

A STUDY ON THE FACTORS DETERMINING THE EASE OF SUBARACHNOID BLOCK IN PREGNANT PATIENTS IN A TERTIARY CARE CENTRE

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Abstract

Background: To study the various factors determining the ease of subarachnoid block in pregnant patients. **Materials and Methods:** A cross sectional observational study was conducted on 300 pregnant patients who underwent either elective or emergency caesarean section in maternity hospitals attached to study the various factors determining the ease of subarachnoid block like BMI, history of previous difficulty in subarachnoid block, PREDIS classification (spinal landmarks), bony abnormalities of spine and Interspinous gap. All these factors were statistically analysed individually with the need of senior or second person to administer the block, number of skin punctures, number of spaces used, need of paraspinous approach, and grading of ease of administering subarachnoid block. **Result:** The study showed that the history of previous difficulty in subarachnoid block, BMI, Interspinous gap, PREDIS classification are significant predictors of difficult subarachnoid block. **Conclusion:** Presence of bony spinal abnormality doesn't have a significant relationship with the number of punctures, number of spaced used. But it is significantly related to the need of paraspinous approach to administer the block.

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INTRODUCTION

Subarachnoid block is one of the most commonly performed procedure for anaesthesia during Cesarean section. It has many advantages. It is technically easy and more economical. There is reduced incidence of post-operative nausea and vomiting. It is dependable, failure rate is much less, awareness is not a problem as seen in general anaesthesia, and it eliminates the poly pharmacy that is seen in general anaesthesia. Patient's airway reflexes are preserved.^[1]

Subarachnoid block being a landmark-based anaesthetic technique, can be difficult in certain patients for as yet unclear reasons. Technical challenges in the performance of this blind technique warranted an investigation into the reasons for difficulty in its performance.^[2]

Anticipated difficulty is one factor that can influence the anaesthesiologist's decision to perform subarachnoid block. The problems during the procedure may be associated with patient dissatisfaction, neurological sequelae, hematoma. Unpleasant experience to patients due to multiple attempts in performing subarachnoid block makes the patient not to accept for subsequent subarachnoid blocks. The complications will increase.

There have been many studies which have been done on various factors determining the difficulty of subarachnoid block, which have given various scoring systems consisting of different parameters like Body Mass Index, Age, Skeletal variations of the Spine like kyphosis, scoliosis, Interspinous gap and some studies on these individual parameters determining the ease of subarachnoid block.^[3]

The area of lacunae is that most of these studies were done on non-pregnant population. So we planned to take up this study to determine the various parameters affecting the difficulty of subarachnoid block in pregnant women.

MATERIALS AND METHODS

It is an Observational, Cross-sectional Hospital based study conducted over a period of 18 months conducted in Modern Govt. Maternity Hospital, Petlaburz and Govt. Maternity Hospital, Sultan Bazaar, Hyderabad. The study protocol was approved by the institutional ethical committee and informed consent was taken from each of the patients. The study included total 300 pregnant woman posted for Cesarean section.

The study of M. M. Atallah, et al (2004),^[4] observed that more than one attempt was required in 18.7% of cases. Taking this value as reference, the minimum

required sample size with 5% margin of error and 5% level of significance is 234 patients. To reduce margin of error, total sample size taken is 300. Formula used is:- $N \geq ((d(1-d))/(ME/\alpha))^2$. Where $Z\alpha$ is value of Z at two sided alpha error of 5%, ME is margin of error and d is difficulty rate.

Calculations

$n \geq ((.187*(1-.187))/ (.05/1.96))^2 = 233.62 = 234$ (approx.)

Inclusion Criteria

All pregnant women posted for Emergency/ Elective Cesarean section.

Exclusion Criteria

Local infection at the site of administering block and Hemodynamically unstable patients.

All the patients were duly examined before surgery and pre-operative assessment sheet was checked. The height, weight, body mass index of the patient was measured. The airway assessment, spine examination were done.

A detailed general and systemic examination was done. Preoperative investigations like Complete Blood Count, Blood Sugar, Blood grouping and typing, Electrocardiograph, chest x-ray, Renal and Liver function tests, Bleeding time, Clotting time, Serum creatinine, HIV, HbSAg and Coagulation profile depending on the history and medical condition of the patient. were evaluated properly.

Study is undertaken in pregnant patients posted for either elective or emergency caesarean section, who fulfil the inclusion and exclusion criteria. All patients were explained about the procedure and its complications and informed consent obtained.

A pre anaesthetic evaluation comprising of history of previous medical and surgical illness, previous anaesthetic exposures, drug allergies and baseline investigations of blood, and airway examination will be done.

Informed and written consent will be taken from the patient. Patient will be kept nil by mouth for atleast 6 hours prior to surgery in case of Elective caesarean. Patient BMI is measured using the weight and height recorded in the first antenatal visit. Preoperative vital parameters in the form of baseline pulse rate, blood pressure and oxygen saturation will be recorded.

History previous difficulty of administering subarachnoid block is assessed by asking the patient whether multiple pricks were needed to administer subarachnoid block in previous surgeries.

Inside the Operation Theatre

All standard monitors were attached to the patient: Non invasive Blood Pressure monitoring, Pulse Oxymeter, 5 Lead Electrocardiogram. An intravenous 18G line was secured. All patients were catheterized with appropriate size Foleys catheter after block is administered, in order to monitor urine

output. Anaesthesia machine was checked, resuscitation equipment and drugs were checked and kept ready, before undertaking the procedure.

After baseline parameters were noted. Inj. Ondansetron 4 mg IV was given for all patients. Patients were kept in sitting position and Spine examination was done: PREDIS study:^[3]

Class 1

Lumbar spinous process can be seen.

Class 2

Lumbar spinous process can be easily found with palpation

Class 3

Lumbar spinous process cannot be easily found with palpation, but median structures are palpable

Class 4

Lumbar spinous processes cannot be found during palpation and median structures cannot be determined.

Interspinous gap was assessed for class 1 and class 2 patients using measuring tape with the patient in sitting position and spine flexed. Measurement is done between two most prominent palpable or visualised points in subsequent lumbar spinous process, mostly L2-L3 or L3-L4 spaces.

Subarachnoid block was administered to the patients in sitting position under strict aseptic conditions using 25 G Quincke needle and the ease of administering block was graded as follows:

Easy: Only one skin puncture (includes redirecting the needle without a new skin puncture).

Moderate: Two skin punctures in the same or different interspinous spaces. Difficult: More than two skin punctures in one or more interspinous spaces. Level of anaesthesia and Modified Bromage score was noted.

Need of a second/ senior person to administer the block was also noted

Statistical Analysis

The presentation of the Categorical variables was done in the form of number and percentage (%). On the other hand, the presentation of the continuous variables was done as mean \pm SD and median values. The following statistical tests were applied for the results:

1. The association of the variables which were quantitative in nature were analysed using Independent t test (for two groups) and ANOVA test (for more than two groups).
2. The association of the variables which were qualitative in nature were analysed using Fisher's Exact test.
3. Pearson correlation coefficient was used to correlate body mass index, interspinous gap with number of punctures and number of spaces.

The data entry was done in the Microsoft EXCEL spreadsheet and the final analysis was done with the use of Statistical Package for Social Sciences (SPSS) software ver 21.0.

RESULTS

Table 1: Distribution details of study subjects.

Age(years)	Frequency	Percentage
<=20	.21	7.00%
21-30	.263	87.67%
31-40	.16	5.33%
Emergency/Elective		
Elective	.102	34.00%
Emergency	.198	66.00%
History of previous difficult SAB		
No	.286	95.33%
Yes	.14	4.67%
PREDIS		
Class 1	.62	20.67%
Class 2	.150	50.00%
Class 3	.63	21.00%
Class 4	.25	8.33%
Spine abnormality		
Absent	.293	97.67%
Scoliosis	.7	2.33%
Need for senior		
Needed	.16	5.33%
Not needed	.284	94.67%
Paraspinal		
No	.290	96.67%
Yes	.10	3.33%
Total	.300	100.00%
Ease of administering block		
Easy	.208	69.33%
Moderate	.58	19.33%
Difficult	.34	11.33%

Table 2: Descriptive statistics of interspinous gap(cm), number of punctures and spaces of study subjects.

Variable	Mean ± SD	Median(IQR) .	Range
Interspinous gap(cm)	7.21 ± 0.72	7(7-8)	4-8
Number of punctures	1.58 ± 1.2	1(1-2)	1-8
Number of spaces	1.13 ± 0.39	1(1-1)	1-3

Table 3: Association of study variables with history of previous difficult SAB.

Need for senior	No (n=286)	Yes (n=14)	Total	P value	Test performed
Needed	12 (4.20%)	4 (28.57%)	16 (5.33%)	0.004	Fisher Exact test
Not needed	274 (95.80%)	10 (71.43%)	284 (94.67%)		
Total	286 (100%)	14 (100%)	300 (100%)		
Number of punctures					
Mean ± SD	1.5 ± 1.1	3.29 ± 1.82	1.58 ± 1.2	0.002	t test;3.655
Median(IQR)	1 (1-2)	3 (2-4)	1 (1-2)		
Range	1-8	1-7	1-8		
Number of spaces					
Mean ± SD	1.1 ± 0.36	1.57 ± 0.65	1.13 ± 0.39	0.018	t test;2.681
Median(IQR)	1 (1-1)	1.5 (1-2)	1 (1-1)		
Range	1-3	1-3	1-3		
Paraspinal					
No	278 (97.20%)	12 (85.71%)	290 (96.67%)	0.074	Fisher Exact test
Yes	8 (2.80%)	2 (14.29%)	10 (3.33%)		
Total	286 (100%)	14 (100%)	300 (100%)		
Ease of administering block					
Easy	206 (72.03%)	2 (14.29%)	208 (69.33%)	<.0001	Fisher Exact test
Moderate	54 (18.88%)	4 (28.57%)	58 (19.33%)		
Difficult	26 (9.09%)	8 (57.14%)	34 (11.33%)		
Total	286 (100%)	14 (100%)	300 (100%)		

Factor of difficulty in previous subarachnoid block was found to have a statistically significant relation with the need of a senior or second person to administer the block, number of punctures and number of spaces and the grading of ease of administering subarachnoid block.

Table 4: Association of study variables with PREDIS.

Need for senior	Class 1 (n=62)	Class 2 (n=150)	Class 3 (n=63)	Class 4 (n=25)	Total	P value	Test performed
Needed	0 (0%)	2 (1.33%)	6 (9.52%)	8 (32%)	16 (5.33%)	<.0001	Fisher Exact test

Not needed	62 (100%)	148 (98.67%)	57 (90.48%)	17 (68%)	284 (94.67%)		
Total	62 (100%)	150 (100%)	63 (100%)	25 (100%)	300 (100%)		
Number of punctures with PREDIS							
Mean ± SD	1.13 ± 0.34	1.16 ± 0.45	2.25 ± 1.53	3.52 ± 1.87	1.58 ± 1.2	<.0001	ANOVA;F value=59.714
Median(IQR)	1 (1-1)	1 (1-1)	2 (1-2)	3 (2-5)	1 (1-2)		
Range	1-2	1-4	1-8	1-7	1-8		
Number of spaces							
Mean ± SD	1.02 ± 0.13	1.03 ± 0.21	1.25 ± 0.51	1.64 ± 0.7	1.13 ± 0.39	<.0001	ANOVA;F value=26.874
Median(IQR)	1 (1-1)	1 (1-1)	1 (1-1)	2 (1-2)	1 (1-1)		
Range	1-2	1-3	1-3	1-3	1-3		
Paraspinal with PREDIS							
No	62 (100%)	148 (98.67%)	59 (93.65%)	21 (84%)	290 (96.67%)	0.001	Fisher Exact test
Yes	0 (0%)	2 (1.33%)	4 (6.35%)	4 (16%)	10 (3.33%)		
Total	62 (100%)	150 (100%)	63 (100%)	25 (100%)	300 (100%)		

Classification to the patients according to PREDIS has a statistically significant relationship with all the outcome factors (need for senior or 2nd person to administer block, number of punctures, number of spaces used, need of paraspinal approach and grading of ease of administering subarachnoid block)

Table 5: Association of study variables with spine abnormality.

Need for senior	Absent (n=293)	Scoliosis (n=7)	Total	P value	Test performed
Needed	15 (5.12%)	1 (14.29%)	16 (5.33%)	0.321	Fisher Exact test
Not needed	278 (94.88%)	6 (85.71%)	284 (94.67%)		
Total	293 (100%)	7 (100%)	300 (100%)		
Number of punctures					
Mean ± SD	1.57 ± 1.2	2.14 ± 0.69	1.58 ± 1.2	0.209	t test;1.259
Median(IQR)	1 (1-2)	2 (2-2.5)	1 (1-2)		
Range	1-8	1-3	1-8		
Number of spaces					
Mean ± SD	1.12 ± 0.37	1.43 ± 0.79	1.13 ± 0.39	0.339	t test;1.037
Median(IQR)	1 (1-1)	1 (1-1.5)	1 (1-1)		
Range	1-3	1-3	1-3		
Paraspinal					
No	285 (97.27%)	5 (71.43%)	290 (96.67%)	0.019	Fisher Exact test
Yes	8 (2.73%)	2 (28.57%)	10 (3.33%)		
Total	293 (100%)	7 (100%)	300 (100%)		

Presence of spinal abnormalities were not having a significant relationship with our various outcome factors like need for senior or second person to administer block, number of punctures, number of spaces used; but was found to have a significant relationship with the need of paraspinal approach.

Table 6: Association of body mass index(kg/m2) and interspinous gap(cm) with need for senior.

Body mass index(kg/m2)	Needed (n=16)	Not needed (n=284)	Total	P value	Test performed
Mean ± SD	29.37 ± 1.83	5.81 ± 2.21	26 ± 2.33	<.0001	t test;6.32
Median(IQR)	29.45 (28.4- 30.225)	25.4 (24.2-27.2)	25.6 (24.2-27.6)		
Range	25.4-33.7	21.6-32.1	21.6-33.7		
Interspinous gap(cm)					
Mean ± SD	5.5 ± 2.12	7.22 ± 0.69	7.21 ± 0.72	0.455	t test;1.149
Median(IQR)	5.5 (4.75-6.25)	7 (7-8)	7 (7-8)		
Range	4-7	5-8	4-8		

Table 7: Association of body mass index(kg/m2) and interspinous gap(cm) with Paraspinal.

Body mass index(kg/m2)	No (n=290)	Yes (n=10)	Total	P value	Test performed
Mean ± SD	25.88 ± 2.24	29.69 ± 1.97	26 ± 2.33	<.0001	t test;5.311
Median(IQR)	25.4 (24.2- 27.35)	29.8 (28.55- 30.3)	25.6 (24.2-27.6)		
Range	21.6-32.1	26.2-33.7	21.6-33.7		
Interspinous gap(cm)					
Mean ± SD	7.23 ± 0.68	5 ± 1.41	7.21 ± 0.72	<.0001	t test;4.568
Median(IQR)	7 (7-8)	5 (4.5-5.5)	7 (7-8)		
Range	5-8	4-6	4-8		

Results of our study show that BMI of the patients has a statistically significant relationship with the grading of ease of administering the block, need for paraspinal approach, and the need for a senior or a second person to administer the block.

Table 8: Association of body mass index(kg/m2) and Interspinous gap(cm) with ease of administering block.

Body mass index(kg/m2)	Easy (n=208)	Moderate (n=58)	Difficult (n=34)	Total	P value	Test performed
Mean ± SD	25.16 ± 1.95	27.11 ± 1.84	29.24 ± 1.46	26 ± 2.33	<.0001	ANOVA;F value=81.162
Median(IQR)	24.6 (23.8-26.2)	27.2 (26.2-28.4)	29.2 (28.45-30.2)	25.6 (24.2-27.6)		
Range	21.6- 32.1	22.8-29.8	25.4- 33.7	21.6- 33.7		
Interspinous gap(cm)						
Mean ± SD	7.31 ± 0.62	6.64 ± 0.81	5.67 ± 1.53	7.21 ± 0.72	<.0001	ANOVA;F value=19.471
Median(IQR)	7 (7-8)	7 (6-7)	6 (5-6.5)	7 (7-8)		
Range	5-8	5-8	4-7	4-8		

Interspinous gap had a significant relationship with the ease of performing subarachnoid block and the need of paraspinal approach, but not significant with the need of senior or a second person to administer the block.

Table 9: Correlation of body mass index, interspinous gap with number of punctures and number of spaces.

Variables	Body mass index(kg/m2)	Interspinous gap(cm)
Number of punctures		
Correlation coefficient	0.512	-0.387
P value	<0.0001	<0.0001
Number of spaces		
Correlation coefficient	0.446	-0.317
P value	<0.0001	<0.0001

Pearson Correlation Coefficient

Results of our study show that BMI of the patients has a statistically significant relationship with the grading of ease of administering the block, need for paraspinal approach, and the need for a senior or a second person to administer the block.

DISCUSSION

Subarachnoid block is one of the most widely used anaesthetic technique for pregnant women undergoing cesarean section. There have been many studies done on the various factors (like age, BMI, Skeletal abnormalities of Spine, Spinal landmarks, Radiological features, Interspinous gap) determining the difficulty of Subarachnoid block. But most of these studies were done on non-pregnant population posted for Orthopedic, Urology surgeries. So this study was undertaken to assess the significance of these factors in pregnant women.

This Observational cross sectional study was conducted in the Maternity hospitals attached to Osmania Medical College with an aim to study the various factors determining the ease of subarachnoid block in Pregnant patients in a tertiary care center. The study included 300 Pregnant women who underwent Emergency or Elective Cesarean section fulfilling the inclusion and exclusion criteria.

The various factors that were assessed in this study were: history of any difficulty in subarachnoid block in previous surgeries if any, BMI, PREDIS scoring for Spine landmarks, presence or absence of any skeletal abnormalities of the Spine, Interspinous gap measured externally in cases where they were visualized or palpable. All these factors were individually analysed with the outcome factors:

need for senior or second person to administer block, number of skin punctures, number of spaces used, need for paraspinal approach, grading of ease of administering block- easy, moderate, difficult-based on the skin punctures and spaces used.

All the patients were pre operatively asked whether they had any painful experience of multiple skin pricks during subarachnoid block in their previous surgeries. This being a very subjective factor and also has recall bias, only 14 of 300 patients gave history of difficulty in previous Subarachnoid block. In our study this factor of difficulty in previous subarachnoid block was found to have a statistically significant relation with the need of a senior or second person to administer the block, number of punctures and number of spaces and the grading of ease of administering subarachnoid block. It was found that this factor didn't have a statistically significant relation with the need of paraspinal approach to administer subarachnoid block.

Though our study proves that the history of any difficulty in previous subarachnoid block to have a significant effect on the ease of administering subarachnoid block, it is inconsistent with results of the study "Predicting a difficulty score for spinal anaesthesia in transurethral lithotripsy surgery" by Khoshrang H et al,^[4] which concluded that there was no significant relationship between the

difficulty score for spinal anaesthesia and history of previous difficult spinal anaesthesia.

This may be because there is a significant recall bias in this factor. Further investigation specifically into the significance of this factor by proper documentation of the number of attempts, number of spaces used for every patient undergoing subarachnoid block will be useful to prove the results of our study.

PREDiction of Difficult Spinal by Yannick LE Manach,^[3] gives us a classification of the patients based on the spinal landmarks as follows: Class 1: Lumbar spinous process can be seen, Class 2: Lumbar spinous process can be easily found with palpation, Class 3: Lumbar spinous process cannot be easily found with palpation, but median structures are palpable, Class 4: Lumbar spinous processes cannot be found during palpation and median structures cannot be determined. So, in our study we have used this PREDIS classification to find the significance of spinal landmarks in the ease of administering subarachnoid block.

The results of our study show that the classification of the patients according to PREDIS has a statistically significant relationship with all the outcome factors (need for senior or 2nd person to administer block, number of punctures, number of spaces used, need of paraspinous approach and grading of ease of administering subarachnoid block)

In the study MM Atallah et al,^[2] they classified patients based on spinal bony landmarks as clear and unclear, and the results showed that spinal bony landmarks is an independent predictor of difficulty during spinal anaesthesia. In another study “Predicting difficulty score for spinal anaesthesia in transurethral lithotripsy surgery” by Khoshranf H et al,^[4] they classified the patients based on lumbar spinous process status as visible, palpable and invisible & impalpable. They also concludes that there was a significant relationship between difficulty score of spinal anaesthesia and the lumbar spinous process status. Similarly our results were consistent with the results of various studies like “Title predictors of difficult subarachnoid block” by Gvalani et al,^[5] and “Predictors of successful neuraxial block: a prospective study” by Oliveria et al⁶ which showed that the quality of the patients’ bony anatomical landmarks were predictors of difficult subarachnoid block.

Exaggerated lumbar lordosis itself is a physiological change in pregnancy. In our study we had 7 of 300 patients who had scoliosis. The results of our study showed that the presence of spinal abnormalities were not having a significant relationship with our various outcome factors like need for senior or second person to administer block, number of punctures, number of spaces used; but was found to have a significant relationship with the need of paraspinous approach. The results are inconsistent with many other studies which have established the significance of spinal bony deformity in relation to

the ease of administering subarachnoid block as an individual predictor¹ and also as a part of the scoring systems that had significant relationship with the ease of administering subarachnoid block.^[2,4,5] This may be due to the factor the significance of the other factors in the scoring system were helpful in establishing the significance of the scoring system. But it is important to note that presence of scoliosis is has a significant relationship with the need of paraspinous approach to administer subarachnoid block. ISG was measured with the patient in sitting position and the back held in flexion using a measuring tape between the most prominent point visualized on two adjacent lumbar spinous processes mostly L2-L3 or L3-L4. This measurement can be one only in patients having class 1, 2 PREDIS (ie where the spinous process is either visualized or palpable).^[6]

Ideal method for the measurement would have been by Ultrasonogram, but due to non availability of Ultrasonogram in the Operation theatre of the maternity hospitals, it was not feasible. Results of our study showed that the Interspinous gap had a significant relationship with the ease of performing subarachnoid block and the need of paraspinous approach, but not significant with the need of senior or a second person to administer the block.

The study “Correlation between spinous process dimensions and ease of spinal anaesthesia” by Hariharan Shankar et al,^[7] which concluded that the single independent predictor of ease or difficulty during spinal anaesthesia was ISG. As this factor is useful only in cases where spinous process is either visualized or palpable (ie PREDIS class 1 or 2) where the administration of subarachnoid block is easier as discussed earlier, further research with accurate radiological assessment of ISG and its relationship with ease of administering subarachnoid block will be more useful. Since most of the patients were shifted for Emergency cesarean section in stretcher trolleys, height and weight measurement at that point of time is difficult, so to maintain a standard measurement, the height and weight were noted from the antenatal card from the first antenatal visit and the BMI was measured. Results of our study show that BMI of the patients has a statistically significant relationship with the grading of ease of administering the block, need for paraspinous approach, and the need for a senior or a second person to administer the block. A study by Anirban Sadhu et al,^[8] a study on the ease of placement of spinal needle in relation to height, weight and BMI in a geriatric population in eastern India concluded that spinal anaesthesia is relatively easy in elderly patients with lesser height, weight and BMI. Many other studies are also consistent with our results showing that BMI is a significant predictor of ease of administering subarachnoid block individually or as a part of a scoring system.^[9,10] Further meta-analysis of studies on all these factors can help us develop an accurate

scoring system to determine the ease of administering subarachnoid block.

CONCLUSION

To conclude PREDIS classification (spinal landmarks), BMI, History of previous difficulty in subarachnoid block, Interspinous gap are significant predictors of ease of administering subarachnoid block.

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