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Original Investigation

Which Approach is Preferred in Spinal Anesthesia: Median or Paramedian? Comparison of Early and Late Complications

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Abstract

Introduction: Spinal anesthesia is usually preferred for short-time surgery; the side effects of the process can show difference with techniques. We aimed to compare early and late complications of median and paramedian techniques in spinal anesthesia.

Methods: Eighty patients with American Society of Anesthesiologists (ASA) I–III were allocated into the following two groups: Group M (median) and Group P (paramedian). Demographic data of the patients, ASA score, number of spinal anesthesia application, total surgery time, discharge time from the hospital, heart rate, mean arterial blood pressure, and early complications were recorded from the medical records of patients. Late complications of patients were learned by calling.

Results: The number of applying spinal anesthesia number and the duration of anesthesia were longer in Group P than in Group M, and the difference was statistically significant ($p<0.05$). Fifty-two early complications and 23 late complications were observed. The common early complication (21%) was hypotension, and late complication (8.7%) was post-spinal headache (Group P, six patients; Group M, one patient); there was no difference between the groups.

Conclusion: There was no significant difference in complications of spinal anesthesia applied via both technical approaches and discharge in short-continuance surgical cases. Although we defined a tendency for post-spinal headache in Group P, there was no statistically significant difference in our study.

Keywords: Complication, median, paramedian, spinal anesthesia

Introduction

Spinal anesthesia is often preferred in short-term surgeries because it is a low-cost technique that can be applied easily, has a high success rate, and allows fast mobilization and early feeding (1). The side effects in this application can vary with the technique that is used (2). Inadequate spinal anesthesia, high or total spinal block, cardiac arrest, respiratory arrest, systemic toxic reaction, hypotension, bradycardia, nausea/vomiting, headache, spinal puncture pain, meningitis or meningismus, neurological sequelae, urinary retention, and hearing loss may be seen as a result of the effect created by the spread of the local anesthetic agent in the subarachnoid space (3).

In our study, we aimed to compare the early and late complication rates of two different techniques (median or paramedian approach) in spinal anesthesia, which is the most preferred anesthetic method in our clinic for short-term surgeries.

Material and Methods

Our study was conducted after the ethics committee approval no. 42883194-01/10405, dated November 18th, 2014, was received from the Ethics Committee of Fırat University Hospital. Of 282 patients who underwent short-term surgeries under spinal anesthesia between January 1st, 2014, and March 1st, 2014, 80 patients aged 18-65 years and classified as ASA I/II/III according to the American Society of Anesthesiologists (ASA) classification, who could be reached at telephone numbers that we had on file, were included in the study. Since the study was retrospective, informed consents were not received from the patients. The files of the patients were obtained from the archive, and the patients in whom the median technique was used were included in Group M (n=40), and those in whom the paramedian technique was used were included in Group P (n=40). Demographic data (age, gender, height, weight), ASA, the number of spinal anesthesia applications, duration of surgery, preoperative and intraoperative heart rate (HR), and mean arterial pressure (MAP) were recorded from the anesthesia follow-up chart, and the discharge durations from the hospital and the number of patients who underwent urinary catheterization were recorded from the nurse observation forms. Information was received from the patients who were contacted by phone about postoperative headache, pain at the site of procedure, hearing complaints, and about the other complaints.

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Statistical Analysis

Statistical analysis was performed with the Statistical Package for Social Sciences 20.0 (IBM Corp., Armonk, NY, USA). A power analysis applied before the study showed that 40 patients were sufficient for a 10% change in early and late complications to be able to determine a 90% power (α=0.05, β=0.1). Student's t-test was used for the statistical evaluation of patients' demographic data, ASA score, spinal anesthesia level, medication dose, preoperative and intraoperative HR, and MAP. Chi-squared test was used for the statistical evaluation of variables such as postoperative nausea/vomiting, headache, and urinary retention. P<0.05 was considered statistically significant.

Results

A total of 80 patients, 40 patients in Group M and 40 patients in Group P, were included in the study. There was no significant difference among the demographic data (age, gender, weight, height) of the groups (Table 1). The duration of operation was 34.8±8.60 min in Group M and 37.20±8.15 min in Group P, and the difference was not statistically significant (p=0.1948). The duration of discharge from the hospital was 32.87±14.88 hours in Group M and 33.74±3.46 hours in Group P, and the difference was not statistically significant (p=0.219). The number of anesthesia applications was 1.2±0.51 in Group M and 1.79±0.65 in Group P, and the difference was found to be statistically significant (Table 1) (p & lt; 0.05). Because paramedian application was not performed frequently, it was considered that the number of procedures increased.

In both the groups, MAP and HR were evaluated in the 5th, 10th, 15th, 20th, 25th, and 30th minute of the operation, and in the 5th, 10th, 15th, 20th, 25th, and 30th minute in the postoperative recovery unit, and there was no significant difference between the groups (Figure 1-4).

When the groups were evaluated in terms of early complications, 16 complications were seen in Group M and 36 complications in Group P. The most common complication was hypotension at a rate of 21%, and it was detected in 8 patients in Group M and in 9 patients in Group P. No significant difference was found between the groups (p=1.000). Nausea and vomiting were observed in 2 patients in Group M and in 7 patients in group P; bradycardia was observed in 4 patients in Group M and in 8 patients in Group P (p=0.1451, p=0.982). Inadequate spinal anesthesia was found in 2 patients in Group M and in 12 patients in Group P, and the difference was statistically significant (p<0.05) (Table 2, Figure 5).

When late complications were evaluated, 10 complications were seen in Group M and 13 complications in Group P. The most common complication was postspinal headache (PSHA) with a rate of 8.7%, and 1 patient was detected in Group M and 6 in Group P. There was no significant difference between the groups (p=0.1135). Pain at the puncture site was observed in 4 patients in Group M and in 1 patient in Group P, urine retention was observed in 5 patients in Group M and in 6 patients in Group P, and no statistically significant difference was detected between the groups (p=0.3708, p=1.000) (Table 3).

Discussion

Despite the advances in medicine and technology, the rates of spinal anesthesia complications can change depending on the local anesthetics that are used, obeying the rules of asepsis, needle di-

Table 1. Demographic data of the groups

	Group M	Group P	p
Age (years)	35.8±11.3	34.5±10.7	0.5988
Gender	21/19	22/18	
Weight (kg)	77.1±9.8	74.5±12.1	0.2942
Height (cm)	172.3±7.4	171.5±9.0	0.664
The number of anesthesia applications	1.2±0.51	1.79±0.65	0.001*
The duration of operation (min)	34.8±8.60	37.20±8.15	0.1948
The duration of discharge (hour)	32.87±14.88	33.74±3.46	0.219

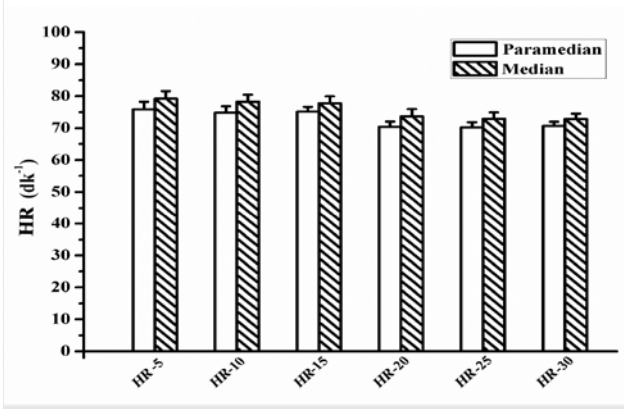

Figure 1. Heart rate (HR) values during operation HR (min-1)

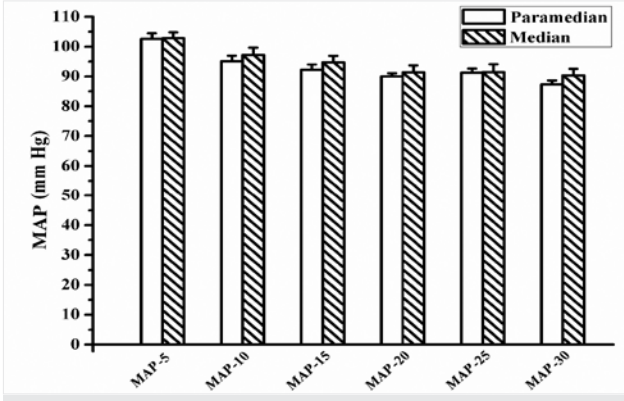

Figure 2. Mean arterial pressure (MAP) values at the time of operation MAP (mmHg)

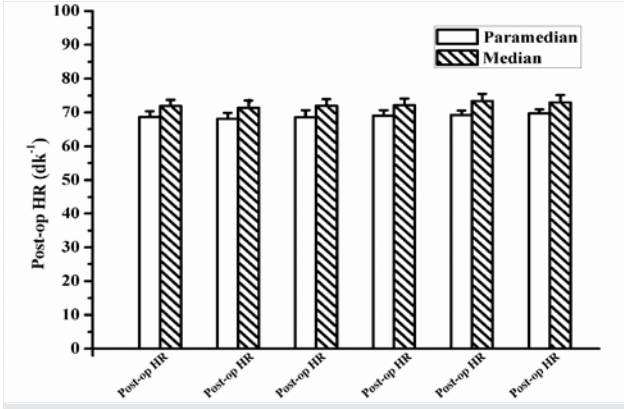

Figure 3. Heart rate values in the Postoperative Recovery Unit
Post-op HR: Heart rate values in the Postoperative Recovery Unit

Table 2. Early complications

Early complications	Group M	Group P	p
Inadequate spinal anesthesia	2	12	0.0068*
High or total spinal block	—	—	—
Cardiac arrest	—	—	—
Respiratory arrest	—	—	—
Systemic toxic reaction	—	—	—
Hypotension	8	9	1.000
Bradycardia	4	8	0.982
Nausea and vomiting	2	7	0.1451

Table 3. Late complications

Late Complications	Group M	Group P	p
Headache	1	6	0.1135
Pain at the spinal puncture site	4	1	0.3708
Meningitis or menengismus	-	-	-
Neurological sequelae	-	-	-
Urine retention	5	6	1.000
Hearing loss	-	-	-

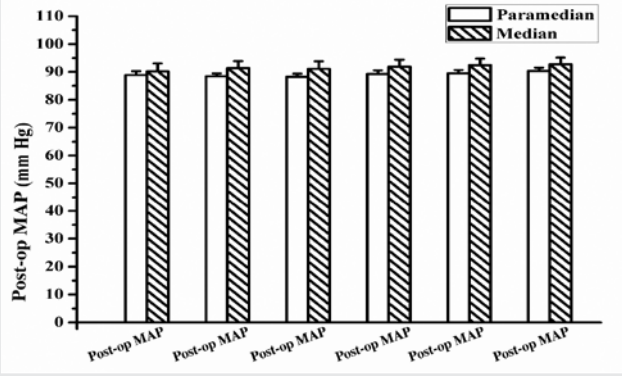

Figure 4. Mean arterial pressure (MAP) values in the Postoperative Recovery Unit
MAP (mmHg)
Post-op MAP: Mean arterial pressure in the Postoperative Recovery Unit

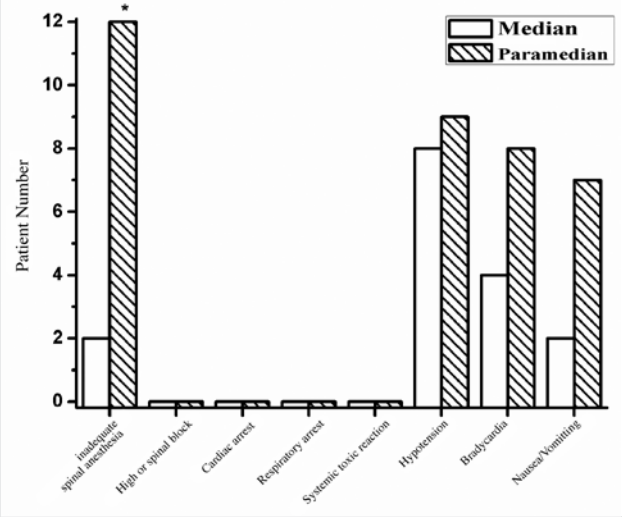

Figure 5. Comparison of early complications

ameter and design (pen tip and small diameter), application technique, and the knowledge and experience of the practitioner (2).

Spinal anesthesia, which is routinely preferred more in median approach, has technical advantages such as easier detection of the procedure site because it requires a three-dimensional view less often, and the widest part of the ligamentum flavum is in the median part (4). Because the bony structure that prevents the progress of the needle in the midline in the elderly and obese people is bypassed, the paramedian approach can be applied more easily in the cases of degenerative changes of vertebral column and in cases in which it is difficult to identify the anatomical points associated with the lumbar spine (5).

Both approaches have advantages and disadvantages relative to each other. For this reason, in our study, we compared the early and late complications of spinal anesthesia that we applied in two different techniques (median or paramedian approach) in 80 patients who would undergo same-day surgery.

A total of 75 complications were seen in 80 patients. Of these, 52 were early complications (36 in Group P, 16 in Group M), and 23 were late complications (13 in Group P, 10 in Group M). The most common early complication was hypotension (9 in Group P, 8 in Group M) with a rate of 21%, and PSHA was found as the late complication (6 in Group P, 1 in Group M) with a rate of 8.7% (Tables 2, 3).

Hypotension is one of the most common early complications of spinal anesthesia. In the literature, the rate of hypotension development during spinal anesthesia ranges between 8.2% and 57.9%. The rate of cardiac arrest due to hypotension and bradycardia was found between 0.018% and 0.029% (6, 7). In a multicenter study conducted for 10 months in order to detect the complication rates after regional anesthesia, spinal anesthesia was applied in 41251 patients among 158083 regional procedures. While cardiac arrest was observed at a rate of 0.027% in the study, the rate of neurological complications, which generally regresses within the first 8 days, was found as 0.034% (8). In another retrospective study, 114 (7.8%) of the 1458 complications which developed in 40822 patients were seen to develop after the application of regional anesthesia. Hypotension was found at a rate of 21.9%, and cardiac arrest was found at a rate of 0.9% in patients with high risk. While the complications were observed in orthopedic patients most commonly, 40.7% of them was recorded in postoperative recovery unit, and 49.3% was recorded within the first postoperative 12 hours (9).

One of the important effects of sympathetic blockade after spinal anesthesia is the triggering of the reflexes, which causes bradycardia with reduced cardiac venous return (10). In a study in which 612 spinal anesthesia cases were evaluated, complications developed in a total of 148 patients. Bradycardia was found in 25.7% of the patients, nausea and vomiting in 13.5%, PSHA in 29.1%, urine retention in 2.7%, hypotension in 21.6%, inadequate spinal anesthesia in 3.4%, and unsuccessful application was found in 2% of the patients (11). In our study, bradycardia was observed at a rate of 15% (4 in Group M, 8 in Group P), and no statistically significant difference was found between the groups. No cardiac arrest or respiratory arrest was observed in any of the patients in our study (Table 2).

In patients undergoing surgery under spinal anesthesia, nausea and vomiting often develop due to cerebral hypoxia, hypoten-

sion, or due to pulling of organs during the procedure (3). Nausea and vomiting should be treated secondary to hypotension. In our study, a total of 11.2% of nausea and vomiting complications were observed in 7 patients in Group P and 2 patients in Group M (Table 2). There was no statistically significant difference between the groups.

The paramedian and median techniques in which combined spinal epidural anesthesia was performed in 40 patients who underwent hip surgery were compared; while there was no difference in terms of complications, paramedian technique was found to be more successful (12). In another study, while the median approach was found to fail in elderly patients who had spinal deformities and for whom general anesthesia was more risky, the paramedian approach was 100% successful, and it was emphasized that the paramedian technique could be an alternative to general anesthesia in this patient profile (13). In terms of success and ease of application, median and paramedian approaches in spinal anesthesia were compared in orthopedic surgery patients who were difficult to be positioned. There was no statistically significant difference between the median or paramedian approaches when compared in terms of ease of application in patients who had more orthopedic degeneration and who were over 55 years of age; the number of trials was clinically found to be lower in the paramedian approach. When compared considering the practitioners, the paramedian approach was found to be applied more successfully with fewer interventions by junior assistants (14).

In a study investigating the causes and failures of neuroaxial blocks, the failure rate in spinal anesthesia in 6966 patients was found to be 3.9%. In all blocks, according to the power of correlation; the independent risk factors were determined as paramedian approach, peripheral vascular disease, epidural block, duration of surgical intervention, expertise requirement, chronic obstructive pulmonary disease, neurological disease, and body weight (15). In our study, inadequate anesthesia application (17.5%) was detected in 12 patients in Group P and in 2 patients in Group M (Table 2). The number of anesthesia applications was found significantly higher in Group P (Table 1). Because the median technique is often preferred in the routine clinical practice, we think that statistical differences are related to the greater experience and dominance in the familiar method.

After spinal anesthesia, the bladder tonus disappears after the blockage of S2–S4 dermatomes, the micturition reflex is inhibited, and urine retention may occur (3). Urine retention was detected in 10 of 125 patients for whom total knee arthroplasty was planned, and it was reported that the risk increased in women and in those who underwent epidural analgesia (16). In our study, urine retention developed in 11.2% of the patients (5 in Group M, 6 in Group P) (Table 3). Urine catheterization was performed in 9 of these patients. There was no statistically significant difference between the groups.

The waist pain after spinal anesthesia is associated with the absence of waist support after the relaxation of paraspinous muscles (8). In a study investigating waist pain after spinal anesthesia, patients were evaluated 5 days, 3 months, and 1 year after spinal anesthesia, and the incidence of pain was found as 18%, 10.7%, and 12.3%, respectively. However, when the patients' stories were carefully examined, it was determined that the majority of the patients had waist pain prior to spinal anesthesia, and after this correction, the procedure-related waist pain that occurred 3 months after spinal anesthesia was specified as only 0.8% (17). In our study, we contacted the patients via telephone 3 months after the procedure and questioned about the waist pain at the puncture site; we found this ratio as 6.3%, and no statistically significant difference was detected between the groups (Table 3).

Nowadays, one of the issues to which great attention is paid is using the most possible economical way and reducing the costs of surgical or medical treatments of patients. In this regard, the anesthesia method and the complications that occur prolong the duration of hospitalization and increase the cost (18). It is known that the needle type and intervention technique used in spinal anesthesia is very effective in PSHA etiology. The incidence varies between 0.1 and 36% (19). It is predicted that PSHA may be seen in the paramedian approach more because it causes more fiber damages with the needle angled toward the medial side to reach the midline, whereas the insertion is made in parallel with the dura fibers in the median approach (20). PSHA was found at a rate of 8.7% (1 in Group M, 6 in Group P) in our study. No statistically significant difference was found in the comparisons between the groups (Table 3). Spinal anesthesia was performed randomly with median or paramedian approach in 400 male patients for whom urological surgery was planned. Headache developed in 42 of 400 patients (10.5%) due to dura-puncture. When the two groups were compared, the incidence of headache related to dura-puncture was significantly higher in the paramedian approach (26, 13%) than in the median approach (16, 8%) in the 30-40 age group (21).

Median and paramedian spinal anesthesia were performed to determine the incidence of PSHA in 250 patients who were in the 50-85 age range and classified as ASA II/III. It developed in 11 patients in the median group and in 15 patients in the paramedian group, and it was suggested that the paramedian approach increased this risk for patients who were between 50 and 60 years old (22). PSHA was found at a rate of 8.7% (1 in Group M, 6 in Group P) in our study. Two of the patients were re-hospitalized to take brain computed tomography, and the other 5 patients underwent anesthesia consultation and medical treatment. There was no statistically significant difference between the groups (Table 3). We think that when the number of patients is increased, the results may also be statistically significant in terms of difference.

Conclusion

Because we think that re-hospitalization of the patient due to anesthetic complications in short-term surgeries, the regulation and delivery of the treatment, and extra analyses for the determination of headache etiology will negatively affect the patient comfort and may bring extra burden to the hospital, the classical median approach should be preferred in this group of patients. However, we think that our results should be supported by the studies to be performed in wider series.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Fırat University Hospital.

Informed Consent: Informed consent was not obtained due to the retrospective nature of the study.

Peer-review: Externally peer-reviewed.

Author contributions: Concept - S.B., F.K.; Design - S.Ö., O.H.; Supervision - S.B., S.Ö.; Resource - F.K., O.H.; Materials - S.B., F.K.; Data Collection and/or Processing - S.Ö., O.H.; Analysis and/or Interpretation- S.B., S.Ö.; Literature Search - F.K., O.H.; Writing - S.B., F.K.; Critical Reviews - S.Ö., O.H.

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