated with higher BMI. Patients with higher BMI and weight often have a poorly palpable interspinous space, so determining the space for needle introduction is often problematic. The latter study is therefore also in accordance with the present one. However, in contrast to the present study it is interesting to note that BMI was found to be a very weak predictor of neuraxial block difficulties in several previous studies.[13,14]

Number of redirections of needle were more in the elderly age group. It was also more in patients with lesser mean height, greater mean weight and greater mean BMI and these were non-significant. Body habitus and spinal anatomy have been shown to be predictors of success[7,9]. Mathematically a combination of greater height and lesser weight leads to a lower BMI. A greater body height is associated with a greater height of the interspinous space. Moreover, a greater body weight contributes to difficult needle placement due to more body fat, less flexibility and less prominent bony landmarks. Therefore, this explains the similar findings in both the present study and that of Shankar H et al.[9] Thus, it is observed that BMI is the main determinant for the ease of placement of spinal needle in most studies. It can also be understood that a lesser height and greater weight leading to greater BMI is an impediment to easy lumbar puncture. The present study was not devoid of pitfalls: randomization of patients were not done and there was subjective interpretation of the parameters since data was collected from different Departments.

ACKNOWLEDGEMENTS

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