

Comparison of Success Rates and Complications of Midline and Paramedian Approaches of Spinal Anaesthesia

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ABSTRACT

BACKGROUND

Neuraxial blockade has a wide range of clinical applications in the field of surgery, obstetrics and even pain management. The technique of spinal anaesthesia is simple and has high success rate and hence is most commonly performed in many institutions. It can be given in two approaches midline and paramedian but is associated with technical difficulties in elderly patients due to calcified interspinous ligaments. Hence, this study was conducted to compare the efficacies of both the approaches in elderly.

METHODS

160 patients of either sex above 50 yrs. of age belonging to ASA PS I-II posted for elective surgery under spinal anaesthesia were included in this observational study and were randomly divided into 2 groups of 80 in each group. M-SAB was done by midline approach group. P-SAB was done by paramedian approach. First attempt success rates were noted. Patients were followed up for 2 days postoperatively for signs of post dural puncture headache. Data was analysed with SPSS version 20.0.

RESULTS

Age, height and weight were compared between the two groups and the difference was found to be statistically insignificant. First attempt success rates were significantly higher in paramedian group (97.5 %) compared with midline (86.3 %) spinal. Incidence of PDPH (Post-Dural-Puncture Headache) was more in midline group (6.3 %) than paramedian group (2.5 %) but the result was statistically insignificant. Haemorrhagic tap was found in 5 out of 80 patients in midline group which was statistically significant. No paraesthesia or hematoma were noted. There were no complications.

CONCLUSIONS

Paramedian approach of lumbar puncture is superior to the conventional midline approach in elderly patients with regard to first attempt success rates and other complications.

KEY WORDS

Spinal Anaesthesia, Midline Approach, Paramedian Approach, Success Rates

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BACKGROUND

Central neuraxial anaesthesia greatly expands the anaesthesiologists armamentarium providing the alternative to general anaesthesia. This technique by blunting the neuro endocrine stress response, reduces the incidence of major perioperative complications. Another importance of subarachnoid blockade is with a small volume of drug profound sympathetic, sensory and motor blockade necessary for surgery is very well obtained. This feature along with its high success rate and simplicity makes it the most commonly preferred regional anaesthetic technique. It can be given by either median or paramedian approach.¹ For the midline approach, the desired interspace is palpated and local anaesthetic is injected into the skin and subcutaneous tissue. The spinal needle is introduced 10 - 15 degree cephalad. The needle traverses subcutaneous tissue, supraspinous ligament, interspinous ligament, ligamentum flavum, epidural space, dura mater, and subarachnoid mater and finally into the subarachnoid space.¹ But in elderly patients this procedure carries significant technical difficulties due to calcified spinal ligaments and inability to adequately flex the spine, So a paramedian approach is used for spinal anaesthesia in such situations. Here, first spinous process is palpated at the desired level. The needle is inserted 1cm lateral to this point. Needle is then directed towards interspace medially and cephalad. The first resistance felt is usually ligamentum flavum and then a distinct pop when needle enters dura mater.² Greater is the discomfort to the patient with increase in the number of attempts and also, more are complications like spinal haematoma, injury to the neural structures and PDPH. Hence, apt approach has to be followed in different scenarios. Midline approach of spinal anaesthesia is routinely practiced whereas paramedian approach is used only when midline approach fails. Hence, this study was conducted to compare the efficacy of midline and paramedian approach of spinal anaesthesia with regards to success rate, difficulties, advantage and complications in geriatric patients.

The aim of the study was to compare the midline and paramedian approaches of spinal anaesthesia with respect to success rates and complications in patients undergoing pelvic and lower limb surgeries

Hypothesis

Paramedian approach of spinal anaesthesia is better in elderly in reducing the number of attempts and complications.

METHODS

A prospective interventional study was conducted in Sree Gokulam Medical College and Research Foundation during 2016-17, 160 patients aged > 50 yrs. who were of physical status 1 and 2 according to ASA classification³ scheduled for pelvic or lower limb surgeries under spinal anaesthesia by either midline (group M n = 80) or paramedian (group P n = 80) approach. Two groups were well matched with respect to age, height, weight, duration of surgery and gauge of the needle. Written informed consent was obtained from each patient after approving the study from Institutional Ethical

Committee. First attempt success rates, paraesthesia were noted. Patients were followed up for 3 days postoperatively for signs of post dural puncture headache.

Inclusion Criteria

- American Society of Anesthesiologist ASA1 and 11; patients of age > 50 yrs. undergoing pelvic and lower limb surgeries,
- Willing for spinal
- No existing neurological diseases
- No infection at the local site
- No coagulopathies
- Less than three attempts of SA (Spinal Anaesthesia)
- Without simultaneous GA (General Anaesthesia) administration

Exclusion Criteria

- More than three attempts of spinal
- History of migraine or headache preoperatively

Sample Size

From the article 'spinal anaesthesia with midline and paramedian technique in elderly patients' published in the Indian Journal of Applied Research vol 5 issue 9 September 2015.

Midline [p1] paramedian [p2].

Where, p-value of the success rates of two approaches

p1 (midline) = 68 % p2 (paramedian) = 92 %

$\alpha = 1 \%$

Power $(1-\beta) = 90 \%$

Sample size,

$$n = \frac{[Z1 - \alpha/2 \sqrt{2P(1-P)} + Z1 - \beta \sqrt{p1(1-p1) + p2(1-p2)}]^2}{[P1 - p2]^2}$$

$$P = \frac{p1 + p2}{2}$$

Substituting in the above formula sample size equals 80 in each group.

Study Variables

Quantitative

Success rates, number of PDPH incidence.

Qualitative

Paraesthesiae, haemorrhagic tap.

Outcome Measurements

Success rates, PDPH incidence, first attempt success rates and other complications like paraesthesiae, haemorrhagic tap.

Study Procedure

After getting clearance from Institutional Research and Ethics Committee, patients were selected as per inclusion and

exclusion criteria. Preoperative evaluation and relevant routine investigations were done. All patients kept nil per orally for 8 hrs. prior to surgery. Informed written consent for participation in the study were obtained from each patient. Patient data was recorded in the proforma. 30 mins prior to surgery all patients received 500 ml Normal Saline (NS) intravenously (preloaded) and monitoring were done with Heart Rate (HR), NIBP (Non-Invasive Blood Pressure) , SpO2 peripheral capillary oxygen saturation , ECG (Electro-Cardio-Gram). Approach of technique was blinded to patients, anesthesiologists who investigated patient outcomes and postoperative ward personnel. Under strict aseptic precautions, SA was given with 25G QB needle with either median or paramedian approach in RLDP (Right Lateral Decubitus Position) at L3-L4 space. If the midline approach is used, desired interspace is palpated. Local anaesthetic 2 % lignocaine is injected into the skin and subcutaneous tissue. Then 25G QB needle is introduced which traverses the subcutaneous tissue, supraspinous ligament, interspinous ligament, ligamentum flavum, epidural space, dura mater, and subarachnoid mater and finally the subarachnoid space. If paramedian technique is used local anaesthetic is infiltrated 1 cm lateral to the inferior spinous process. The needle is then directed medially and cephalad which passes through subcutaneous fat, paraspinous muscle, ligamentum flavum, dura and finally subarachnoid space. Around 2.5 - 3.5 ml of 0.5 % (H) bupivacaine was used according to type of surgery. The number of attempts, success rates, paraesthesiae, bloody tap were observed, and patients were followed from first postoperative day by another anaesthesiologist and were asked whether they were suffering from any problem concerning anaesthesia up to 3rd day (PDPH).

Statistical Analysis

After collecting the data, it was entered in Microsoft Excel and analysed using SPSS software version 20. The necessary statistical tables were constructed along with charts and diagrams. Qualitative variables were expressed as percentages. Chi square and t test were used to compare the two groups wherever needed.

RESULTS

Demographics

Both groups were comparable in view of their age (Table 1), height (Table 2) and weight (Table 3).

Comparison of Outcome Parameters

Success Rates

Table shows that there were 100 % success rates which means lumbar puncture was successfully accomplished in 160 cases through either of approaches with single or multiple attempts.

First Attempt Success Rates

- Single attempt for a successful Lumbar Puncture (LP) was performed in 97.5 % of P group and 86.3 % of M group
- Which shows there is a significant difference in the percentage of two groups.

- Chi-square analysis yielded a p value of 0.009 which is significant at 0.01 level.

PDPH Incidence

- 2.5 % of study population complained of PDPH in P Group
- 6.3 % of study population complained of PDPH in M Group
- Chi square was test of analysis
- Which shows a P value of 0.246, which is > than 0.05 hence statistically insignificant.

Comparison of Complications

None of the patients complained of any paraesthesia or haematoma in either of the group.

Age	Paramedian		Midline	
	Count	Percent	Count	Percent
51 - 60	25	31.3	23	28.8
61 - 70	38	47.5	30	37.5
> 70	17	21.3	27	33.8
Mean ± SD	64.9 ± 6.2		66.9 ± 8.1	

Table 1. Age and Mode of Approach

Data was analysed by t-test and was found to yield a p value of 0.072 which is > 0.05 Is no significant difference in the age between two patient groups

Mode of Approach	Mean	SD	N	t	P
Paramedian	162.9	6.9	80	0.38	0.704
Midline	163.3	8.0	80		

Table 2. Height and Mode of Approach

t test analysis of this data obtained a p value of 0.704 which shows groups were comparable with regards to height distribution but statistically insignificant.

Mode of Approach	Mean	SD	N	t	P
Paramedian	70.0	8.6	80	2.49*	0.014
Midline	66.1	10.8	80		

Table 3. Weight and Mode of Approach

t test was used to compare this data and p value obtained was 0.014 which shows both groups are comparable

Success Rate	Paramedian		Midline		χ ²	P
	Count	Percent	Count	Percent		
Yes	80	100.0	80	100.0	-	-
No	0	0.0	0	0.0		

Table 4. Success Rate and Mode of Approach

Table shows that there were 100 % success rates which means lumbar puncture was successfully accomplished in 160 cases through either of approaches with single or multiple attempts

First Attempt Success Rate	Paramedian		Midline		χ ²	P
	Count	Percent	Count	Percent		
Succeeded with single attempt	78	97.5	69	86.3	6.78**	0.009
Succeeded with more than one attempt	2	2.5	11	13.8		

Table 5. First Attempt Success Rate and Mode of Approach

** - Significant at 0.01 level

PDPH Incidence	Paramedian		Midline		χ ²	P
	Count	Percent	Count	Percent		
Yes	2	2.5	5	6.3	1.34	0.246
No	78	97.5	75	93.8		

Table 6. Incidence of PDPH and Mode of Approach

Paraesthesia / Haematoma	Paramedian		Midline		χ ²	P
	Count	Percent	Count	Percent		
Yes	0	0.0	0	0.0	-	-
No	80	100.0	80	100.0		

Table 7. Paresthesia / Haematoma and Mode of Approach

Haemorrhagic Tap	Paramedian		Midline		χ ²	P
	Count	Percent	Count	Percent		
Yes	2	2.5	5	6.3	1.34	0.246
No	78	97.5	75	93.8		

Table 8. Haemorrhagic Tap and Mode of Approach

DISCUSSION

With regards to simplicity, appreciable success rates, lesser complications pre as well postoperatively, spinal anaesthesia is preferred to general anaesthesia for lower abdominal and lower limb surgeries and it is usually administered through midline approach. But when it comes to different scenarios like difficulty in flexing spine as in elderly, fractures, difficulty in palpating the spine as in obesity, paramedian approach is a better option to be attempted first. This approach which does not require flexed posture may be ideal in such situations as needle placement through para spinal muscle mass is easy. This approach offers several advantages over midline approach.⁴ With multiple attempts there are higher incidence of paraesthesia in patients with lumbar spine pathology.⁵ The results of study revealed that there was a significant first attempt success rates, 12 % more in paramedian group compared with midline approach of spinal anaesthesia.

PDPH incidence was about 4 % more in midline approach than paramedian. Incidence of haemorrhagic tap was more in midline group compared to paramedian. No other clinically significant complications were observed.

Rabinowitz et al conducted a study on 40 elderly patients aged > 75 yr. who underwent open surgical repair of a hip fracture under spinal, comparing both approaches and found that success rate was 85 % in paramedian approach as compared to 45 % in the median approach.⁶ Mericq o et al conducted a similar study and concluded that in patients who are elderly and with spinal deformity, paramedian approach is a safe alternative with higher success rate.⁷ Podder et al randomly allocated 50 patients scheduled for lower limb surgery after placing a lumbar epidural catheter in the sitting position with the back in unflexed position by either the midline or paramedian approach and concluded that with a patient sitting in neutral position, it is easier for insertion of needle in paramedian approach as compared to midline approach.⁸ Molina et al conducted a similar study comparing both techniques and found higher success rate with paramedian.⁹ Blomberg et al conducted study on 40 patients and found statistically significant difference between the two techniques in regard to repeated number of attempts and production of paresthesia.¹⁰ Leeda et al conducted study on 30 patients and found higher incidence of paraesthesia with midline approach.¹¹ Our findings are again consistent with the above studies.

A study by Haider et al on 50 patients undergoing different elective surgeries under spinal anaesthesia found a statistically significant difference in the incidence of PDPH with the two approaches and concluded that the paramedian approach using the Quincke needle reduces the incidence of PDPH significantly.¹² Paraesthesia was noted when the patient complained of a sharp pain in hips or legs while inserting the needle. In our study paraesthesia was not felt in the patients in either group.

Vascular trauma can be a complication of spinal anaesthesia. Epidural vessels are situated laterally. So, midline approach provides a relatively avascular plane. On the other hand, paramedian approach may encounter vessels leading to bloody tap. In our study the incidence of haemorrhagic tap in the paramedian group was 2.5 % which is comparable with other studies.

Limitations

The main limitations of the study were small study population and short periods of follow up. Gender as a medium of comparison for PDPH incidence was not done which could have altered the results. A large study population could have yielded more significant results.

Summary

The study was an observational study to compare the midline and paramedian approaches of spinal anaesthesia with respect to success rates and complications in patients undergoing pelvic and lower limb surgeries. It was seen that first attempt success rates were more with paramedian approach to midline approach. With paramedian approach PDPH incidence and haemorrhagic taps were less. No other clinically significant complications were observed in either of the approaches.

CONCLUSIONS

Paramedian approach of lumbar puncture is superior to the conventional midline approach in elderly patients with regard to first attempt success rates and other complications.

Data sharing statement provided by the authors is available with the full text of this article at jemds.com.

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