Original Article

A prospective randomized study for assessing difficulty score for spinal anaesthesia

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Abstract

Background: Spinal anaesthesia is one of the most popular and widely used anaesthetic procedures that provides complete sensory and motor block, as well as postoperative analgesia with a high success rate. Although, increasing co-morbidities, concomitant medication, surgery for advanced malignancy, patients with degenerative vertebral anomalies, as well as instances of infection poses a real challenge to the use of spinal anaesthesia. **Material and Methods:** A total of hundred patients were randomly allocated into two groups. For Group J, anaesthesia residents with an experience of six months to three years and for Group S senior anaesthetists with more than three years of experience had given the spinal anaesthesia. They were independently assessed and stratified according to the categories of the five difficulty predictors of spinal anaesthesia and data was analyzed by ROC curve. **Results:** Group J could successfully give subarachnoid block (SA) in 42 cases out of 50, whereas, group S, could successfully give SA block in less than 4 attempts in 43 cases and at 4th attempt in 7 cases. It was found that spinal score of 4 or more than 4 was a predictor of difficult SA block. **Discussion:** Spinal score of 4 or more than 4 could be considered as a difficult score from our study population. Use of difficulty score can stratify patients to the appropriate anaesthesiologists, reducing the number of trials thereby reducing the patient discomfort and the number of complications.
Keywords: Spinal anaesthesia, difficulty score, difficulty predictors, senior anaesthesiologists

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INTRODUCTION

Spinal anaesthesia, a landmark-based anaesthetic technique, is the widely used procedure of anaesthesia that provides complete sensory and motor block with a high success rate. This is due to its efficacy, rapidity, minimal effect on mental status, reduction of blood loss and protection against thromboembolic episodes. It also reduces the risk of vomiting and pulmonary aspiration in emergency patients with full stomach and also useful in patients with chronic airway disease[1]. Due to the invasive nature of spinal anaesthesia, there are several types of complications that may occur with different incidence. Multiple attempts at needle placement may cause discomfort, higher incidence of spinal haematoma, postdural puncture headache and trauma to neural structures[2-5]. Many factors influence the anesthesiologist's decision to perform spinal anaesthesia. Most influential factors are the site of surgery, presence of pulmonary disease, postoperative pain management and patient acceptance. Other important factors to be taken into consideration are local infection, uncorrected hypovolemia, pre-existing neurologic disease, coagulopathy, bacteremia, and mental status of the patient[6]. However, at times, the experience of the anesthesiologist as well as anticipated difficulty of the procedure itself are also to be considered, especially where general anaesthesia is contraindicated and therefore spinal anaesthesia has to be successful. Identifying factors associated with technically difficult subarachnoid block is necessary. Accurate preoperative

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prediction of potential difficulty can help to reduce the incidence of multiple puncture. It can also help in avoiding prolonged, difficult, painful and unsuccessful procedure rendering the technique more acceptable and less risky to the patient. The present study was undertaken to assess a simple, accurate and easy applicable score to predict difficulty during performance of spinal anaesthesia, compare senior and junior anaesthetists and to determine the predictive performance of the difficulty variables.

MATERIAL AND METHODS

In this prospective randomized study, a total of one hundred patients of more than 20 years old from both sexes of ASA physical status I/II admitted for surgical procedures on elective or semi emergency basis were included. The study was approved by the hospital ethics committee and written consents were obtained. Patients with coagulation defects, cardiopulmonary or neurological diseases, and refusing spinal anaesthesia were excluded from the study. Preoperative evaluation and routine laboratory and radiographic investigations were done. Patients were randomly allocated into two groups. For Group J, anaesthesia residents with more than six months and less than three years of experience and for Group Ssenior anaesthetists with more than three years of experience had given the spinal anaesthesia. In both groups, spinal blocks were performed via midline approach using 25 G needles with the patient in sitting position and after establishing the free flow of Ringer lactate solution in arm vein. The difficulty encountered in performing the spinal puncture was evaluated by two outcome variables. First, the number of attempts required for successful needle placement (i.e. free and clear flow of CSF obtained through the needle) at the initial spinal level. Each new skin puncture was considered another attempt. However, redirecting the needle without a new skin puncture was not considered an additional attempt. Second, the number of spinal levels attempted before completing the puncture. Two levels only were allowed for the resident, after which the senior anaesthesiologist was made to take over and was allowed two more attempts. The success or failure of spinal anaesthesia was also recorded. Anaesthesia was considered complete and successful if the surgical procedure was completed without any analgesic or anaesthetic supplementation. Information obtained from preoperative multifactorial difficulty variables gave a score for each patient (Table 1). The scores of all patients were stratified into a wide range of scores (nine levels: 0±8).

Table 1: Parameters used for calculating spinal score of a patient[6]

	0	1	2	3
Age(yrs)	20-40	41-60	> 60	
BMI (kg/m^2)	< 22	22-27	> 27-34	> 34
Spinal bony landmark	Palpable	Non palpable		
Spinal bony deformity	Absent	Present		
Radiological characteristic of lumber vertebrae	Easy	Difficult		

Data was analyzed by Receiver operating characteristics (ROC) curve[7] to spot out the case where spinal would be definitely difficult. Patient characteristics were presented as mean, standard error of mean and range with *P* value calculation using Chi-square test.

RESULTS

The demographic data and characteristics of the patients in both groups and the total study population are shown in Table 2. Both groups were comparable, with no statistical differences between them. However, statistically significant difference in mean height in both the groups was present. It seemed that seniors have given spinal to patients whose mean height was more than the mean height of patients, who were given spinal by juniors.

Table 2: Comparison of Demographic data in both groups

Parameters	Group J	Group S	*P* value
No. of patients (n)	50	50	
Mean age (years)	39.50±13.00	40.46±13.23	0.716
Mean weight (kg)	57.06±6.04	58.76±6.52	0.179
Mean height (Meter)	1.52±0.064	1.60±0.052	0.000*
ASA Status I/II	36/14	34/16	0.663
Sex Males/Female	9/41	10/40	0.799

*P< 0.05 = significant

Table 3 shows the distribution of five variables used to calculate spinal score of the patients in both the group. It was observed that both the groups were statistically comparable regarding four variables of spinal score out of five, namely age, spinal bony land mark, spinal bony deformity and radiological features of lumbar spine such as intervertebral space narrowing, presence or absence of calcification and osteophytes. The distribution of BMI was statistically different in both the groups. Patients with BMI of less than 22 were more in group S, whereas, more than 27 were more in group J.

Table 3: Distribution of 'Five Variables' for Spinal Score in each group

Variables		Group		Total	'P' value
		Group J	Group S		
AGE (YRS)	20-40	27 (54%)	29 (58%)	56 (56%)	0.601
	40-60	18 (36.0%)	16 (32%)	34 (34%)	
	>60	5(10%)	5 (10%)	10(10%)	
BMI	<22	6 (12%)	15 (30%)	21 (21%)	0.021*
	22-27	34 (68%)	31 (62%)	65 (65%)	
	27-34	10 (20%)	4 (8%)	14 (14%)	
BONY LAND MARK	Palpable	34(68%)	35 (70%)	69 (69%)	1.000
	Non palpable	16(32%)	15 (30%)	31 (62%)	
BONY DEFORMITY	Absent	47 (94%)	46 (92%)	93 (93%)	0.695
	Present	3 (6%)	49 (98%)	7 (7%)	
RADIOLOGY FEATURES	Easy	32 (64%)	35 (70%)	67 (67%)	0.065
	Difficult	18 (36%)	15 (30%)	33 (33%)	

* Significant

Group J could successfully give SA block in 42 cases out of 50. They were successful in 26 cases at 1st attempt, in 7 cases at 2nd attempt, in 7 cases at 3rd attempt and in 2 cases at 4th attempt. However, in 8 cases, in which they could not successfully complete SA block even at 4th attempt, the seniors took over and seniors were successful in all the 8 cases. Out of theses 8 cases, the seniors succeeded in 5 cases at 1st attempt, 1 case at 2nd attempt and 2 cases at 3rd attempt. Hence the total number of attempts in these cases became 5th, 6th and 7th attempt. However, when we look at the number of primary attempts by group S, it is evident that in all the 50 cases they could successfully give SA block in less than 4 attempts in 43 cases and at 4th attempt in 7 cases. This shows that seniors were successful in 100% of cases whether they attempted initially or they took over after four attempts by juniors.

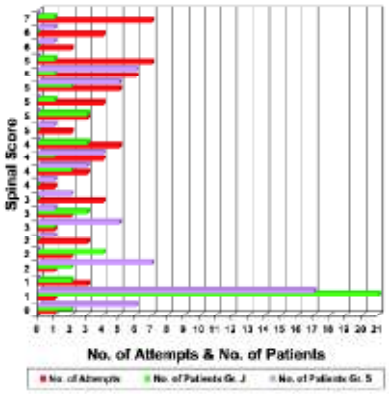
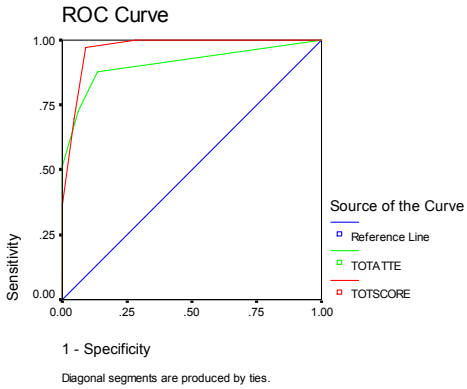


Figure 1: Spinal score Vs Number of Attempts and Number of patients

All the cases in which Group J could not succeed in giving SA block had their spinal score 4 or more. It was also found that whether the score was 4 or more, Group S could successfully accomplish SA block in these patients in 4 or less than 4 attempts.



TOTATTE = Total No. of Attempts
TOTSCORE = Total Spinal Score

Figure 2: ROC curve obtained to determine sensitivity and specificity

ROC curve for score 4 with the score above (score 5) and the score below (score 3) was compared to determine the appropriate score comparable with a balance between the true difficulty rate (sensitivity) and the true easy rate (specificity) as shown in graph 2. Below score 3 and above score 5 there was a total imbalance between the sensitivity and specificity rate. It became evident spinal score of 4 or more than 4 was a predictor of difficult SA block.

DISCUSSION

Multiple attempts at needle placement for SA block may cause trauma to neural structures, may increase chances of postdural puncture headache and spinal haematoma in addition to discomfort to patients. Accurate preoperative prediction of potential difficulty can help to reduce the incidence of multiple puncture rendering the technique more acceptable and less risky to the patient. This will add to the delivery of high quality care, as it would reduce patients discomfort as well as complications. An objective scoring (Spinal Score) system was therefore used in this study to serve as a reproducible quantitative measure of the expected difficulty for spinal anaesthesia. In patients with spinal scores 3 or less than 3 (35 patients in Group J, 39 patients in group S) usually SA block could be completed with 1 attempt by both group. Only 9 out of 35 in Group J and 4 out of 39 patients in Group S required more than 1 attempt to complete SA block. As spinal score for a patient increased, the attempt rate also increased i.e. procedure became more and more difficult. It was found that for a particular spinal score, juniors found it more difficult to give SA block in comparison to seniors. Spinal score of 4 or more than 4 could be considered as a difficult score from our study population. Plotting ROC curve for spinal score versus number of

attempts statistically confirmed this finding of ours. Similar findings were observed by Atallah *et al*[7] where in score 4 was the difficulty score at or above which difficulty was expected. To conclude, the thoughtful use of this difficulty score can stratify patients to the appropriate anaesthesiologists, reducing the number of trials and levels, improving the performance of spinal puncture and thereby reducing the patient discomfort and the number of complications.

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