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Median Versus Paramedian Spinal Anesthesia: PDPH Incidence in Urological Procedures.

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ABSTRACT

Spinal anaesthesia is a popular method for anaesthesia in the lower body, offering advantages over general anaesthesia. The paramedian and median methods are most commonly used. Spinal anaesthesia has many benefits, but postdural puncture headache (PDPH) is the most common risk. This study aimed to find out how often PDPH happens in Libyan patients having spinal anaesthesia for urological surgeries, comparing the median and paramedian methods because there are not many records available. This prospective study occurred at the Specialty Surgical Centre in Benghazi, Libya, from September 18, 2019, to February 18, 2020. Patients undergoing urological surgery under spinal anaesthesia were divided into two groups based on the method used: median (Group M) and paramedian (Group P). Researchers collected age, BMI, and gender data to better understand PDPH prevalence and compare the two companies. All the data were coded and analysed using SPSS 27. The study included 60 patients, including 53 adult males and 7 females, ranging in age from 11 to 70 years, with a median age of 55.5 ± 18.2 years. Normal PDPH prevalence was 8.3%, with 13.3% in Group M and 3.3% in Group P. Statistical analysis showed no significant difference in PDPH prevalence between the two companies (p=0.4). Patients' age, gender, and BMI did not differ significantly between the two groups, according to logistic regression analysis. While a larger number of patients in the median institution had PDPH, the difference was not statistically significant. These findings support previous research on needle insertion techniques and PDPH, but the authors suggest conducting larger studies with more populations to confirm and improve those findings.

Keywords: medial technique, paramedian technique, postdural puncture headache, spinal anaesthesia, urological surgeries

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1.INTRODUCTION

Spinal anaesthesia is an extensively used approach in various surgical techniques because of its unique advantages compared to general anaesthesia [1]. One key gain of spinal anaesthesia is its capacity to anesthetize a selected location of the body, without interfering with respiratory function. Moreover, it starts faster than general anaesthesia, taking into account an instant initiation of the surgical procedure [2]. Furthermore, spinal anaesthesia normally has a shorter period, leading to a quicker healing time and, in advance, patient mobility [3]. Median (M) and paramedian (P) techniques are commonplace strategies to obtain spinal anaesthesia. Each method has its personal traits. The median technique, as an example, whilst being the extra frequently used, can pose technical challenges, especially in older individuals with structural degenerative changes of their spine. Conversely, the paramedian method is regularly preferred for its quicker and speedier catheter insertion [4] and the capability to manage anaesthesia without the need for a flexed position [5].

While spinal anaesthesia offers several benefits, it's essential to recognise its complications like postdural puncture headache (PDPH), bleeding, contamination, hypotension, urinary retention, and nerve injury [6]. The pronounced occurrence of PDPH varies significantly worldwide, stimulated by many factors, including affected person attributes, needle design, and the technique used [7]. Women, particularly pregnant and postnormal delivery at a high risk of PDPH. Similarly, a higher chance is found in individuals with lower body mass indices (BMI), while the peak age for its prevalence lies between 18 and 30 years [8]. The occurrence is also stimulated by way of numerous factors, which include the diameter of the spinal needle used for dural puncture, with smaller diameters being related to a decreased risk [9]. Moreover, the patient's positioning in the course of spinal anaesthesia may additionally have an essential position as cautioned with the aid of Sharma et al [10] who proposed that the lateral decubitus position is less likely to cause PDPH compared to the sitting position [10].

PDPH is mainly diagnosed based on clinical symptoms, laboratory tests, or further tests like neuroimaging are rarely indicated if complications or alternative conditions, such as subdural hematoma or venous

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thrombosis, are suspected [11, 12]. To decrease the risk of PDPH, several preventive measures can be taken, including the usage of small-diameter needles or atraumatic spinal needles, aligning the needle bevel with the dural fibers, and considering prophylactic epidural blood patches or epidural saline. Regarding the management of PDPH, simple steps like rest, adequate hydration, or using caffeine can help, alongside medications such as antiemetics, paracetamol, or even sphenopalatine ganglion and occipital nerve blocks and epidural blood patch for more severe cases. Fortunately, the majority of PDPH cases are self-limited, with approximately 75% improving within seven days and 88% resolving completely by six weeks, without any specific treatment. [13-15].

Many research papers have studied the prevalence of post-dural puncture headache following spinal anesthesia, with a primary emphasis on obstetric patients [16]. Some studies have extended their scope to include orthopedic patients [17, 18] or patients undergoing lower limb surgeries [19]. On the other hand, there is a paucity of research dedicated to urological interventions. For instance, Harrison and Langham [20] surveyed 100 patients who underwent spinal anesthesia in urology theaters, but they did not account for spinal anesthesia approaches. A more recent investigation in 2023 compared post-dural puncture headache occurrences between paramedian and median approaches, but it was limited to patients undergoing nephrolithotripsy [21]. With the scarcity of studies within our region, significant gaps persist in the literature concerning potential variations in PDPH rates between median and paramedian techniques. Therefore, the primary objective of this research was to investigate the incidence of post-dural puncture headache in patients undergoing spinal anesthesia for urological procedures and to test the difference in incidence between paramedian and median approaches. Such a study aims not only to enhance patient care but also to optimize resource distribution and enhance the efficiency of hospital resources.

2.MATERIALS AND METHODS

2.1.Study Design and Location

The prospective study was conducted at the Specialty Surgical Centre Benghazi between September 18th, 2019, and February 18th, 2020.

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2.2.Study Population

60 patients who needed urological procedures under spinal anaesthesia.

1.Inclusion criteria

a.Patients who did not complain of headache before spinal anaesthesia.

b.Patients who did not have features of hypovolemia in the perioperative period.

c.Patients who are hemodynamically stable with no blood pressure fluctuations.

2.Exclusion criteria

a.Patients with a history of headaches or chronic pain.

b.Patients with a history of PDPH.

c.Patients with anxiety or cognitive impairment.

2.3.Data Collection

Baseline data were obtained, including age, gender, presence of diabetes mellitus or hypertension, and BMI through the index: Weight (kg)/ Height $(m)^2$.

Spinal anaesthesia was administered in either a lateral or sitting position at L3–4 or L4–5 level by a single anaesthesiologist utilizing a 25G Quincke spinal needle. Patients were randomly and equally allocated to either the Median approach (M) or the Paramedian approach (P) groups. In Group M, spinal anaesthesia was administered by guiding the needle through the supraspinous ligament, interspinous ligament, and ligamentum flavum to the dura. The Group P technique directly targets the ligamentum flavum after traversing the paraspinal muscles. This method involved inserting the spinal needle 1cm lateral and below the spinous process at a cephalad angle of 10–15°.

To evaluate PDPH, patients were inquired about headache occurrence using a binary scale (yes or no response). Individuals experiencing headaches within 5 days post-surgery were examined for positional effects. Headache onset or aggravation within 15 minutes of standing in an upright position, followed by relief within 30 minutes of returning to a supine position, was classified as PDPH. The pain intensity scoring was assessed using the Visual Analogue Scale (VAS). The VAS score consists of a 10 cm line with 10 mm to each point of the scale and two end-points representing no pain and worst possible pain, where 0 = no pain, 1–3 = mild, 4–6 = moderate, and 7–10 = severe pain [22].

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2.4.Statistical Analysis

Data was analysed using IBM SPSS Statistics, version 27. Initially, demographic data were assessed through descriptive statistics: mean ± standard deviation (S.D.) for numerical data and counts/percentages for categorical data. The t-test was employed to evaluate mean differences, while the chi-square test ($\chi 2$) was used to compare the incidence of PDPH between the two approach groups. Factors associated with PDPH were investigated through logistic regression analysis, presenting odds ratios (OR) with a 95% confidence interval (CI) to indicate the strength of association; significance was considered for P-values < 0.05.

2.5.Ethical Considerations

Information about the study was given to all participants or their accompanying adult by the researcher anaesthesiologist. Before they enrolled in the study, participants provided formal consent. For individuals below 18 years, consent was acquired from their legal guardian. Personal information was omitted to uphold participant confidentiality.

3.RESULTS

3.1.General Characteristics of the Study Population

The study enrolled 60 patients who underwent various types of urological procedures under spinal anaesthesia. Of these patients, 53 (88%) were males and 7 (12%) were females, and their age ranged from 11 to 70 years, with a mean age of 55.5 ± 18.2 years. A total of 48.3% were in the 61 years and above age group, with a mean age of 68.8 ± 1.7, and most were males. For further information, please refer to Table (1).

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Table (1). Age distribution among the study population

Males Females			Gender		Total
Age group	years 30 ≥	Count	9	1	10
		Percentage	15%	1.7%	16.7%
	years 31-60	Count	18	3	21
		Percentage	30%	5%	35%
	years 61 ≤	Count	26	3	29
		Percentage	43.3%	5%	48.3%
Total Percentage		Count	53	7	60
		88%	12%	100%	

Among the study participants, 14 (23.3 %) were solely hypertensive, 15 patients (25%) were solely diabetic, and 3 (5%) had both conditions. It was also shown that the study population had a mean BMI of 23.5 ± 2.8, with 60% having a normal BMI and 33.3% being overweight. Obese and underweight patients each comprise 3.3% of the study population.

As illustrated in Figure 1, Cystoscopy, transurethral resection of bladder tumor (TURBT), and varicocele surgeries were the most commonly performed urological procedures. Less frequent procedures were also shown to provide a comprehensive overview. The study also examined the distribution of these surgeries based on the spinal approach used. Within the median approach group, 30% underwent TURBT, 16.7% underwent varicocele surgeries, and 13.3% had cystoscopy. Among the paramedian approach group, the distribution was 36.7% for cystoscopy, 20% for varicocele surgeries, and 13.3% each for TURBT and transurethral resection of the prostate (TURP) surgeries.

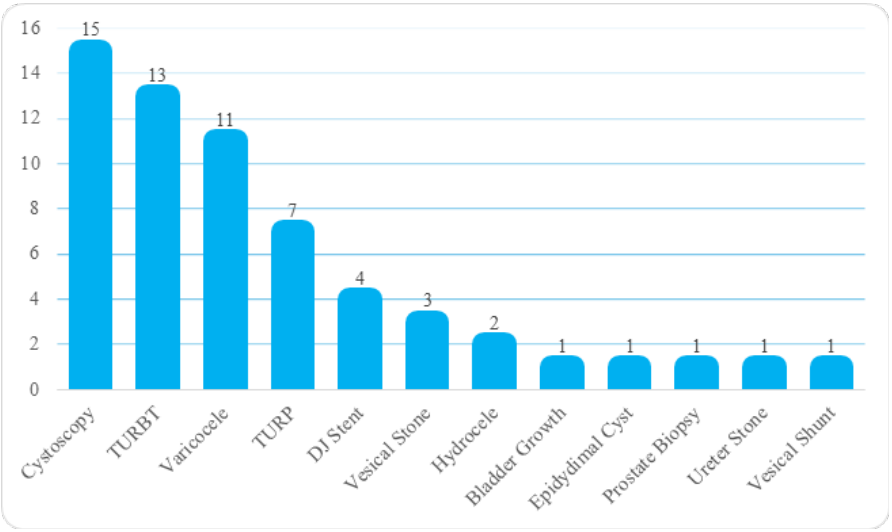

Figure (1). Types of urological procedures done in the study.

The demographic variables of the study population are displayed in Table (2) Considering both approaches to spinal anaesthesia.

Table (2). Demographic variables according to the spinal anesthesia approach.

Variable	Subclass	Median approach (n = 30)	Paramedian approach (n = 30)	p-value
Gender	Males	26 (86.7%)	27 (90%)	1
	Females	4 (13.3%)	3 (10%)	
Age (mean ± SD)		54.7 ± 17.4	52.3 ± 19.1	0.6
BMI (mean ± SD)		23.9 ± 2.6	23.2 ± 3.0	0.3
Diabetes mellitus	Diabetics	11 (36.7%)	7 (23.3%)	0.2
	Not diabetics	19 (63.3%)	23 (76.7%)	
Hypertension	Hypertensives	8 (26.7%)	9 (30%)	0.7
	Not hypertensives	22 (73.3%)	21 (70%)	

3.2.Incidence of PDPH Among the Study Population

Among the study population, 5 patients (8.3%), 3 males and 2 females, experienced a post-dural puncture headache with pain severity ranging from mild (80%) to moderate (20%) on a visual analogue scale. The distribution of PDPH among both genders didn't demonstrate any statistical significance, with a p-value of 0.09. Considering age distribution, 2 patients were aged 30 years or younger, while 3 patients fell within the 31-60-year age group, with a p-value of 0.06. Most patients (60%) complained of PDPH within 72 hours postoperatively, and the rest (40%) developed PDPH on the fourth day after spinal anaesthesia.

Table (3) presents the incidence of PDPH within the median and paramedian groups, as well as their gender distribution. Within Group M, four individuals (13.3%) reported PDPH. Three of them had mild headaches, and one had a moderate-severity headache. In Group P, only one individual (3.3%) reported PDPH, which was of mild severity. The p-value was 0.4, suggesting no statistically significant difference.

Table (3). Incidence of PDPH between the median and paramedian groups

Postdural puncture headache	Gender distribution	Median approach (group (n = 30	Paramedian approach (group (n = 30	p-value
Yes	Male	(75%) 3	(0%) 0	0.4
	Female	(25%) 1	(100%) 1	
No	Male	(88.5%) 23	(93.1%) 27	
	Female	(11.5%) 3	(6.9%) 2	

Univariable logistic regression revealed no significant association between PDPH incidence and age, gender or BMI, as evidenced by corresponding p-values of 0.06, 0.06, and 0.9, respectively. For more details, refer to Table (4).

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Table (4). Binary logistic regression of each independent variable with PDPH

	Univariate analysis		
	OR	95% CI	p-value
Age (years)	0.954	0.907-1.003	0.063
Gender (male/female)	0.150	0.020-1.121	0.065
BMI (Kg)	0.980	0.709-1.354	0.902

Abbreviations: OR = Odds Ratio, CI = Confidence Interval, BMI = Body Mass Index.

4.DISCUSSION

Our study reported a PDPH incidence of 8.3%, lower than that observed in studies from other African countries such as East Ethiopia, Kenya, Egypt, and others [23-25]. Similarly, this rate was less than the 20% reported by Oumer et al [17] among orthopedic patients in Addis Ababa, Ethiopia, possibly due to their use of needle sizes ranging from 18 to 23G. Compared to worldwide studies, our rate was lower than those reported in a study from Iran (10%) but higher than reports from Germany (5.9%) and the USA (2%) [18, 26, 27]. Similarly, Khraise et al [28] reported a lower incidence of 6.3% in parturients, which may be explained by their use of a mixture of needle types with needle sizes >25G while our study utilized only 25G cutting-type needles [28].

Regarding headache severity, our study has shown that 80% of study participants experienced mild headaches, and this was similar to the result of Mohammed et al [29] who reported that 61.9% of women had mild pain [29]. However, our results contrast with those of Tafesse and Melkamayew [23], who showed that more than two-thirds of the study participants had moderate to severe PDPH. The possible explanation for this discrepancy is that the needles that they used included ≥ 23 gauges, which are responsible for the CSF leakage in large amounts [23].

Considering the relationship between age, gender and PDPH, previous research has yielded mixed results. A study from Dhulikhel Hospital, Nepal, found that individuals aged 18-30 years were more susceptible to PDPH than those aged 31-45 years [30]. However, our study revealed a different trend, with patients aged 31-60 years being more likely to have PDPH in comparison to younger patients. Regarding gender, some studies have reported no significant impact of gender on the incidence of PDPH

[31-33], and this corresponds to our study's results. However, a study was conducted by DelPizzo et al [27] in New York, involving 300 patients undergoing simple knee arthroscopy, showed a higher incidence of PDPH in women compared to men [27]. A similar study has shown a higher incidence in women by 2-3 times than in men. While the exact reasons for this disparity remain unclear, it was claimed that hormonal differences and heightened female pain sensitivity may contribute to this phenomenon [34].

Regarding the disparity in PDPH occurrence between the two approaches, our study demonstrated an increase in the median approach, but without statistical significance. This result aligned with that of Jahromi et al [21] who suggested the paramedian approach as a superior approach in reducing PDPH, albeit without a statistical difference [21]. Similarly, Mosaffa et al [18] discovered no substantial variance in PDPH occurrence between the two approaches. Consequently, they recommend the paramedian approach, particularly for elderly patients with spinal degenerative changes and those who may find it challenging to adopt the appropriate position for the median approach. In contrast, other studies revealed another trend and showed a significant variation in the PDPH incidence between the two approaches. For example, a study of Haider et al [35], which included 50 patients undergoing various alternative surgeries during the spinal neuraxial anaesthesia, concluded that the possibility of PDPH [35] was reduced by using a paramedian approach with Quincke needle type markedly diminishes the chances of PDPH. On the contrary, a study conducted by Nisar et al [36] highlighted in Pakistan reported a higher incidence of PDPH with the paramedian approach compared to the median approach [36]. These contradictory results require large and more diverse studies to achieve integrated guidelines on the optimal approach to spinal anaesthesia.

5.CONCLUSIONS

Postdural puncture headache (PDPH) creates significant challenges for patients and health professionals, which negatively affects the patient's satisfaction and quality of care. Despite its effects, the prevalence and contributing factors of PDPH among urological patients in our region are poorly understood, emphasizing the need for focused research. Therefore, the purpose of

this study was to determine the occurrence of headaches after spinal anaesthesia in patients scheduled for urological procedures and to compare the occurrence between median and paramedian approaches. By identifying the frequency of PDPH and potential determinants, this study not only wants to improve the patient's satisfaction, but also to optimize the use of the health care system and improve the hospital's efficiency.

This study presented several significant findings. PDPH, a common complication of spinal anaesthesia, was infrequent, with an incidence of 8%. The severity of headaches ranged from mild to moderate and did not require specific interventions. Furthermore, the median approach group showed a higher incidence of PDPH (80% vs 20%), but this did not reach statistical significance. Additionally, the study did not demonstrate statistical significance among age, gender, and BMI as predictors of PDPH.

Nevertheless, these findings must be interpreted alongside certain limitations. The predominantly male cohort (88%) may limit its generalizability, as females are generally at higher risk for PDPH. Similarly, the small sample size (n=60) and reliance on a single needle type reduce the power to detect significant differences. Finally, factors like patient age, comorbidities, and anatomical variations that might influence PDPH occurrence may not have been equally distributed between the two groups.

Based on these findings, the study presents several key recommendations. Firstly, further research should involve larger and more diverse populations to validate the observed results. Secondly, additional studies are needed to explore other potential contributors to PDPH, as this study found no significant association with age, gender, or BMI. Finally, while PDPH is typically self-limiting, healthcare providers are encouraged to remain vigilant in monitoring patients for this common complication following spinal anaesthesia.

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7.REFERENCES

1.Capdevila X, Aveline C, Delaunay L, Bouaziz H, Zetlaoui P, Choquet O, et al. Factors determining the choice of spinal versus general anesthesia in patients undergoing ambulatory surgery: results of a multicenter observational study. Advances in Therapy. 2020;37:527-40.https://doi.org/10.1007/s12325-019-01171-6

2.Fedorov A, Lehto A, Klein J. Inhibition of mitochondrial respiration by general anesthetic drugs. Naunyn-Schmiedeberg's Archives of Pharmacology. 2023;396(2):375-81. https://doi.org/10.1007/s00210-022-02338-9

3.Siddiqi A, Mahmoud Y, Secic M, Tozzi JM, Emara A, Piuzzi NS, et al. Mepivacaine versus bupivacaine spinal anesthesia for primary total joint arthroplasty: a systematic review and meta-analysis. The Journal of Arthroplasty. 2022;37(7):1396-404. e5.https://doi.org/10.1016/j.arth.2022.03.031

4.Leeda M, Stienstra R, Arbous M, Dahan A, Veering BT, Burm A, et al. Lumbar epidural catheter insertion: the midline vs. the paramedian approach. European journal of anaesthesiology. 2005;22(11):839-42.https://doi.org/10.1017/S0265021505001419

5.Podder S, Kumar N, Yaddanapudi LN, Chari P. Paramedian lumbar epidural catheter insertion with patients in the sitting position is equally successful in the flexed and unflexed spine. Anesthesia & Analgesia. 2004;99(6):1829-32.https://doi.org/10.1213/01.ANE.0000136774.99702.14

6.Peterson EE, Riley BL, Windsor RB, editors. Pediatric intracranial hypotension and post-dural puncture headache. Seminars in Pediatric Neurology; 2021: Elsevier.

7.Choi DY, Lee SE, Lee MW, Lee KH, Kang E, Kwon JY, et al. Prediction of the Cervical Epidural Space Depth from the Skin Using Cervical X-Ray, During Cervical Epidural Block with Paramedian Approach. Journal of Pain Research. 2023:2079-90.https://doi.org/10.2147/JPR.S409347

8.Liu S, Carpenter RL, Neal JM. Epidural anesthesia and analgesia: their role in postoperative outcome. The Journal of the American Society of Anesthesiologists. 1995;82(6):1474-506.

9.Lambert DH, Hurley RJ, Hertwig L, Datta S. Role of needle gauge and tip configuration in the production of lumbar puncture headache. Regional anesthesia and pain medicine. 1997;22(1):66-72.https://doi.org/10.1016/

S1098-7339(06)80058-1

10.Sharma HM, Khandelwal M, Beniwal S, Gurjar SS, Sharma S. Comparison of sitting versus lateral decubitus position during spinal anaesthesia on the occurrence of post-dural puncture headache in patients undergoing lower segment caesarean section: A randomised controlled trial. Indian Journal of Anaesthesia. 2022;66(10):738-40.https://doi.org/10.4103/ija.ija_725_21

11.Stanhope E, Foulds L, Sayed G, Goldmann U. Diagnosing causes of headache within the postpartum period. J Obstet Gynaecol. 2018;38(5):728

12.Kurnutala LN, Kim D, Sayeed H, Sibai N. Persistent spinal headache after removal of intrathecal drug delivery system: a case report and review of literature. Anesthesiology and pain medicine. 2015;5(5).https://doi.org/10.5812/aapm.29786

13.Befikadu A, Timerga S, Mihretu F, Siyoum F, Agmuas A. Prevention and Management of Post-Dural Puncture Headache (PDPH). International Journal of Anesthetics and Anesthesiology. 2022;9(2):143-4.https://doi.org/10.23937/2377-4630/1410143

14.Apfel C, Saxena A, Cakmakkaya O, Gaiser R, George E, Radke O. Prevention of postdural puncture headache after accidental dural puncture: a quantitative systematic review. British journal of anaesthesia. 2010;105(3):255-63.https://doi.org/10.1093/bja/aeq191

15.Weji BG, Obsa MS, Melese KG, Azeze GA. Incidence and risk factors of postdural puncture headache: prospective cohort study design. Perioperative Medicine. 2020;9:1-6. https://doi.org/10.1186/s13741-020-00164-2

16.Karami T, Karami N, Rastgo H. Comparison of the effect of paramedian and median methods on postdural puncture headache among candidates for elective ce-sarean sections undergoing spinal anesthesia. A double blind. Pediatr Anesth Crit Care J. 2021;9:116-22.https://doi.org/10.14587/paccj.2021.19a

17.Oumer KE, Aychew H, Daniel T, Mekete G, Belete KG, Negash TT. Incidence and associated factors of post-dural puncture headache among orthopaedic patients after spinal anesthesia: a prospective cohort study. Annals of Medicine and Surgery. 2023;85(10):4703-8.https://doi.org/10.1097/ms9.0000000000001167

18.Mosaffa F, Karimi K, Madadi F, Khoshnevis SH, Besheli LD, Eajazi A. Post-dural puncture headache: a comparison between

median and paramedian approaches in orthopedic patients. Anesthesiology and Pain Medicine. 2011;1(2):66-9.https://doi.org/10.5812/kowsar.22287523.2159

19.DelPizzo K, Luu T, Fields KG, Sideris A, Dong N, Edmonds C, et al. Risk of postdural puncture headache in adolescents and adults. Anesthesia & Analgesia. 2020;131(1):273-9.https://doi.org/10.1213/ANE.0000000000004691

20.Harrison D, Langham B. Spinal anaesthesia for urological surgery: a survey of failure rate, postdural puncture headache and patient satisfaction. Anaesthesia. 1992;47(10):902-3

21.Jahromi MSS, Zabetian H, Kalani N, Khosravani F, Yousefi A. Comparing the Incidence of Postdural Puncture Headache (PDPH) between Median and Paramedian Approaches in Nephrolithotripsy under Spinal Anesthesia. International Journal of Medical Investigation. 2023;12(1):83-91

22.Mohamed R, Amin M, Omar H. Computed tomography-guided celiac plexus neurolysis for intractable pain of unresectable pancreatic cancer. Egyptian Journal of Radiology and Nuclear Medicine. 2017;48:627-37.10.1016/j.ejrnm.2017.03.027.

23.Tafesse D, Melkamayew A. Magnitude of postdural puncture headache and associated factors in obstetric mothers undergone spinal anesthesia for caesarean section. J of Anes & Cri Open Access. 2019;11(2):46-50

24.Gisore E, Mung'ayi V, Sharif T. Incidence of post-dural puncture headache following caesarean section under spinal anaesthesia at the Aga Khan University Hospital, Nairobi. East African medical journal. 2010;87(6):227-30.https://doi.org/10.4314/eamj.v87i6.63078

25.Ali HM, Mohamed MY, Ahmed YM. Postdural puncture headache after spinal anesthesia in cesarean section: Experience in six months in 2736 patients in Kasr El aini teaching hospital–Cairo University. Egyptian Journal of Anaesthesia. 2014;30(4):383-6. https://doi.org/10.1016/j.egja.2014.06.001

26.Weinrich J, von Heymann C, Henkelmann A, Balzer F, Obbarius A, Ritschl P, et al. Postdural puncture headache after neuraxial anesthesia: incidence and risk factors. Der Anaesthesist. 2020;69:878-85.https://doi.org/10.1007/s00101-020-00846-y

27.DelPizzo K, Cheng J, Dong N, Edmonds CR, Kahn RL, Fields KG, et al. Post-dural puncture headache is uncommon in young

ambulatory surgery patients. HSS Journal®. 2017;13(2):146-51

28.Khraise WN, Allouh MZ, El-Radaideh KM, Said RS, Al-Rusan AM. Assessment of risk factors for postdural puncture headache in women undergoing cesarean delivery in Jordan: a retrospective analytical study. Local and Regional Anesthesia. 2017:9-13.https://doi.org/10.2147/LRA.S129811

29.Mohammed A, Ayyuba R, Salisu I, Nagoma A, Owolabi L, Ibrahim A. An analysis of postdural puncture headache in obstetric patients: A study from Kano, Nigeria. Tropical Journal of Obstetrics and Gynaecology. 2017;34(1):16-20

30.Singh J, Ranjit S, Shrestha S, Limbu T, Marahatta SB. Post dural puncture headache. Journal of Institute of Medicine Nepal. 2011;32(2):30-2.https://doi.org/10.59779/jiomnepal.501

31.Dittmann M, Schaefer HG, Renkl F, Greve I. Spinal anaesthesia with 29 gauge Quincke point needles and post dural puncture headache in 2,378 patients. Acta anaesthesiologica scandinavica. 1994;38(7):691-3.https://doi.org/10.1111/j.1399-6576.1994.tb03978.x

32.Lybecker H, Møller JT, May O, Nielsen HK. Incidence and prediction of postdural puncture headache A prospective study of 1021 spinal anesthesias. Anesthesia & Analgesia. 1990;70(4):389-94

33.Tarkkila PJ, Heine H, Tervo R-R. Comparison of Sprotte and Quincke needles with respect to post dural puncture headache and backache. Regional Anesthesia and Pain Medicine. 1992;17(5):283-7

34.Wu CL, Rowlingson AJ, Cohen SR, Michaels RK, Courpas GE, Joe EM, et al. Gender and post–dural puncture headache. The Journal of the American Society of Anesthesiologists. 2006;105(3):613-8

35.Haider S, Butt KJ, Aziz M, Qasim M. Post dural puncture headache-a comparison of midline and paramedian approaches. Biomedica. 2005;21(July-December):90-2

36.Nisar A, Saleem J, Hussain S, Bashir K. Comparison of postdural puncture headache in median and paramedian approach under spinal anesthesia in cesarean section. Pak J Med Health Sci. 2016;10(1):298-301.