Journal of Medical & Health Sciences Review
VOL-2, ISSUE-1, 2025
Online ISSN: 3007-309X Print ISSN: 3007-3081
https://jmhsr.com/index.php/jmhsr

COMPARISON OF SURFACE LANDMARK VS PRE-PROCEDURAL ULTRASONOGRAPHY ASSISTED MIDLINE APPROACH FOR IDENTIFICATION OF SUBARACHNOID SPACE IN ELECTIVE C SECTION

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ABSTRACT

OBJECTIVE: To compare the method of surface anatomical landmark with the method of pre-procedural ultrasonography assisted midline approach for identification of inter-spinous lumber level for spinal anesthesia in elective cesarean section cases.

STUDY DESIGN: Randomized Control Trial

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VOL-2, ISSUE-1, 2025
Online ISSN: 3007-309X Print ISSN: 3007-3081
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STUDY SETTING: Obstetric floor, department of anesthesia, Hayatabad Medical Complex Peshawar

DURATION OF STUDY: 6 months

SUBJECT AND METHODS:

All the patients due for elective C-sections under spinal anesthesia were enrolled in the study keeping in view the inclusion/ exclusion criteria. A written informed consent were obtained from all the enrolled patients. All the enrolled patients were divided into two groups, Group A being Ultrasound-guided technique and Group B being surface landmark-guided technique. During the procedure, parameters such as insertion attempts, passes and time taken for performing the procedure was recorded in both the groups. All the information obtained were recorded in a proforma attached.

RESULTS:

This study was conducted on 68 patients presented for elective C-section. Patients were divided into two group, 34 in each group. In group A (ultrasound) group the mean age of the patients was 29.12±5.9 years and in group B (landmark) group the mean age was 27.97±6.82 years. The mean no of insertion attempts in group A was 1.24±0.61 and in group B it was 2.79±1.99. The mean no of needles passes was 2.97±1.38 in group A and in group B it was 7.71±2.70. The mean procedural time in group A was 4.26±1.18 minutes and 6.26±2.09 minutes in group B. According to age distribution, in group A 18 (52.9%) patients were in the age group of 18 to 28 years and 16 (47.1%) in the age group of 29 to 40 years. In group B 19 (55.9%) patients belonged to the age group of 18 to 28 years and 15 (44.1%) belonged to the age group of 29 to 40 years. According to the comparison of first attempt success in both groups, 85.3% success rate was observed in group A and 47.1% success rate was observed in group B, the difference was statistically significant (P-value < 0.05).

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CONLCUSION:

From our study we conclude that preprocedural ultrasonography assisted midline approach is an effective method for identification of inter-spinous lumber level for spinal anesthesia in elective cesarean section cases as compared to the method of surface anatomical landamark. Preprocedural ultrasonography assisted midline approach had 85.3% first attempt success rate as compared to surface anatomical landmark method which had first attempt success rate of 47.1% (P-value < 0.05). The difference was statistically significant.

KEYWORDS: Surface anatomical landmark, Pre-procedural ultrasonography, Subarachnoid space, Cesarean section

INTRODUCTION

Spinal Anesthesia is considered as safe anesthetic technique in obstetric surgeries as it provides dense block, rapid onset & easy to perform the procedure of spinal block.[1] Its success depends on the proper identification of anatomical landmarks to enter in the subarachnoid space. However in pregnancy especially during labor pain it is very difficult for anesthesiologists to successfully identify & perform this block.[2] Lower segment cesarean section (LSCS) is the most commonly performed obstetric surgery and. spinal anesthesia is the most preferable block used during this procedure. For this technique a combination of parameters are used as a guide including surface anatomical landmark, the operator's perception of loss of resistance during spinal needle insertion, and/or visualizing the free flow of CSF in the spinal needle on its insertion in the subarachnoid space. Usually spinous processes are taken as anatomical surface land marks but in many patients, these are not always easily palpable due to so many reasons like in patients with edema, obesity, any spinal deformity, or previous spinal surgery. To overcome this technical difficulty, ultrasound of the spine is recently educated by some researchers to be useful method for identifying the exact place for the

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insertion of spinal needle to be placed in the subarachnoid space. [3] Li M et al compared the anatomical surface landmark technique with pre-puncture ultrasound examination. The success rate for first attempt was higher in ultrasound group as compared to surface landmark group i.e 87.5% vs 52.5%. In ultrasound group fewer cases requiring >10 needle passes as compared to surface landmark group i.e 1 vs 17. However difference in the time taken to identify the needle insertion site between the 2 groups was not statistically significant. Patient satisfaction score was statistically significant for ultrasound group. [4] Dhanger S et al studied 100 pregnant women undergoing elective caesarean section under spinal anesthesia. They were equally distributed into ultrasound group and surface landmark group. It was concluded that the number of attempts for needle insertion was 1.04 ± 0.19 in ultrasound group as compared to surface landmark group was 1.97 ± 0.77 i.e., these were significantly less in ultrasound group as compared to surface landmark group. [5] Urfalioğlu A et al randomized patients for cesarean section into two equal groups i.e., in landmark group and ultrasound group. The numbers of skin punctures and needle passes, total procedure time (TPT) and spinal block occurrence time (SBOT) were recorded in both groups. TPT was significantly longer in the ultrasound than in the landmark group (8 ± 2 and 5 ± 1 respectively). Whereas SBOT values were similar for both groups. The numbers of skin punctures and needle passes were significantly fewer in the ultrasound than in the landmark group.[6] The study will be helpful to investigate which method is better for identification of lumber inter-spinous level for spinal anesthesia in our population to prevent unnecessary pricking of the patient as this issue is never investigated in our local population. So we will be able to choose the better technique of the two for spinal anesthesia in elective C-section.

MATERIAL AND METHODS:

SETTING: Obstetric floor, department of anesthesia, Hayatabad Medical Complex Peshawar. **STUDY DESIGN:** Randomized Control Trial

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DURATION OF STUDY: Minimum of 6 months after approval of the synopsis

SAMPLE SIZE: Sample size will be 68 i.e. 34 for each group using first-attempt success rate in ultrasound group as 87.5 % & in surface landmark group as 52.5 % based on previous study[4] Significance level will be 5% and power will be 90% under WHO sample size calculation formula.

SAMPLING TECHNIQUE: Consecutive nonprobability sampling

Inclusion criteria

1. A normal singleton pregnancy
2. With gestational age of ≥37 weeks.
3. Patients having age 18-40 years
4. Obese ladies

Exclusion criteria

1. Those who refuse spinal anesthesia
2. Patients with spinal deformities,
3. History of past spinal surgery,
4. Patients having coagulopathy

DATA COLLECTION PROCEDURE: After getting approval of the synopsis from institute ethics committee & CPSP, all the patients due for elective C-sections under spinal anesthesia were enrolled in the study keeping in view the inclusion/ exclusion criteria. A written informed consent were obtained from all the enrolled patients. All the enrolled patients were divided into two groups, Group A being Ultrasound-guided technique and Group B being surface landmark-guided technique. All patients were given pre-medication as per departmental protocol and shifted in the left lateral position. In the operation theatre, after attaching all monitors (non-invasive blood pressure, pulse oximetry and electrocardiogram) and recording baseline parameters, intravenous access were established and the patients were positioned in sitting posture or left lateral position depending on patient comfort. In Group B L3–L4 interspace were

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identified by traditional landmark technique and time taken for the identification of the interspace (time from which the anesthesiologist started palpating to identify the landmark to completion of palpation) were noted. In Group A ultrasound, curvilinear probe (3–6 MHz) of portable ultrasound machine was used for pre-procedural marking. At this selected interspace, the probe was positioned in transverse view and a skin marker was used to mark the midpoint of the long and short borders of the probe. The point of intersection of both lines was identified as the needle entry point. Time taken for identification of the interspace (the time from when ultrasound probe is placed on the patient to completion of marking was noted. Spinal anesthesia was given with 25-G, point needle in both groups. During the procedure, parameters such as insertion attempts, passes and time taken for performing the procedure was recorded in both the groups. All the information obtained were recorded in a proforma attached.

STATISTICAL ANALYSIS: All the analysis were done in SPSS 21. Mean and standard deviation were computed for numeric variables like age, number of insertion attempts, number of needle passes and total procedural time. Frequencies and percentages were calculated for categorical variable like first attempt success, parity & education status (uneducated, educated). First attempt success rate was stratified among age, parity & education status (uneducated, educated) to see the effect modifiers. Post stratification Chi-square test will be applied and P-value <0.05 will be taken as significant. Chi-square Test was applied to compare outcome in both groups, keeping p-value < 0.05 as significant. All the results were presented as tables and graphs.

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RESULTS:

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TABLE 1 DESCRIPTIVE STATISTICS

Variables	Groups			
	Group A (Ultrasound)		Group B (Landmark) Total	
	Mean	Std. Deviation	Mean	Std. Deviation
Age in years	29.12	5.968	27.97	6.825
No of insertion attempts	1.24	0.61	2.79	1.99
No of needle passes	2.97	1.381	7.71	2.703
Total procedural time (m)	4.26	1.189	6.26	2.093

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TABLE 2 AGE DISTRIBUTION

		Age distribution		Total
		18 to 28	29 to 40	
Groups	Group A (Ultrasound)	18	16	34
		52.9%	47.1%	100.0%
	Group B (Landmark)	19	15	34
		55.9%	44.1%	100.0%
Total		37	31	68
		54.4%	45.6%	100.0%

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TABLE 3 COMPARISON OF FIRST ATTEMPT SUCCESS IN BOTH GROUPS

		First attempt success		Total	P value
		Yes	No		
Groups	Group A (Ultrasound)	29	5	34	0.001
		85.3%	14.7%	100.0%	
	Group B (Landmark)	16	18	34	
		47.1%	52.9%	100.0%	
Total		45	23	68	
		66.2%	33.8%	100.0%	

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TABLE 4 FREQUENCY OF PARITY IN BOTH GROUPS

		Parity		Total
		< 2	> 2	
Groups	Group A (Ultrasound)	22	12	34
		64.7%	35.3%	100.0%
	Group B (Landmark)	20	14	34
		58.8%	41.2%	100.0%
Total		42	26	68
		61.8%	38.2%	100.0%

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TABLE 5 EDUCATON STATUS IN BOTH GROUPS

		Education status		Total
		Educated	Uneducated	
Groups	Group A (Ultrasound)	21	13	34
		61.8%	38.2%	100.0%
	Group B (Landmark)	18	16	34
		52.9%	47.1%	100.0%
Total		39	29	68
		57.4%	42.6%	100.0%

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TABLE 6 STRATIFICATION OF FIRST ATTEMPT SUCCESS IN BOTH GROUPS W.R.T AGE

Age distribution			First attempt success		Total	P value
			Yes	No		
18 to 28	Groups	Group A (Ultrasound)	14	4	18	0.01
			77.8%	22.2%	100.0%	
		Group B (Landmark)	7	12	19	
			36.8%	63.2%	100.0%	
	Total		21	16	37	
			56.8%	43.2%	100.0%	
29 to 40	Groups	Group A (Ultrasound)	15	1	16	0.02
			93.8%	6.2%	100.0%	
		Group B (Landmark)	9	6	15	
			60.0%	40.0%	100.0%	
	Total		24	7	31	
			77.4%	22.6%	100.0%	

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TABLE 7 STRATIFICATION OF FIRST ATTEMPT SUCCESS IN BOTH GROUPS W.R.T PARITY

Parity			First attempt success		Total	P value
			Yes	No		
< 2	Groups	Group A (Ultrasound)	18	4	22	0.02
			81.8%	18.2%	100.0%	
		Group B (Landmark)	10	10	20	
			50.0%	50.0%	100.0%	
	Total		28	14	42	
			66.7%	33.3%	100.0%	
> 2	Groups	Group A (Ultrasound)	11	1	12	0.009
			91.7%	8.3%	100.0%	
		Group B (Landmark)	6	8	14	
			42.9%	57.1%	100.0%	
	Total		17	9	26	
			65.4%	34.6%	100.0%	

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TABLE 8 STRATIFICATION OF FIRST ATTEMPT SUCCESS IN BOTH GROUPS W.R.T EDUCATION STATUS

Education status			First attempt success		Total	P value
			Yes	No		
Educated	Groups	Group A (Ultrasound)	18	3	21	0.002
			85.7%	14.3%	100.0%	
		Group B (Landmark)	7	11	18	
			38.9%	61.1%	100.0%	
	Total		25	14	39	
			64.1%	35.9%	100.0%	
Uneducated	Groups	Group A (Ultrasound)	11	2	13	0.10
			84.6%	15.4%	100.0%	
		Group B (Landmark)	9	7	16	
			56.2%	43.8%	100.0%	
	Total		20	9	29	
			69.0%	31.0%	100.0%	

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DISCUSSION:

One of the most popular procedures used in obstetric anaesthesia is spinal anaesthesia, which requires on the accurate identification of anatomical landmarks. The natural anatomical alterations of pregnancy and labour pain, on the other hand, present a significant difficulty to anaesthesiologists in achieving a successful subarachnoid block. Because of the difficulties in detecting the image via the tiny acoustic windows formed by the bone framework of the spine, the use of ultrasound for the central neuraxial block is still unappreciated[7].

The ideal way for providing spinal anaesthesia is via a single skin puncture with no needle redirection, according to the Second American Society of Regional Anesthesia Consensus on Neuraxial Anesthesia and Anticoagulation[8]. In this case, neuraxial ultrasound tests may help with patient evaluations before to spinal anaesthesia. Palpation based on anatomic landmarks has been demonstrated to be ineffective at identifying related interspaces, which can result in unintended intracord injection, resulting in spinal cord injury and long-term neurological consequences. Ultrasound guidance has increased the precision and efficacy of neuraxial anaesthetic procedures, according to a recent meta-analysis[9].

In epidural blockade, preoperative ultrasound allows for the determination of skin-epidural distance, midline, and needle insertion site, as well as reducing the number of skin punctures required and increasing blockage success rates to as high as 71 % compared to 20 % for the traditional loss of resistance method. The use of ultrasonography has been found to reduce the incidence of post-dural headache and the rate of vascular puncture[10]. Balki et al. reported that ultrasound use in epidural blockade increased the success rate of first needle introduction by 30%–60% than conventional landmark methods and reduced the difficulty of epidural catheter insertion[11]. Preoperative ultrasound examination prior to spinal anaesthesia decreases the number of skin punctures required; therefore, significantly increases the success rate of the first attempt at needle introduction

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than the conventional landmark method owing to the visualisation of vertebral structures and accurate determination of the needle insertion site.

Our findings show that when ultrasonography was used instead of a landmark, the number of skin punctures and needle passes was reduced. Our findings are comparable to those of other studies. Ultrasound was found to be more accurate than palpation in identifying lumbar interspaces and reducing the number of attempts required to deliver the block in a research[12]. In our study the number of insertion attempts in ultrasound group vs landmark group was 1.24±0.61 vs 2.79±1.99, which is comparable to a study by Dhanger S et al[5] which showed that the number of attempts for needle insertion was 1.04 ± 0.19 in ultrasound group as compared to surface landmark group was 1.97 ± 0.77.

The first-time success rate in our study was 85.3% in the ultrasound group and 47.1% in the landmark group, the difference was statistically significant (P-value < 0.05), which was identical to a study by Lim et al[13]. When compared to a standard landmark-based technique, Grau et al[14]. found that using real-time ultrasound guidance for simultaneous spinal–epidural insertion in a younger obstetric cohort considerably reduced the number of needle passes required. Our results are also comparable to a study[6] in which the success rate for first attempt was higher in ultrasound group as compared to surface landmark group i.e 87.5% vs 52.5%. In a study by Dhanger S et al[5,] it was reported that the success rate of first attempt was 96% in ultrasound group and 30% in landmark group thus further validating our findings. When compared to a traditional landmark-based midline approach, our study found that using a pre-procedural ultrasound-guided midline spinal technique resulted in a significant reduction in the number of attempts and passes required for successful spinal anaesthesia in patients undergoing caesarean section.

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CONCLUSION:

From our study we conclude that preprocedural ultrasonography assisted midline approach is an effective method for identification of inter-spinous lumber level for spinal anesthesia in elective cesarean section cases as compared to the method of surface anatomical landamark. Preprocedural ultrasonography assisted midline approach had 85.3% first attempt success rate as compared to surface anatomical landmark method which had first attempt success rate of 47.1%. The difference was statistically significant.

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