Section: Anaesthesiology

Original Research Article

A PROSPECTIVE COMPARATIVE STUDY OF IMPACT OF BODY MASS INDEX ON INCIDENCE OF POST-DURAL PUNCTURE HEADACHE IN PARTURIENT WOMEN

M. Ashok Kumar[1], B V Rajeshwari[2], P. Vijaya Narasimha Reddy[3]

[1]Assistant Professor, Department of Anaesthesiology, Fathima Institute of Medical Sciences, Kadapa, Andhra Pradesh, India.
[2]Assistant Professor, Department of Anaesthesiology, Fathima Institute of Medical Sciences, Kadapa, Andhra Pradesh, India.
[3]Associate Professor, Department of General Medicine, Government Medical College (RIMS), Kadapa, Andhra Pradesh, India

Received : 09/01/2025
Received in revised form : 11/03/2025
Accepted : 27/03/2025

Keywords:
Headache, Spinal anaesthesia, Cesarean section, Body mass index.

Corresponding Author:
Dr. M. Ashok Kumar,
Email: drmoodeashokkumar@gmail.com

DOI: 10.47009/jamp.2025.7.2.80

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (2); 398-401

Abstract

Background: Previous studies have been controversial as to the relationship between post-dural puncture headache (PDPH) and body mass index (BMI) in parturient patients. Therefore, we decided to survey this complication in a group of patients whose pregnancies were terminated by cesarean-section under spinal anaesthesia. It was hypothesized that patients with higher BMI will have lower incidence of PDPH. **Materials and Methods:** After studying the patients files and calling them, the demographic information was extracted and recorded. Also, development of PDPH up to three days after cesarean-section in the current delivery and headache score based on 0-10 verbal numeric rating scale (NRS) were documented. **Result:** This study was performed on 80 women who had undergone cesarean section under spinal anaesthesia in Fathima Institute of Medical Sciences, Kadapa (March 2023 to February 2024). The age of the subjects was between 20 years and 40 years old (29.24 ± 2.27). The mean of BMI before cesarean/section (kg/m^2) 30.21 ± 2.82. From the 80 parturient patients, 40 (50%) women were non-obese and the rest (50%) were obese (BMI above 30 kg/m2); 97.90% of them were non-smoker and 92% had not any past history of PDPH in the previous neuro-axial anaesthesia/analgesia. Of the patients who did not develop PDPH, 31 (77.50 %) had a BMI <30 (Group-I) and 32 (80 %) had a BMI ≥30 (Group-II) (P = 0.396). **Conclusion:** The incidence of PDPH was reduced by increased BMI at the time of cesarean-section. In obese patients, the higher intra-abdominal pressure decreases the leakage of CSF from the dural puncture point; thus, by increasing the BMI, the incidence of PDPH is decreased. This study also showed that the severity of PDPH did not significantly change with BMI, weight gain during pregnancy or any other analyzed factors.

INTRODUCTION

Post-dural puncture headache (PDPH), which is among the most common complications of spinal anaesthesia (SA), develops following a dural puncture. Although the mechanism of PDPH is not clear, the most common cause is cerebrospinal fluid (CSF) leakage from the rent caused by the needleused for SA, which decreases the intracranial pressure and places tension on the meningeal vessels and nerves.[1] PDPH is seen more frequently in young patients due to their increased physical sensitivity, decreased pain threshold, and increased mobility. Dehydration, rapid changes in blood volume, intra-abdominal pressure changes during labor, and insufficient fluid replacement after delivery occur in parturient women.[2] Delivery stress also increases the incidence of PDPH in obstetric patients.[3] The rate of PDPH ranges from 0.7% to 28% and is highest in obstetric patients.[4,5] When 25G spinal needles were used, the prevalence of PDPH was 4.3%.[6]Other factors that affect the prevalence of PDPH are age, gender, puncture technique, anaesthetist's experience, early postoperative mobilization, needle thickness, and type of needle tip.[7] Obesity may protect against PDPH in parturient women,[8-11] increased intra-abdominal fat tissue reduced CSF leakage by increasing the pressure in the epidural space.[12-14] Hence, this study examined the impact of body mass index (BMI) on PDPH in elective cesarean section patients in whom 25G spinal needles were used. The

ISSN (O): 2687-5365; ISSN (P): 2753-6556

primary objectives of this study are to investigate the effects of BMI on the development of PDPH. A secondary objective is to investigate the age factor.

MATERIALS AND METHODS

This study is a hospital based comparative study, was approved by Ethical Committee of Fathima Institute of Medical Sciences, Kadapa. Duration of study March 2023 to February 2024.A written informed consent was obtained from thepregnant females who accepted to participate in this study. In this study, we studied the files of elective cesarean section candidates.

Inclusion criteria were age of 20 years to 40 years old, American Society of Anaesthesiologists (ASA) class I and II, receiving spinal anaesthesia with the first try using Quincke needles (25G) (Becton Dickinson, Spain), use of intrathecal 0.5% bupivacaine without preservative substance for spinal anaesthesia, and elective Cesarean/ Section. All patients were evaluated by ananaesthesiologist preoperatively and the history of headache was recorded.

Exclusion criteria were twin or multiple gestation, gestational diabetes, preeclampsia or eclampsia, H/O migraine or any other types of headache, psychiatric diseases and change in the anaesthesia plan to general anaesthesia during surgery.

Sample size: After studying the files of 150cases of cesarean/section, 80 subjects were matched with the inclusion and exclusion criteria and also were available and cooperative to answer the questionnaire. Their following information was extracted and recorded in a checklist including age, gravid number, history of smoking, height, last weight before pregnancy, weight gain during pregnancy, pre-cesarean weight and BMI, history of PDPH in previous neuroaxial technique, having PDPH up to three days after delivery in the current spinal method of anaesthesia, PDPH start date, headache score based on 0-10 verbal numeric rating scale (NRS), and the need for treatment with epidural blood patch, supportive treatments such as hydration, analgesics or other self healing treatment. To validate the primary and secondary data, a sensitivity analysis was conducted by a cut-off value of 30 kg/m2, which is accepted as the threshold value defining obesity by the World Health Organization (WHO).

In parallel, patients were divided into 2 groups: based on adult obesity and BMI, calculated in the database using their weight at the time of the procedure: Group 1: Non obese, Patients (BMI<30 kg/m^2, Group<30); Group 2: Obese patients (BMI ≥ 30 kg/m^2, Group ≥ 30).

Formula: $n = z\alpha 2 \text{ X } pq / d2$

Where, n is the required sample size.

Z α is the standard normal deviate, which is equal to 1.96 at 95% confidence interval.

p is the prevalence in the population of the factor under study.

q = 100-p

d = Absolute precision is taken as 5% p = 2.5% q = 97.5%

n = number of samples is to be studied

Furthermore, severity of PDPH was assessed using a NRS extending from 0-10; 0=no headache, 1-3=mild headache, 4-7=moderate headache, >7=severe headache. The primary outcome of this study was presence of PDPH.

Secondary outcomes included association of the incidence and severity of PDPH with the height, smoking, and weight gain during pregnancy, the last weight before pregnancy, and the last weight and BMI before caesarean section. In fact, in this study, the BMI differentiation of patients as obese and lean was determined, and in the next stage, the incidence of PDPH in these patients was examined.

Statistical analysis: Statistical analyses were done using SPSS for Windows software (version 22; SPSS Inc., Chicago, IL, USA). The Chi-square test was used to compare qualitative data. A P value of < 0.05 was accepted as statistically significant. Data are presented as mean ± standard deviation (SD) oras numbers (n) and Percent.

RESULTS

The study included 80 patients aged 18–40 years with ASA physical status I II, who underwent elective cesarean section under SA. The age of the subjects was between 20 years and 40 years old (29.24 ± 2.27). The mean of BMI before cesarean/section (kg/m2) 30.21 ± 2.82, duration of operation (min) was 36.45 ± 4.89. The demographic distribution of parturient patients shows in [Table 1].

Table 1: The demographic distribution of parturient patients.

Variable	Mean±SD
Age (years)	29.24 ± 2.27
Weight (kg)	68.23 ± 5.89
Height (cm)	149.45 ± 7.25
BMI before cesarean/section (kg/m2)	30.21 ± 2.82
Duration of operation (min)	36.45 ± 4.89

Data are presented as mean±standard deviations (SD)

The parturient patients were between gravid 1-8; 25 (31.25%) gravid 1, 32 (40%) gravid 2, 8 (10%)

ISSN (O): 2687-5365; ISSN (P): 2753-6556

gravid 3, 5 (6.25%) gravid 4, 5 (6.25%) gravid 5, 2 (2.5%) gravid 6, 2 (2.5%) gravid 7 and 1 (1.25%) gravid 8.

From the 80 parturient patients, 40 (50%) women were non-obese and the rest (50%) were obese (BMI above 30 kg/m2); 97.90% of them were non-smoker and 92% had not any past history of PDPH in the previous neuro-axial anaesthesia/analgesia. In this study, only 17 patients (21.25%) developed headache after the current spinal anaesthesia.

Of the patients who did not develop PDPH, 31 (77.50 %) had a BMI <30 and 32 (80 %) had a BMI ≥30 (P = 0.396) [Table 2].

Table 2: PDPH distribution according to BMI

Variable		PDPH distribution according to BMI (%)		p-value
		Group-I (n=40)	Group-II (n=40)	
Incidence of PDPH	Yes	9 (22.50 %)	8 (20 %)	0.396
	No	31 (77.50 %)	32 (80 %)	

Group I: BMI<30, Group II: BMI≥30; PDPH: post-dural puncture headache

As displayed in [Table 3], there was a significant relationship between pre-cesarean weight and also the amount of weight gain during pregnancy period and the incidence of post-dural puncture headache (p-value: respectively 0.008 and <0.001). That is, with the increase in pregnancy weight gain and pre-cesarean weight, the incidence of headache will decrease.

Table 3: The relation of pre-cesarean weight (kg) and weight gain during pregnancy (kg) with the incidence of post-spinal headache

Variable	Incidence of post-spinal Headache [mean ± std deviation]		p-value
	Yes	No	
Pre-cesarean Weight (kg)	77.56 ± 9.58	73.27 ± 5.78	0.008
Weight gain during pregnancy (kg)	13.24 ± 2.32	11.21 ± 2.58	<0.001

DISCUSSION

The present study showed that most headache cases occurred in patients with BMI<30, but the NRSin the parturient women with different BMI levels did not have any significant difference.

Regional anaesthesia is safe for cesarean operations. PDPH has become one of the most common complications of spinal anaesthesia. The rent opened by the spinal needle in the duramater leads to CSF leakage, a decrease in intracranial pressure, and tension on the meningeal vessels and nerves, which isthought to lead to PDPH. The prevalence of PDPH in spinal anaesthesias 0.2–24%, although it is more common in obstetric cases.[15] The changes in fluid and blood volumes, and intra-abdominalpressure during and after delivery, are associated with PDPH in obstetric cases.[16]

The age of the subjects was between 20 years and 40 years old (28.24 ± 3.27). The mean of BMI before cesarean/section (kg/m2) 30.21 ± 2.82. In parallel, there are anumber of similarities among our study population and other studies that showed a lower incidence of PDPH,[17,18] which may account for our findings to find an effect of BMI on outcome. These include similarity in BMI demographics and dural puncture with the same needles. Previous studies,[19] that noted lower rates of PDPH as BMI increased were conducted after spinal anaesthesia. But, in contrast with these findings, in a study by Miu et al,[13] which assessed the association between body mass index and PDPH in patients with cesarean section did not show that patients with high body mass index were less likely to have PDPH.6, while our study, unlike that of Miu et al,[13] confirmed this idea. In addition, our findings on the relationship of BMI with PDPH after dural puncture are consistent with the findings of Peralta et al, which reported that the relationship between BMI and PDPH in women with cesarean section by spinal method, showing that the prevalence of PDPH in patients with higher BMI was reduced.[20,21] The results of this study confirm our findings.

Our study also showed that the severity of headache after the spinal anaesthesia (numerical rating scale in cases who had headache related to dural puncture) did not changed with patients' age, gravid number, height, weight before pregnancy, weight gain during the pregnancy period, pre-cesarean weight, and BMI (p-value>0.05). Also, in patients with the past history of PDPH, the severity of post-spinal headache was not significantly greater than the others (p-value: 0.386). According to the results of the present study, it is suggested that spinal technique should be used as the anaesthesia method in lean pregnant women (BMI less than 30 kg/m2) with more precautions because these people are considered to be in higher risk of PDPH. It seems that the presumptive cause of the decrease in PDPH rate in obese patients is that the increase in BMI leads to the higher intraabdominal pressure which decreases the CSF leakage from the rent of the dura at the site of needle entrance. In parallel, Hogan et al. suggested that intraabdominal pressure increases linearly with body weight and found a decrease in CSF volume with external abdominal compression that may simulate a static increase in abdominal pressure similar to that found in pregnancy.[22,23] Moreover, the same investigators recommended that the mechanism involves "inward movement of soft tissue in the intervertebral foramen". Increased abdominal pressure in the obese parturient may also

ISSN (O): 2687-5365; ISSN (P): 2753-6556

enhance pregnancy-induced epidural venous engorgement, resulting in a decrease in the volume of CSF in the lumbar neuraxial canal.[24] BMI with a high level of confidence. So the comparison may be more appropriate if done on a non-pregnant population indicated for spinal anaesthesia.

CONCLUSION

Taken together, our data confirm the previously reported association between high BMI and reduced likelihood of a PDPH, and there was not any statistical relationship between the patients' characteristics such as height, weight and BMI. The severity and need for treatment of a PDPH were not influenced by body weight; this study also showed that the severity of PDPH did not significantly change with BMI. It is recommended that further studies should be conducted about the effective factors on the severity of post-spinal headache in larger sample sizes.

REFERENCES

1. Jafari E. Headache in women. InHeadache and Migraine in Practice. Academic Press. 2022;265-300.
2. Hashemi M, Akhlagh SH, Shadegan SH, Taheri M, Farbood A, Dadkhah P, Asadi S. The impact of increased body mass index on the incidence and severity of post-spinal headache after cesarean section. J Res Med Dent Sci. 2019;7(2):1-5.
3. Costa AC, Satalich JR, Al-Bizri E, Shodhan S, Romeiser JL, Adsumelli R, Abola RE, Steinberg ES, Bennett-Guerrero E. A ten-year retrospective study of post-dural puncture headache in 32,655 obstetric patients. Canadian Journal of Anesthesia/Journal canadiend'anesthésie. 2019;66(12):1464-71.
4. Taylor CR, Dominguez JE, Habib AS. Obesity and obstetric anesthesia: current insights. Local and regional anesthesia. 2019;12:111.
5. Li H, Wang Y, Oprea AD, Li J. Postdural Puncture Headache—Risks and Current Treatment. Current Pain and Headache Reports. 2022:1-2.
6. Albaqami MS, Alwarhi FI, Alqarni AA. The efficacy of sphenopalatine ganglion block for the treatment of postdural puncture headache among obstetric population. Saudi Journal of Anaesthesia. 2022;16(1):45.
7. Angle P, Thompson D, Szalai JP, Tang SL. Expectant management of postdural puncture headache increases hospital length of stay and emergency room visits. Canadian Journal of Anesthesia. 2005;52(4):397-402.
8. Flegal KM, Carroll MD, Ogden CL, Johnson CL. Prevalence and trends in obesity among US adults, 1999-2000. Jama. 2002;288(14):1723-7.
9. Beyaz SG, Ergönenç T, Saritaş A, Şahin F, Ülgen AM, Eman A, Doğan B. The interrelation between body mass index and post-dural puncture headache in parturient women. Journal of Anaesthesiology, Clinical Pharmacology. 2021;37(3):425.
10. Choi PT, Galinski SE, Takeuchi L, Lucas S, Tamayo C, Jadad AR. PDPH is a common complication of neuraxial blockade in parturients: a meta-analysis of obstetrical studies. Canadian Journal of Anesthesia. 2003;50(5):460-9.
11. Birajdar SB, Allolli DN, Javed M. Study of incidence of postdural puncture headache (PDPH) in pregnant women with different body mass index undergoing caesarean section under spinal anaesthesia. Indian J ClinAnaesth. 2016;3(3):443.
12. Hashemi M, Akhlagh SH, Shadegan SH, Taheri M, Farbood A, Dadkhah P, Asadi S. The impact of increased body mass index on the incidence and severity of post-spinal headache after cesarean section. J Res Med Dent Sci. 2019;7(2):1-5.
13. Miu M, Paech MJ, Nathan E. The relationship between body mass index and post-dural puncture headache in obstetric patients. International journal of obstetric anesthesia. 2014;23(4):371-5.
14. Shivan M, Smita P, Parul M, Keshaban M. Effect of reinsertion of the spinal needle stylet after spinal anaesthesia procedure on post dural puncture headache in women undergoing caesarean delivery. Indian journal of anaesthesia. 2020;64(11):971.
15. Sharma SK, Gambling DR, Joshi GP, Sidawi JE, Herrera ER. Comparison of 26-gauge Atraucan® and 25-gauge Whitacre needles: insertion characteristics and complications. Canadian journal of anaesthesia. 1995;42(8):706-10.
16. Vallejo MC, Mandell GL, Sabo DP, Ramanathan S. Postdural puncture headache: a randomized comparison of five spinal needles in obstetric patients. Anesthesia& Analgesia. 2000;91(4):916-20.
17. Bansal T, Kumar P, Hooda S. Regional anaesthesia—Still a comfortable choice in morbidly obese parturient. Colombian Journal of Anesthesiology. 2013;41(4):302-5.
18. Russell IF. A prospective controlled study of continuous spinal analgesia versus repeat epidural analgesia after accidental dural puncture in labour. International journal of obstetric anesthesia. 2012;21(1):7-16.
19. Shivan M, Smita P, Parul M, Keshaban M. Effect of reinsertion of the spinal needle stylet after spinal anaesthesia procedure on post dural puncture headache in women undergoing caesarean delivery. Indian journal of anaesthesia. 2020;64(11):971.
20. Gaiser RR. Postdural puncture headache: an evidence-based approach. Anesthesiology clinics. 2017;35(1):157-67.
21. Peralta F, Higgins N, Lange E, Wong CA, McCarthy RJ. The relationship of body mass index with the incidence of postdural puncture headache in parturients. Anesthesia& Analgesia. 2015;121(2):451-6.
22. Hogan QH, Prost R, Kulier A, Taylor ML, Liu S, Mark L. Magnetic resonance imaging of cerebrospinal fluid volume and the influence of body habitus and abdominal pressure. The Journal of the American Society of Anesthesiologists. 1996;84(6):1341-9.
23. Günkaya M, Arar C, Mordeniz C, Baran O, Topçu B. Effect of waist circumference and body mass index on the level of spinal anesthesia. Ain-Shams Journal of Anesthesiology. 2022;14(1):1-6.
24. Daviskiba S, Shuman H, Ayyash M, Vadlamudi G, Smietana S, Goyert G. A multidisciplinary approach to caring for a pregnant patient with blue rubber bleb nevus syndrome: A case report. Case Reports in Women's Health. 2022;34:e00403.

ISSN (O): 2687-5365; ISSN (P): 2753-6556