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Original Research Article

To find out the difference in the number of passes between landmark-guided midline and preprocedure ultrasound-guided paramedian techniques in spinal anesthesia

Dr. Bhavekar Nivedita Pramodrao[1] (Assistant Professor), Dr. Vikas Kumar Sharma[2] (Senior Resident), Dr. Shailesh Mishra[3] (Assistant Professor) & Dr. Swati Vijaykumar Nimje[4] (Resident)

Department of Anesthesiology, Dr. Vithalrao Vikhe Patil Foundation's Medical College & Hospital, Ahamadnagar, Maharashtra[1]
Department of Anaesthesiology, Sawai Man Singh Medical College & Attached Hospitals, Jaipur, Rajasthan[2]
Department of Anaesthesiology, People's College of Medical Sciences and Research Center, Bhopal[3]
Department of Anaesthesiology, Government Medical College, Akola, Maharashtra[4]
Corresponding Author: Dr. Bhavekar Nivedita Pramodrao

Abstract:
Background & Method: The aim of the study is to find out the difference in the number of passes between landmark-guided midline and preprocedure ultrasound-guided paramedian techniques in spinal anesthesia. . After obtaining ethical committee approval, 128 patients satisfying inclusion and exclusion criteria were recruited for the study. All consented patients scheduled to undergo elective surgery like TKR, THR, TURP, URSL, hernioplasty under spinal anaesthesia were included in this study. Informed written consent was obtained from all patients before procedure.
Result: Time for identifying landmark in second was noted between two groups and analysis was done. It was found that time for identifying landmark in second in group A (14.91 ± 3.5) was very much less than the group B (92.55 ± 18.25) and this difference was statistically significant ($p < 0.001$).
After positioning and prior to administration of sedation patients were asked for their periprocedural pain scores measured using 11point verbal rating scale (0=no pain ,10=most pain imaginable). In our study periprocedural VAS score in group A was 3.11 ± 1.1 while in group B it was found to be 2.94 ± 0.77.
Conclusion: The use of paramedian spinal anaesthesia guided by ultrasound scanning for the identification of landmarks significantly decreases the number of passes and attempts to enter into the subarachnoid space and gave better patient satisfaction.

Keywords: midline, preprocedure, ultrasound-guided, paramedian & spinal anesthesia.

Study Designed: Randomized comparative Study.

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1. Introduction

Spinal anesthesia also called sub arachnoid block is a form regional anesthesia involving the injection of local anesthetic into the subarachnoid space.
Dr. August Karl Gustav Bier was credited for the administration of first SAB in 1898. SAB & EB had been approached via midline technique. Subsequently, paramedian approach (PMA) was described by many authors. The "lumbosacral puncture" was first described by Taylor JA in 1940 & truly is a special variant of the conventional PMA[1].
At present spinal anesthesia is widely used by the clinical anaesthesiologists due to its procedural simplicity, low cost & better physiological benefits. Spinal anesthesia may be useful when patients wish to remain conscious or when comorbidities such as severe respiratory disease or a difficult airway increase the risks of using general anesthesia[2].
Spinal anesthesia is most commonly used for patients who require surgical anesthesia for procedures of known duration that involve the lower extremities, perineum, pelvic girdle, or lower abdomen.
Subarachnoid space can be traversed from the posterior aspect of the body either through a midline approach (MA) or a paramedian approach (PMA). Till date spinal anaesthesia is mostly performed using a surface landmark based 'blind' midline technique. This approach is technically difficult in the geriatric patients because of degenerative changes in the spine. Calcification of supraspinous and interspinous ligaments in the geriatric age group makes midline approach difficult[3]. The use of large gauge spinal needles and introducer needles have their own detrimental effects. Modern regional anaesthesia practice demands least discomfort to patient.
In the midline technique, the needle is inserted below the lower edge of the spinous process of the selected upper vertebrae and passes through the skin, subcutaneous tissue, supraspinous ligament, interspinous ligament, ligamentum flavum as well as the epidural space until it reaches dura arachnoids and pierces it. In paramedian technique, needle is inserted 1cm and 1cm caudal to the caudal edge of more superior process with approximately is degree of the sagittal plane. In this technique, interspinous and supraspinous ligaments are put aside, and ligamentum flavum is the first resistance with which one might encounter[4].
There is some definitive limitation of midline approach like repeated attempts, advanced degenerative joint disease, severe arthritis of vertebral column, kyphoscoliosis, calcified spinal ligaments, previous spinal surgery, difficulty in flexing the spine, non-cooperative patients, hyperaesthetic patients., vertebral interspace difficult to feel, e.g. obese or oedematous patients, or no assistants available for positioning the patient[5]. To overcome above limitations, we need paramedian approach. There is another approach described as 'lumbosacral puncture' or Taylor's approach, which actually is a variant of conventional paramedian approach[6].

2. Material & Method

Present study was conducted at NH Rabindranath Tagore International Institute of Cardiac Sciences, 124 Mukundapur EM Bypass, Kolkata a tertiary level multi-specialty hospital in Kolkata.
Patients undergoing surgeries like total knee replacement (TKR) and total hip replacement (THR), inguinal hernia, urological procedures like transurethral resection of prostate (TURP), ureteroscopic lithotripsy (URSL) etc. between the age group of 20 to 80 years of age under the spinal anesthesia.

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A prospective, randomized, comparative study was done in the department of Anesthesiology of Rabindranath Tagore International Institute of Cardiac Sciences, Mukundapur, Kolkata from March 2016 to February 2017 in period of 1 year. The approval of ethical committee and scientific committee was obtained prior to study. After obtaining ethical committee approval, 128 patients satisfying inclusion and exclusion criteria were recruited for the study. All consented patients scheduled to undergo elective surgery like TKR, THR, TURP, URSL, hernioplasty under spinal anaesthesia were included in this study. Informed written consent was obtained from all patients before procedure.

INCLUSION CRITERIA:

1. The patients between the age group 20 to 80 years willing to give consent for surgeries like, Total knee replacement(TKR), Total hip replacement(THR), Transurethral resection of prostate(TURP), Ureteroscopic lithotripsy (URSL), Hernioplasty Under spinal anaesthesia.

EXCLUSION CRITERIA:

Patients with

1. Allergy to local anaesthetics.
2. Bleeding diathesis and coagulopathy.
3. Severe hypovolemic state.
4. Infection at the site of injection.
5. Pre-existing neurological deficits
6. Previous spine surgery

3. Results

Table-1: Age group wise distribution of population in the study

		GROUP		Total		
		Group A	Group B		p Value	Significance
Age	21-30	2(3.13)	3(4.69)	5(3.91)	0.664	Not Significant
	31-40	5(7.81)	4(6.25)	9(7.03)		
	41-50	9(14.06)	6(9.38)	15(11.72)		
	51-60	23(35.94)	17(26.56)	40(31.25)		
	61-70	22(34.38)	29(45.31)	51(39.84)		
	71-80	3(4.69)	5(7.81)	8(6.25)		
Total		64(100)	64(100)	128(100)		

In our study we have included the patients of age group 20-80 years of age. Overall including both group most patients were in age group 61-70 years (39.84%), followed by 51-60 years (31.25%). The patients in age group 21-30, 31-40, 41-50, 51-60, 61-70, and 71-80 were 3.91%, 7.03%, 11.72%, 31.25%, 39.84% and 6.25% respectively.

In group A The patients in age group 21-30, 31-40, 41-50, 51-60, 61-70, and 71-80 were 3.13%, 7.81%, 14.06%, 35.94%, 34.38% and 4.69% respectively.

In group B The patients in age group 21-30, 31-40, 41-50, 51-60, 61-70, and 71-80 were 4.69%, 6.25%, 9.38%, 26.56%, 45.31% and 7.81% respectively.

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Table-2: distribution of patients in two groups by height

	GROUP			
	Group A	Group B		
	Mean ± Std. Deviation	Mean ± Std. Deviation	p Value	Significance
Height(Cm)	164.59 ± 5.64	164.02 ± 5.58	0.624	Not Significant

The height in cm (mean ± SD) of the patients in group A was 164.59 ± 5.64 cm while in group B was 164.02 ± 5.58 cm (p=0.624), so there is no significant difference in height in two groups.

Table-3: distribution of patients in two groups by BMI

	GROUP			
	Group A	Group B		
	Mean ± Std. Deviation	Mean ± Std. Deviation	p Value	Significance
BMI(Kg/M²)	27.52 ± 2.29	27.86 ± 3.16	0.327	Not Significant

The BMI in Kg/M^2 (mean ± SD) of the patients in group A was 27.52 ± 2.29 Kg/M^2 while in group B was 27.86 ± 3.16 kg/M^2 (p=0.327), so there is no significant difference in BMI in two groups.

Table-4: Time for Identifying Landmarks in two groups

	GROUP			
	Group A	Group B		
	Mean ± Std. Deviation	Mean ± Std. Deviation	p Value	Significance

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Time For Identifying Landmark in seconds	14.91 ± 3.5	92.55 ± 18.25	<0.001	Significant

Time for identifying landmark in second was noted between two groups and analysis was done. It was found that time for identifying landmark in second in group A (14.91 ± 3.5) was very much less than the group B (92.55 ± 18.25) and this difference was statistically significant ($p < 0.001$).

Table-5: Periprocedural VAS Score

		GROUP		Total		
		Group A	Group B		p Value	Significance
Periprocedural VAS Score	1	2(3.13)	0(0)	2(1.56)	0.056	Not Significant
	2	19(29.69)	19(29.69)	38(29.69)		
	3	23(35.94)	32(50)	55(42.97)		
	4	10(15.63)	11(17.19)	21(16.41)		
	5	10(15.63)	2(3.13)	12(9.38)		
Total		64(100)	64(100)	128(100)		

After positioning and prior to administration of sedation patients were asked for their periprocedural pain scores measured using 11point verbal rating scale (0=no pain ,10=most pain imaginable). In our study periprocedural VAS score in group A was 3.11 ± 1.1 while in group B it was found to be 2.94 ± 0.77.

4. Discussion

The standard technique of spinal anesthesia that is currently practiced is essentially a conventional ‘blind’ technique based on palpable landmarks. The spinal needle is advanced towards the dura with reliance on tactile feedback, pops, clicks and bony resistance. If the initial needle pass fails, success with subsequent passes relies on the ability to appropriately redirect the needle based on the operator’s anatomical knowledge and experience[7]. Traditional techniques can be challenging in patients with poorly palpable surface landmarks, age-related changes or abnormal spinal anatomy. Although a higher BMI is not an independent indicator of difficult spinal anesthesia, those with poorly palpable bony landmarks are predictive of multiple needle passes and longer procedural times. In addition, neuraxial anesthesia in elderly patients may be challenging owing to the presence of osteophytes and narrowing of the disc spaces[8].

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Early evidence suggests that ultrasound guided spinal anesthesia may be particularly beneficial in patients with poor bony landmarks. In addition, ultrasonography in patients with normal anatomy or abnormal anatomy allows for a more accurate determination of the level of needle insertion than palpation of surface landmarks alone, and enables the prediction of depth with a high degree of accuracy. Preprocedural ultrasonography has also been shown to facilitate needle insertion in a number of populations including obstetric patients, older orthopedic patients and patients with complex anatomy.

Preprocedural ultrasound scanning involves identification of the spinous processes, laminae and dura and provides useful information on the depth and optimal angle from the skin to the neuraxial space. The two standard views are the transverse and parasagittal views that would allow for identification of an ideal trajectory to the dura. Once the target is centered on the image, the skin is marked at the estimated center of the transducer. Although preprocedural ultrasound imaging of the lumbar spine can help by providing additional anatomical information, the actual needle insertion remains a 'blind' technique[9].

A study by Chin et al, in 2013 on use of ultrasound to facilitates spinal anaesthesia for total joint arthroplasty shows that ultrasound imaging of the lumber spine can be useful to detect absence of technical difficulties in performing dural puncture and thus selecting optimal intervertebral level for spinal anaesthesia in the older orthopedic population.

5. Conclusion

The use of paramedian spinal anaesthesia guided by ultrasound scanning for the identification of landmarks significantly decreases the number of passes and attempts to enter into the subarachnoid space and gave better patient satisfaction. Spinal anesthesia is widely used by the anaesthesiologists due to its procedural simplicity, low cost & better physiological benefits. Spinal anesthesia may be useful when patients wish to remain conscious or when comorbidities such as severe respiratory disease or a difficult airway increase the risks of using general anesthesia.

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