

## COMPARISON OF PARAMEDIAN WITH MIDLINE TECHNIQUE OF SPINAL ANAESTHESIA IN ELDERLY

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### ABSTRACT

**Objective:** To compare the technique of paramedian with midline approach of subarachnoid block in terms of number of attempts and frequency of success rate in elderly patients undergoing elective lower body surgeries.

**Study Design:** Randomized controlled trial.

**Place and Duration of Study:** This study was carried out at Anaesthesia department of Combined Military Hospital Lahore. Six months from Jan 2014 to Jun 2014.

**Material and Methods:** One hundred and seventy elderly patients were scheduled for lower body surgery, using spinal anaesthesia. They were randomized to either Midline approach (n=85) or Paramedian approach (n=85) by lottery method. The outcome measures number of attempts and success rate were noted in both groups and analyzed using SPSS version 18.

**Results:** The successful block in first attempt was 95.3% in Paramedian group and 58.8% in Midline group. Mean number of attempts in paramedian group was  $1.24 \pm 0.52$  as compared to  $1.95 \pm 0.97$  in midline group. A  $p$ -value  $<0.05$  was taken significant.

**Conclusion:** The Paramedian technique was found associated with higher success rate, lesser possibility of repeated number of attempts in elderly patients as compared to Midline approach.

**Keywords:** Elderly, Lumbar puncture, Midline approach, Number of attempts, Paramedian approach, Spinal anaesthesia, Success rate.

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### INTRODUCTION

The spinal cord is flattened antero-posteriorly, especially in the lumbar region but remaining anatomy is cylindrical. The spinal canal contains the spinal cord covered by the meninges, fatty tissues and a venous plexus. The meninges are composed of three layers: the Pia mater, Arachnoid mater and the Dura mater; all are contiguous with their cranial counterparts. The Pia mater closely invests the spinal cord and brain and is a highly vascular membrane as compared the Arachnoid mater which is a delicate nonvascular membrane usually closely attached to the outer most, thicker and dense layer and the Dura mater. Between the two innermost membranes is the space of interest in spinal anaesthesia, the subarachnoid space. This

space contains the cerebrospinal fluid, spinal nerves, blood vessels, a trabecular network between the two membranes and the lateral extension of the pia matter, the dentate ligament, which supply lateral support from the spinal cord to the Dura matter. The third outermost layer is the longitudinally organized fibroelastic membrane the Dura matter. The potential space that exists between the Dura and Arachnoid membranes is the spinal subdural space which generally is poorly demarcated. The potential space which lies outside the Dura mater is the extradural space, which is being used now a days for epidural anaesthesia.

J. Leonard Corning (1855-1923) performed the first spinal analgesia, a New York neurologist, in 1885. While experimenting with cocaine on the spinal nerves of dog, he accidentally pierced the Dura. Later he deliberately repeated the intradural injection in a patient, called it spinal anaesthesia and suggested it might be used in

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surgery. He wrote the first book on local analgesia in 1886.

The first planned spinal analgesia for surgery in man was performed by August Bier (1861-1949) on 16 August 1898 in Kiel, when he courageously injected 3 ml of 0.5% cocaine solution into a 34 years old labourer<sup>1</sup>. After using it on 6 patients, and to prove his faith in his method, he and his assistant Dr. Hildebrandt each injected 2 ml of 1% cocaine into each other's theca, with courage bordering on heroism<sup>2</sup>. Bier advised spinal analgesia for operations on lower limbs, but later gave it up owing to the drug toxicity<sup>3</sup>. Spinal, epidural, and caudal neuraxial blocks result in stepwise sympathetic block, sensory analgesia and motor block, drug response depends on dose, concentration, or volume of local anesthetic after insertion of a needle in the plane of the neuraxis<sup>4</sup>. Continuous spinal anesthesia is a very reliable and versatile technique for providing effective anesthesia and analgesia<sup>3</sup>. The number of elderly patients presenting for lower limb and urological surgeries surgery has increased exponentially in recent years and spinal anaesthesia appears to be more beneficial in such patients. In elderly patients, the midline approach for spinal anaesthesia may be technically difficult due to age-related degenerative anatomical changes. These changes include osseocalcifications of the spinal cord ligaments<sup>3</sup>.

In a study the success rate was 85% and 45% for paramedian group and midline group respectively ( $p$  0.02) after the first attempt in elderly<sup>5</sup>.

The other study shows a success rate of 96% for paramedian group and 84% for midline group ( $p$  0.046)<sup>6</sup>.

In the elderly frail patients with spinal deformity, declared high-risk for general anesthesia and where lumbar puncture through midline approach fails due to spinal abnormalities, paramedian route is an alternate safe approach with faster catheter insertion and success rate of up to 100%<sup>7</sup>.

As midline approach is commonly used locally so rationale of my study is to compare it with paramedian approach in order to decrease the failure rate and number of attempts in elderly patients for spinal anaesthesia.

## **MATERIAL AND METHODS**

It was a randomized control trial carried out in Combined Military Hospital (CMH) Lahore. The sampling technique was Consecutive Sampling. This study was carried out at Anaesthesia department of Combined Military Hospital Lahore for 06 months (1<sup>st</sup> Jan 2014 to 30<sup>th</sup> Jun 2014).

A total of 170 patients were included in this study. Sample size was calculated by using WHO sample size calculator by taking level of significance 5% and power of the test 80%. Anticipated population proportion (P1) is 96% in success rate for paramedian technique, anticipated population proportion (P2) is 84% in success rate for mid-line technique, the sample size ( $n$ ) calculated is 170.

Patients were divided in 2 groups randomly by lottery method. Eighty five patients in group A in which Paramedian technique of spinal anesthesia was used. Eighty five patients in group B in which the Midline technique of spinal anesthesia was used in elderly. Patient age  $\geq$  60 years and both sex, patients willing for the spinal anaesthesia. Patient having (ASA) status- I or II. Patients under-going elective lower body surgeries (pelvic and lower limb). Included patients having traumatic deformity of the spine, patients having any congenital anomaly of spine, patients undergoing emergency lower body surgeries, patients having any contraindication to sub arachnoid block e.g. valvular heart lesions (severe aortic and mitral valve stenosis) local sepsis, coagulation defect, increased intracranial pressure.

Informed written consent was obtained and the subjects were divided in 2 groups by lottery method. Each group consists of 85 patients. A thorough and detailed history of present and past medical, surgical illness and anaesthetic drugs

exposure was also noted. History was followed by general and systemic examinations of the patients and review of baseline investigations. Inj. Metoclopramide was given IV slowly 1 hour preoperatively. In the operating room continuous cardiac monitoring (ECG, heart rate, NIBP) was done. Pulse oximetry was done using a finger probe. Pre-load all patients with 10 ml/kg Ringer lactate solution prior to subarachnoid block.

Spinal anaesthesia administered by trainee researcher under supervision of a Consultant Anaesthesiologist with midline and paramedian technique. The local asepsis was done with pyodine draped and sterile towels. Subarachnoid block was given using 25 gauge Quincke needle at the L3-L4 interspaces and 0.75 % hyperbaric bupivacaine 2.0 ml was injected. Frequency of successful block and total number of attempts were noted. If subarachnoid block could not be done in three attempts, it was declared unsuccessful. After giving spinal anaesthesia, the patient was lied down in supine position. Level of sensory blockade and hemodynamic indicators were noted. Crystalloids, colloids or blood was transfused as maintenance fluid according to the hemorrhage. 0.5 mg Inj. Phenylephrine given intravenously for hypotension. Any other complications which came across were managed accordingly. All data was entered on predesigned performa and analyzed using SPSS 20.

## RESULTS

A Total of 170 patients were included in this study. Patients were divided in 2 groups randomly by lottery method. Eighty five patients in group A in which Paramedian technique of spinal anesthesia was used. Eighty five patients in group B in which the midline technique of spinal anesthesia was used in elderly.

Main outcome measures were number of attempts and success rate of spinal anesthesia in both groups.

All data was entered and analyzed using SPSS version 20. Frequencies and percentage were calculated for qualitative variables (success rate, gender). Mean and standard deviations

were calculated for quantitative data (number of attempts, age).

For comparison of quantitative variables by both approaches independent sample t-test was used.

For comparison of qualitative variables chi square test was used.

A *p*-value <0.05 was significant.

Mean age in paramedian (group A) was  $67.44 \pm 7.34$  SD and in midline (group B) was  $68.14 \pm 7.9$  SD. There were 84.7% (72) males and 15.3% (13) females in group A while in group B there were 63.5% (54) males and 36.5% (31) females.

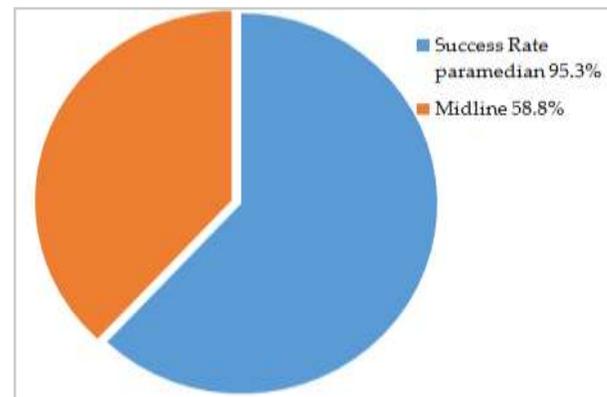


Figure: Success rate in paramedian group and in midline group.

Success rate in paramedian group was 95.3% i.e. 81 out of 85 patients and in Midline group it was 58.8% which means 50 out of 85 patients (figure). The mean numbers of attempts were  $1.24 \pm 0.527$  SD in group A and  $1.95 \pm 0.97$  SD in group B (*p*-value 0.001).

## DISCUSSION

Spinal anesthesia lowers the incidence of postoperative CNS dysfunction and respiratory complications, that's why it is preferred for abdominal-pelvic and lower limb surgeries. Regional anaesthesia reduces the postoperative mortality and other serious complications. Research work is still going on to determine, whether these benefits are solely due to neural blockade or due to avoidance of general

anaesthesia. Nevertheless, findings are more in the favour of neuraxial blockade<sup>8,9</sup>.

There are two approaches mostly used for spinal anaesthesia<sup>10</sup>. Initially, midline approach for subarachnoid block was described, later on the paramedian and lastly Taylor's approach. But still the midline approach remains the technique of choice for majority of surgical procedures<sup>11</sup>. The primary reason in favour of midline approach is the developmental anatomy and hence this midline fusion of two sides of the vertebral body facilitates the needle insertion and less chance of complications like, tissue injury; vascular puncture and nerve damage<sup>12</sup>. In clinical practice the incidence of "bloody taps" is 10-15% for all spinal cases<sup>12</sup> irrespective of midline or paramedian approach. The advantages of paramedian approach over midline approach are well established. In para-median approach as there are less chances of developing PDPH<sup>10</sup> and it can be performed in an unflexed spine<sup>9</sup>. Complications are shared equally by both paramedian and midline approaches. Regarding procedure paramedian technique can be carried out with same ease, time and confidence as that of midline approach, but with a significantly faster catheter insertion<sup>13</sup>. Learning for the beginners is easy, with good vertebral anatomical knowledge of paramedian technique. In spite of all these favorable points, why this approach is less frequently utilized, needs thorough investigations. It might be our long time habit, "old is gold", lesser acceptance to newer techniques or lack of clinical practice of this technique by the trainers<sup>9</sup>.

Usually spinal anaesthesia is administered through midline technique. In certain conditions like obesity, senile anatomical changes, spinal deformity or fracture it is very difficult to make proper position and administer subarachnoid block through midline approach. In elderly patients it is difficult to do lumbar puncture due to ossification of supraspinous and interspinous ligaments<sup>14,11</sup>. An alternative approach of subarachnoid block is paramedian technique which is easy for needle placement through spinal

muscle mass and is not dependent on flexed posture<sup>15</sup>.

The paramedian approach somewhat frees the Anaesthesiologist from dependency upon whether the patient can co-operate by appropriately flexing the spine or not. Even in full extension, it is impossible to occlude this route to subarachnoid space. Should the patient cooperation be less than ideal, this would be the indication to consider paramedian approach. The paramedian approach is superior over midline approach as it has got less technical problems especially in elderly patients as compared to midline approach<sup>11</sup>.

The successful location of the targeted space in the first attempt is influenced by a number of factors including quality of patient's anatomical landmarks, the adequacy of patient's positioning, provider's level of experience, age of the patient (due to ossification of ligaments) and technique of spinal anaesthesia<sup>12</sup>.

A study carried out by Ahsan-ul-haq *et al*<sup>7</sup> at paramedian approach of subarachnoid block demonstrated a success rate of 100%. In elderly patients with multiple systemic illnesses, considered high-risk for general anaesthesia paramedian approach of regional anaesthesia is preferred with maximum success rate.

Srinivasan *et al*<sup>13</sup> concludes that in patients who are elderly and with spinal deformity, older patients with degenerative changes in the spine and intervertebral spaces and those who cannot take the proper position. Paramedian approach is a safe alternative with improved success rate<sup>13,16</sup>.

Bapat concludes that with a patient sitting in an unflexed position, it is usually possible to insert needle in paramedian approach as compared to midline approach<sup>17</sup>.

The results of my study are comparable with the above mentioned studies with success rate of 95.3% (81 out of 85 patients) with Paramedian technique as compared to success rate of 58% (50 out of 85 patients) in Midline technique. The mean number of attempts in Paramedian group

was  $1.24 \pm 0.52$  S.D and in Midline group it was  $1.95 \pm 0.97$  S.D.

## CONCLUSION

The Paramedian technique is associated with higher success rate, lesser possibility of repeated number of attempts in elderly patients as compared to Midline approach.

## CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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