POST DURAL PUNCTURE HEADACHE: A COMPARISON OF MIDLINE AND PARAMEDIAN APPROACH OF SPINAL ANESTHESIA

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ABSTRACT

Objective: To compare the midline and paramedian approaches of spinal anesthesia in terms of incidence of Post Dural Puncture Headache among patients undergoing surgery.

Study Design: Comparative prospective study.

Place and Duration of Study: Department of Anesthesiology, Pakistan Naval Ship (PNS) Shifa Karachi, from Jan to June 2018.

Methodology: After the approval of the hospital ethics committee, 214 (n=107 in each group) patients undergoing elective infra-umbilical surgery were included in our study. Group A were administered spinal anesthesia in sitting position via midline approach; whereas, paramedian approach was used in group B.

Results: A total of 214 participants were studied. The two groups did not vary in demographic profile (p=0.017). The frequency of post-dural puncture headache was 2 (1.8%) in group B versus 10 (9.3%) in group A. There was no effect of American Society of Anesthesiologist physical status, gender, type of surgery, and age on the frequency of post dural puncture headache.

Conclusion: There was a significantly lower frequency of post dural puncture headache in the paramedian approach for spinal anesthesia.

Keywords: Midline approach, Para median approach, Postdural puncture headache, Spinal anesthesia.

INTRODUCTION

Different techniques and modalities are used to anesthetize the patient for the smooth conduction of surgery including, general anesthesia, spinal anesthesia, different types of regional anesthesia and monitored anesthesia care. According to the authors' knowledge, limited local studies are available that compare midline to the paramedian approach of spinal anesthesia in the context of occurrence of post dural puncture headaches. If the paramedian approach shows a reduced frequency of post dural puncture headache with equally effective spinal anesthesia, it can be frequently used for administration of spinal anesthesia.

Spinal anesthesia is associated with lower perioperative complications and better post-operative recovery as compared to general anesthesia[1-3]. Usually, spinal anesthesia is administered through the midline approach. In the midline approach the spine is palpated, and the patient's body positioned so that a needle passes parallel to the floor between the upper and lower spi-nous processes of the respective vertebrae. This requires greater patient co-operation which might be difficult in some pregnant female and geriatric patients. In the paramedian approach the needle is introduced 2cm lateral to the inferior aspect of the superior spinous process of the desired level and is directed 10^{o} to 25^{o} towards the midline. The paramedian approach may be preferred if there is limited spine flexion, calcifications and ossifications of the interspinous and supraspinous ligaments in old age, congenital anomalies, and traumatic deformities of the spine[4,5]. How-ever, the paramedian approach may be associated with a higherrisk of a bloody tap; paresthesia etc[6,7].

Postdural puncture headache (PDPH) is a complication of neuraxial anesthesia. It is due to cerebrospinal fluid leaking through a dural puncture site resulting in reduced fluid levels in the brain and spinal cord. This headache is

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Received: 07 Apr 2020; revised received: 03 Jun 2020; accepted: 10 Jun 2020

usually exacerbated by movement, sitting, or standing and may be associated with nausea, vomiting, tinnitus, hearing loss, dizziness, diplopia, vertigo, and paresthesia. The frequency of post-dural puncture headache (PDPH) has been reported to be 0.16% to 86%[8]. Beveled needle, larger gauge needle, female gender, pregnancy, younger age, and history of previous headache before spinal anesthesia have been reported as inde-pendent risk factors for postdural puncture headache[9,10]. The rationale of this study was to compare the effectiveness of either of the two methods of administering spinal anesthesia in lowering the incidence of post dural puncture headache.

METHODOLOGY

After the approval of the hospital ethics committee, (ERC/2020/ANS/10) this randomized clinical trial was conducted at the department of Anesthesiology, Pakistan PNS Shifa Karachi, for six months from January to June 2018. World Health Organization (WHO) sample size calculator was used with following assumptions: Level of significance (a)=5%, Power of test = 80%, P1 (anticipated post dural puncture headache)=9.3%. P2 (anticipated post dural puncture headache)=1.6%.

To calculate a sample size of 214 (n=107 in each group)[11]. The study population was divided into two groups by non-probability consecutive sampling. All the patients with ages 18-50 years; both genders, American Society of Anesthesiologist Class I/II; body mass index (<30 kg/m^2) who underwent elective lower limb or lower abdominal surgery under spinal anesthesia. To avoid heterogeneity, we selected only elective procedures without any overt signs and symptoms of hypovolemia in the perioperative period. Patients who refused to participate; who were allergic to drugs used; the history of spinal anesthesia associated postdural puncture headache; who had a contraindication to spinal anesthesia or patients requiring more than three attempts at spinal anesthesia, were excluded from our study. Pre-anesthesia assessment and preparation was done as per institute guidelines. All the participants were explained both the procedures with possible complications and benefits and had the liberty to refuse the procedure. They were randomly assigned to two groups with the help of a sealed envelope technique. Informed consent was obtained, and the patient data was collected on a specially designed proforma. Group A was administered spinal anesthesia with a midline approach, while group B had a paramedian approach. Spinal anesthesia was given using 25/26-gauge Quincke needle at the level of L3-4, L4-5 space, and 2.5ml of bupivacaine heavy (hyperbaric) 0.5% was given for both approaches. The bevel of the needle was kept parallel to the longitudinal fibers of the dura.

The data was analyzed using SPSS-20. The quantitative data like age, degree of paresthesia was expressed as mean ± standard deviation (SD). Frequencies and percentages were calculated for postdural puncture headache, American society of anesthesiologist physical status, and type of surgery. An independent sample t-test was used to compare quantitative variables. Chi-square was used for qualitative variables. The multivariant binomial regression was used for post-stratification effect modifiers (table-II). The *p*-value ≤0.05 was taken as significant.

RESULTS

A total 0f 214 participants were studied. The mean age of study population was 33.46 years ± 6.13. The mean age in group A was 31.7 years ± 5.6 versus 35.1 years ± 6.1 in group B; *p*=0.188.

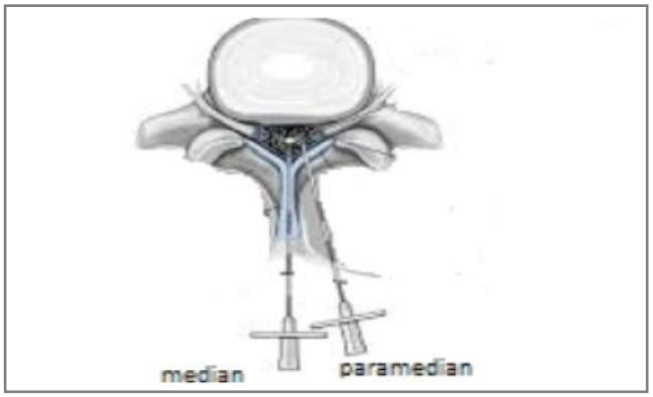

Figure: Needle direction in median and paramedian approach.

The comparison of demographic profile was given in table-I.

The overall frequency of postdural puncture headache was 12 (5.6%) in our study population with frequency of 10 (9.3%) in group A versus 2 (1.8%) in group B; *p*=0.017. We found no effect of age, gender, type of surgery or American society of anesthesiologists physical status on the frequency of postdural puncture headache. The comparison of effect modifier is given in table-II.

Table-I: Comparison of demographic profile of study groups.

Variable		Group A	Group B	*p*-value
Gender	Male	80 (37.4%)	71 (33.2%)	0.177
	Female	27 (12.6%)	36 (16.8%)	
Type of surgery	Abdominal	55 (25.7%)	61 (28.5%)	0.061
	LSCS	21 (9.8%)	29 (13.6%)	
	Orthopedics	31 (14.5%)	16 (7.5%)	
American society of anesthesiologist physical status	I	81 (37.9%)	80 (40.7%)	0.318
American society of anesthesiologist physical status	II	26 (12.1%)	20 (9.3%)	0.318

Table-II: Comparison of study variables in two groups.

Variable			Group A	Group B	*p*-value
American society of anesthesiologists Physical Status	I	Postdural puncture headache	9 (5.4%)	1 (0.6%)	0.006
		No postdural puncture headache	72 (42.9%)	86 (51.2%)	
	II	Postdural puncture headache	1 (2.2%)	1 (2.2%)	0.849
		No postdural puncture headache	25 (54.3%)	19 (41.3%)	
Gender	Females	Postdural puncture headache	2 (3.2%)	1 (1.6%)	0.393
		No postdural puncture headache	25 (39.7%)	35 (55.6%)	
	Males	Postdural puncture headache	8 (5.3%)	1 (0.7%)	0.026
		No postdural puncture headache	72 (47.7%)	70 (46.4%)	
Type of surgery	Abdominal	Postdural puncture headache	2 (1.7%)	1 (0.9%)	0.449
		No postdural puncture headache	53 (45.7%)	60 (51.7%)	
	LSCS	Postdural puncture headache	1 (2%)	1 (2%)	0.815
		No postdural puncture headache	20 (40%)	28 (56%)	
	Orthopedics	Postdural puncture headache	7 (14.9%)	-	0.039
		No postdural puncture headache	24 (51.1%)	16 (34%)	
Age (years)	≤35	Postdural puncture headache	8 (6%)	1 (0.7%)	0.065
		No postdural puncture headache	72 (53.7%)	53 (39.6%)	
	>35	Postdural puncture headache	2 (2.5%)	1 (1.3%)	0.219
		No postdural puncture headache	25 (31.3%)	52 (65%)	

DISCUSSION

Our study has shown a significantly lower frequency of postdural puncture headache after spinal anesthesia for various surgeries using paramedian approach versus midline approach. Although various studies have been done to see the impact of patient related factors, anesthetist experience and type of needle used for spinal anesthesia on postdural puncture headache. However, there is no consensus on the optimal approach to spinal anesthesia to prevent post-dural puncture headache. Most anesthetists favor landmark midline/median approach. Other approaches include landmark or ultrasound guided paramedian, Taylor's approach and transforaminal approach[5,12,13]. Paramedian or Taylor's approach is usually reserved for anticipated difficult neuraxial anesthesia either due to anatomy or patient positioning. The midline approach involves passage of needle through the supraspinal and interspinal ligaments and the ligamentum flavum, but the paramedian approach avoids the supraspinal and interspinal ligaments and approaches the ligamentum flavum directly after passing through the paraspinal muscles. There is

larger area exposed to the needle in paramedian approach.

Postdural puncture headache is defined as a bilateral headache that develops within 7 days after dural puncture. It characteristically worsens 15 minutes after resuming sitting position and improves or disappears within 30 minutes of resuming supine position. It can be managed with medical as well as autologous epidural blood patch. It may result is prolonged recovery and delayed mobilization as well as psychosomatic side effects. More sinister side effects like subdural hematoma and seizures are rare but may prove fatal. The exact mechanism of development of postdural puncture headache is unclear. The postulated pathogenesis involves cerebrospinal fluid (CSF) leak through the dural puncture site resulting in intracranial hypotension leading to traction on intracranial structures and vasodilatation of cerebralvessels resulting in headache[14].

Bapat *et al*, reported that none of their patient developed postdural puncture headache; with 8% incidence of paresthesia in midline approach versus 2% in paramedian approach. Although they reported 100% success in both approaches; first time success was higher 92% in paramedian group versus 68% in midline group[15]. Singh *et al*, studied both approaches in a randomized controlled trial of 100 patients. They reported mild to moderate postdural puncture headache in 20% in median approach group versus 4% in paramedian approach, $p<0.01$. They also reported a higher backache in midline group (10%) versus paramedian group (2%), $p\leq0.01$[16]. The lesser the frequency of postdural puncture headache we reported in paramedian group may be explained by perforation of dura mater and arachnoid at different angles resulting in a valve mechanism that prevented greater loss of cerebrospinal fluid[17].

Mosaffa *et al*, reported similar frequency of postdural puncture headache 9.3% versus 10.7% ($p=0.875$) after spinal anesthesia for orthopedic surgery[18]. Similar findings were reported by Bansal *et al*, who reported 5% frequency of postdural puncture headache in median approach versus 1 (1%) in paramedian approach[19]. These result do not correlate with our findings. However, their study population was parturient undergoing cesarean section only; whereas, we studied orthopedics, abdominal as well as cesarean section.

RECOMMENDATIONS

We recommend that the paramedian approach should routinely be taught and used for spinal anesthesia. Further larger randomized control trial for comparison of the two approaches is required to validate results. If proven safer, the paramedian approach may be used as a gold standard approach to prevent post dural puncture headache.

LIMITATION OF STUDY

As we included all types of surgeries to evaluate the frequency of postdural puncture headache between two methods, so further studies with larger sample size may be needed to validate our results

CONCLUSION

There is significantly lower frequency of postdural puncture headache in paramedian approach for spinal anesthesia.

CONFLICT OF INTEREST

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

REFERENCES

1. Shih YJ, Hsieh CH, Kang TW, Peng SY, Fan KT. General versus Spinal anesthesia: which is risk factor for octogenarian Hip fracture repair Patients?. Inter J Gero 2010; 4(1): 37-42.
2. Milosavljevic BS , Pavlovic AP, Trpkovic SV , Influence of spinal and general anesthesia on the metabolic, hormonal, and hemodynamic response in elective surgical patients. Med Sci Monit 2014; 20(1): 1833-40.
3. Xiang P, Sun JM, Kim YA. General anesthesia vs spinal anesthesia for patients undergoing total-hip arthroplasty: a meta-analysis. Medicine 2019; 90(16): e14925-31.
4. Miller RD, Muravchick S. Spinal, Epidural and Caudal anesthesia. In: Miller RD, editor. Anesthisia Vol 2 . 61 ed. India; Elsevier Churchill Livingstone: 2005; 2(61): ed1653-83.
5. Patil AD, Bapat M, Patil SA, Gogna RL. Spinal anesthesia using Taylor's Approach helps avoid general anestehsia in short stature asthmatic patient. Saudi J Anaes 2015; 9(4): 474-76.

6. Leeda M, Stienstra R, Arbous MS, Dahan A, Veering B, Burm AG, et al. Lumbar epidural catheter insertion: the midline vs the paramedian approach. Eur J Anaes 2005; 22(1): 839-42.
7. Muranaka k, Mizutani H, Seo K, Yoshida M, Gohara T, Miyawaki H. A comparison between midline and paramedian approaches for combined spinal-epidural anesthesia. Masui 2001; 50(1): 1085-88.
8. Ghaleb A, Khorasani A, Mangar D. Postdural puncture headache. Int J Gen Med 2012; 5(1): 45-51.
9. Haller G, Cornet J, Boldi MO, Myers C, Savoldelli G, Kern C. Risk factors for post-dural puncture headache following injury of the dural membrane: a root-cause analysis and nested case-control study. Int J Obstet Anes 2018; 36(1): 17-27.
10. Zorrila VA, MAthur V, Wu CL, Grant MC. The impact of spinal needle selction on postdural puncture headache: a Meta-analysis and Metaregression of arndomzied studies. Reg Anesthe Pain Med 2018; 43(5): 502-08.
11. Firdous T, Siddiqui MA , Siddiqui SM. Frequency of post dural puncture headache in patients undergoing elective cesarean section under spinal anesthesia with median versus paramedian approach. Anaes Pain Inten Care 2016; 20(2): 165-70.
12. Conroy PH, Luyet C, Mc Cartney CJ. Real-ultrasound-guided spinal anesthesia: A prospective obser-vational study of a new approach. Anesthesiol Res Pract 2013: 252818.
13. Transforaminal sacral approach for spinal anesthesia in orthopedic surgery: A noval Apporach. Anesth Essays Res 2014; 8(2): 253-55.
14. Turnbull DK, Sheperd DB. Post-dural puncture headache: pathogenesis, prevention and treatment. BJA 2003; 91(5): 718-29.
15. Bapat V, Vishwasrao V. Spinal Anethesia with midline and paramedian Technique in elderly patients. Ind J Appl Res 2015; 5(9): 442-44.
16. Singh B, Sohal AS, Singh I, Goyal S, Kaur P, Attri JP. Incidence of postspinal headache and low backache following median and paramedian approaches in spinal anesthesia. Anesth Essay Res 2018; 12(10): 186-89.
17. Jabbari A, Alijanpour E, Mir M, Hashem NB, Rabiea SM, Rupani MA. Post spinal puncture headache, an old problem and new concepts: a review of articles about predisposing factors. Caspian J Intern Med 2013; 4(1): 595-02.
18. Mosaffa F, Karimi K, Modadi F, Khoshnevis SH, Beshali LD, Eajazi A. Post-dural Puncture Headache: a comparison between median and paramedian approaches in orthopedic Patients. Anesth Pain Med 2011; 1(2): 66-69.
19. Bansal T, Vashisht G, Sharma R. A study to compare median versus paramedian approach regarding incidence of postdural puncture headache under spinal anesthesia in cesarean section. Ind Anaes Forum 2018; 19(1): 61-64.