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PREDICTING DIFFICULTY SCORE FOR SPINAL ANAESTHESIA IN PATIENTS UNDERGOING LOWER LIMB AND LOWER ABDOMINAL SURGERY

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ABSTRACT

Background: In this study we wanted to investigate as to whether there was any significant relationship between spinous process abnormalities and BMI as predictors of the difficulty score for spinal anaesthesia.

Methods: This was a prospective randomised study conducted among in-patients of TSHRC scheduled for lower limb and lower abdominal surgery under spinal anaesthesia. 96 patients aged 18 to 75 years undergoing lower abdominal and lower limb surgeries belonging to ASA I and ASA II were included in the study.

Results: The majority of research participants (62.5%) had normal BMIs. 12.5 percent had a BMI of ≥30.0, while 18.8% had a BMI of 25.0–29.9. The majority of the patients-73 individuals, or 76% had easy spinal anaesthesia. 18 patients (19%) had quite difficult spinal anaesthesia performed. In the moderate group, the needle needed to be redirected in the same location in 12 patients (13%) and a new effort was performed in a second space in 6 patients (6%). Five patients were found to have difficult spinal anaesthesia, four of them attempted in the second space with redirection and one patient (1%) attempted it in the third space. 53 patients or 55% of the total had visible spinal processes, while about 7 patients or 7% of the total had invisible and impalpable spinal processes. 36 patients (38%) had a spinal process that could be felt.

Conclusion: A BMI of >30 and an impalpable and invisible spinous process are risk factors for problematic spinal anaesthesia. Patients with a visibly perceptible spinous process and a BMI of 25–30 provide a moderate challenge for spinal anaesthesia.

Keywords: Predicting Difficulty Score, Spinal Anaesthesia, BMI.

INTRODUCTION

A frequent regional anaesthetic technique used for surgery on the lower limbs, abdomen, urology and gynaecology is spinal anaesthesia. This kind of anaesthesia is quite safe, has a clear end point, is rapid and has several advantages, including better analgesia, lower rates of morbidity and mortality and more cost-effective. There is a lower incidence of thromboembolic phenomenon, myocardial infarction, post-operative analgesia need and stress reaction to surgical stimulation. Research has indicated that although the process appears simple and uncomplicated, there is a low incidence of first-pass success .[1-3]

Numerous ailments including kyphoscoliosis, osteoarthritis, and prior spine surgery, can interfere with needle entry. Repeated attempts to insert the needle may result in discomfort for the patient as well as an increased risk of PDPH,hematoma and neurological sequelae.

By lowering the frequency of repeated efforts, accurate preoperative prediction of probable difficulty can make the method more tolerable and less dangerous for the patient. The quality of spinal bony landmarks is a separate indicator of predicting difficulty.

Risk communication and counselling of the patient have decreased patient discontent. The goal of developing the DSP was to identify individuals who may require challenging spinal-arachnoid puncture treatments. It will enable the medical professional to properly arrange the procedure and provide tailored preoperative counselling.

Given the widespread use of spinal anaesthesia, a precise grading system to assess the likelihood of a challenging SAB is essential. It may help lower the spinal anaesthesia failure rate. The purpose of this study was to investigate whether there was any significant relationship between spinous process abnormalities and BMI as predictors of the difficulty score for spinal anaesthesia.

MATERIALS & METHODS

This was a prospective randomised study conducted among in-patients of TSHRC scheduled for lower limb and lower abdominal surgeries under spinal anaesthesia. 96 patients aged 18 to 75 years undergoing lower abdominal and lower limb surgeries belonging to ASA I and ASA II were included in the study. Patients refusing to participate in the study, those with intrinsic or idiopathic coagulopathy, infection at the injection site, raised ICP, and those belonging to ASA classes III and IV were excluded from the study.

Data were recorded including age, gender, height, weight, BMI (Body Mass Index) and spinous process anatomy. Every patient in the operating room had a multipara monitor attached to them. The IV line was secured and baseline measurements such as blood pressure, heart rate, SPO2 and ECG were recorded. All patients received spinal anaesthesia (SAB) in the sitting position from a median approach from an anesthesiologist with over five years of experience, using a 25G spinal needle (Whitacre). Depending on need, 10-15 ml/kg of IV fluid were co-loaded into each patient. The following headings list the predictors of spinal anaesthesia difficulty.

A. Distribution of spinal anaesthesia difficulty by body mass index (BMI) levels calculated as (kg/m2)

1. < 20
2. 20 – 25
3. 25 – 30
4. > 30

B. The anatomy of the spinous process was divided into three categories-

1. Visible
2. Invisible but palpable

3. Invisible and impalpable

Statistical Analysis

The data was analysed by STATA software version 10.0. A chi-square test was used for analysis.

RESULTS

Demographic Profile

The study patients demographic features are displayed in Table 1. There were 41female patients (43%) and 55 male patients (57%) . The age range of 41–60 years old comprised the majority of them (44%). While 62.5% of the study participants had normal BMIs, 18.8% had BMIs between 25.0 and 29.9 and 12.5% had BMIs of ≥ 30.0.

	Demographic Variables	No. of Patients	Percentage	Chi square Test	P-Value
Gender	Female	41	42.7	6.063*	0.048
	Male	55	57.3		
	Total	96	100.0		
Age Group	16 – 40	29	30.2	2.042	0.153
	41 – 60	43	43.8		
	>60	24	25.0		
BMI	<18.5	6	6.3	75.00**	0.000
	18.5 – 24.9	60	62.5		
	25.0 – 29.9	18	18.8		
	≥30.0	12	12.5		

Table 1: Demographic Characteristics of Patients *Statistically Significant at 5% Level i.e. P<0.05**Statistically Significant at 0.1% Level i.e. P<0.001

Difficulty of Spinal Anaesthesia

The level of spinal anaesthesia difficulties is shown in Table 2. The majority of the patients,73 individuals or 76% had easy spinal anaesthesia. 18 patients (19%) had quite difficult spinal anaesthesia performed. In the moderate group, the needle needed to be redirected in the same location in 12 patients (13%) and a new effort was performed in a second space in 6 patients (6%). Five patients were found to have difficult spinal anaesthesia; four of them attempted in the second space with redirection, and one patient (1%) attempted in the third space.

Grading	Core	No. of Patients	%	Chi Square Test	P-Value	Sig. at 5% level
Easy	First Attempt	73	76.0	191.812**	0.000	Yes
Moderate	First Space with redirection	12	12.5			
	Attempt in Second Space	6	6.3			
Difficult	Second Space with redirection	4	4.2			
	Attempt in Third Space	1	1.0			
Total		96	100.0			

Table 2: Difficulty of Spinal Anaesthesia

**Statistically Significant at 1% level i.e.P<0.001

Table 3 presents the complexity of spinal anaesthesia in relation to the various spinal processes' anatomical features. 53 patients, or 55% of the total, had visible spinal processes, while about 7 patients, or 7% of the total, had invisible and impalpable spinal processes. 36 patients (38%) had a spinal process that could be felt.

Grading	No. of Patients	%	Chi Square Test	P-Value	Sig. at 5% level
Visible	53	55.2	33.813**	0.000	Yes
Invisible but Palpable	36	37.5			
Invisible & Impalpable	7	7.3			
Total	96	100.0			

Table 3: Difficulty of Spinal Anaesthesia in Different Spinal Process Condition of Patients

****Statistically Significant at 1% level i.e. P<0.001**

Table 4 displays the correlation between the difficulty of spinal anaesthesia and two predictor variables: spinal process conditions and BMI. Chi-square analysis revealed a statistically significant correlation between spinal anaesthesia difficulty and BMI (χ^2 value = 30.53, $p<0.001$) and spinal process problems (χ^2 value = 61.74, $p<0.001$). It was found that 4% of patients with intermediate difficulty levels and about 96% of patients with visible spinal problems received easy spinal anaesthesia. Spinal anaesthesia was straightforward for about 58% of patients with palpable conditions and challenging for about 3% of them. But 57% (n = 7) of those with impalpable and invisible conditions had trouble achieving spinal anaesthesia.

The majority of patients with underweight (100%, n = 6), normal (82%, n = 60), and overweight (83%, n = 18) had easy spinal anaesthesia, according to the data; in contrast, the majority of patients with obesity (n = 12) had either moderate (42%) or difficult (33%) spinal anaesthesia.

Level Difficulty (%)					**Total**	**Chi-Square Test**	**P-Value**	**Sig. at 5% Level**
Spinal Process		**Easy**	**Moderate**	**Difficulty**				
Visible		96.2	3.8	0.0	53	61.741**	0.000	Yes
Palpable		58.3	38.9	2.8	36			
Invisible & Impalpable		14.3	28.6	57.1	7			
Total		76.0	18.8	5.2	96			
BMI	<18.5	100.0	0.0	0.0	6	30.526**	0.000	Yes
	18.5 – 24.9	81.7	16.7	1.7	60			
	25.0 – 29.9	83.3	16.7	0.0	18			
	≥30.0	25.0	41.7	33.3	12			
Total		**100.0**	**0.0**	**0.0**	**96**			

Table 4: Distribution of Spinal Anaesthesia Difficulty by BMI Levels and Spinal Process Conditions

**Statistically Significant at 1% level i.e., P<0.001

DISCUSSION

Due to its distinct advantages over general anaesthesia, spinal anaesthesia is becoming more and more popular every day. Given the widespread use of spinal anaesthesia, a precise grading system to assess the likelihood of a challenging SAB is essential. It can help lower the frequency of repeated attempts making the method less hazardous and more acceptable.

The purpose of the current study was to investigate the potential predictive value of BMI and spinous process abnormalities in determining the spinal anaesthesia difficulty score.

The bulk of the patients in this study,73 individuals or 76% had easy spinal anaesthesia. In the Ružman T et al. study[4] 69.3% of patients had a successful first puncture, although the overall success rate was 97.5%. Merely 2.5% of patients required an additional form of anaesthesia. These outcomes were nearly identical to those of earlier research. Harrison and Langham found a 75% first-time success rate in their investigation of 100 spinal blocks.[5] Sprung et al. showed that 64% of patients had early success and 98% had final success.[6] Additionally, the total success rate in the study by Kopacz et al. was 99%[7] which is similar to the findings shown here.

In the past, scoring schemes have been put up to forecast the difficulty of spinal anaesthesia. Age, BMI, bony spinal landmark, bony deformity, and radiological characteristics make up the five factors in the Atallah et al.[1] score, compared to Khoshrang et al.'s[10] score which contains four variables: BMI, radiographic characteristics, spinal bony deformity, and the difficult-to-locate spinous process. The score developed by Del Buono et al.[8] also has four variables: spinal deformity, palpability, visibility, and previous history of problematic spinal anaesthesia.

BMI has a significant role in determining how simple it is to insert a spinal needle. BMI has an impact on subarachnoid space depth.[9] In this study, first puncture success was correlated with a smaller subarachnoid space depth. Kim et al. also discovered a strong correlation between the

number of attempts and success rate of the initial puncture and the distance from the skin to the subarachnoid or epidural area.

The results of the chi-square analysis in this study indicate that there is a statistically significant correlation between spinal anaesthesia difficulty and BMI (χ^2 value = 30.53, $p<0.001$). Similar findings were found in the Khoshrang H et al. study[10] where the one-way ANOVA parametric test revealed a significant correlation between BMI and spinal severity (P = 0.068). The Pearson correlation coefficient (P = 0.004, Pearson correlation = 0.286), which indicates a connection between rising BMI and rising SA difficulty, further supported this finding. However, 427 pregnant patients were assessed in the Ellinas et al. study.[11] They discovered that, whereas BMI was not an independent predictor of either end point, the practitioner's ability was the most important predictor of difficulties in SA.[12]

The majority of the 73 individuals in the current study (76% of the patients) experienced easy spinal anaesthesia. 18 patients (19%) had quite difficult spinal anaesthesia performed. Six patients (6%) in the moderate group attempted second space and twelve patients(13%) attempted first space with redirection. Five individuals were found to have difficult spinal anaesthesia, and one patient (1%) attempted it in third space. Prakash et al.[12] also noted a correlation between technical block challenges and the calibre of spinal anatomical landmarks. In patients with good palpability of spinous processes, first punctures without needle redirection were often successful. Individuals with difficult or absent palpable landmarks were linked to a spinal block that was technically challenging. Additionally, prior research indicates that the complexity of executing a spinal block is correlated with the quality of anatomical landmarks. Accessibility to subarachnoid space is correlated with the interspinous gap as palpated.[13]

A statistically significant correlation was observed between the spinal process conditions (χ^2value = 61.74, $p<0.001$) and the difficulties of spinal anaesthesia. A significant link between spinous process state, radiologic lesion, skeletal spinal deformity, and difficulty score for SA was demonstrated by Khoshrang H et al.[10]. These variables might be employed as predictors to ascertain the difficulty score for SA. The authors noted that the condition of the spinous process was the most significant factor in predicting the severity of the spinal condition. Patients with this complication required longer times for the anaesthesia process, which resulted in longer anaesthesia times; additionally, the need for more punctures and needle relocation would cause headaches and backaches, which would not be to the patients' satisfaction. They came to the conclusion that giving anesthesiologists access to a scoring system that measures the degree of difficulty associated with spinal anaesthesia could aid them in predicting whether spinal anaesthesia would be successful or unsuccessful, assist them in selecting the most appropriate technique for the patient's condition, and be useful in emergency scenarios. The findings of the 300-patient study conducted by Atallah et al.[1] also demonstrated that radiologic signs of the vertebra and the state of the spinal process were two significant predictors of problematic SA.[1] According to a study by Sprung et al.[5] body habit affected the frequency of spinal puncture attempts, while spine anatomical characteristics had the greatest influence on spinal severity. Age, gender, needle size, and anesthesiologist experience did not affect spinal severity in this study.[11]

CONCLUSION

A BMI of >30 and an impalpable and invisible spinous process are risk factors for problematic spinal anaesthesia. Patients with a visibly perceptible spinous process and a BMI of 25–30 provide a moderate challenge for spinal anaesthesia.

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