

Post Dural Puncture Headache (PDPH) and Associated Factors after Spinal Anesthesia among Patients in University of Gondar Referral and Teaching Hospital, Gondar, North West Ethiopia

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Abstract

Background: Post dural puncture headache (PDPH) has been a problem for patients after dural puncture. It is one of the most frequently occurring complications following spinal anesthesia (SA). It is believed to originate from persistent leakage of cerebrospinal fluid (CSF) through the punctured Dura, greater than the CSF production after lumbar puncture. Although the problem has been widely reported, its magnitude and associated factors has never been studied in our country. Thus, the aim of this study is to assess the magnitude of post dural puncture headache (PDPH) and associated factors after spinal anesthesia among patients in university of Gondar referral and teaching hospital.

Methods: An institution based cross sectional study was conducted from February 25-April 10, 2013 in University of Gondar teaching and referral hospital, Gondar, Ethiopia. A total of 116 patients aged 17-74 years were included in the study. Data was collected by interviewing patients using structured and pre-tested questionnaire and reviewing chart. Both bivariable and multivariable logistic regressions were used to determine the association between post dural puncture headache and independent variables.

Results: Out of 116 patients who have undergone spinal anesthesia 45 (38.8%) patients developed post dural puncture headache. Sex [AOR=0.2; 95% CI: 0.058, 0.67], repeated attempts [AOR=0.22; 95% CI: 0.09, 0.54], and needle sizes [AOR=5.3; 95% CI: 1.66, 16.93] were found to be significantly associated with Post Dural puncture headache.

Conclusion: Prevalence of post dural puncture headache was found to be high among patients in the University of Gondar teaching and referral hospital after spinal anesthesia (SA). The hospital management and the anesthetists of University of Gondar teaching and referral hospital should minimize the incidence of post dural puncture headache by avoiding use of big needles and repeated attempt especially on female patients.

Keywords: PDPH; Gondar; Ethiopia

Introduction

Since August Bier reported the first case in 1898, post-dural puncture headache (PDPH) has been a problem for patients following dural puncture. PDPH is an important iatrogenic cause of patient morbidity in modern anesthesia [1,2].

Post-dural puncture headache typically presents as a postural headache that worsens when a patient is in the upright position and lessens to some extent when a patient is in the recumbent position [1-6]. PDPH is believed to originate from persistent leakage of cerebrospinal fluid (CSF) greater than the cerebrospinal fluid production after lumbar puncture [3]. According to the diagnostic criteria of the International Headache Society (IHS) in 2004, the headache can appear up to the fifth day after puncture and disappears spontaneously within a week, or up to 48 hours after an epidural blood patch (EBP) and accompanied by neck stiffness, tinnitus, hypoacusia (partial loss of hearing), photophobia, and nausea [7]. Even though the

IHS reported this, recent studies indicated the latency period to be within 3 days [4-6,8-12], and another study conducted in 2012 to evaluate the validity of the diagnostic criteria for Post-Dural puncture headache showed that some patients can suffer from PDPH in the absence of the associated symptoms [4].

Factors predisposing for PDPH can be patient or equipment (needle). Women, particularly during pregnancy, are considered at increased risk for PDPH [1,2,4]. High levels of estrogens in women can influence the tone of the cerebral vessels, thus increasing the vascular distension response to CSF hypotension [1-4].

The incidence of PDPH is highest in young individuals [1,2,4,5] and lean patients [1-4]. Women who are obese or morbidly obese may have a decreased incidence of PDPH as a result of the increased intra-abdominal pressure which acts as an abdominal binder helping to seal the defect in the dura and decreasing the loss of CSF [1].

The incidence of PDPH is also directly related to the needle diameter that pierces the Dura mater. The incidence is significantly higher when large bore needles greater than 22 G than when smaller

needles (<25 G) were used [1,2,4,5]. Although smaller diameter needle punctures used for spinal block decrease the risk of PDPH, these needles are technically difficult to use and are associated with a lower success rate in spinal anesthesia [1-4]. Not only the size of the needle affects the incidence of PDPH, but also the type of needle tips [1,2,4]. The cutting needle bevels are more common to cause PDPH than the less traumatic pencil point needle bevels. The direction of the needle bevel during insertion also contributes to the occurrence of PDPH. If the bevel of the spinal needle is inserted perpendicular to the fibres of the Dura (which are believed to run longitudinally) an increased incidence of PDPH is expected [1,2,4-6,13,14].

Another factor is a past history of PDPH [1,2,4,15,16]. Patients with previous history of PDPH have a significantly more probability of developing PDPH on the subsequent lumbar punctures. Repeated Dural puncture due to inexperience of the procedure performer or technical difficulty also increases the chance of PDPH on patients [1,2,5].

Different studies have reported widely different incidence of PDPH. In our country we could not find published research done on this topic, so the prevalence of PDPH is not known in our situation. Knowing the prevalence of PDPH and its associated factors in our situation helps to recognize the magnitude of the problem and may help to facilitate actions to reduce its occurrence. This research can also help as a baseline for future researches on related topics by indicating the prevalence rate and associated risk factors of PDPH in this area.

Methods

Study design, setting and period

An institution based cross sectional study was conducted among patients in the University of Gondar teaching and referral hospital from February 25-April 10, 2013. Gondar town, which is the capital of North Gondar zone, is one of the historical towns in the country and located at about 727 Km Northwest of Addis Ababa. According to the 2007 Ethiopian census report, Gondar has a total population of 206,987 and more than half (108,902) of them were females [17].

Sample size and sampling technique

All patients (124) who have undergone their surgical procedure under spinal anesthesia between February 25 and April 10, 2013 were included in the study. The study has included all surgical and obstetric patients of Gondar teaching and referral hospital who have undergone their surgical procedure under spinal anesthesia by excluding patients with impaired cognitive ability.

Data collection procedure

A structured and pretested questionnaire was prepared to collect data both from the chart and patient interview. Socio demographic data like the patient's age and sex, the American Society of Anesthesiologists (ASA) status, patient position, size of the needle and number of attempts were collected from the chart. The data for the outcome variable was collected by interviewing the patients using questionnaire at least 12 hours after the dural puncture had been performed and those who didn't complain headache at the first visit were followed up each day until the 3rd day to see if they develop headache in the consecutive days. For patients who experienced PDPH

severity of pain was determined using visual analogue scale (VAS) and verbal rating scale. To ensure quality of data pre-test of the questionnaire was done on 20 patients from Bahirdar Felege Hiwot hospital to check for accuracy and clarity of information and anesthetist who had an experience was collected the data after training had been given. Data collection procedure was also supervised by a consultant anesthesiologist and investigators.

Data analysis procedures

The collected data were cleaned, coded, and entered in to EPI info 7 and then exported to SPSS version 20 for further analysis. The patients were identified as having PDPH if Headache develops within three days after dural puncture and a headache that worsens within 15 minutes after sitting or standing and/or improves within 15 minutes after lying. Once patients diagnosed as having PDPH, the severity of this pain was assessed using VAS and NAS (for those who can read and write) or verbal rating scale (for those who can't read or write).

Both descriptive and analytic statistics were computed and data were presented by tables, graphs, percentile and texts. All independent variables were analyzed using binary logistic regression with the dependent variable PDPH using SPSS version 20 and those which were significant at a p-value of <0.2 were fitted to a multivariate logistic regression to check their association with the outcome variable, PDPH at a p-value of <0.05. Hosmer-Lemeshow (0.82) test of goodness of fit was performed to check the appropriateness of the model for analysis.

Ethical considerations

Before actual data collection ethical clearance was obtained from the ethical review board of University of Gondar. Formal letter of cooperation was written to Hospital administrators. The objectives of the study were explained and written consent was obtained from each participant. Confidentiality was maintained at all levels of the study by avoiding identifiers, using codes to identify patients, keeping privacy of the study participants during data collection and locking the questionnaires securely. For seriously ill patients advice has been given to revisit health institution.

Results

Socio-demographic and physical characteristics

A total of 116 patients were included in the analysis making the response rate of 93.35%. The majority of patients included in this study were female patients (78.4%). The age of study participants range from 17 to 74 years with mean age of 33.8 year and a standard deviation of 14.2 year and majority (93.1%) of them were ASA I (Table 1 and Figure 1).

Spinal anesthesia related history of patients

Ten patients (8.6%) had a previous history of spinal anesthesia (SA) exposure and three (37.5%) of them complained a PDPH like headache after the procedure. Almost all patients (99.1%) had been given SA on a sitting position. 20 G was the most frequently used spinal needle to administer SA (42.5% of patients) whereas 25 G was used only in one patient. There were 5 cases (4.3%) of failed block that were converted to general anesthesia (GA) and two of these patients have developed PDPH (Table 2).

Variable		Frequency: n (%)
Age (years)	15-29	76 (65.5%)
	30-59	34 (29.3%)
	>60	6 (5.2%)
Sex	Female	91 (78.4%)
	Male	25 (21.6%)
BMI	<18.5 (underweight)	18 (15.5%)
	18.5-24.9 (normal)	91 (78.4%)
	25-29.9 (overweight)	7 (6%)
ASA	ASA I	108 (93.1%)
	ASA II	8 (6.9%)

Table 1: Socio-demographic and physical characteristics of the study participants in GUH from February 25-April 10, 2013.

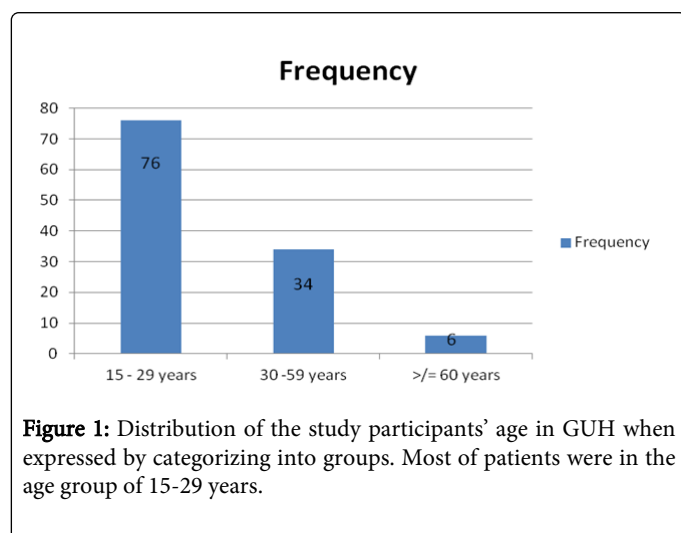


Figure 1: Distribution of the study participants' age in GUH when expressed by categorizing into groups. Most of patients were in the age group of 15-29 years.

Prevalence of PDPH

In this study PDPH was observed on 45 patients (38.8%) whereas 11 patients (9.5%) complained headache but they didn't fulfill the criteria to be classified as patients with PDPH (Figure 2).

The proportion of PDPH varies greatly when different needle sizes were used. For instance the proportion of PDPH was very high (63.6%) when 18G spinal needles were used, whereas the proportion was low (8.3%) when small needles were used (Table 3).

Severity of PDPH

Among 45 patients who developed PDPH, majority of them have developed mild (42.2%) followed by moderate (31.1%) pain (Figure 3). On 80% of patients with PDPH either of neck stiffness, nausea, or photophobia was observed (Figure 4).

Variable	Frequency: n (%)
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Previous SA	Yes	10 (8.6%)
	No	106 (91.4%)
Previous history of PDPH	Yes	3 (2.6%)
	No	113 (97.4%)
Position	Sitting	115 (99.1%)
	Lateral	1 (0.9%)
Number of attempts	Single attempt	64 (55.2%)
	Twice attempt	36 (31%)
	>2 attempts	16 (13.8%)
Size of SA needle	18 Gauge	11 (9.5%)
	20 Gauge	49 (42.5%)
	22 Gauge	29 (25%)
	24 Gauge	15 (12.9%)
	25 Gauge	1 (0.9%)
	26 Gauge	5 (4.3%)
A successful block	27 Gauge	6 (5.2%)
	Yes	111 (95.7%)
Associated symptoms	No	5 (4.3%)
	Neck stiffness	34 (29.3%)
Associated symptoms	Tinnitus	2 (1.7%)
	Photophobia	1 (0.9%)
	Nausea	10 (8.6%)
	None	69 (59.5%)

Table 2: Spinal anesthesia related parameters of the study participants in GUH from February 25-April 10, 2013.

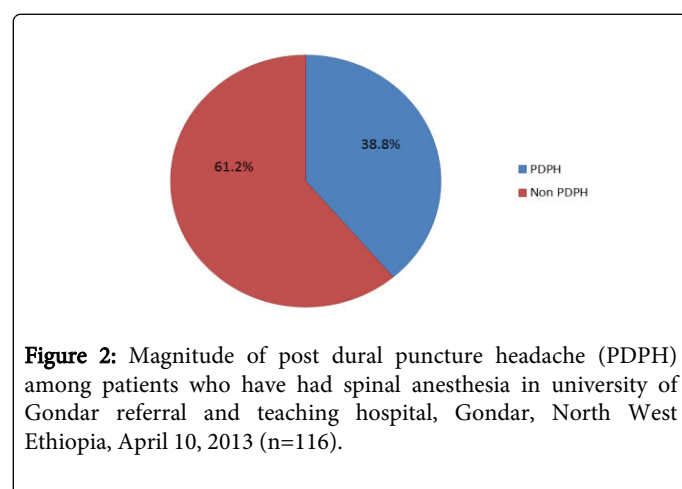


Figure 2: Magnitude of post dural puncture headache (PDPH) among patients who have had spinal anesthesia in university of Gondar referral and teaching hospital, Gondar, North West Ethiopia, April 10, 2013 (n=116).

Needle size used	PDPH	% of patients with PDPH
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	Yes	No	
18G	7	4	63.60%
20G	24	25	49%
22G	9	20	31%
24G	4	11	26.60%
<24 G (25, 26 and 27)	1	11	8.30%

Table 3: percentage of PDPH developed when specific needle sizes were used among the study participants of GUH who developed PDPH, February 25-April 10, 2013.

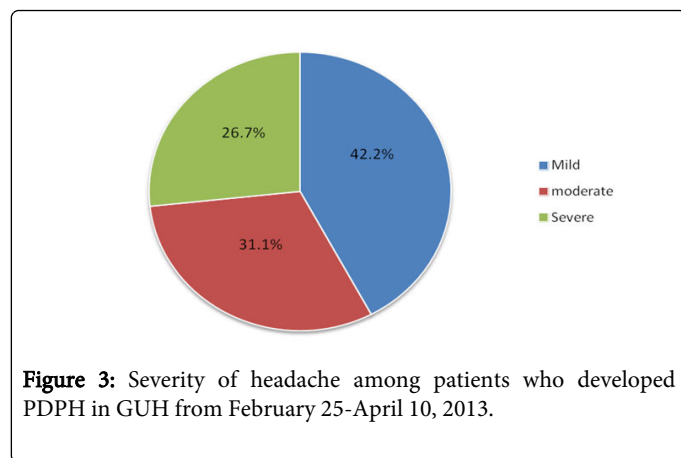


Figure 3: Severity of headache among patients who developed PDPH in GUH from February 25-April 10, 2013.

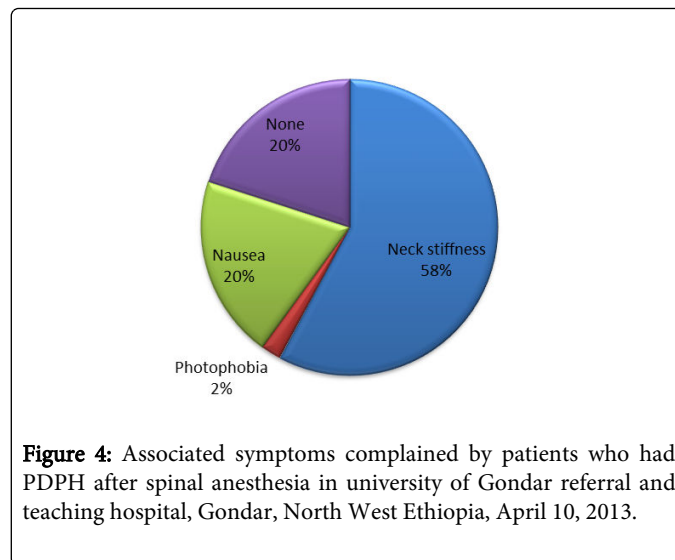


Figure 4: Associated symptoms complained by patients who had PDPH after spinal anesthesia in university of Gondar referral and teaching hospital, Gondar, North West Ethiopia, April 10, 2013.

Factors associated with PDPH

The result of bivariate logistic regression indicated that sex, BMI, needle size and number of attempts were significantly associated with PDPH of patients. However, by multivariate logistic regression analysis only sex, needle size and number of attempts were found to be statistically significant at p-value<0.05 (Table 4).

In this study sex was significantly associated with the outcome variable PDPH. Male patients are 80% less likely to develop PDPH than female patients (AOR=0.2, 95% CI: 0.058, 0.67).

Variables		PDPH		COR (95% CI)	AOR (95% CI)	P-value
		Yes	No			
Sex	Male	4	21	0.23 (0.074, 0.731)	0.2 (0.058, 0.67)	0.009
	Female	41	50	1	1	
Spinal needles	Large needles*	40	49	3.6 (1.25, 10.34)	5.3 (1.66, 16.93)	0.005
	Small needles**	5	22	1	1	
Attempt	Single	17	47	0.31 (0.14, 0.67)	0.22 (0.09, 0.54)	0.001
	Multiple	28	24	1	1	

Table 4: Factors associated with PDPH of patients who had SA in GUH, February 25-April 10, 2013. *needle sizes larger than 24 G; **needle sizes<24 G.

Size of the needle used to administer SA is also significantly associated with the development of PDPH. Patients received SA using bigger spinal needles were more than 5 times more likely to develop PDPH than patients who received SA using smaller needles (AOR=5.3, 95% CI: 1.66,16.93).

Another significant association was found between number of attempts and PDPH. Patients who received SA on the first attempt were 78% less likely to develop PDPH than their counter part patients who had a repeated attempt (AOR=0.22, 95% CI: 0.09, 0.54).

Discussion

Different researches showed different values of the prevalence of PDPH. In this study the overall prevalence of PDPH was 38.8%. This result is found to be higher than the usual figures reported by most studies [4,6,8,13]. The possible cause for this could be because most (77%) of the study participants in our study were received SA using big spinal needles. The study participants in this study were also prone to repeated number of attempts. The other possible cause for this higher figure could be again most (78%) of participants were female.

These factors were found to be significantly associated with the development of PDPH in our study and many other literatures.

In our study the majority of patients have experienced mild (42.2) and moderate (31.1%) PDPH pain, which is the same as studies conducted in Ghana [18], Australia [19] and Pakistan [12]. On the other hand 26.7% of patients with PDPH complained as having severe pain. This figure in line with studies conducted in Australia on obstetric patients, which has reported as 27.7% [19] and Pakistan which has reported as 28.6% severe headache [12]. Unlike the figures reported in the above studies, a study conducted in Denmark to grade the severity of PDPH reported that 60% of patients rated their pain as severe [20]. The reason behind the discrepancy in severity of pain could be the cultural effect. Because pain has psychological, social, and spiritual as well as physical dimensions, it is greatly influenced by cultural factors. People of different cultures respond differently to pain. For instance, people who passed through a lot of pain and sufferings, like people in Africa, are less likely to complain a severe pain for a given intensity of pain than people who didn't pass through such pain and suffering like people in Scandinavia [21].

In this study we found out that being male is a protective factor for PDPH. Male patients are 80% less likely to develop PDPH than female patients [AOR=0.2; 95% CI: 0.058, 0.67]. The reason for an increased risk of PDPH for females could be the high level of estrogens in women. High levels of estrogens in women can influence the tone of the cerebral vessels, increasing the vascular distension response to CSF hypotension [1-4]. This finding was similar with different studies [1,2,4-6,22-25]. But in some studies no significant association was reported between gender and the incidence of PDPH [26,27].

Size of the spinal needle used was significantly associated with the development of PDPH in this study. Patients who received SA using big needles were about five times more likely to develop PDPH than those patients who received SA using small needles [AOR=5.3; 95% CI:1.66, 16.93]. The reason behind this is bigger needles leave bigger opening on the Dura, so more CSF leak than smaller opening caused by smaller needles. Many studies support our finding [1,2,5,21,23,28-30].

Another significant association was found between the number of attempts and the development of PDPH. Patients for whom SA was successful at the first attempt were 78% less likely to develop PDPH than those patients for whom attempt was repeated [AOR=0.22; 95% CI: 0.09, 0.54]. This could be due to as the number of attempt increase the probability of piercing the Dura matter repeatedly will increase, which increases the volume of CSF leak, thereby increasing the probability of development of CSF hypotension & PDPH. This finding in lines with findings of different studies [1,2,5,23] even if some other studies couldn't find significant association between the number of attempts and PDPH development [26,30,31].

On the other hand BMI, age of the patients and previous history of PDPH were not associated with the development of PDPH even though these variables (lower BMI, younger age, and previous history of PDPH) have reported as risk factors for PDPH in different studies [1,2,4,5,15,27]. This could be most likely due to the small sample size to compare different categories of BMI, age, and patients with and without previous history of PDPH in our study.

Even though this study indicated very important results, using small sample size, not including very important variables like level of the anesthetist performing the SA, the effect of needle tip on the prevalence of PDPH, and direction of the needle bevel during insertion and only following patients for three days since some patients may develop PDPH till the 7th day after Dural puncture are

some of the limitations of the study. In addition the study is not out of the effect of cross sectional study design which unable to indicate the temporal relationship.

Conclusions

The study revealed that prevalence of PDPH was too high when compared to other studies out of which majority of the patients have been suffered from severe headache. The study also showed that being female, big spinal needles and repeated number of attempts were factors significantly associated with PDPH.

Recommendations

The hospital management and the anesthetists of University of Gondar teaching and referral hospital should minimize the incidence of Post Dural puncture headache by avoiding use of big needles and repeated attempt especially on female patients.

Competing Interests

The authors of this study declare that there were no conflicts of interests.

Authors' Contributions

AA, wrote the proposal, participated in data collection, analyzed the data and drafted the paper. TK and ZA approved the proposal with some revisions, participated in data analysis and revised subsequent drafts of the paper. All authors read and approved the final manuscript.

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