

Factors Contributing to Headache and its Associated Symptoms for Post Lumbar Puncture Patients

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Abstract

Background: Post lumbar puncture headache is the most common serious complication resulting from lumbar punctures. There are interrelated factors can magnified the incidence and severity of post lumbar puncture headache. **Aim:** This study aimed to assess factors contributing to headache and its associated symptoms for post-lumbar puncture patients. **Design:** A descriptive explorative design was utilized in the current study. **Setting:** This study conducted in general surgery, orthopedic, gynecology and urology departments at Beni-Suef University Hospital. **Study subjects:** Convenient sample of 80 patients included from the above-mentioned setting from both genders. **Tools: (I)** Lumbar Puncture Interview Questionnaire: It include three parts: factors related to patients, factors related to practitioner and lumbar puncture procedure. **(II)** Tension Headache Dairy: To assess patients for post lumbar puncture headache and its associated symptoms. **Results:** Revealed that more than half of studied subjects had post lumbar puncture headache and there was significant relation between post lumbar puncture headache and age, gender, educational level, past history of headache, needle diameter, and number of dural puncture trails. **Conclusion:** overall, the study showed that there were interrelated factors affecting on post lumbar puncture headache incidence that include non-modifiable factors related to patients' characteristics as age, gender, past history of headache, pregnancy and past history of previous lumbar puncture headache. While, there were modifiable factors related to lumbar puncture procedure and practitioner experience that include needle diameter, number of trails to enter subarachnoid space, amount of cerebrospinal fluid lost during procedure. **Recommendations:** The study should be replicated on large sample size and in different hospitals setting in order to generalize the results and figure out more factors affecting the incidence of post lumbar puncture headache and its associated symptoms.

Keywords: Factors contributing, Headache associated symptoms, Lumbar puncture.

Introduction

Lumbar puncture (LP) is a key therapeutic and diagnostic procedure in medicine, especially in clinical neurology and medicine at all. LP is most frequently performed procedure in neurology,

radiology, emergency room (ER) and operating room (OR). Doctors or specially trained nurses can do this procedure (Monserate et al., 2015).

The lumbar puncture procedure had therapeutic and diagnostic indications and mainly used for diagnostic purposes to rule out potential life-threatening conditions (eg, bacterial meningitis or subarachnoid hemorrhage), measuring cerebrospinal fluid (CSF) pressure or for myelography. The therapeutic purposes of LP can be a route for administration of antibiotics, steroids to patients with suspected bacterial meningitis, fluids, chemotherapy and anesthetic agent can injected into subarachnoid space (**Costerus, Brouwer & van de Beek, 2018**).

Although the LP is relatively safe procedure, several adverse events has reported including headache, local pain or backache, and rarely cranial neuropathies, hemorrhage, nerve root injury and meningitis. Among these adverse events post-lumbar puncture headache (PLPH) is considered one of the most frequent and disabling complications in many patients after LP procedure (**Kim et al., 2012**).

The overall incidence of PLPH after ambulatory diagnostic LP varies from 0.1-36%, after spinal anesthesia (SA) varies greatly from 2-40% depending on many modifiable and non-modifiable factors (**Jabbari et al., 2013**). PLPH develops in 16%–86% of cases after attempted epidural block with large bore needles and causing inadvertent LP (**Ghaleb, Khorasani & Mangar, 2012**).

The International Headache Society (IHS) defined PLPH as a headache that develops within 5 days from LP and resolves within 1 week spontaneously or within 48 hours after effective treatment with epidural blood patch (EBP). The headache usually worsens within 15 minutes after sitting or standing and disappears or improves within 15 minutes after lying down. The PLPH is generally located in the frontal or occipital areas or both, but may also involve neck and upper shoulders. The severe PLPH may be

associated with nausea, vomiting, blurred vision, vertigo, hearing alteration (**Zhang et al., 2016**).

Two main hypotheses could explain the pathophysiology of PLPH. The first suggests a reduction in CSF pressure leading to a downward shift of the brain and subsequent tension on the meninges and other pain-sensitive structures when the individual sits upright. The second hypothesis proposes that the CSF leak leads to compensatory cerebral vasodilation resulting in PLPH both mechanisms play a role in PLPH. The link between damage to the dura, CSF leak leading to invention of the a traumatic needle (ATN) later (**Peralta & Devroe, 2017**).

There are modifiable and non-modifiable risk factors of PLPH. Non-modifiable risk factors include female gender increase risk twice more than men, young age (20–40 years old), low body mass index (BMI), being pregnant woman was the highest in the parturient can reach up to 38%. Patients who had a history of chronic or recurrent headaches were three times as likely to acquire PLPH than patients who did not (**Jabbari et al., 2013**).

Modifiable risk factors depend on operator experience and technique of LP procedure as perpendicular bevel orientation, large needle gauge (G) (22 g or more) or cutting spinal needles type as Quincke needle, median approach, and didn't replacing stylet before withdrawing the needle and numbers of trails for needle insertion (**Atallah et al., 2017**).

Prevention and adequate management can be helpful in reducing PLPH intensity, duration and frequency or a prophylaxis for this condition. The patients instructed and managed well by doctors and nurses before, during, and after the procedure. The patient should be instructed for bedrest, oral or intravenous (IV) hydration before, during and after

procedure and may be given simple analgesics such as acetaminophen, caffeine IV or oral and if headache severe EBP can be done (Calderon & Copenhaver, 2013 and Domingues, Duarte, Rocha & Teixeira, 2015).

Significance of the Study

Headaches are a common health problem. When severe can affect quality of life and daily routine. The LP is increasingly performed procedure nowadays for its benefits in diagnosis, treatment and for easily applicability in different setting in hospital and centers. The PLPH commonest problem after LP procedure and continue to be a significant cause of morbidity especially in parturient (Monserate et al., 2015).

Incidence of PLPH reach one third or more of cases following LP procedure. This depend on modifiable and non-modifiable factors can magnitude or decrease incidence of PLPH (Jacobus, 2012 and Duits et al., 2016). Well identification of risk factors, adequate management and prophylactic measures about LP procedure, complications, relieving and aggravating factors as giving instructions or educational programs to patients especially who frequently preform LP or highly risky patients for PLPH (Sachs & Smiley, 2014). So that, it is the responsibility of all health care members as nurses, doctors who participate in treatment and alleviate patients complain.

Aim of the study

The present study was conducted to fulfill the following aim:

- Assess factors contributing to headache and its associated symptoms for post lumbar puncture patients.

Research Question

The following question was formulated to achieve the aim of the current study: What are the modifiable and non-modifiable factors contributing to headache and its associated symptoms for post diagnostic and therapeutic lumbar puncture patients?

Subject and methods

Research Design: A descriptive exploratory design was conducted to achieve the aim of this study.

Setting of the Study: This study was conducted in general surgery, orthopedic, gynecology, urology departments at Beni-Suef University Hospital.

Data Collection Tools

Tools of data collection:

Two tools used to collect necessary data to fulfill the study aim.

1) **Lumbar Puncture Interview Questionnaire.**

2) **Tension Headache Dairy.**

Tool (1): Lumbar Puncture Interview Questionnaire:

It adapted from **Blennow & the Alzheimer's Association (2010)**. It was used to assess factors contributing to post lumbar puncture headache and its associated symptoms. This tool written in English language. It included three parts:

Part (1): Factors related to patients:

This part including the following eight sections:

Section 1: Patients' demographic data: this section used to assess the

patients' demographic data which involved 5 questions included the following items age, gender, level of education, patient occupation and marital status.

Section 2: Patients' clinical data: this section include 4 closed ended questions and 1 MCQ. It was concerned with assessing sleeping hours of patients before the procedure and measuring patients' vital signs before, during and after lumbar puncture procedure, patients' weight, height, and calculating body mass index as a person's weight in kilograms divided by the square of the person's height in meters (kg/m²). It classified according to **WHO, (1997)**. This was used to assess nutritional status of patients.

- Below 18.5 considered underweight.

- 18.5–24.9 considered normal weight.

- 25.0–29.9 considered overweight.

- 30.0–34.9 considered obesity class I.

- 35.0–39.9 considered obesity class II.

- Above 40 considered obesity class III.

Section 3: Patients' present medical problem: this section include 8 MCQ and yes and no questions. It was concerned with the current diagnosis of patients, reason for LP. There was part concerned with female patients undergoing LP and they assessed if they were a pregnant, complain of present pregnancy associated problems as eclampsia, migraine, caffeine withdrawal and sinusitis. They assessed if they had

children and their number, previous mode of delivery and type of anesthesia used.

Section 4: Patients' past medical history: this section include 3 MCQ questions. It was concerned with past medical history of the patients, history of headache and history of chronic pain.

Section 5: Patients' past surgical and LP history: this section include 3 yes and no questions. It was concerned with history of surgical operation, history of previous LP and if patient answered yes for past LP history patient specified its reasons and numbers, and concerned with history of previous post lumbar puncture complications.

Section 6: Patients' smoking and addiction history: this section include 2 yes and no questions and it was concerned with asking patients if they were smoking or not or ex-smoker and they were addict or not.

Section 7: Assessment of patients' knowledge level: this section concerned with assessing present patients' level of knowledge regarding lumbar puncture procedure, its indications, and most common complications, characteristics of post lumbar puncture headache, assessed if they had instructions, and by whom given, different positions during and after procedure, their knowledge regarding caffeine and fluid intake before and after the procedure, relieving and aggravating measures. This section consisted of 10 questions in the form MCQs and yes and no questions. **Scoring system of patients' knowledge:** There were 10 questions to assess patients' knowledge level. One degree given for each correct answer, while the incorrect answer done, zero given that made total score 10 degree. **The total score of patients' knowledge was 10 degree:** It considered that

- $\geq 50\%$ was satisfactory level of patient knowledge (≥ 5 degree)

- $<50\%$ was unsatisfactory level of patient knowledge (< 5 degree)

Section 8: Patients' assessment for present post LP complications: this section include 9 MCQ and yes and no questions. It was concerned with complications after present lumbar puncture procedure as needle site pain, post-lumbar puncture headache, and other mild or severe complications and patients also assessed for what positions they assumed and duration of bed rest they took after the procedure.

Part (2): Factors related to LP practitioner:

This part include 2 MCQ type of questions and it was concerned with who performed lumbar puncture procedure and their experience.

Part (3): Factors related to the LP Procedure:

This part include 15 MCQ and yes and no questions and it was concerned with asking about the patient view and attitude toward lumbar puncture procedure, patient fasting and pre anesthetic medication. Needle diameter, type, angle of insertion, bevel orientation, position of patient during puncture, lumbar puncture level, and CSF flow, amount of CSF lost during procedure and if there was hemorrhage during needle insertion and number of trails for needle insertion and assessed if stylet replaced before needle has removed.

Tool (2): Tension Headache Dairy

This tool written in English language. It was used to assess patients for post lumbar puncture headache and its

associated symptoms. It adapted from **Derrer, (2016).**

This tool include 17 yes and no, close ended, and MCQ questions. It was recorded daily by investigator from the first day in the hospital and continued by telephone interview with the patients after their discharge from the hospital for presence of post-lumbar puncture headache and any other adverse events to seven day from lumbar puncture procedure. This tool was concerned with assessing patients for the following items: date, time of headache onset, headache duration, presence or absence of warning signs (aura), location of the pain, and type of pain. Intensity of headache measured by numerical rating scale (NRS) from 0 to 10 point which, a zero point indicate no pain, from 1 to 3 mild pain, from 4 to 6 moderate pain, from 7 to 10 severe pain (**van Dijk et al., 2012**) and patients assessed for presence of **other general symptoms** as nausea, vomiting, neck stiffness, and dizziness. **Ear related symptoms** as tinnitus and hearing loss. **Eye related symptoms** as double vision, photophobia. It was also used to assess medication taken, sleeping hours after lumbar puncture procedure, medication taken and its effect on headache, how headache effecting patient normal routine and identifying patient reliving and aggravating factors causing headache.

Scoring system:

The tension headache dairy tool included 17 items from yes and no, close ended, and MCQ questions type. The scores of items included in this tool summed up and total scores divided in frequencies and percentage.

Pilot Study

A pilot study was conducted to test feasibility and applicability of tools used in this study and as well as to estimate, the

time needed to fill the tools. It carried out on 10% of total study subjects (8 patients). There was no modifications on tools were done after pilot study so that, the subjects who included in the pilot study were included in the main study group.

Ethical Considerations

The ethical research considerations in this study included the following:

1- The research approval of protocol was obtained from scientific research ethical committee in faculty of nursing at Ain Shams University before starting the study.

2- The investigator clarified the aim of the study to the subjects included in the study.

3- The investigator assured maintaining anonymity and confidentiality of the subjects' data.

4- Subjects informed that they allowed choosing to participate or not in the study and that, they had the right to withdraw from the study at my time without giving any reasons.

5-Ethics, values, culture and beliefs of subjects respected.

6- An approval obtained from the directors of Beni-Suef university hospital of general surgery, orthopedic, gynecology and urology departments to conduct the study.

Field Work

- Data collected in three months, from beginning of November 2017 to the end of January 2018. The investigator visited the study settings for three days (Sunday, Tuesday and Thursday) weekly. It took about 30-45 minutes to fill the lumbar puncture interview questionnaire. The investigator filled the interview questionnaire from patients before (in their care departments), during (in operating room) and after (in their care departments) the lumbar puncture procedure.

- The investigator attended with the patients in operating room to fill the parts that concerned with factors related to practitioner and lumbar puncture procedure by asking the anesthesiologist who performed the lumbar puncture procedure to fill the items included in these parts. All parts of the interview questionnaire filled by the investigator.

- Headache Tension Dairy tool used after lumbar puncture procedure. It was recorded daily to fill the items included at this part from the first day from the procedure along seven days. It was recorded by the investigator from patients in the hospital and continued by telephone interview after patients discharged from the hospital for presence of post-lumbar puncture headache and its associated symptoms. It took about 15 -30 minutes to fill this tool with patients in hospital and in each call after their discharge from the hospital.

Result

Table 1: Frequencies and percentage distribution of studied subjects according to their demographic characteristics (n. 80).

Demographic characteristics	No.	%
Age		
≥ 18 < 30	37	46.3
≥ 30 < 40	24	30.0
≥ 40 < 50	11	13.7
≥ 50	8	10.0
Mean ± SD 32.36 ± 11.25		
Gender		
Male	43	53.7
Female	37	46.3
Patient level of education		
Can't read and write	5	6.3
Read and write	14	17.5
Secondary education	39	48.7
Higher education	22	27.5
Occupation		
Student	8	10.1
Worker	26	32.5
Employ	13	16.2
Retired	5	6.2
House wife	28	35.0
Marital Status		
Single	22	27.5
Married	58	72.5

Table 1. Showed that the mean score of studied subjects age was 32.36 ± 11.25 and the percentage of male subjects were 53.7. While 48.7 % of them had secondary level of education and 35% of them were house wife and 72.5% of them were married.

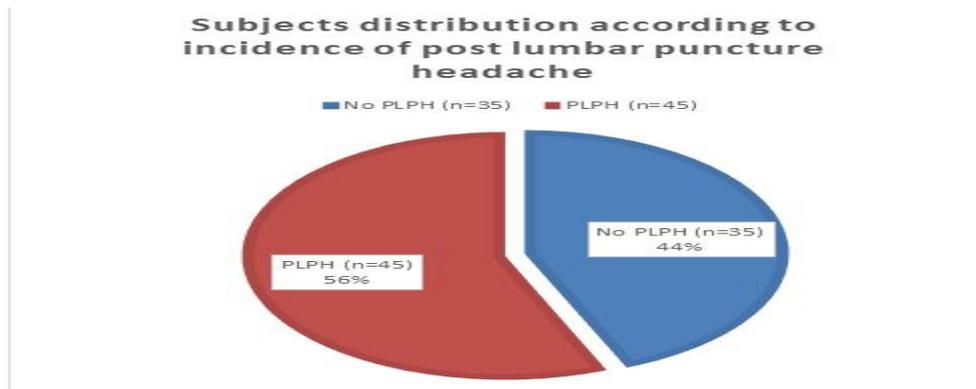


Figure 1: Frequency and percentage distribution of the total studied subjects according to incidence of post lumbar puncture headache (n. 80).

Figure 1. Illustrated that 56% of studied subjects had post lumbar puncture

Table 2: Frequency and percentage distribution of headache characteristics among studied subjects (n.45).

Headache characteristics	No.	%
Headache onset:		
< 6 hours after lumbar puncture	13	28.8
6 > 24 hours after lumbar puncture	21	46.7
1 > 2 days after lumbar puncture	7	15.6
> 2 days after lumbar puncture	4	8.9
Headache duration:		
<1 day	0	0.0
1– 2 days	11	24.4
3– 4 days	25	55.6
5–7 days	9	20.0
*Location of pain:		
Frontal	37	82.2
Occipital	8	17.7
Diffuse all over the head	25	55.6
Affecting one side of head	2	4.4
Type of pain:		
Pressing	11	24.4
Throbbing or pulsating	34	75.6

* Numbers are not mutually exclusive.

Table 2. Showed that 46.7% of subjects developed headache from 6 to 24 hrs after lumbar puncture procedure and 55.6 % of them had headache for 3–4 days. While, 82.2% of them had frontal pain and 75.6% of them had throbbing or pulsating type of pain.

Table 3: Frequency and percentage distribution of headache associated symptoms among studied subjects (n. 45).

Associated symptoms	No.	%
Associated symptoms with headache:		
No	5	11.1
Yes	40	88.9
* Associated general symptoms		
Nausea	7	15.6
Pain Radiating to neck or shoulder that cause neck stiffness	36	80.0
Dizziness	7	15.6
* Associated eye symptoms		
Double vision	17	37.8
* Associated ear symptoms		
Tinnitus	3	6.7
Hours of sleep changes after lumbar puncture:		
Same as before LP procedure	33	73.3
Increase after LP procedure	1	2.2
Decrease after LP procedure	11	24.5

* Numbers are not mutually exclusive.

Table 3. Illustrated that 88.9% of subjects had post lumbar puncture headache associated symptoms and 80.0% of them had pain radiating to neck or shoulder that cause neck stiffness. While, 37.8% of them had double vision and 6.7% of them had tinnitus. However, there were 73.3% of them had the same sleeping hours before and after the procedure.

Table 4: Relation between post lumbar puncture headache and factors related to subjects' demographic characteristics (n. 80).

Demographic characteristics	PLPH (n= 45)		No PLPH (n= 35)		X ²	P Value
	No.	%	No.	%		
Education level						
Can't read & write	1	2.2	4	11.4	15.79	0.014*
Read & Write	4	8.9	10	28.6		
Secondary education	27	60.0	12	34.3		
Higher Education	13	28.9	9	25.7		
Occupation						
Student	4	8.9	4	11.4	12.95	0.113
Worker	11	24.4	15	42.9		
Employ	7	15.6	6	17.1		
Retired	3	6.7	2	5.7		
House wife	20	44.4	8	22.9		
Gender						
Male	22	48.9	21	60.0	5.05	0.050*
Female	23	51.1	14	40.0		
Age						
18 > 30	24	53.4	13	37.1	12.73	0.048*
30 > 40	15	33.3	9	25.8		
40 > 50	4	8.9	7	20.0		
≥ 50	2	4.4	6	17.1		

- Insignificant at $p > 0.05$, * Significant at $p < 0.05$

Table 4. Revealed that there was a statistical significant relation between post lumbar puncture headache and age, gender and educational level at p (0.048, 0.050, 0.014) respectively. While, there was no statistical significant relation between post lumbar puncture headache and occupation at p 0.113.

Table 5: Relation between post lumbar puncture headache and factors related to subjects' clinical data (n. 80).

Clinical data	PLPH(n=45)		No PLPH(n= 35)		X ²	P Value
	No.	%	No.	%		
Body Mass Index						
Normal	27	60.0	13	37.1	16.40	0.003**
Over weight	15	33.3	12	34.3		
Obese	3	6.7	10	28.6		
Duration of Supine position assumed after LP						
< 1 hour	3	6.7	1	2.8	11.14	0.025*
1 > 3 hours	19	42.2	5	14.3		
>3 hours	23	51.1	29	82.9		

* Significant at $p < 0.05$, ** highly significant at $p < 0.01$

Table 5. Revealed that there was a highly statistical significant relation between post lumbar puncture headache and body mass index of studied subjects at p 0.003. While, there was a statistical significant relation between post lumbar puncture headache and duration of supine position assumed after lumbar puncture procedure at p 0.025.

Table 6: Relation between post lumbar puncture headache and factors related to female subjects characteristics (n. 37).

Female characteristics	PLPH (n= 23)		No (n= 14)		X ²	P Value
	No.	%	No.	%		
Pregnancy:						
No	3	13.1	13	92.9	22.61	0.000**
Yes	20	86.9	1	7.1		
Present pregnancy associated problems (21)						
Pre-eclampsia						
No	12	60.0	1	100.0	6.21	0.044*
Yes	8	40.0	0	00.0		
Migraines						
No	18	90.0	1	100.0	1.29	0.525
Yes	2	10.0	0	00.0		
Past history of pregnancy:						
Previous mode of delivery						
Nulli para	7	30.4	1	7.1	19.14	0.000**
Vaginal delivery	3	13.1	13	92.9		
Cesarean section	13	56.5	0	00.0		
Type of anesthesia used in delivery						
No anesthesia	10	43.5	14	100.0	19.14	0.000**
Spinal	13	56.5	0	0.0		

Insignificant at p>0.05, * Significant at p<0.05, ** highly significant at p<0.01

Table 6. Showed that, there was a highly statistical significant relation between post lumbar puncture headache and pregnant women and who had previous history of cesarean section with spinal anesthesia at p value 0.000 and there was a statistical significant relation between post lumbar puncture headache and women complaining pre-eclampsia during their present pregnancy at p 0.044.

Table 7: Relation between post lumbar puncture headache and factors related to subjects medical history, smoking and addiction history (n. 80).

Medical history, smoking and addiction history	PLPH (N=45)		No PLPH (N= 35)		X ²	P Value
	No.	%	No.	%		
Previous medical history:						
Type of comorbidities:						
Cardiovascular disorder	3	6.7	13	37.1	3	0.002**
Respiratory disorder	0	0.0	6	17.1	0	0.001**
Endocrine/metabolic disorder	0	0.0	2	5.7	0	0.129
Renal disorder	3	6.7	1	2.9	0.81	0.667
Patients' history of chronic pain:						
No	43	95.6	31	88.5	2.09	0.351
Mild	1	2.2	3	8.6		
Moderate	1	2.2	1	2.9		
Patients' medical history of headache:						
No	35	77.8	35	100.0	8.89	0.011*
Mild	9	20.0	0	0.0		
Moderate	1	2.2	0	0.0		
Smoking and addiction history:						
Smoking:						
No	40	88.9	22	62.9	46.47	0.000**
Yes	0	0.0	13	37.1		
Ex-smoker	5	11.1	0	0.0		
Addiction:						
No	45	100.0	29	82.9	34.11	0.000**
Yes	0	0.0	6	17.1		

Insignificant at $p > 0.05$, * Significant at $p < 0.05$, ** highly significant at $p < 0.01$

Table 7. Revealed that there was a highly statistical significant relation between post lumbar puncture headache and subjects who had cardiovascular disorder, respiratory disorder and smoker and addict subjects at p (0.002, 0.001, 0.00) respectively. There was a statistical significant relation between post lumbar puncture headache and subjects who had history of headache at p 0.011. While, there was no statistical significant relation between post lumbar puncture headache and subjects who had chronic pain disorders at p value 0.351.

Table 8: Relation between post lumbar puncture headache and factors related to subjects' lumbar puncture history (n. 80).

Lumbar puncture history	puncture	PLPH (n=45)		No (n= 35)		X ²	P Value
		No.	%	No.	%		
Lumbar puncture history:							
No		18	40.0	17	48.6	2.20	0.332
Yes		27	60.0	18	51.4		
Number of previous LPs (45)							
One		10	37.1	14	77.8	11.89	0.454
Two		5	18.5	3	16.6		
Three		8	29.6	1	5.6		
Four		1	3.7	0	00.0		
Five		2	7.4	0	00.0		
Six		1	3.7	0	00.0		
Cause of previous lumbar puncture							
Abdominal surgery		16	59.3	9	50.0	2.93	0.569
Pelvic surgery		6	22.2	6	33.3		
Lower limb surgery		5	18.5	3	16.7		
Complications with previous lumbar puncture							
No		10	37.0	16	88.9	11.39	0.003**
Yes, P LPH		17	63.0	2	11.1		

-Insignificant at $p > 0.05$, ** highly significant at $p < 0.01$

Table 8. Revealed that there was a statistical insignificant relation between post lumbar puncture headache and lumbar puncture history, number and cause of previous lumbar puncture at p value (0.332, 0.454, 0.569) respectively. While, there was a highly statistical significant relation with subjects who experienced previous post lumbar puncture headache complications at p value 0.003.

Table 9: Relation between post lumbar puncture headache and factors related to practitioner and LP procedure (n. 80).

Factors	PLPH(n=45)		No (n=35)		X ²	P Value
	No.	%	No.	%		
Experience of practitioner performing LP:						
Experienced	29	64.4	16	45.7	3.56	0.168
Highly experienced	16	35.6	19	54.3		
Needle Diameter						
20G (0.9 mm)	1	2.3	7	20.0	7.98	0.018*
22G (0.7 mm)	44	97.7	28	80.0		
Number of trails to enter the subarachnoid space:						
1 trail	24	53.3	21	60.0	7.38	0.024*
2– 4 trails	21	46.7	14	40.0		
Angle of insertion (approach):						
Para-median	21	46.7	21	60.0	1.50	0.472
Median	24	53.3	14	40.0		
Cerebrospinal fluid obtained:						
Free flow or drip	44	97.7	33	94.3	1.64	0.439
Withdrawn via syringe using negative pressure	1	2.3	2	5.7		
Hemorrhage during lumbar puncture:						
No	16	35.6	20	57.1	14.08	0.000**
Yes, mild (initial CSF was slightly bloody)	29	64.4	15	42.9		
CSF lost during lumbar puncture:						
< 1 ml	36	80.0	29	82.9	11.84	0.002**
1 > 3 ml	9	20.0	6	17.1		

-Insignificant at $p > 0.05$, * Significant at $p < 0.05$, ** highly significant at $p < 0.01$

Table 9. Showed that there was a statistical significant relation between post lumbar puncture headache and needle diameter and number of trails to enter the subarachnoid space at p value (0.018, 0.024) respectively. While, there was a highly statistical significant relation of post lumbar puncture headache with presence of hemorrhage and amount of cerebrospinal fluid lost during procedure at p value 0.000, 0.002 respectively.

Discussion

Part 1: Concerned with patients demographic characteristics.

In relation to demographic characteristics, the results of the present study showed that, the mean of the studied subjects' age were 32.36 ± 11.25 . This finding showed near half of present

studied subjects their age ranged between 18- <30 years. This explains that most of those patients were young adults, which put them, at higher risk for post lumbar puncture headache, as young age is one of the non-modifiable risk factors.

This finding is consistent with what was reported by **Kassa, Beyen & Denu, (2015)** who found in their study "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" that the mean of their studied patients' age were 33.8 ± 14.2 .

Related to gender, the present study results showed that more than half of studied subjects were male. This finding was consistent with what was reported by **Park, Shin, Ha, Park & Kim, (2014)** in their study titled "Does Lumbar Puncture at Night Prevent Post-Dural Puncture Headache?" where carried out in Haeundae Paik Hospital that more than half of their study subjects were male.

While, this finding was not consistent with what was reported by **Singh et al., (2018)** in study titled "Incidence of Postspinal Headache and Low Backache Following the Median and Paramedian Approaches in Spinal Anesthesia" where carried out in India who illustrated that the majority of their studied subjects were females.

Concerning subjects' level of education, the present study result showed that near half of studied subjects' level of education were secondary level and less than one fifth were read and write while, more than one quarter were higher education level. This explain part of knowledge deficit of studied subjects regarding the procedure, post lumbar puncture headache and aggravating and relieving measures.

This finding contradict with **Salah, Gomaa, Shehata & Mahdy, (2013)** who stated in their study titled "Effect of Pre-Discharge Instructions on Prevention of Headache and Its Associated Symptoms among Patients

Undergoing Diagnostic Lumbar Puncture" where, conducted at lumbar puncture unit at hematology and hereditary department (medicine 12) affiliated to Ain Shams University Hospital that more than one sixth of the study subjects were secondary level, less than one quarter were university degree and more than half were read and write.

Part 2: Concerned with post lumbar puncture headache incidence.

Regarding incidence of post lumbar puncture headache among studied subjects, this result showed that more than half of studied subjects complain of post lumbar puncture headache. The possible explanations for this high incidence that most of study subjects were young, near half with secondary level of education with inadequate instructions and using large traumatic type of needle for spinal anesthesia all of this interrelated factors can rise incidence of post lumbar puncture headache in this study compared with other studies.

These findings were in agreement with **Seupaul, Somerville, Viscusi, Shepard & Hauter, (2005)** who founded more than half of studied subject complain of post lumbar puncture headache. This finding was inconsistent with what reported by **Baig, (2014)** who founded that less than one quarter of studied subjects complain of post lumbar puncture headache and also **Dodge, Heather, Geraciotti, Thomas, (2013)** and **Duits et al., (2016)** showed that less than one third of their studied subjects got post lumbar puncture headache.

Part 3: Concerned with post lumbar puncture headache and its associated symptoms characteristics.

Regarding post lumbar puncture headache onset, the finding of the current study showed that most subjects' headache started in the first 48 hours. This finding was greatly supported by **Amorim, Gomes de Barros & Valença, (2012)** who conducted a study titled "Post-dural (post-lumbar) puncture headache: Risk factors and clinical features" which carried out in Hospital da Restaurac in Brazil". **Nguyen & Walters, (2014)** also assured that the interval for the occurrence of headache after spinal anesthesia to be the first 48 hours.

This finding was not supported by **Imbelloni, Sobral & Carneiro, (2001)** who conducted a study titled "Post-dural puncture headache and spinal needle design. Experience in 5050 cases" and founded that most of their studied subjects experienced post lumbar puncture headache in first 4 days.

Related to location and type of pain, the present study showed that most of subjects had frontal pain. While, less than one quarter of them had occipital pain and one tenth developed temporal pain. This finding disagreed with **Salah et al., (2013)** who emphasized that less than half had occipital pain and one fifth had frontal pain.

This finding were in the same line with **Malik, Farooqi, Khan & Ishaq, (2012)** who conducted a study titled "To Compare The Frequency and Severity of Post-Dural Puncture Headache (PDPH) in Parturient Given Spinal Anesthesia with 25G Quincke with that of 25G Whitacre Needle" conducted at Shalamar Hospital Lahore, reported that most of subjects had frontal pain and one quarter of them had pain at occipital & temporal region.

Concerning post lumbar puncture associated symptoms, the finding of the current study showed that the majority of patients with post lumbar puncture headache complained of headache-associated symptoms. This finding was in agreement with **Amorim et al., (2012)** which indicated that more than two third of post lumbar puncture patients had at least one of the following associated symptoms (neck stiffness, tinnitus, hypoacusia, photophobia or nausea).

Part 4: Concerned with the relations between the variables of the study.

Relation between post lumbar puncture headache and risk factors related to patients:

Concerning relation between post lumbar puncture headache and subjects' demographic characteristics, the findings of the present study revealed that there were a significant relation of post lumbar puncture headache and most items of subjects' demographic characteristics include age, gender and educational level. Meanwhile, there was a statistical insignificant relation between post lumbar puncture headache and subjects occupation.

The finding agreed with **Bezov Lipton & Ashina, (2010)** whose study titled "Post-Dural Puncture Headache: Part I Diagnosis, Epidemiology, Etiology, and Pathophysiology" which conducted in Montefiore Hospital, showed that the risk was highest in 20 to 30-year-old. This age group is 3-5 times more likely to develop post lumbar puncture headache than those after 60. Women had almost 2-time risk more than men do.

Center & Geraciotti Jr, (2013) assured that post lumbar puncture headache had strong correlation with age, as subjects in their 20s had a higher rate (40.0%) than those in their 30s (35.0%) who had, in turn, a higher rate than those 40 years. The same study showed disagreement with current study finding regarding gender, which indicated that there was no statistical significant relation between post lumbar puncture headache and gender.

Concerning relation between post lumbar puncture headache and body mass index, the finding of the present study revealed that there was a highly significant relation between post lumbar puncture headache and subjects body mass index.

This finding agreed with **Ghaleb, (2010)** who indicated that lean individual had higher risk for post lumbar puncture headache. **de Almeida et al., (2011)** illustrated in study titled "Incidence of Post Dural Puncture Headache in Research Volunteers" that subjects with body mass index a less than or equal to the clinical validated cut-off of 25.0 were 3.26 times more likely to experience PLPH than those greater than 25.0.

There was disagreement with **Miu Paech & Nathan, (2014)** who showed that no significance difference between body mass index > 30 or < 30 and no difference in the rate of post lumbar puncture headache. In addition, there was no correlation founded between body mass index and the severity of the headache.

Regarding duration of bed rest following lumbar puncture and post lumbar puncture headache, the finding of the present study revealed that there

was a significant relation between post lumbar puncture headache and duration of bed rest following lumbar puncture.

This finding agreed with **Li et al., (2018)** who conducted a study titled "Investigation of the optimal duration of bed rest in the supine position to reduce complications after lumbar puncture combined with intrathecal chemotherapy: a multicenter prospective randomized controlled trial" showed that laying down for more than 6hr after lumbar puncture procedure leading to a significant reduction of post lumbar puncture headache.

There was disagreement with **Park et al., (2014)** who indicated in their study there was no relation between prolonged bed rest and incidence of post lumbar puncture headache and **Thoennissen et al., (2001)** who conducted a study titled "Does bed rest after cervical or lumbar puncture prevent headache? A systematic review and meta-analysis" found that there was no evidence that longer bed rest after cervical or lumbar puncture was better than immediate mobilization or short bed rest in reducing the incidence of headache.

Concerning relation between post lumbar puncture headache and female characteristics, the finding of the present study revealed that there was a significant relation between post lumbar puncture headache and most of items where, there were a highly significant relation between post lumbar puncture headache and pregnancy and previous spinal anesthesia type used for previous delivery.

This finding were on the same line with **Malik et al., (2012)** who illustrated that post lumbar puncture

headache strongly correlated with young pregnant females. **Brull, McCartney, Chan & El-Beheiry, (2007)** who indicated in the study titled "Neurological Complications after Regional Anesthesia: Contemporary Estimates of Risk" that there was higher incidence for post lumbar puncture headache among young aged, pregnant females.

Current study finding illustrated that, there were a significant relation between post lumbar puncture headache and present pregnancy associated complain as pre-eclampsia. This finding in agree with **Goldszmidt, Kern, Chaput & Macarthur, (2005)** who assured that there were different types of headache and differentiated between them according to underlying causes and clinical picture to every type and indicated there was a significant relation between post lumbar puncture headache and parturient complained pre-eclampsia.

Also, this finding was on the same line with **Stella, Jodicke, How, Harkness & Sibai, (2007)** who conducted study titled "Postpartum headache: is your work-up complete?" and differentiated secondary headaches result from regional anesthesia complications, obstetric complications or neurologic lesions and their finding showed a significant relation between post lumbar puncture headache and parturient complained pre-eclampsia.

Concerning relation between post lumbar puncture headache and present pregnancy associated complain as migraine, the finding of the present study revealed that there was insignificant relation between post lumbar puncture headache and migraine. This finding was on the same line with **Jabbari et al., (2013)** who revealed that

there was no significant relation between history of post lumbar puncture headache and migraine.

This finding contradicted with **Hatfalvi, (1995)** who stated that patients with history of headache, especially vascular type (migraine, toxic and cluster), might be more susceptible to the development of post lumbar puncture headache.

Concerning relation between post lumbar puncture headache and subjects' comorbidity, current study finding illustrated that, there were a highly significant relation between post lumbar puncture headache and subjects with medical history of cardiovascular and respiratory disorders.

This finding contradicted with **Van-Oosterhout et al., (2013)** who indicated that cardiovascular disorder were known as risk factors for thrombosis and this could influence on the development of post lumbar puncture headache but there was no significant relation to predict this.

Regarding relation between post lumbar puncture headache and chronic or recurrent headache, current study finding illustrated that, there was a significant relation between post lumbar puncture headache and subjects with mild history of headache.

This finding showed agreement with **Clark, Solomon, Senanayake, & Gallagher, (1996)** who reported that a history of chronic or recurrent headache was associated with three times the likelihood of development of post lumbar puncture headache. Also this finding on the same line with **Khlebtovsky et al., (2015)** who founded a significant relation between history of

headache and post lumbar puncture headache.

Concerning relation between post lumbar puncture headache and history of smoking and addiction, the current study finding showed that, there was a highly significant relation between post lumbar puncture headache and history of smoking and addiction. This finding agreed with **Center & Geraciotti Jr, (2013)** who conducted study titled "Cigarette Smokers Have Reduced Risk for Post-Dural Puncture Headache" stated that non-smoker developing a post lumbar puncture headache were approximately 3.3 times than of smokers.

This finding contradicted with **Gleim, Stitham, Tang, Martin & Hwa, (2012)** who indicated that there was insignificant relation between smoking and post lumbar puncture headache incidence and severity.

Regarding relation between post lumbar puncture headache and history of previous post lumbar puncture headache, the finding of the present study revealed that there was a highly statistical significant relation between new attack of post lumbar puncture headache and history of post lumbar puncture headache complication.

This finding were on the same line with **Amorim & Valença, (2008)** who illustrated that there was a significant relation between post lumbar puncture headache and history of post lumbar puncture headache. also **Amorim et al., (2012)** indicated that the risk of a new occurrence of post lumbar puncture headache was 4.3 times greater in patients with a previous history of post lumbar puncture headache especially females.

Concerning relation between post lumbar puncture headache and type of surgery performed, the finding of the present study revealed that there was a statistically insignificant relation between post lumbar puncture headache and type of surgery performed that used lumbar puncture for anesthesia.

This result was congruent with **Jabbari et al., (2013)** and also with **Choi et al., (2003)** who conducted study titled "PDPH is a common complication of neuraxial blockade in parturients: a meta-analysis of obstetrical studies" and both studies showed that there was no a statistical significance difference in incidence of post lumbar puncture headache and type of surgery performed.

Relation between post lumbar puncture headache and factors related to practitioner and lumbar puncture procedure:

Regarding incidence of post lumbar puncture headache and practitioner level of experience, the current study showed that there was a statistically insignificant relation between post lumbar puncture headache and practitioner level of experience. This finding agreed with **Khlebtovsky et al., (2015)** who founded that operator experience was unrelated to the risk of post lumbar puncture headache.

This finding was in contrary with **Sadashivaiah, Wilson, McLure & Lyons, (2010)** which conducted study titled "Double-space combined spinal-epidural technique for elective caesarean section: a review of 10 years' experience in a United Kingdom teaching maternity unit" that showed there was relation between post lumbar puncture headache and practitioner level of experience.

Regarding correlation between post lumbar puncture headache and needle diameter, this study finding showed a significant relation between post lumbar puncture headache and needle diameter. This finding on the same line with **Peralta & Devroe, (2017)** who illustrated in study titled "Any news on the post-dural puncture headache front?" that large cutting needle associated with high incidence of post lumbar puncture headache.

Also, this finding on the same line with **Arevalo-Rodriguez et al., (2017)** who illustrated that large needle, traumatic type had higher incidence for headache despite on small a traumatic needle had technical difficulties and experience.

Regarding correlation between post lumbar puncture headache and number of trails done to enter subarachnoid space, this study finding showed a significant relation between post lumbar puncture headache and number of trails done to enter subarachnoid space. This finding agreed with **Golzari, Mahmoodpoor & Rikhtegar, (2015)** in study titled "Factors Contributing to Post-Lumbar Puncture Headache" that showed significant relation between post lumbar puncture headache and number of attempts done to enter subarachnoid space.

Concerning angle of needle insertion and post lumbar puncture headache, this study finding showed insignificant relation between post lumbar puncture headache and angle of needle insertion into subarachnoid space.

This finding disagreed with **Singh et al., (2018)** which showed that median approach had 5 times risk for

post lumbar puncture headache than para-median approach and **Behary & Mohammed, (2016)** assured that there was a strong relation of median approach on incidence of post lumbar puncture headache.

As regard to relation between post lumbar puncture headache and cerebrospinal fluid flow, the finding in the present study showed that there was a statistically insignificant relation between post lumbar puncture headache and flow of cerebrospinal fluid. This finding agreed with **Duits et al., (2016)** who stated that free flow of cerebrospinal fluid seemed to give a slightly lower risk for headache compared with active withdrawal, although the effect was only significant for nonspecific and severe headache.

Regarding correlation between post lumbar puncture headache and amount of cerebrospinal fluid lost, the finding in the present study showed that there was a statistically high significant relation between post lumbar puncture headache and cerebrospinal fluid amount lost during needle insertion.

This finding on contrary with **de Almeida et al., (2011)** which founded insignificant relation between post lumbar puncture headache and cerebrospinal fluid amount lost during lumbar puncture procedure and **Bezov, Ashina & Lipton, (2010)** assured that post lumbar puncture headache not affected by loss of cerebrospinal fluid during needle insertion or with cerebrospinal fluid sample analysis.

Conclusion

Overall, more than half of the study subjects developed PLPH. This attributed to interrelated factors that

magnified the incidence of PLPH. Factors related to subjects' characteristics showed that near half of study subjects aged between 18 \geq 30 years with secondary level of education. While, more than half of the female subjects were pregnant. Most of subjects who had history of headache and more than one third of them who had positive history of PLPH experienced new attack of headache.

Moreover, there were other factors related to practitioner experience and LP procedure indicated that more than half of subjects developed PLPH their LP performed by experienced anesthesiologist and had median approach for needle insertion. As well as there were a highly statistical significance difference between PLPH and pregnancy, pregnant women complained pre-eclampsia, amount of CSF lost during LP, BMI, history of PLPH. While, there were a statistical significance difference between PLPH and age, gender, history of headache, needle diameter and number of trails done to enter subarachnoid space.

Recommendations

Recommendations for patient related factors:

- Developing a simplified and comprehensive booklet or brochure including basic information about lumbar puncture procedure as definition, indications, risk factors for lumbar puncture complications and prevention.

- Patients should be encouraged for contacting health care team regarding post discharge relieving and aggravating measures of post lumbar puncture headache, therapeutic regimen and for follow up especially with one-day surgery or highly

risk patients or frequently performed lumbar puncture procedure.

Recommendations for practitioner and lumbar puncture procedure related factors:

- Continuous assessment of patient's before, during and after lumbar puncture by health care providers to identify risk factors of post lumbar puncture headache.

- Providing continuous training courses and evaluation about risk and protective factors of post lumbar puncture headache and updated lumbar puncture procedure technique and guidelines.

Recommendations for further studies:

- Further studies on constructing and testing the effect of applying check list about protective factors of post lumbar puncture headache for undergoing lumbar puncture procedure patients.

- Further studies should be conducted on assessing health care team level of knowledge regarding lumbar puncture procedure, risk factors of post lumbar puncture headache and its management.

- Further studies should be conducted about the obstacles that interfere with health care team to provide pre-procedural instructions to patients.

The study should be replicated on large sample size and in different hospitals setting in order to generalize the results and figure out more factors if present.

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