



Research Article

The effect of modified paramedian and median approaches of spinal anesthesia on postspinal acute low back pain in patients undergoing urological surgery: a prospective cohort study

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ABSTRACT

Background: Low back pain after spinal anesthesia may be a complicated issue for many patients. We aimed to evaluate the incidence of postspinal low back pain in the modified paramedian approach of spinal anesthesia compared to the classical median approach.

Materials and Method: The study is a prospective non-randomized observational trial. We included 297 patients aged 20 to 80 years who underwent urological surgery under spinal anesthesia. Patients were allocated into two groups: In Group P, patients underwent spinal anesthesia by using a modified paramedian approach and in Group M, the classical median approach was used. Primary outcome was the incidence of postoperative low back pain. Secondary outcomes were number of needle insertion attempts, needle bone contacts and patient satisfaction.

Results: The incidence of low back pain in Group M was 70.3% on the first day, 39.5% on the 7th day and 5.9% at the end of one month after surgery. In Group P, the incidence of low back pain was 30.7% on the first day, 12.4% on the 7th day and 0.7% at the end of one month after surgery. The low back pain scores were significantly lower in group P at all-time points. Patient satisfaction was significantly higher in group P ($p=0.038$). The number of needle interventions ($p=0.001$) and bone contact ($p=0.000$) were significantly lower in group P.

Conclusions: Low back pain was less common with the modified paramedian approach compared to the classical median spinal approach. We found lower number of needle insertion attempts and bone contacts in the modified paramedian technique. Patient satisfaction was also higher in the paramedian technique.

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1. Introduction

Spinal anesthesia is a technique frequently used in urological, obstetric, orthopedic, lower abdominal and anorectal surgeries. There are several complications associated with spinal anesthesia. Low back pain is one of the complications of spinal anesthesia which affects the length of stay and recovery time in patients undergoing urologic surgery. The incidence of postspinal low back pain has been reported to vary between 9% and 29% [1–3].

The "modified paramedian technique" for spinal and epidural anesthesia was first described by Chen et al. in 2020. The researchers inserted the spinal needle from 0.5 cm caudal and 0.5 cm lateral to the spinous process in cesarean section patients. It has been reported that the shorter distance between the needle insertion site and the interspinous space reduces the risk of lamina contact [4]. This technique may possibly reduce the incidence of low back pain due to high success rates and low bony contact.

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The aim of this prospective observational study was to evaluate the effect of modified paramedian spinal technique on low back pain after spinal anesthesia in patients undergoing urologic surgery. We compared the 'modified paramedian approach' with the classical 'median' approach. The primary aim was to compare acute low back pain rates. The secondary aims were to assess the number of needle passes, the frequency of bone contact and to determine patient satisfaction in the modified paramedian technique.

2. Materials and Method

Ethics committee approval dated 23/06/2022 and numbered 92 was obtained from Sakarya University Faculty of Medicine, Non-Drug Clinical Research Ethics Committee for this prospective observational study. Informed consent forms were obtained from all patients. Patients who underwent urologic surgery under spinal anesthesia between 15/07/2022 and 15/04/2023 were included. Inclusion criteria were patients aged between 20-80 and having American Society of Anesthesiologists (ASA) classification of I, II or III. Exclusion criteria were: patients with a history of low back pain, patients with a history of previous vertebral surgery, patients whose surgery time exceeded 2.5 hours.

The spinal blocks were performed by a resident or specialist physician with 3 years or more experience. Median and modified paramedian approaches are the main methods used for spinal anesthesia in our clinic. The preferred technique and the intervertebral level for needle insertion when administering spinal anesthesia was determined by the clinician who performed the spinal block. Standard monitoring is applied to all patients before the spinal procedure. All procedure was performed in the sitting or lateral position after the block site was prepared with povidone iodine. A 25 Gauge Quincke spinal needle (25 G, Egemen Spinal İğne®, İzmir, Turkey) was used for all patients. A guide for spinal needle or skin infiltration of local anesthetics before needle insertion was not implemented. The appropriate intervertebral space (L3-4, L4-5 or L5-S1) was determined by the operator who performed the spinal block. The needle is inserted 0.5 cm lateral and 0.5 caudal to the spinous process for the modified paramedian approach. Acute low back pain was questioned by surgical ward visit and by telephone contact. The patients were followed up in the surgical ward on the first day of surgery and questioned for acute low back pain. Later, the patients were called by telephone on Day 7 of the surgery and 30 days after the surgery.

Demographic data were recorded as gender, age, height, weight, body mass index. Spinal approach (modified paramedian/median), intervertebral level preferred by the performer of spinal blocks (L3-4, L4-5, L5-S1), patient position during performance of spinal block (sitting, lateral), and patient position during the surgery (lithotomy, supine, prone), duration of surgery, number of interventions and bone contacts, postoperative hospitalization time were recorded.

Postoperative low back pain of the patients was questioned by using the NRS (numeric rating scale between 0 and 10; 0 is no pain and 10 is worst pain) which was recorded as mild (1-3/10), moderate (4-6/10), severe (7-10/10). When NRS was 4 and above, rescue analgesics (oral paracetamol, nonsteroidal anti-inflammatory drugs) were given. At the end of 30 days, patient satisfaction of the spinal technique was questioned as yes or no.

3. Sample Size and Statistical Analyses

In a previous study, 2% incidence of low back pain was found in the paramedian method and 10% in the median method [5]. When the sample size was calculated based on this study and considering the alpha 0.05, beta 0.2 and the power 0.8, the total number of patients was calculated as 274. Considering possible data losses, a total of 353 patients were included in the study in the projected study period. Descriptive statistics of the data included mean, standard deviation, median (min-max), frequency. Distribution of variables was analyzed by Kolmogorov Smirnov test. Independent sample t test, Mann-Whitney u test were used to analyze quantitative independent data. The analysis of qualitative independent data was done by using chi-square test. If chi-square test conditions were not met, Fisher's exact test was used. SPSS 28.0 program was used in the analysis. $p < 0.05$ was considered statistically significant.

4. Results

Records of 353 patients were analyzed. Of these patients, 34 were excluded because they did not meet the inclusion criteria. 9 patients were excluded because they did not respond to the phone calls and 13 patients left the study voluntarily. The number of patients who underwent spinal anesthesia by using median approach was 152 in Group M and the number of patients who underwent modified paramedian approach was 145 in Group P. The flowchart of the study was shown in Fig. 1.

The demographic data (age, gender, height, weight, and ASA classification) were comparable between the groups (Table 1). BMI was 27.7 ± 4.4 with a median value of 27.7 in the Group P and 26.6 ± 5.0 in Group M with a median value of 25.9. BMI was significantly higher in the paramedian approach group ($p = 0.018$) (Table 1).

There was no significant difference between the groups in the distribution of surgery type, anesthesia and surgical position. L3-L4 intervertebral space for spinal block was preferred in 92 patients in Group M (60.5%) and in 70 patients (48.3%) in Group P. L4-L5 intervertebral space was preferred in 55 patients in Group M (36.2%) and in 75 patients (51.7%) in Group P and L5-S1 intervertebral space was used in 5 patients in Group M (3.3%) and in no patients in Group P. The L3-L4 intervertebral space was preferred significantly higher in Group M and the L4-L5 intervertebral space was preferred significantly higher in Group P ($p = 0.004$) (Table 2).

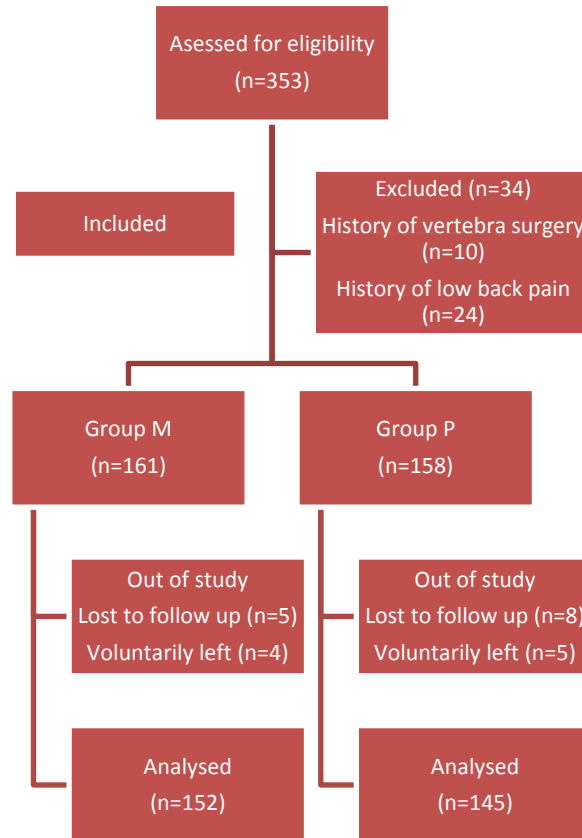


Fig. 1. Flow chart of the study.

Table 1. Comparison of demographic data.

Data is given as numbers (n), percentage, mean \pm standard deviation (SD) and median values.

		Group M				Group P				p
		Mean	\pm	SD	Median	Mean	\pm	SD	Median	
Age		58.17	\pm	14.43	62.00	59.79	\pm	14.33	65.00	0.231 ^m
Gender	Female	30		19.7%		23		15.9%		0.383 ^{x²}
	Male	122		80.3%		122		84.1%		
Height (cm)		170.2	\pm	8.9	170.0	169.6	\pm	7.1	170.0	0.525 ^m
Weight (kg)		76.9	\pm	14.3	78.0	79.6	\pm	12.4	78.0	0.219 ^m
BMI (kg/m ²)		26.6	\pm	5.0	25.9	27.7*	\pm	4.4	27.7	0.018 ^m
ASA	I	18		11.8%		15		10.3%		0.784 ^{x²}
	II	93		61.2%		86		59.3%		
	III	41		27.0%		44		30.3%		

BMI: Body mass index; ^m Mann-Whitney u test; ^{x²} Chi-square test (Fisher's exact test)

There was no significant difference regarding the duration of surgery and length of hospital stay between the groups. The number of needle insertion attempts and the frequency of bone contacts were significantly lower in Group P ($p=0.000$ and $p=0.001$ respectively) (Table 3).

The incidence of low back pain in Group M was 70.3% on the first day, 39.5% on the 7th day and 5.9% at the end of one month after surgery. In Group P, the incidence of low back pain was 30.7% on the first day, 12.4% on

the 7th day and 0.7% at the end of one month after surgery.

The comparison of low back pain scores on day one, day 7 and at the end of one month after surgery are given in Table 4. The low back pain scores were found significantly lower in the paramedian approach group. Patient satisfaction was 98.6% in Group P and 94.1% in Group M. Patient satisfaction was significantly higher in Group P (Table 4).

Table 2. Comparison of type of surgery, anesthesia methods and approaches. Data is given as numbers (n), percentage.

	Group M		Group P		p
	n	%	n	%	
Case					
TUR-P	29	19.1%	37	25.5%	0.858 χ^2
TUR-T	28	18.4%	26	17.9%	
URS	44	28.9%	33	22.8%	
Cystoscopy	13	8.6%	17	11.7%	
Hydrocelectomy	5	3.3%	5	3.4%	
Internal Urethrotomy	8	5.3%	5	3.4%	
RIRS	10	6.6%	8	5.5%	
DJ Stent	6	3.9%	5	3.4%	
Other	9	5.9%	9	6.2%	
Injection level					
L3-L4	92	60.5%*	70	48.3%	0.004 χ^2
L4-L5	55	36.2%	75	51.7%*	
L5-S1	5	3.3%	0	0.0%	
Anesthesia Position					
Sitting	146	96.1%	142	97.9%	0.510 χ^2
Lateral	5	3.3%	3	2.1%	
Surgical Position					
Lithotomy	145	95.4%	138	95.2%	0.928 χ^2
Supine	7	4.6%	7	4.8%	

TUR-P: Transurethral resection of prostate; TUR-T: Transurethral resection of bladder tumor; URS: Ureteroscopy; RIRS: Retrograde intrarenal surgery; χ^2 Chi-square test (Fisher's exact test); * $p < 0.05$

Table 3. Comparison of surgical time, needle insertion attempt, bone contact and length of hospitalization. Data is given as numbers (n), percentage, mean \pm standard deviation (SD) and minimum-maximum values.

	Group M						Group P						p	
	Mean	\pm	SD	Min	-	Max	Mean	\pm	SD	Min	-	Max		
Surgery duration (min)	49.7	\pm	19.0	15.0	-	125.0	47.5	\pm	20.0	15.0	-	135.0	0.314	^m
Needle insertion attempt	1.3	\pm	0.5	1.0	-	3.0	1.1	\pm	0.4	1.0	-	3.0	0.001*	^m
Number of bone contact	0.9	\pm	0.9	0.0	-	3.0	0.4	\pm	0.6	0.0	-	3.0	0.000*	^m
Hospitalization (day)	1.9	\pm	1.5	1.0	-	13.0	2.0	\pm	1.8	1.0	-	19.0	0.262	^m

^m Mann-Whitney u test; * $p < 0.05$

5. Discussion

The present study demonstrated that modified paramedian approach of spinal anesthesia resulted in less low back pain compared to the classical median approach in patients undergoing urological surgery. In our study, patient satisfaction was higher in the modified paramedian approach compared to the median spinal approach. In the modified paramedian technique, the needle is inserted 0.5 cm lateral and 0.5 cm caudal to the spinous process. This technique was first described by Chen et al. [4]. By using this technique, number of bone contacts by needle was also lower than the median technique.

In the literature, there are studies with different methodologies investigating the effect of median and

paramedian spinal techniques on low back pain [5–8]. In the study of Behary and Mohammed [9], the incidence of low back pain in patients undergoing cesarean section was reported 1.7% in the paramedian technique and 7.1% in the median technique. In this study, paramedian technique was defined as 1 cm lateral and 1 cm caudal to the midline. In the study by Singh et al. [5] which investigated 100 patients undergoing lower abdominal surgery, the incidence of low back pain in the paramedian approach was reported as 2% and in the median approach as 10%. The paramedian technique used in the study was described as inserting the needle 1 cm lateral and 1 cm caudal to the spinous process.

In contrast to these studies, there are studies reporting that the paramedian approach has no effect on postspinal low back pain. In a retrospective study by

Bayındır et al. [10] evaluating the early and late complications of spinal anesthesia among 80 patients, one patient in the paramedian group and 4 patients in the me-

dian group complained about “pain at the injection site”. No significant difference was found between the groups regarding the incidence of low back pain.

Table 4. Comparison of pain scores on day one, day 7 and at the end of one month after surgery. Comparison of patient satisfaction. Data is given as numbers and percentage.

		Group M		Group P		p	
		n	%	n	%		
Day one	No pain	45	29.6%	86	59.3%	0.000	x ²
	Mild	25	16.4%	27	18.6%		
	Moderate	47	30.9%	22	15.2%		
	Severe	35	23.0%	10	6.9%		
Day 7	No pain	92	60.5%	127	87.6%	0.000	x ²
	Mild	35	23.0%	15	10.3%		
	Moderate	23	15.1%	3	2.1%		
	Severe	2	1.3%	0	0.0%		
Day 30	No pain	143	94.1%	144	99.3%	0.012	x ²
	Mild	5	3.3%	1	0.7%		
	Moderate	4	2.6%	0	0.0%		
	Severe	0	0.0%	0	0.0%		
Patient satisfaction	Yes	143	94.1%	143	98.6%	0.038	x ²
	No	9	5.9%	2	1.4%		

x² Chi-square test (Fisher's exact test); * p<0.05

Lee et al. [11] investigated the effect of paramedian and median approach on early postspinal low back pain and found that the incidence of low back pain was 36% (18/50) in the median spinal technique and 16% (8/50) in the paramedian spinal technique. Patients were questioned about postspinal low back pain on day one, day 7 and at the end of 1st, 2nd and 3rd months. Postspinal low back pain was significantly lower in the paramedian spinal technique only on day 7. The three months follow-up was comparable between the groups. The paramedian technique was described as needle insertion from 1 cm lateral and 1 cm caudal to the spinous process.

Dadkbah et al. [12] reported the incidence of postspinal low back pain in the first 24 hours as 21% with the median approach and 25% with the paramedian approach. The paramedian approach was performed with a 25 G Quincke spinal needle 1 cm lateral and 1 cm caudal to the midline and the patients were followed up for one week postoperatively. In this study, there was no significant difference between the two approaches in terms of postspinal low back pain. The researchers reported that more than two attempts may be associated with low back pain. Mishra et al. [13] performed compared paramedian with median spinal approach in 60 obese female patients and reported that low back pain after one week was lower in patients underwent paramedian approach. No significant differences were found in the three months follow-up.

The advantages of the modified paramedian spinal technique in our study seems that number of needle passes and bone contact were lower compared to the classic median technique. This may lead to a lower inci-

dence of low back pain as we found in our study. In our study, we evaluated a different and modified paramedian technique which is different from the aforementioned studies howbeit, our results are consistent with these studies. The disadvantages of the modified paramedian technique are being a less performed technique resulting in the lack of experience.

The limitations of the study are that it was single centered and the patients were not randomized. Lithotomy was not among the exclusion criteria, and postoperative analgesia follow-up was not performed. Another limitation is the BMI was significantly higher in the paramedian approach group. As expected, a higher BMI may lead to possible difficulties such as higher number of spinal attempts or bone contacts. However contrarily, needle insertion attempts and frequency of bone contact were lower in the paramedian approach group. It seems that the difference in BMI in favor of the median approach group did not affect the results clinically. The preference of the intervertebral level was L3-L4 interspace in the median approach group as there was more patients with lower BMI in this group. On the other hand, the preference of the intervertebral level was L4-L5 interspace in the median approach group as there was more patients with higher BMI in this group. Another limitation is sitting and lateral position during spinal anesthesia may affect the number of needle passes and pain and the distinguishment of these positions and evaluation of both positions separately was not done in our study. Bone contact is something that can be recognized by the practitioner therefore, it cannot be blinded. Post dura-puncture headache is one of the main complica-

tions of spinal anesthesia however we could not assess this in our study due to different incidences of dural-puncture headache and low back pain which required different number of sample sizes.

6. Conclusions

In our study, the number of needle insertion attempts and frequency of bone contacts were found lower in the modified paramedian spinal approach. However, further research and prospective randomized controlled studies are needed to come to the conclusion that modified paramedian approach reduces the number of needle attempts and bone contacts. Considering the low back-pain scores, the modified paramedian technique can be a strong alternative to the classic median spinal technique.

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Conflict of Interest

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Author Contributions

All of the authors made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; were involved in drafting the manuscript or revising it critically for important intellectual content; and gave final approval of the version to be published.

Data Availability

The datasets created and/or analyzed during the current study are not publicly available, but are available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate

This study was approved by the ethics committee of Sakarya University Faculty of Medicine Clinical Research Ethics Committee (Ethics application no: E-16214662-050.01.04-149651-92). Written informed consent was obtained from the participants. All methods were performed in accordance with relevant guidelines and regulations.

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