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ORIGINAL ARTICLE

# The relationship between body mass index and post-dural puncture headache in obstetric patients

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## ABSTRACT

**Background:** Difficult epidural insertion and accidental dural puncture are more likely in the obese pregnant population. Low-level evidence suggests that the risk of post-dural puncture headache declines as body mass index increases.

**Methods:** We retrospectively reviewed prospective data on 18315 obstetric epidural and combined spinal–epidural insertions, identifying 125 (0.7%) accidental dural punctures or post-dural puncture headaches between 2007 and 2012. The audit record and patient medical record were examined to determine patient body mass index, headache characteristics and use of a therapeutic epidural blood patch. Women were classified into two groups: non-obese (body mass index <30 kg/m<sup>2</sup>, Group <30) or obese (body mass index ≥30 kg/m<sup>2</sup>, Group ≥30). Statistical analysis was by chi-square or Fisher exact tests, with  $P < 0.05$  considered significant.

**Results:** Compared to Group <30 ( $n = 65$ ), women in Group ≥30 ( $n = 60$ ) did not significantly differ in the incidence of post-dural puncture headache (82% vs 80%,  $P = 0.83$ ); its intensity (severe 36% vs. 23%,  $P = 0.34$ ); or the need for epidural blood patch (57% vs. 54%,  $P = 0.81$ ). Groups also did not differ significantly when confining analysis to those who had a witnessed accidental dural puncture ( $n = 93$ ) or to women with a body mass index >40 kg/m<sup>2</sup> ( $n = 10$ ) vs. Group <30.

**Conclusion:** This retrospective study found no evidence that women of higher body mass index are less likely to develop a post-dural puncture headache or that the characteristics of the headache and use of epidural blood patch were different.

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**Keywords:** Obesity; Headache; Post-dural puncture; Epidural blood patch

## Introduction

Post-dural puncture headache (PDPH) secondary to accidental dural puncture (ADP) is a recognised complication of epidural placement in the obstetric population.<sup>1</sup> PDPH is postural, relieved in the supine position, and sometimes accompanied by visual disturbances or nausea. Symptoms usually appear within the first two days, worsen within several hours and may become moderate to severe.<sup>2–5</sup> In non-obese parturients, the incidence of ADP, as a complication of epidural insertion for labour analgesia, has a reported incidence of 0.16–1.3%.<sup>4</sup> In obese women, epidural insertion is often more difficult to perform and has both a higher failure rate and a higher risk of ADP.<sup>5–8</sup> Previous studies have reported an ADP incidence as high as 4% in the obese population.<sup>8</sup> Despite the greater risk, limited

low-level evidence suggests that morbidly obese pregnant women are less susceptible to the development of PDPH.<sup>9–13</sup>

The purpose of this retrospective study was to review headaches after ADP occurring over a six-year period in a single tertiary maternity unit, and to assess the effect of body mass index (BMI) on events after ADP, including the risk of PDPH.

## Methods

The Health Department of Western Australia Governance, Evidence, Knowledge, Outcomes (GEKO) system for Quality Indicators Anaesthetics, approved this retrospective study. The King Edward Memorial Hospital for Women is a tertiary referral obstetric hospital delivering approximately 6000 women per annum, of whom approximately 50% receive neuraxial analgesia or anaesthesia. The anaesthetic department audit database was used to identify women with either

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documented ADP or PDPH following epidural, spinal or combined spinal–epidural (CSE) analgesic or anaesthetic blocks from 2007 to 2012, inclusive. All epidural techniques were performed with a 16-gauge needle and spinal techniques with a 25–27-gauge non-cutting needle. An ADP was diagnosed based on either witnessed flow of cerebrospinal fluid (CSF) via the needle or catheter or the development of a PDPH meeting the international diagnostic criteria after difficult epidural insertion.<sup>5</sup>

Data were collected prospectively, with all women followed daily and given instructions as to how to notify the department if worried by headache post-discharge. The medical notes, anaesthetic record and anaesthetic department database record form were inspected for details pertaining to insertion, PDPH and management. Data collected included BMI, incidence, onset after epidural needle insertion and intensity of PDPH (also categorised for specific neuraxial technique and for witnessed ADP), and the incidence and outcome of an epidural blood patch (EBP). PDPH was managed either conservatively with bed rest or with an EBP if symptoms were severe or if PDPH persisted after several days.

Women who had a witnessed ADP were divided into two groups according to the international classification of adult obesity, based on BMI, calculated in the database using their weight at the time of the procedure: Group <30 (non-obese women of BMI <30 kg/m<sup>2</sup>) or Group ≥30 (BMI ≥30 kg/m<sup>2</sup>). A sub-set of Group ≥30, namely those with morbid obesity (BMI >40 kg/m<sup>2</sup>, *n* = 10) was also compared with non-obese women.

### Statistical analysis

Descriptive statistics were used to describe outcomes for epidural and CSE techniques and for BMI groups with between-group comparisons using chi-square or Fisher exact tests. Statistical analysis was conducted using LogXact statistical software in Cytel Studio 8 (Cytel Inc., Cambridge, MA, USA). A *P* value <0.05 was considered statistically significant.

### Results

The overall incidence rate of ADP, with or without subsequent PDPH, among those having epidural needle insertion, was 0.7% (125 of 18 315). In association with epidural or CSE techniques, the incidence was 62/7555 (0.9%) and 63/10 760 (0.6%), respectively (Table 1). Of the 125 women, 65 were in Group <30 (mean BMI 24.4 kg/m<sup>2</sup>, range 18–29.9 kg/m<sup>2</sup>) and 60 were in Group ≥30 (mean BMI 35.4 kg/m<sup>2</sup>, range 30–58 kg/m<sup>2</sup>) (Table 2). Ninety-three of the 125 women had a witnessed ADP.

Among the study population in whom ADP occurred, 48% had a BMI ≥30 kg/m<sup>2</sup>. This compared with 51% of the cohort of women without an ADP

(*n* = 18 190) associated with an epidural or CSE technique across the same period of time.

Mode of delivery among the overall cohort and the sub-group in whom the ADP was witnessed was vaginal delivery 45% vs. 48% and caesarean delivery 55% vs. 52%, respectively. Among non-obese and obese patients the incidence of vaginal delivery was 46% vs. 43% and of caesarean delivery 54% vs. 57% (*P* = 0.75). Women having an epidural-only technique were more likely to have a witnessed ADP and to have an early-onset PDPH (Table 3). There was no significant difference between Group <30 and Group ≥30 with respect to observation of CSF through the epidural needle during insertion. Of the 93 women who had a witnessed ADP, 75% developed a PDPH (epidural 70% vs. CSE 80%) compared with an 81% incidence overall. Thirty-nine (42%) of these 93 women with witnessed ADP required an EBP compared with 17 of 32 (53%) of those who did not have a witnessed ADP (*P* = 0.27).

Compared to Group <30, women in Group ≥30 did not differ significantly in the incidence of PDPH, either overall or among only those 93 who had a witnessed ADP. Comparing Group <30 to Group ≥30, severe PDPH occurred in 36% and 23%, respectively (*P* = 0.34). An EBP was performed in 57% of Group <30 vs. 54% of Group ≥30 (*P* = 0.81). A sub-set of women with BMI >40 kg/m<sup>2</sup> was compared with those with BMI <30 kg/m<sup>2</sup> showed no statistically significant differences in outcomes.

### Discussion

This retrospective study found that the incidence of PDPH following ADP did not differ significantly between pregnant women classified as obese (according to standards for non-pregnant weight) and women within a normal or overweight BMI classification.<sup>14</sup> Previous studies have suggested obesity might be a protective factor against development of PDPH after ADP in obstetric patients:<sup>9–13</sup> although most of these studies were only published as meeting abstracts.<sup>10–13</sup> These investigators postulated that increased abdominal fat increases intra-abdominal and epidural pressure, reducing CSF leak after ADP. Headache after dural puncture is a recognised complication of neuraxial blockade,<sup>1</sup> initiated in response to continuous leak of CSF. Although not always associated pathologically, PDPH is usually associated with a reduced intracranial volume, downward brain displacement and compensatory increase in cerebral blood flow.<sup>15,16</sup> PDPH has the potential to cause significant morbidity, may persist for weeks<sup>2–4,6</sup> and is associated with chronic headaches.<sup>17</sup>

The incidence of ADP from either an epidural or CSE in our teaching institution was 0.7%. There is on-going debate as to the figure that is more representative of contemporary practice, with smaller units reporting higher

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