



COMPARISON OF ULTRASOUND GUIDED MARKING FOR PARAMEDIAN APPROACH VERSUS MIDLINE APPROACH AT L5-S1 ON THE SUCCESS OF SUBARACHNOID BLOCK

Anaesthesiology

Sridivya Vemulapalli

MBBS, MD, Senior Resident, Seth GSMC and KEM Hospital, Mumbai

Rajendra Patel

MBBS, DA, MD, Professor, Seth GSMC and KEM Hospital, Mumbai

Saheel Borse

MBBS, MD, Seth GSMC and KEM Hospital, Mumbai

ABSTRACT

Background and Aims: Introduction of ultrasound for central neuraxial blockade has been revolutionary in the field of regional anaesthesia. It not only helps in identifying the specific level easily but also avoids unanticipated difficulties and improves patient's comfort. We hypothesised that the routine use of pre-procedure ultrasound-guided marking may reduce the number of passes and attempts. **Material & Methods:** Eighty consenting patients scheduled for elective general surgeries were randomised into two groups by seal envelope method, and pre-procedure ultrasound-guided marking was used for paramedian approach in Group P, and midline approach was used in Group M at L5-S1 interspace. **Results:** We found that the first pass success rate (primary outcome) was significantly greater in the midline approach group (Group M) (29, 72.5 %) than in paramedian approach (group P) (19, 47.5%; $p < 0.05$). We also found in the group with midline approach total 38 (95%) participants had successful procedure and in group with paramedian approach only 24 (60%) participants had successful procedure in the first attempt, this difference was statistically significant. **Conclusion:** In view of pre-procedure ultrasound marking guided number of passes, attempts and complications at L5-S1, the midline group is found to be better than the paramedian group.

KEYWORDS

attempt, pass, pre-procedure, L5-S1, ultrasound.

INTRODUCTION

Spinal anaesthesia is commonly performed for many therapeutic and diagnostic procedures. It is a common technique of regional anaesthesia being used for lower abdominal and lower limb surgeries (1) Taking multiple attempts may lead to complications and long-term disability. Compared to other techniques, spinal anaesthesia shows a clear endpoint where the free flow of cerebrospinal fluid is indicative of correct placement of the spinal needle (2). Ultrasound scanning is a comparatively newer technique that may prove advantageous to guide the placement of the needle for the central neuraxial blockade and can even be beneficial in patients whose landmarks are difficult to identify due to abnormal spine anatomy or obesity. This technique is non-invasive and safe (3) The use of ultrasound is a rapidly advancing field and is also one of the most frequently used imaging modalities (4) While scanning, one can locate the midline and identify the lumbar interspace. L5-S1 interspace is known to be the widest interlaminar space and the patient's inability to flex does not affect this space. Case reports on landmark guided techniques suggested high success rates with the L5-S1 paramedian approach (Taylor's approach) (5) (6) (7) (8). Hence, we hypothesized that the routine use of pre-procedure ultrasound-guided marking may reduce the number of passes in the paramedian approach compared to the midline approach at L5S1.

METHODOLOGY

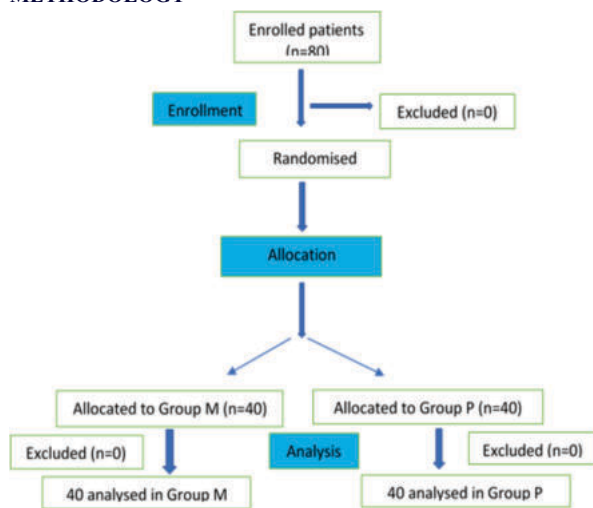


Figure 1: Recruitment of study

A pass is defined as the number of forward advancements of the spinal needle i.e., withdrawal and redirection of the spinal needle without exiting the skin. Any backward needle movement, followed by a forward movement without removing the needle from the skin, is considered a redirection. First pass success is considered when the spinal needle is inserted once and successful, with no redirections. Second pass is considered when the needle is inserted once but redirected again. An attempt is defined as the number of times the spinal needle was withdrawn from the skin and reinserted. Needle insertion is defined as an individual skin puncture. We considered both first and second pass for successful completion of subarachnoid block in the first attempt as the needle is redirected and not withdrawn out of the skin. Whenever the needle is withdrawn out of the skin and a new puncture is taken, it is counted as a second attempt.

All consented patients, between the age group of 35-55y scheduled for general surgeries requiring spinal anaesthesia are included. A curvilinear probe (3–6 MHz) of a portable ultrasound machine is used for marking.



Figure 2.A- Skin marking made with the probe positioned to get the best parasagittal oblique view. 2.B- Midpoint of the long border of probe marked in Transverse median view



Figure 3.A- Parasagittal oblique view at L5. 3.B-Transverse median view at L5-S1

In Group P, for the paramedian approach, the sacrum was identified first in parasagittal oblique view following which the interlaminar space between L5 and S1 was noted. The skin entry point is marked with a skin marker at the intersection of the lines joining the midpoint of the long border of the probe and the midpoint of the short border of the probe marked during parasagittal oblique view. The midpoint of the long border of the probe in the transverse median view is used to aid the medial angulation of the needle in addition to the probe angle in the parasagittal oblique view. (figure 2) (figure3)

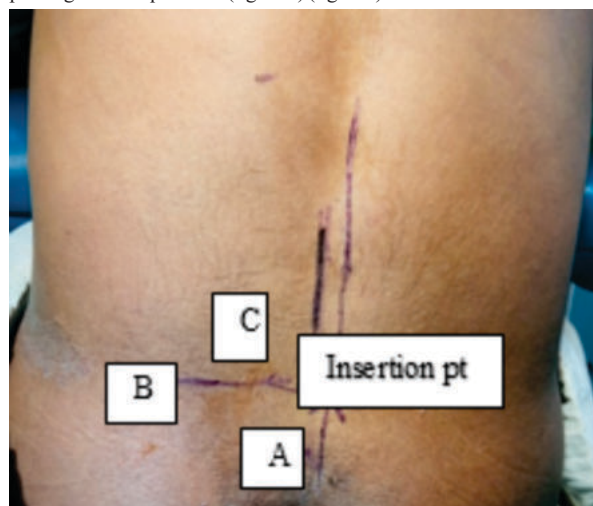


Figure 4- Skin markings: A- Midpoint of the short border of the probe in PSO view B-Midpoint of the Long border of the probe in PSO view C- Midpoint of the Long border of the probe in Transverse median view provides angulation. (Group P)

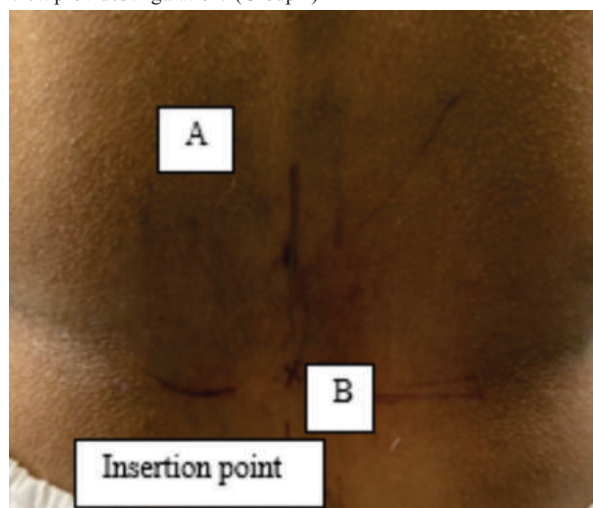


Figure 5- Skin marks made at the midpoint of the probe's long and short edges, the intersection of which provides an appropriate needle insertion point for a midline approach to intrathecal space. A- midpoint of the long border of the probe, B- the midpoint of the short border of the probe. (Group M)

For the midline approach in Group M, the L5-S1 is first identified in the Longitudinal view, and the skin markings were made at the midline of the long and short borders. The probe is rotated in the midline 90 degrees to obtain a transverse laminar view, and skin markings were made at the long and short borders of the probe, the intersection of which provided the entry point of the needle. (figure 4) (figure5). The primary outcome was successful dural puncture in the first pass. Secondary outcomes included- within first two passes, a first attempt and within first two attempts, pulse (baseline, during and after the procedure), blood pressure (baseline, during and after the procedure), complications encountered during the procedure such as hypotension, bradycardia, frank blood in the spinal needle, failure to perform spinal anaesthesia and conversion to General Anaesthesia. Data is visually inspected for normality and Shapiro-Wilks's test will be done to check for normal distribution.

RESULTS

We screened a total of eighty patients. The final number of patients included was 40 patients for each group. No patients were lost to follow-up.

Table 1- Patient's Characteristics In Group M And Group P – Mean Distribution

Variable	Group M	Group P	p value
Age	43.3±9.11	40.03±5.06	0.024
Height (cm)	65.53 ±6.80	63.63 ± 6.03	
Weight (kg)	166.58 ±6.74	164.93± 6.322	
BMI	23.59± 1.67	23.48 ±1.86	

Table 2- Distribution Of The Study Subjects Based On The Successful Dural Puncture On First Pass (%)

Variable		Group M (n=40)		Group P (n=40)		p-Value
Primary outcome		No.	Percentage	No.	Percentage	
A successful dural puncture on the first pass	Yes	29	72.5%	19	47.5%	<0.05*
	No	11	27.5%	21	52.5%	

No.- number, %- Percentage, p value= <0.05, significant

Table 3 – Secondary Outcomes

Table 5. Secondary Outcomes						
Variable		Group M (n=40)		Group P (n=40)		p-Value
Secondary outcome		No.	%	No.	%	
Successful dural puncture in the first attempt	yes	38	95	24	60	p=<0.05*
	no	2	5	16	40	
Successful dural puncture in the first attempt	yes	38	95	24	60	p=<0.05*
	no	2	5	16	40	
Successful dural puncture in the second attempt	yes	2	100	12	75	p=0.422
	no	0		4	25	

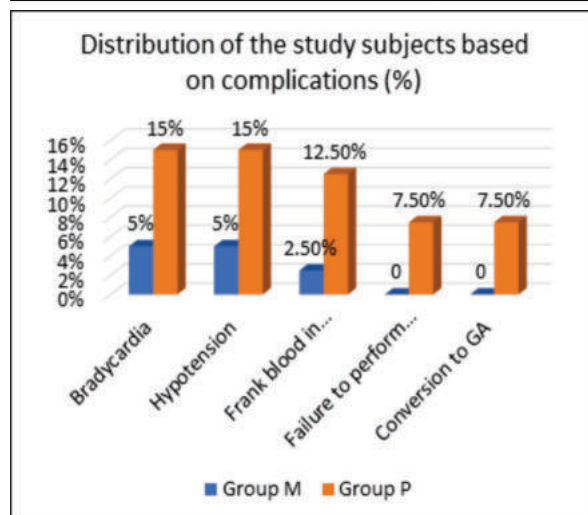


Figure 6- Distribution Of Complications Associated With The Procedure. no.- Number, %- Percentage, P Value= 0.231, Not Significant

We compared first pass and second pass independently for successful completion of the subarachnoid block, we found that the first pass success rate (primary outcome) was significantly greater in the midline approach group. (Group M) than in the paramedian approach (group P). Participants in whom the first pass was unsuccessful needle insertion on second pass was compared. In comparison, the second pass success rate was also significantly greater in the midline approach group than in the paramedian approach. In the first attempt, we considered both the first and second pass for successful completion of the subarachnoid block, we found in the group with midline approach the first attempt and second attempt success rate was higher than the paramedian group, this difference was found to be statistically significant.

More complications were observed in patients in group P compared to Group M. But this was not found to be statistically significant. Patients with complications were followed-up to 24 hours as per hospital protocol with no consequences.

DISCUSSION

One of the recent technological advances in the field of anaesthesia is ultrasound imaging. An ultrasound machine is now an integral part of modern anaesthesia practice (9). Spinal ultrasonography is relatively a new topic of interest. Spinal anaesthesia is traditionally performed using landmark-based techniques. The use of ultrasound imaging has shown to be superior to clinical palpation as a method of identifying the intervertebral space in elderly and obese patients where palpation of landmarks is difficult. The needle insertion point and the marking for the same can be determined by ultrasound examination (10). It is observed to reduce the number of puncture attempts. Multiple needle passes are associated with minor and major hemorrhagic complications and post-dural puncture headaches (11). There is limited data regarding the efficiency of this technique in routine operative cases needing intrathecal anaesthesia. A study conducted by Marwan S Rizk et al, found that successful dural punctures in first pass and first attempt was more in the ultrasound midline group than the ultrasound paramedian group. Similar studies conducted by Anil et al, and Srinivas et al found that the first pass and first attempt success rate was more in the ultrasound group compared to the landmark group. (12). In our study, we observed that successful dural puncture in the first pass is observed in 72.5% of the patients in Group M (midline group) and 47.5% of the patients in Group P (paramedian group) p value < 0.05. Successful dural puncture observed in the second pass was 81.8% in Group M, and 23.8% in Group P, with p value < 0.05. Showing that the midline group had a better outcome compared to the paramedian group, consistent with the above study. Srinivas et al also concluded that use of preprocedural ultrasound-guided spinal technique resulted in a >50% reduction in the number of passes required for success compared with a conventional landmark-based approach (13). In the study conducted by Marwan S Rizk et al, a successful dural puncture in the first attempt was observed in 77% cases in Group LM (landmark midline), and 42% cases in Group UP (ultrasound paramedian) and 73% cases in Group UM (ultrasound midline) with a p -value of < 0.001, showing that first attempt and overall success rates of dural puncture in the midline ultrasound group and landmark midline group were not significantly different and were higher than the rates achieved with pre-procedural ultrasound-guided paramedian spinal technique (14). We found in the group with midline approach total of 38 (95%) participants had a successful procedure and in the group with paramedian approach only 24 (60%) participants had a successful procedure in the first attempt, this difference was found to be statistically significant. Only (2, 5%) patients in group M required a second attempt for successful procedure compared to (16, 40%) in group P. All the patients in Group M had a successful second attempt, while (12, 75%) had a successful second attempt. (Table 2), (Table 3). In terms of complications, in the study done by Srinivasan et al, alternative techniques were employed in three patients in group C (landmark midline) and five patients in group P (ultrasound paramedian). (13). In the study done by Marwan S Rizk, more complications occurred in group UP (ultrasound paramedian) than ultrasound midline and landmark midline groups (14). In our study, more complications bradycardia (6, 15%), hypotension (6, 15%), and frank blood in spindle needle (5, 12.5%) were observed in patients in group P compared to Group M 5%, 5% and 0 respectively. All the patients achieved complete sensory block in Group M while in four patients alternative method of achieving spinal anaesthesia was performed, out of which 3 (7.5%) patients of group P spinal block was not achieved and hence had to be converted to General Anaesthesia. (Table 4)

CONCLUSION

Hence, we conclude, in view of pre-procedure ultrasound marking guided number of passes and number of attempts at L5-S1, the midline group is better than the paramedian group. Lesser number of complications were observed in the midline group compared to paramedian group.

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