

The interrelation between body mass index and post-dural puncture headache in parturient women

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Abstract

Background and Aims: Post-dural puncture headache is seen more frequently in pregnant women due to stress, dehydration, intra-abdominal pressure, and insufficient fluid replacement after delivery. Obesity protects against post-dural puncture headache in pregnant women; increased intra-abdominal fat tissue reduced cerebrospinal fluid leakage by increasing the pressure in the epidural space. Therefore, this study investigated the influence of body mass index on post-dural puncture headache in elective cesarean section patients in whom 27G spinal needles were used.

Material and Methods: The study included 464 women who underwent elective cesarean section under spinal anesthesia. Dural puncture performed with a 27G Quincke spinal needle at the L3-4 or L4-5 intervertebral space and given 12.5 mg hyperbaric bupivacaine intrathecally. The patients were questioned regarding headache and low back pain 6, 12, 24, and 48 h after the procedure, and by phone calls on days 3 and 7.

Results: Post-dural puncture headache developed in 38 (8.2%) patients. Of the patients who developed post-dural puncture headache, 23 (60.5%) had a body mass index <30 and 15 (39.5%) had a body mass index ≥30. Of the patients who did not develop post-dural puncture headache, 258 (60, 6%) had a body mass index <30 and 168 (39, 4%) had a body mass index ≥30.

Conclusion: This prospective study found the body mass index values did not affect post-dural puncture headache in the elective cesarean section performed under spinal anesthesia.


Keywords: Body mass index, cesarean section, parturient, post-dural puncture headache, spinal anesthesia

Introduction

Post-dural puncture headache (PDPH), which is among the most common complications of spinal anesthesia (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 hole caused by the needle

used for SA, which decreases the intracranial pressure and places tension on the meningeal vessels and nerves. 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.^[1] Delivery stress also increases the incidence of

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PDPH in obstetric patients.^[2] The rate of PDPH ranges from 0.7% to 28% and is highest in obstetric patients.^[3,4] When 25G spinal needles were used, the prevalence of PDPH was 4.3%.^[5] Other factors that affect the prevalence of PDPH are age, gender, puncture technique, anesthetist's experience, early postoperative mobilization, needle thickness, and type of needle tip.^[6] Obesity may protect against PDPH in parturient women;^[7-10] increased intra-abdominal fat tissue reduced CSF leakage by increasing the pressure in the epidural space.^[11,12]

Hence, this study examined the impact of body mass index (BMI) on PDPH in elective cesarean section patients in whom 27G spinal needles were used. The primary objectives of this study is to investigate the effects of BMI on the development of PDPH. Secondary objectives is to investigate the age factor.

Material and Methods

Local ethics committee approval was obtained from Sakarya University for this prospective clinical study and it was registered on www.ClinicalTrials.gov (NCT02999919). The study included 464 women aged 18–40 years, with the American Society of Anesthesiologists (ASA) physical status I-II who underwent elective cesarean section under SA. We excluded those patients who had undergone lumbar disc or vertebra surgery, had chronic low back pain or headache or had contraindications for the neuraxial block. According to World Health Organization (WHO) criteria, BMI (body weight [kg]/height ²[m]) <25 is considered normal, BMI 25–30 is overweight, BMI 30–35 is a grade I obesity, and BMI 35–40 is grade II obesity.^[13] Therefore, the patients with a BMI of less than 30 were accepted as normal weight (group I) and those with a BMI above 30 were postulated as obese (group II). After the patients were shifted to the operating room, 10 mL/kg of 0.9% NaCl was administered for 30 min through a 20G cannula. Metoclopramide 20 mg IV was administered for aspiration prophylaxis. The patients were monitored with respect to electrocardiography, noninvasive artery pressure, heart rate, and peripheral oxygen saturation, and given 12.5 mg hyperbaric bupivacaine intrathecally following a successful dural puncture performed with a 27G Quincke spinal needle at the L3-4 or L4-5 intervertebral space in the sitting position (with the needle tip directed upward). The procedure was attempted a maximum of two times at the same level and a maximum of three procedures were performed. If the procedure could not be completed within three attempts, the patient was excluded from the study. The sensory block level was evaluated with a pin-prick test; the operation started

when the sensory block level was T4. All patients were given 2 L/min oxygen by mask. Intravenous atropine 0.01 mg/kg was administered if the heart rate fell below 60 bpm; 5 mg ephedrine was administered intravenously if the mean blood pressure decreased by 20% of the baseline value measured just before SA or below 60 mmHg. Demographic characteristics, BMI, vital signs, anesthesia and operating times, motor block time, and side effects (nausea, vomiting, bradycardia, hypotension, and flushing) were recorded. The patients were advised not to stand during the first 6 h after the procedure and were also monitored for side effects (nausea, itching, respiratory difficulty, back pain, and headache). The patients were interrogated about headache and low back pain 6, 12, 24, and 48 h after the procedure, and by phone calls on days 3 and 7. PDPH was defined as pain in the frontal or occipital regions when sitting or standing; the pain was aggravated on coughing or sneezing and decreased or was relieved by lying down. Severity was recorded on a numerical rating scale (NRS) as follows: 0 (no headache); 1–3 (mild headache); 4–7 (moderate headache); and 8–10 (severe headache). The duration of headache and presence of additional findings such a shearing loss, tinnitus, photo-sensitivity, nausea, or vomiting were recorded. The patients who had been diagnosed with PDPH in the hospital were treated with intravenous fluid, oral/intravenous analgesics, and oral caffeine; the patients who had been discharged were invited to return to the hospital for treatment. This treatment protocol could be repeated two times and an epidural blood patch was applied if symptoms did not regress.

All patient interviews and treatments were performed by a specialist who was unaware of the patient groups and was not involved in the operations of the patients.

Statistical analyses were done using SPSS for Windows software (ver. 10.0; 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) or as numbers (n) and percent.

Results

Figure 1 shows the CONSORT diagram for our study.

The study included 464 patients aged 18–40 years with ASA physical status I-II, who underwent elective cesarean section under SA. Table 1 shows the age, weight, height, BMI, and operating time of the patients. The average development time of the right and left Bromage

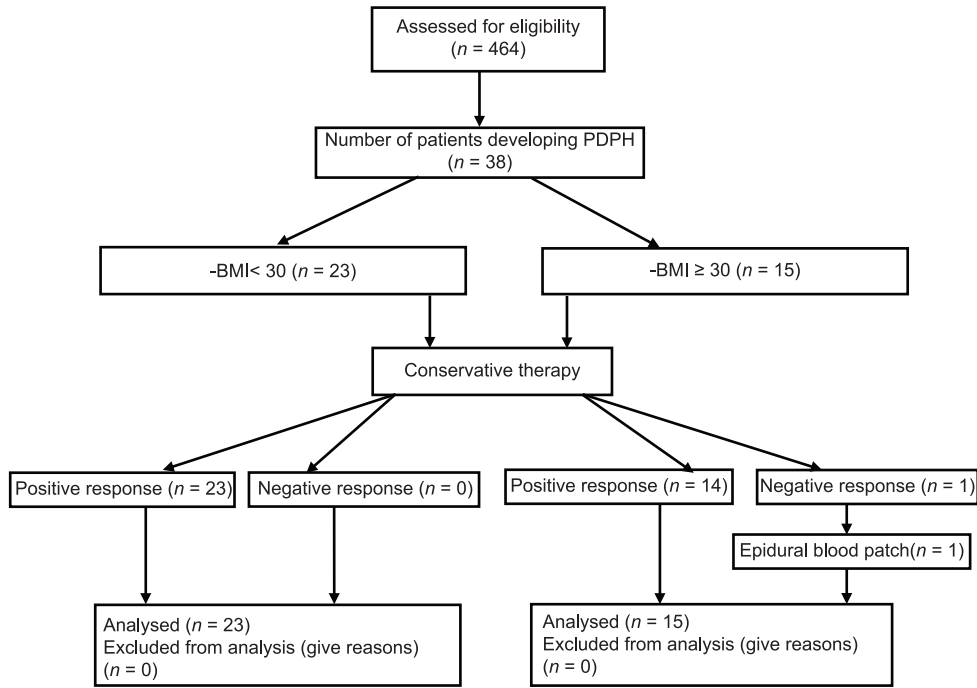


Figure 1: CONSORT diagram

3 motor blocks was 168 seconds. During the procedure, 12 (2.58%) patients were administered 0.01 mg/kg atropine intravenously for heart rates below 60 bpm and 69 (14.87%) patients were given IV ephedrine when the blood pressure decreased 20% from the baseline values or the mean artery pressure was below 60 mmHg. Nausea developed in 73 (15.73%) patients and vomiting was observed in 11 (2.37%) patients. At the 6th hour, itching, breathing difficulty, and vomiting were not observed, 3 (0.64%) patients had nausea and 14 (3.01%) patients had back pain. Mobilization was allowed 6 h later. PDPH developed in 38 (8.2%) patients. Of the patients who developed PDPH, 23 (60, 5%) had a BMI <30 and 15 (39, 5%) had a BMI ≥30 ($P = 0.494$) [Figure 1]. Of the patients who did not develop PDPH, 258 (60, 6%) had a BMI <30 and 168 (39, 4%) had a BMI ≥30 ($P = 0.494$) [Table 2]. The mean BMI and age of the patients who developed or did not develop PDPH were similar [Table 3].

The mean NRS score of the patients who developed PDPH was 3.6 ± 1.7 .

Of the 38 patients who developed PDPH, 13 were diagnosed in the hospital and 25 were diagnosed by telephone interviews. Twelve of the 13 patients diagnosed in the hospital responded to IV fluids, oral/IV analgesics and oral caffeine and were discharged from hospital. The epidural blood patch was applied to a patient who was diagnosed in the hospital with a BMI of 32.7 and did not

Table 1: The demographic distribution of parturient patients

| | Mean ± SD |
|--------------------------------------|---------------|
| Age (years) | 27.22 ± 3.78 |
| Weight (kg) | 74.18 ± 11.29 |
| Height (cm) | 159.65 ± 6.26 |
| Body mass index (kg/m ²) | 28.9 ± 4.15 |
| Duration of operation (min) | 37.21 ± 7.26 |

Data are presented as mean ± standard deviations (SD)

Table 2: PDPH distribution according to BMI

| | Group I (n=281) | Group II (n=183) | Total (n=464) | P |
|----------|-----------------|------------------|---------------|-------|
| PDPH Yes | 23 (8.2%) | 15 (8.2%) | 38 | 0.494 |
| No | 258 (91.8%) | 168 (91.8%) | 426 | |

Group I: BMI <30, Group II: BMI ≥30

PDPH: post-dural puncture headache

Table 3: Mean age and BMI of the patients with and without PDPH

| | Post-dural puncture headache | | P |
|-------------|------------------------------|--------------|-------|
| | Yes (n=38) | No (n=426) | |
| Age (years) | 27.73 ± 3.92 | 28.04 ± 4.82 | 0.925 |
| BMI | 29.1 ± 3.93 | 29.3 ± 4.11 | 0.938 |

Data are presented as mean ± standard deviations (SD)

respond to regular treatment. Twenty-five patients with PDPH who were invited by telephone after discharge were treated with IV fluids, oral/IV analgesics and oral caffeine. The mean headache duration was 18 h. During the headache, hearing loss and vomiting were not observed,

while three (0.64%) patients had tinnitus and two (0.43%) patients had photosensitivity. Tinnitus and photosensitivity disappeared when the headache resolved.

Discussion

The BMI values determined according to the WHO criteria did not affect PDPH in the elective cesarean section performed under SA with 27 G Quincke spinal needle [Table 3].

Regional anesthesia is safe for cesarean operations. PDPH has become one of the most common complications of SA. The hole opened by the spinal needle in the dura mater leads to CSF leakage, a decrease in intracranial pressure, and tension on the meningeal vessels and nerves, which is thought to lead to PDPH. The prevalence of PDPH in SA is 0.2–24%, although it is more common in obstetric cases.^[5] The changes in fluid and blood volumes, and intra-abdominal pressure during and after delivery, are associated with PDPH in obstetric cases.^[11]

PDPH is usually severe, bilateral, and radiates to the occiput, nape of neck, and shoulders from behind the orbits or frontal region. It increases with sitting or standing, and decreases, or is even eliminated, by lying down. The pain may be accompanied by nausea, photophobia, tinnitus, diplopia, and hearing disturbances. In total, 90% of PDPH is seen within the first 3 days and 66% within the first 48 h.^[14,15] Small and pencil-point needles reduced the incidence of PDPH in many studies.^[16] The PDPH incidence reported by Rasooli *et al.*^[17] who used a 27G Quincke needle, was high compared with other studies.^[16-18] We used a 27G Quincke spinal needle and found a PDPH incidence of 8.2% in parturient women. One of the reasons for the different incidences found in parturient women may be the SA technique; inserting the needle parallel to the dura fibers is proposed to reduce PDPH incidence.^[17]

Many factors play a role in the development of PDPH, including age, gender, obesity, early mobilization, pregnancy status, and diameter and structure of the needle. All of our parturient patients were within the same age range, and needles of the same diameter and structure were used for all patients. SA was performed using the same technique by an anesthesiologist who had at least 5 years of experience and mobilization of the patients was restricted for 6 h. The PDPH incidence decreases when small needles are used; however, technical difficulties arise and the success rate of SA decreases when these needles are employed.^[12] The main technical difficulty is a failure to recognize a dural puncture due to slow CSF flow from thin needles, which may lead to repeated trials. Therefore, we prefer not to use spinal needles smaller than 27G in our practice.

In the literature, obesity may be a protective factor against the development of PDPH in contrast to the results we found in our study. Intra-abdominal fat tissue was reported to decrease the pressure gradient from the intrathecal area to the epidural field area by increasing the pressure in the epidural area, and CSF leakage was suggested to decrease for this reason^[19] in studies that reported that a high BMI protects against PDPH development.^[7-9] Faure *et al.*^[19] suggested that PDPH risk decreases in morbidly obese individuals due to reduced movement ability and sedentary living habits. Similarly, in a retrospective cohort study and review, it is reported that PDPH decreases with increasing BMI and that increased intra-abdominal pressure in parturient women precipitated pooling in the epidural veins, thereby reducing CSF leakage by reducing the CSF volume in the lumbar neuraxial canal.^[20,21]

Kuntz *et al.*^[21] also reported a relationship between low BMI and increased PDPH. In the study conducted by Franz *et al.*^[22] with pregnant women, headache development was significantly lower in super-obese patients than morbidly obese, obese and normal patients after dural puncture with Tuohy needle. In a retrospective study by Hashamei *et al.*^[23] in 343 patients, an inverse and significant relationship was found between pre-cesarean BMI and PDPH. Most cases of headache occurred in patients with BMI <30, but there was no significant difference in NRS in women who gave birth with different BMI levels. Ljubisavljevic *et al.*^[25] reported that BMI had no effect on headache that developed after lumbar puncture in a study of 252 patients.

Miu *et al.*^[24] found no difference in PDPH developing after unexpected dural puncture between parturient women with a high or normal BMI; they also reported that the small number of patients with a BMI >40 was a limitation of their study. We also found no significant difference between PDPH and the mean BMI in parturient women for whom a 27G Quincke spinal needle was used and also had very few patients with a BMI >40.

In conclusion, there was no significant relationship between PDPH and BMI when a 27G Quincke spinal needle was used in patients undergoing an elective cesarean section under SA. More randomized, controlled studies are required to evaluate the relationship between PDPH and BMI.

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Conflicts of interest

There are no conflicts of interest.

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