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Original Research Article

A Comparison between Median and Paramedian Technique of Giving Spinal Anaesthesia in Elderly Patients Undergoing Elective Lower Abdominal and Lower Extremity Procedures

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Abstract

Introduction: Spinal anaesthesia is difficult in the elderly because of the age related physiological changes of the spinal anatomy and difficult positioning by the classical midline approach. The paramedian approach, although not widely used, can overcome these difficulties. The study was done to compare the technical ease in performing spinal anaesthesia between these two approaches in the elderly.

Materials and Methods: This prospective randomised double blinded study was done in elderly patients of age more than 65 years undergoing lower abdominal and lower extremity surgeries. Successful puncture at first attempt, Number of attempts, Redirections of the needle, Duration of the procedure, Failures and Incidence of paraesthesia and backache were noted. 60 patients were randomized into two groups of 30 each : Group M: Patients received spinal anaesthesia by Median approach. Group PM: Patients received spinal anaesthesia by Paramedian approach.

Results: The success rate at the first puncture was much high in the paramedian group compared to the median group. ($p=0.015$). Number of fresh needle attempts, needle redirections and failures were significantly less in paramedian group compared to median group.($p<0.001$), ($p=0.005$), ($p<0.001$) respectively. No difference was found in the incidence of paresthesia in the two groups. The incidence of backache was more in the median group in the immediate postoperative period. ($p<0.001$).

Conclusion: Paramedian approach has more success rate, less technical difficulties and more patient comfort than the median approach in elderly patients and it should be considered as the preferred initial approach of giving spinal anaesthesia in the elderly.

Keywords: median approach, paramedian approach, lumbar puncture, spinal anaesthesia, elderly.

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Introduction

Aging has been characterized as a comprehensive, progressive and irreversible biological process resulting in maintenance of life with a diminishing capability for adaptation. An increasing elderly population with the advances in medical science are posing challenges to the anesthesiologists to provide safe and effective geriatric anesthesia. Regional anesthesia is preferred for lower abdominal and lower extremity surgeries in the elderly as it lowers the incidence of post operative pulmonary thromboembolism, favors early mobilization, has better lung mechanics, decreases perioperative blood loss, diminish neuroendocrine stress response to surgery, causes less postoperative confusion, provides good postoperative analgesia minimizing opioid use and its side effects [1]

However, regional techniques are difficult in elderly due to the age-related changes of ligaments, connective tissues, and bones of vertebral column and difficult positioning. Paramedian approach can be considered in these situations as it offers a much larger opening in to the spinal cord and is less affected by old age changes and inadequate positioning. Even though several studies has been done to compare the median and the paramedian approaches in spinal and epidural anaesthesia, studies done in elderly population alone are limited.

Materials and methods

The study was conducted in the Department of Anesthesiology at St. Johns Medical College and Hospital from August 2008 to March 2011. After obtaining approval from the Ethical Clearance Committee and written informed consent, 60 patients of age >65 years of either sex belonging to ASA I & II undergoing elective procedures such as TURP, inguinal hernia repair and orthopedic procedures under spinal anesthesia were included in the study. The 60 patients were randomized (sealed envelope) into two groups (30 each): Group M: Patients received spinal anesthesia by Median approach. (n=30). Group PM: Patients received spinal anesthesia by Paramedian approach. (n=30 .Inclusion criteria were Age >65 yrs, ASA Grade I, II, no contraindications for spinal anesthesia, Surgery: Inguinal hernias, TURP, Orthopedic procedures for lower extremities. Exclusion criteria were Contraindications for spinal anesthesia: Absolute being Patient refusal, Infection at the site of injection, Hypovolemia, Indeterminate neurologic disease, Coagulopathy, increased intracranial pressure and Relative contraindications being Sepsis distinct from the anatomic site of puncture, Unknown duration of surgery.

Patients were placed in either left or right lateral position. All lumbar punctures were performed by either a resident or staff anesthesiologist experienced in both the median and paramedian approach. Strict aseptic and antiseptic precautions were taken and then the procedure was performed as follows in left lateral position.

In PM group: After identifying the correct level for spinal anesthesia placement, the spinous process is palpated. A skin wheel was raised on any side 1-2 cm away from the mid line at L2-3 or L 3-4 after infiltrating with 2 ml of 2% lignocaine. 25 gauge Quincke's spinal needle was used. The spinal needle was introduced 1 cm lateral to this point and directed toward the middle of the interspace. The ligamentum flavum is usually the first resistance identified, but sometimes the lamina is contacted. If this is the case, redirection of the needle should be performed. When the free flow of CSF was confirmed 3.0-3.25 cc of 0.5% Bupivacaine was injected.

In M group: The 25 gauge Quincke's spinal needle was inserted in the midline of the L2-L3 or L3-L4 interspace in between the two spinous processes after local infiltration of 2 ml of 2% lignocaine at the

site of injection. After obtaining a free flow of CSF 3.0-3.25 cc of 0.5% Bupivacaine heavy was injected.

After the procedure was performed the patient was turned back to the supine position and the heart rate and NIBP were recorded at 0, 5, 10, 15, 30, 45, 60, 90,120, 180, 240 min. intervals. The resident or the staff anesthesiologist experienced with both the approaches were selected randomly to perform the procedure. An independent observer blinded to the study, counted the success at first attempt, number of needle redirections, no. of attempts, failures, and duration of the procedure. Success was defined as obtaining CSF in one attempt. The number of needle attempts was defined as the number of fresh attempts done to obtain a successful subarachnoid tap. Number of needle redirections was defined as the change in the direction of the needle to obtain a successful subarachnoid tap. Duration of procedure was defined as the time from needle insertion to withdrawal. An attempt was considered unsuccessful if the operator removed the stylet and saw no CSF. Failure was considered when no CSF was obtained after 2 attempts. In case of failure in the initial approach, the resident anesthesiologist tried the other approach. If the other approach also failed, the staff anesthesiologist performed for the final attempt. In case of failure in the final attempt and in case of failed or inadequate depth of spinal anesthesia, the patients were given general anesthesia. The incidence of paresthesia was observed during the procedure. Paresthesia is defined as the shooting radicular pain experienced by the patient at the time of introduction of the spinal needle.

The patients were followed up in the post operative period to assess the incidence backache in the immediate and day one of the postoperative period.

Results and observations:

Study Design:

A comparative study was done in 60 elderly patients, randomized into two groups: 30 patients in Group M (Median Technique) and 30 patients in Group PM (Paramedian), to compare the technical ease and incidence of backache in patients undergoing spinal anesthesia for lower abdominal and lower extremity procedures

Table 1 shows the demographic distributions in the two groups in terms of age, sex, height, weight and BMI (body mass index), types of surgery, ASA (American Association of Anesthesiology) status and person performing either resident doctor (R) or S (senior faculty). The distribution of age, height, weight, BMI and types of surgeries in between the M group and PM group was not statistically significant but that of ASA grading was significant with p=0.021*. In group M, 14 residents performed the procedure (46.7%) and 16 staffs performed the procedure (53.3%). In group PM 27 residents (90%) and 3 staffs (10%) performed the procedure, the distribution was statistically significant (p<0.001). Table 2: Comparison of first successful attempts between two groups, Number of first attempts were significantly more in Group PM compared to Group M with P=0.015*

Number of attempts were significantly less in Group PM compared to Group M with P<0.001** as shown in Table 3. Number of redirections were significantly more in Group M with P=0.005**(Table-4). Number of failures were significantly more in Group M compared to Group PM with P<0.001**(Table-5).

The mean duration of procedure was 3.27 min and a standard deviation of 1.95 min. in group M and the mean duration of procedure was 1.90 min and a standard deviation of 0.96 min. in group PM. The difference between the two groups was statistically significant (p=0.001) as shown in Graph 1. Incidence of Paresthesia was statistically similar in two groups of patients with p=0.389 as shown in Table 6.

Figure 2 shows the graphical representation showing the distribution of hemodynamic parameters observed between the two variables. The mean heart rate, Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Mean Arterial Pressure (MAP) in the two groups M and PM after performance of the subarachnoid block was similar. As shown in Table 7, in group M 12 patients had mild backache in immediate postoperative period, 3 patients had mild backache on day 1 of postoperative period and none of the patients had backache on day 2 of postoperative period. Whereas none of the patients had backache in group PM in any of the days postoperatively. However, the result was statistically significant only in the immediate postoperative period ($p<0.001$).

Table 1: Shows the demographic distributions in the two groups in terms of age, sex, height, weight and BMI (body mass index), types of surgery, ASA (American Association of Anesthesiology) status and person performing either resident doctor (R) or S (senior faculty)

Variables	Group M	Group PM	P value
Age	71.77±5.73	71.43±6.10	0.828
Sex	M23(76.7%) F7(23.3%)	M 22(73.3%) F 8 (26.7%)	0.766
Height in cm	155.47±4.61	157.17±3.67	0.119
Weight in kg	59.96±7.53	60.23±7.65	0.892
BMI* (kg/m2)	24.81±3.10	24.33±2.51	0.518
Hernia Surgery Lower extremity surgery TURP† surgery	3(10%) 11(36.7%) 16(53.3%)	3(10%) 13(43.3%) 14(46.7%)	0.861
Resident (R) ‡ performing procedure Senior (S) §	14(46.7%) 16(53.3%)	27(90%) 3 (10%)	<0.001
ASA‖ I ASA II	10(33.3%) 20(66.7%)	2(6.7%) 28(93.3%)	0.021

*BMI - Body Mass Index; †TURP-Transurethral Resection of Prostate; ‡ R- Resident; § S – Senior; ASA - American society of Anaesthesiology

Table 2: Comparison of first successful attempts between two groups

First attempts	Group M		Group PM	
	No	%	No	%
First attempts	6	20.0	15	50.0
2 or more attempts	24	80.0	15	50.0
Total	30	100.0	30	100.0
	P=0.015			

Table 3: Number of attempts

Number of attempts	Group M		Group PM		
	No	%	No	%	
1-2	13	43.3	26	86.7	
3-4	16	53.3	4	13.3	
>4	1	3.3	0	0.0	
Total	30	100.0	30	100.0	
Mean ± SD	2.70±1.18		1.70±0.88		P<0.001

Table 4: Redirection

Redirection	Group M		Group PM		
	No	%	No	%	
Nil	2	6.7	11	36.7	
1-2	9	30.0	12	40.0	
3-4	13	43.3	4	13.3	
>4	6	20.0	3	10.0	
Total	30	100.0	30	100.0	P=0.005

Table 5: Incidence of failure

Failure	Group M		Group PM		
	No	%	No	%	
Nil	8	26.7	24	80.0	
1-2	21	70.0	6	20.0	
>2	1	3.3	0	0.0	
Total	30	100.0	30	100.0	P<0.001

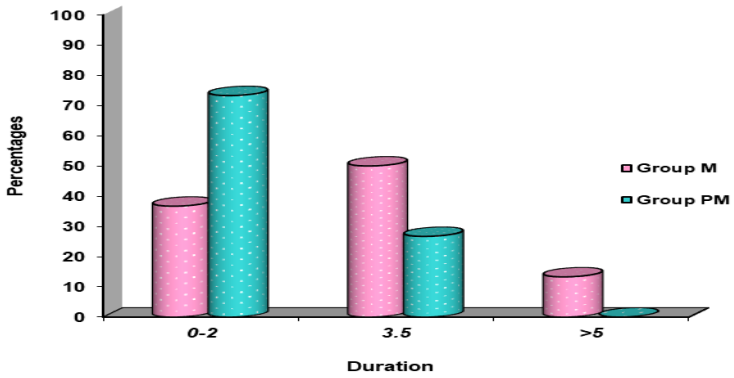

Figure 1: comparison of duration of procedure between the two groups

Table 6: Paresthesia

Paresthesia	Group M		Group PM		
	No	%	No	%	
No	26	86.7	28	93.3	
Yes	4	13.3	2	6.7	
Total	30	100.0	30	100.0	P=0.389

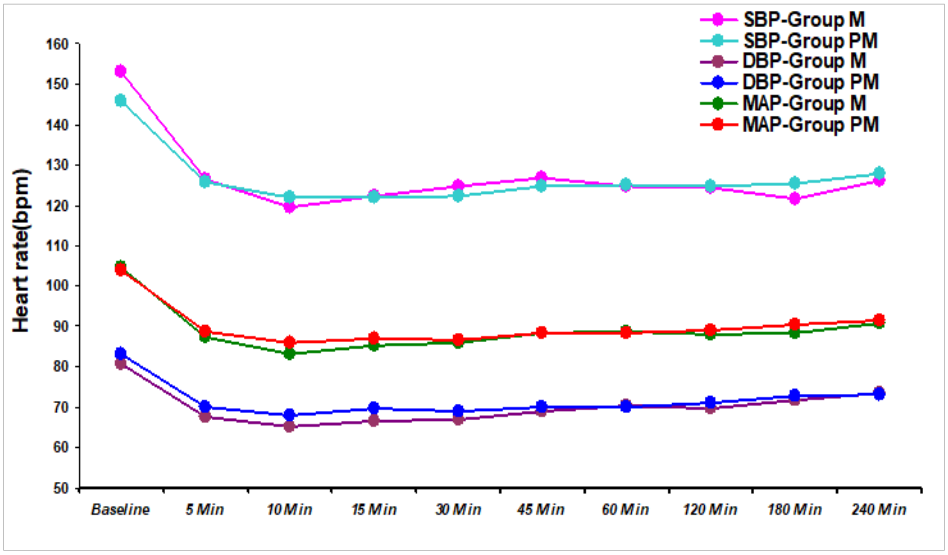

Figure 2: Graphical representation showing the distribution of hemodynamic parameters observed between the two variables.

Table 7: Post-operative assessment of backache

Backache	Group M	Group PM	P value
BDO*			
• Not present	18	30	<0.001**
• present	12	0	
BD1†			
• Not present	27	30	0.237
• Present	3	0	
BD2‡			
• Not present	30	30	1.000
• Present	0	0	

*BDO – Backache Day Zero; †BD1-Backache Day 1st; ‡ BD2- Backache day 2nd

Discussion:

Regional anesthesia in elderly patients poses many challenges to the anesthesiologist in terms of technical difficulty due to the age related degenerative changes of the spine and the vertebral column as well as difficulty in positioning due to osteoporotic and osteoarthritic changes. In our study, sixty elderly patients undergoing lower abdominal, orthopaedic lower extremity and TURP surgeries under spinal anaesthesia were included. In our study there were no significant differences in the demographic characteristics of the patients between the median and paramedian group with respect to the age, sex, height, weight, BMI and surgeries except for the ASA class distribution which was found to be statistically significant. However that didn't influence the result of the study. We found that the successful puncture at first attempt was high in the paramedian group (50% in paramedian group v/s 20% in the median group). Numbers of successful first attempts were also higher, 15 patients in group PM compared to 6 patients in group M. The difference between the two groups with respect to the success in the first attempt was statistically significant, p=0.015. we noted that in group M, 1-2 needle attempts were required in 43.3 %, 3-4 attempts in 53.3% and more than 4 attempts in 3.3 % of the patients. In group PM 1-2 needle attempts were required in 86.7 % and 3-4 attempts in 13.3 % and none

required more than 4 attempts. These difference in the number of fresh attempts performed between the two groups were statistically significant (p<0.001). The number of needle redirections was also found to be less in the paramedian group. 3-4 redirections were required in 13 patients in median group compared to only 4 patients in the paramedian group. No needle redirections were required in 11 patients in PM group compared to 2 patients in M group (p<0.005).

In a similar study, in the elderly frail patients with spinal deformity, who were considered high-risk for general anaesthesia and where lumbar puncture by midline approach failed, para median route was found to be an alternate safe approach with success rate of 100% [2] . Shehzad et al found the successful block in first attempt to be 95.3% in Paramedian group and 58.8% in Midline group in elderly patients undergoing spinal anaesthesia.. Mean number of attempts in paramedian group was 1.24 ± 0.52 as compared to 1.95 ± 0.97 in midline group [3].

Bano N et al observed a high success rate of 98.3% in paramedian approach as compared to 80%, in median approach(p value 0.001) when administering spinal anaesthesia in elderly patients undergoing lower abdominal or limbs; general or orthopaedic surgery. The number of attempts were significantly less in paramedian group[4]. similarly various other studies too reported success with PM approach in elderly [5,6,7]. Zhurda et al noted that the average number of fresh attempts was 2±1 in M group and 2–8 in PM group, and the average of needle redirections in M group was 8 (0–11) and in PM group was 1 (0–3) respectively (p=0.037 [8]. However, no difference in the successful subarachnoid puncture in the first attempt was found between the M and PM approaches of giving combined spinal and epidural anaesthesia (PM and M) (89% versus 94%) in patients undergoing elective gynaecological surgery. It was stated that longer spinal needles should be used for the PM technique [9]. It could be explained by the fact that many predictors could influence the quality of successful neuraxial block such as age, gender, height, weight, body habitus, anatomical landmarks, spinal deformity, patient positioning, needle types and gauges, approach, spinal level of block and providers level of experiences and in different studies, age group selected, surgical procedures and positioning were different.

In our study even though the number of residents to staffs performing the block in median group was similar, there were less number of staff who performed the block in the PM group. And the difference was found to be statistically significant (p=<0.001). Although all spinals were given by residents with more than one year's experience, still there are different groups of residents with varying skill levels, as our hospital is a teaching hospital. Patient's anatomical landmarks, positioning and providers level of experience are said to be a strong predictors of difficult spinal [10]. However, M. M. Atallah et al found no difference between the senior and junior anesthetists performing the block [11].

In our hospital the midline approach is the preferred approach for spinal anesthesia. Even the same happens in other countries too. Everyone (>95%) used midline approach for epidural and the paramedian approach was reserved when encountering difficult spinal [12]. Familiarity with the median approach also would have contributed to the low success rate in the first attempt for paramedian approach in our study. Not only that, the technique is easy to learn by the amateur trainees too [13].

Failure was considered when no CSF was obtained after two attempts. In our study no failure was observed in 24 patients in PM group (80%) and 8 patients (26.7%) in M

group. The difference between the two groups with respect to the no. of failures was statistically significant (p<0.00). None of our patients required general anesthesia. Rabinowitz et al noticed a failure in 11 patients in the M group versus 3 patients in the PM group with a statistical significance of p<0.001) [7].

The mean duration of performing the procedure in our study was (1.90+/-0.96 min) in PM group and (3.27+/-1.95 min) in the M group.(p=0.001). The difference was statistically significant with respect to the duration of the procedure. Similar findings were found by Zhurda et al where the average time of procedure in M group was 4± 3.2 minutes and in the PM group was 2±1.2 minutes (p= 0.047) (8) and others [14].

Rabinowitz et al however did not find any significant difference in the duration of the procedure in the median and paramedian technique of giving spinal anesthesia .Duration time was 4+/-2.5 min in the M group and 3+/-2 min in the PM group [7].

Horlocker et al in a retrospective review of 4767 patients of spinal anesthesia by different approaches, noted a 6.3% incidence of paresthesia. They noted that patients who complained about paresthesia had an increased risk of post operative neurological dysfunction [15]. Paraesthesia was felt by 5 patients (10%) in midline group and 2 patients (4%) in paramedian group while giving SAB in elderly [16]. Paresthesia was experienced by 4 patients in M group and 2 patients in PM group in our study, but the difference was not statistically significant, that may be due to the small sample size. Similar to our study, in a study with 100 parturient of ASA I-II who underwent caesarean delivery under spinal anaesthesia, no significant difference in the incidence of paraesthesia between the two groups was noted [17].

Backache is believed to be due to the trauma to the subcutaneous tissue and the ligaments with increasing needle attempts. Incidence of backache in the M group and PM group was statistically significant only in the immediate postoperative period(p<0.001) in our study. The incidence of pain at the injection site of spinal needle was also found to be less in the paramedian approach by Rafiei et al [18]. Pain at the site of injection has been reported to occur in the early postoperative period. In our study 12 patients of Median group and none in the Paramedian group had backache in the immediate postoperative period. The intensity of the backache was however, insignificant in the first and second postoperative day. The low incidence of backache in PM approach can be explained by the patient positioning, local infiltration, avoidance of puncture through ligaments and avoiding active spinal flexion during positioning [19]. However, K. schwabe et al. in their study found that the patient characteristics and technical factors were not associated with the incidence of persistent back pain in the post operative period after spinal anesthesia instead pre-existing back pain was the only variable associated with persistent back pain after 3 months (P < 0.0001) [20].

Some of the drawbacks that might have influenced the results of this study are the fact that, although all anesthesiologists who administered spinal anesthesia as a part of this study had a minimum experience of 100 spinal anesthesia, there could still be difference in experience, technical expertise and relatively greater experience with median technique of giving spinal anesthesia than the paramedian technique. [21]

Paresthesia is a subjective sensation that is difficult to explain to the patient and therefore difficult to evaluate. Many patients tend to describe pain at lumbar puncture as shock like could be false positives. Since different patients have different pain threshold, there could be a subjective error in the evaluation of backache, in the postoperative period. We

did not use any form of pain scale to define the severity of backache.

The results of the study could have been influenced by the different surgical procedures taken for the study. As the orthopedic procedures required additional difficulties in positioning compared to the hernia and the TURP surgeries.

Conclusion Multiple attempts at spinal punctures may be hazardous in elderly. Paramedian approach has more success rate, less technical difficulties and more patients comfort than in the median approach in elderly patients. Paramedian approach can be considered as the preferred initial approach of giving spinal anaesthesia in the elderly.

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