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Original article

Incidence and Risk Factors of Post Dural Puncture Headache After Spinal Anesthesia in Tripoli Hospitals

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ABSTRACT

Post Dural Puncture Headache (PDPH) remains a prominent clinical concern to the present day and common complication seen in the field of anesthesiology and pain medicine. Identification of such risk factors is a crucial step in the rational modification of anesthetic practice and evaluation of therapeutic interventions. This study was conducted to demonstrate the incidence and risk factors of PDPH in patients after spinal Anesthesia during three days' post operations at general hospital in Tripoli, Libya. In this study certain factors related to patient history, baseline clinical state or anesthetic technique might be associated with an increased risk for this side effect, so it was collected historical, physiologic, and technical data to determine their association with PDPH. Out of total of 100 patients distributed over 5 different hospitals admitted over a period (from November 2020 to April 2021) 27% of them have a PDPH, while 92.5% of cases with PDPH are females, that 55.6% of PDPH cases are between 20 and 25 years old, and this percentage getting smaller as patients get older, most of the operations were caesarean section, at a rate of 58%, followed by lower abdominal surgeries with 19% of cases, and orthopedic surgeries with 17% of cases, while the lowest percentage was for the Urologic surgeries. 55% of cases with PDPH are classified as (case I), and 44% of them are classified as (case II), 81.5% of PDPH cases used noncutting needles. In this study the PDPH remains the most problem in hospitalized patients after spinal Anesthesia at Tripoli hospitals can be caused by variety of risk factors, associated with ASA physical states, nonprofessional technique, the females are more common than males and the percentage increasing in early age group.

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INTRODUCTION

Post Dural Puncture Headache (PDPH) is a direct consequence of the puncture hole in the dura, which results in loss of CSF (acts as a cushion supporting and protecting the brain) causes downward displacement of the brain and resultant stretch on sensitive supporting structures [1]. Pain also results from distention of blood vessels, which must compensate for the loss of CSF because of the fixed volume of the skull.

The pain associated with PDPH begins from the first 24 hours to 72 hours (about 3 days) after transgression of the dura but can occur immediately even up to several months after the event. Most cases of PDPH will resolve spontaneously within 7 days if left untreated [2], Initial treatment is usually conservative and consists of bed rest, intravenous fluids, analgesics, and caffeine (500 mg (about half the weight of a small paper clip) IV) [3,4]. However, in cases where the

headache is severe enough that conservative management becomes unsustainable. Epidural blood patch (EBP), if not contraindicated, is the treatment of choice in these cases, especially if symptoms suggestive of cranial nerve involvement are present which can normally be relieved (in >90% cases) by injecting 20–30 mL of the patient's own venous blood into the epidural space under strict aseptic conditions [3,5].

The characteristic feature of PDPH is its postural component: it appears or intensifies with sitting or standing and is partially or completely relieved by recumbency. This feature is so distinctive that it is difficult to consider the diagnosis in its absence [6].

PDPH is typically occipital or frontal (or both) and is usually described as dull or throbbing. Associated symptoms such as nausea, vomiting, anorexia, and malaise are common. Ocular disturbances, blurred vision or photophobia may occur and are believed to result from stretching of the cranial nerves, most commonly cranial nerve VI, as the brain descends because of the loss of CSF [7].

Spinal anesthesia results from the injection of a local anesthetic drug directly into the cerebrospinal fluid (CSF) within the subarachnoid (intrathecal) space. The spinal needle can only be inserted below the second lumbar and above the first sacral vertebra; the upper limit is determined by the termination of the spinal cord and the lower limit because the sacral vertebrae are fused, and access becomes impossible. When the tip of the needle is correctly positioned, CSF will appear at the hub. A single injection of local anesthetic is normally used, limiting the technique's duration. A fine, 25–27 G needle with a 'pencil point' or tapered point (for example, a Whitacre or Sprotte needle) is used with the patient in the lateral decubitus, sitting, or less commonly, the prone position [8,9]. Although spinal anesthesia has long been considered a safe technique used for surgical procedures involving the lower abdominal area, perineum, and lower extremities in orthopedic, urologic, and obstetric surgery, but is often followed by PDPH [10].

It was hypothesized that certain factors related to patient history, baseline clinical state or anesthetic technique might be associated with an increased risk for this side effect, so it was collected historical, physiologic, and technical data to determine their association with PDPH.

Several factors contribute to the development of headache after lumbar puncture, including needle size, needle design, direction of the bevel, and number of LP attempts. Namely, using smaller diameter and non-cutting needles is correlated with a lower incidence of headache after LP but it is more difficult to use and has a greater failure rate than larger needles of either type. Additionally, insertion of the needle with the bevel parallel to the dural fibers facilitates closure of the hole and minimizes cerebrospinal fluid leakage [11].

PDPH remains a prominent clinical concern to the present day and common complication seen in the field of anesthesiology and pain medicine. Identification of such risk factors is a crucial step in the rational modification of anesthetic practice and evaluation of therapeutic interventions. The goal of this study was to determine the incidence and risk factors of PDPH.

METHODS

Study design

The study employed an observational design and was conducted across five distinct hospitals from November 2020 to April 2021, focusing on patients who had undergone surgical procedures. Approval for the study was obtained from the research committee of the Faculty of Medical Technology at the University of Tripoli, Libya.

Data collection

Data was gathered from 100 patient records, encompassing pre-operative patient information, the nature of the surgical procedure, and post-operative follow-up conducted by contacting the patient over a period of three days. This was undertaken to ascertain the occurrence of Post-Dural Puncture Headache (PDPH). The included details were belonged to patients underwent surgical procedures involving the lower abdominal area, perineum, and lower extremities within the disciplines of orthopedic, urologic, and obstetric surgery.

Statistical analysis

The collected data was subjected to rigorous statistical analysis using IBM SPSS statistics 26 and Microsoft excel. Descriptive statistics such as frequencies, means, and standard deviations were employed to summarize the demographic characteristics of the patient cohort, as well as the key variables related to surgical procedures and anesthetic techniques. Additionally, inferential statistical tests, including t-tests, chi-square tests, and regression analysis, were utilized to explore potential associations between the collected variables and the incidence of PDPH. The significance level was set at $p < 0.05$ for all statistical tests.

RESULTS

Out of the total number of cases, 75% of the cases were female while 25% were males since 44% of cases were in the twenties and the reason for this may be because most of the cases underwent cesarean, with heights less than 170 cm, and 55% of wights were less than 76kg (table 1).

Table 1. Demographic characteristics: gender, age group, height, and weight.

Personal Information		*n*	*%*
Gender	Female	75	%75
	Male	25	%25
Age groups	20-29	44	44%
	30-39	28	28%
	40-49	12	12%
	50-59	4	4%
	60-69	6	6%
	70-79	1	1%
	80-89	5	5%
Hight	<=170	84	%84
	>=170	16	%16
Wight	<=76	55	%55
	>=76	45	%45

In the dataset, it is evident that 59% of cases are either pregnant or breastfeeding (Table 2). When queried about the use of anticoagulant medication, the majority were found to be negative, with 18% confirming its use, including 13% specifically mentioning aspirin. Regarding the presence of disturbances or disorders in the nervous, respiratory, or cardiovascular systems, most cases were found to have no such conditions. Similarly, 85% of cases had stable blood pressure, while 13% suffered from hypertension. Furthermore, the majority of cases did not have diabetes, and were not identified as smokers or alcohol users. Overall, it was observed that 98% of cases did not have a history of disease, with 64% classified as normal healthy patients, and 35% classified as patients with mild systemic disease.

Table 2. Patients Health Status Overview

Health status		*n*	*%*
Pregnant or breastfeeding	No	18	%18
	Yes	59	%59
	None	23	%23
Taking regular anti-clotting treatment	No	82	%82
	Yes	18	%18
Anticoagulant drugs	Clopidogrel	1	%1
	Nadroparin Calcium	4	%4
	Aspirin	13	%13
	None	82	%82
Disorder in cardiovascular system	No	89	%89
	Yes	11	%11
Blood pressure disturbance	Hypertension	13	%13
	Hypotension	2	%2
	None	85	%85
Disorder in respiratory system	No	96	96%
	Yes	4	4%
Diabetes	No	86	86%
	Yes	14	14%
Disorder in nerves system	No	98	98%
	Yes	2	2%
Smoker or alcoholic	No	92	92%
	Yes	8	8%

Regular treatment for sedative or anti-depressant drugs	No	100	100%
	Yes	0	0%
History of carsickness	No	98	%98
	Yes	2	%2
ASA physical status	I	64	64%
	II	35	35%
	III	1	1%

The results pertaining to the surgical procedure include its classification, the attributes of the anesthesia employed, the administration method, and the occurrence of postoperative headaches (Table 3).

Table 3. Details of surgical procedures

Information about surgery		***N***	***%***
The type of surgery	Caesarean sections	58	58%
	Orthopedic surgery	17	17%
	Urologic surgery	6	6%
	Lower abdominal surgery	19	19%
The position of spinal puncture	Lateral	1	1%
	Sitting	99	99%
The site of spinal puncture	L2, L3	3	3%
	L3, L4	77	77%
	L4, L5	20	20%
Shape of needle used in spinal puncture	Cutting	10	10%
	Noncutting	90	90%
Diameter of needle used in spinal puncture	25	45	45%
	26	53	53%
	27	2	2%
The local anesthesia used in spinal puncture	Lidocaine	7	7%
	Bupivacaine	93	93%
The anesthetic dose	<=Median dose	95	95%
	>=Median dose	4	4%
	Missing	1	1%
Sedation score 30min after blockade	1,2	38	38%
	3,4	61	61%
	5,6	1	1%
Vasoconstrictor used in spinal puncture	Ephedrine	66	66%
	Phenylephrine	0	0%
	None	34	34%
PDPH	Mild	14	14%
	Moderate	7	7%
	Severe	6	6%
	None	72	72%
	Missing	1	1%
Headache onset time	24	7	7%
	30	1	1%
	48	10	10%
	72	9	9%
	None	73	73%

As indicated in (table 3), most procedures were caesarean sections, accounting for 58% of the cases, followed by lower abdominal surgeries at 19%, orthopedic surgeries at 17%, with urologic surgeries having the lowest percentage. Moreover, 99% of the cases underwent spinal puncture in a seated position, with 77% of them receiving the needle insertion between the third and fourth lumbar vertebrae, while 20% had it placed between the fourth and fifth lumbar vertebrae. Regarding the needle characteristics, 99% of cases utilized a non-cutting needle with a diameter ranging between 25- and 26-gauge sizes. It is noteworthy that 93% of cases received Bupivacaine, with 95% administered a

dosage below the median. Additionally, 61% of cases achieved a sedation score ranging between 3 and 4, 30 minutes post-blockade, while 66% of them were administered Ephedrine as a vasoconstrictor.
In response to inquiries regarding postoperative headaches, 27% of cases acknowledged experiencing them. Among these cases, 14% reported mild headaches, while the remaining individuals described the intensity of their headaches as moderate (7%) or severe (6%). Interestingly, 10% of the cases experiencing headaches noted that the onset of pain occurred more than 48 hours following the surgical procedure.
Since the data are either ordinal or nominal, in addition to the small size of sample, nonparametric methods to analyze data and get inferences were used. To detect relations between "(PDPH) headache after spinal. A" and all other factors under study, χ^2 *dependency test* was used, for a level of significance $\alpha = 0.05$,to test the following hypotheses:

H_0: ***The (PDPH) is independent of the factor under study***
H_1: ***The (PDPH) is depending on the factor under study***

The results are as follows:

Table 4. Results of χ^2 dependency test

Variables		***Calculated value***	***P-value***
PDPH after spinal puncture Vs Pregnant or breastfeeding	Pearson Chi-Square	4.455	.216
	Contingency Coefficient	0.234	.216
	D.F	3	
	Decision	***Accept H_0***	
PDPH after spinal puncture Vs Taking regular anti-clotting treatment	Pearson Chi-Square	2.421	.490
	Contingency Coefficient	.155	.490
	D.F	3	
	Decision	***Accept H_0***	
PDPH after spinal puncture Vs History of carsickness	Pearson Chi-Square	7.00	.042
	Contingency Coefficient	.258	.042
	D.F	3	
	Decision	***Reject H_0***	
PDPH after spinal puncture Vs Disorder in cardiovascular system	Pearson Chi-Square	20.933	.000
	Contingency Coefficient	.420	.000
	D.F	3	
	Decision	***Reject H_0***	
PDPH after spinal puncture Vs Blood pressure disturbance	Pearson Chi-Square	51.198	.000
	Contingency Coefficient	.584	.000
	D.F	6	
	Decision	***Reject H_0***	
PDPH after spinal puncture Vs Disorder in respiratory system	Pearson Chi-Square	2.740	.433
	Contingency Coefficient	.164	.433
	D.F	3	
	Decision	***Accept H_0***	
PDPH after spinal puncture Vs Diabetes	Pearson Chi-Square	2.127	.546
	Contingency Coefficient	.145	.546
	D.F	3	
	Decision	***Accept H_0***	
PDPH after spinal puncture Vs Disorder in nerves system	Pearson Chi-Square	.765	.858
	Contingency Coefficient	.088	.858
	D.F	3	
	Decision	***Accept H_0***	
PDPH after spinal puncture Vs Smoker or alcoholic	Pearson Chi-Square	2.703	.440
	Contingency Coefficient	.163	.440
	D.F	3	
	Decision	***Accept H_0***	
PDPH after spinal puncture	Pearson Chi-Square	12.308	.196

Vs The type of surgery	Contingency Coefficient	.333	.196
	D.F	9	
	Decision	***Accept H_0***	
PDPH after spinal puncture Vs The position of spinal puncture	Pearson Chi-Square	6.133	.105
	Contingency Coefficient	.242	.105
	D.F	3	
	Decision	***Accept H_0***	
PDPH after spinal puncture Vs The site of spinal puncture	Pearson Chi-Square	8.813	.184
	Contingency Coefficient	.286	.184
	D.F	6	
	Decision	***Accept H_0***	
PDPH after spinal puncture Vs The shape of needle in spinal	Pearson Chi-Square	7.121	.048
	Contingency Coefficient	.259	.048
	D.F	3	
	Decision	***Reject H_0***	
PDPH after spinal puncture Vs The diameter of needle in S. P	Pearson Chi-Square	6.018	.421
	Contingency Coefficient	.239	.421
	D.F	6	
	Decision	***Accept H_0***	
PDPH after spinal puncture Vs The local anesthesia used in S. P	Pearson Chi-Square	2.372	.499
	Contingency Coefficient	.153	.499
	D.F	3	
	Decision	***Accept H_0***	
PDPH after spinal puncture Vs The anesthetic dose	Pearson Chi-Square	5.920	.116
	Contingency Coefficient	.239	.116
	D.F	3	
	Decision	***Accept H_0***	
PDPH after spinal puncture Vs Vasoconstrictor used in S. P	Pearson Chi-Square	9.015	.173
	Contingency Coefficient	.290	.173
	D.F	6	
	Decision	***Accept H_0***	
PDPH after spinal puncture Vs ASA physical status	Pearson Chi-Square	13.043	.042
	Contingency Coefficient	.341	.042
	D.F	6	
	Decision	***Reject H_0***	

From the previous table, and by comparing the P-value of Pearson chi-square with $\alpha = 0.05$, if P-value < 0.05, the null hypothesis that the PDPH is independent of the factor under study was accepted, but if it's not, the null hypothesis will be rejected and accept the alternative hypothesis that the PDPH is depending on the factor under study.
So, the null hypothesis has been rejected five times for five factors as follows:

1. History of carsickness:

To analyze the link between (PDPH) and carsickness history, a contingency has been calculated:

Table 5. Contingency table for PDPH and history of carsickness

Headache after spinal puncture	**History of carsickness**	
	No	Yes
Mild	14	0
Moderate	7	0
Severe	5	1
None	70	1

2. Disorder in cardiovascular system:

To assess the link between (PDPH) and cardiovascular disorders, a contingency has been calculated:

Table 6. Contingency table for PDPH and disorder in cardiovascular system

Headache after spinal puncture	Disorder in cardiovascular system	
	No	Yes
Mild	12	2
Moderate	6	1
Severe	2	4
None	67	4

It is evident that severe PDPH is more prevalent among cases who responded affirmatively when queried about cardiovascular system disorders, while mild PDPH is more likely among cases who answered negatively.

3. Blood pressure disturbance:

To assess the relation between (PDPH) and blood pressure disturbance.

Table 7. Contingency table for PDPH and blood pressure disturbance

Headache after spinal puncture	Blood pressure disturbance		
	Hypertension	Hypotension	None
Mild	2	0	12
Moderate	0	0	7
Severe	4	2	0
None	7	0	65

It is apparent that severe PDPH is most likely to occur in cases with blood pressure disturbances, particularly among those with hypertension.

4. Shape of needles in spinal puncture:

Contingency has been calculated to assess the link between PDPH and shape of needles:

Table 8. Contingency table for PDPH and the shape of needle in spinal

Headache after spinal puncture	The shape of needle in spinal anesthesia	
	Cutting	Noncutting
Mild	3	11
Moderate	0	7
Severe	2	4
None	5	67

From the data, it is apparent that PDPH is more likely to occur in cases where a non-cutting needle was utilized during the spinal procedure.

5. ASA physical status:

To analyze the link between PDPH and the ASA physical status, a contingency has been calculated:

Table 9. Contingency table for PDPH and the ASA physical status

Headache after spinal puncture	ASA physical status		
	I	II	III
Mild	11	3	0
Moderate	4	3	0
Severe	0	6	0
None	48	23	1

It is observable that severe PDPH is more likely to manifest in cases classified as patients with mild systemic disease.

DISCUSSION

This study aligns with numerous previous studies conducted worldwide on PDPH, particularly in its reliance on critical factors that may increase the likelihood of its occurrence, such as health status (ASA classification), physician experience, needle design, and surgical conditions [12-14].

By examining 100 patients across five different hospitals, this study aimed to identify all potential factors affecting PDPH and determine which factors have the most significant impact. Out of the patients surveyed, 27% experienced PDPH, a percentage that aligns closely with the findings of previous study [12] reporting a PDPH incidence of 28.7%. However, it contrasts with the results reported in other studies, which documented an 18.1% and 25.9% occurrence of PDPH among pediatric cases [13,14].

As previously mentioned, 75% of the cases are females, with 92.5% of PDPH cases being females. Although this hypothesis is not statistically significant, it suggests that women are more prone to experiencing PDPH. This observation aligns with the findings of study by Zorrilla-Vaca, A *et al*. [15] and is consistent with another previous study [14], which indicated that among children, girls are more predisposed to developing PDPH compared to boys.

Regarding age groups, this study showed that 55.6% of PDPH cases were between 20 and 25 years old, and this percentage getting smaller as patients get older; this approves what comes in the study reported by Schmittner MD *et al*, and Zorrilla-Vaca, A *et al* [12,15], but disagrees with the previous study [14], which shown an increasing in PDPH with increasing age in teenagers. Zorrilla-Vaca, A *et al*. [15] revealed that, most cases had orthopedic and urologic surgeries, while in this study showed that most of the operations were Caesarean section, at a rate of 58%, followed by Lower Abdominal surgeries with 19% of cases, and Orthopedic surgeries with 17% of cases, while the lowest percentage was for the Urologic surgeries.

Previous study reported that, 96% of cases of PDPH were classified as normal healthy patients (case I), while 4% were classified as patients with mild systemic disease (case II) [12]. In comparison, in this study, 55% of cases with PDPH were classified as (case I), and 44% of them are classified as (case II); because of this convergent percentage, the relation between ASA physical status and PDPH incidence has been analyzed, which was statistically significant; and it was also significant for other health status factors such as the history of carsickness, disordering in the cardiovascular system, and blood pressure disturbance.

Most previous studies have relationships between the PDPH incidence and the shape of a needle that used. Bezov, D *et al*, [16] revealed that, smaller needles produce a lower incidence of PDPH than larger needles of the same type. Furthermore, using noncutting produced a lower incidence of PDPH than cutting needles. On the other hand, the findings of the preceding study [16] diverge from the current study concerning the tip design of spinal needles. Notably, the former study reported an incidence of approximately 81.5% of PDPH cases associated with the utilization of noncutting needles., and there is statistically significant evidence about dependency between noncutting needles and severe PDPH.

CONCLUSION

PDPH remains the most problem in hospitalized patients after spinal anesthesia at Tripoli hospitals can be caused by variety of risk factors, in current study most risk factors associated with ASA physical states showed that ASAI patients classified as normal healthy patients more incidence to the PDPH. It occurs in patients instead of noncutting needle used because of nonprofessional technique (direction of the bevel and lumber of LP attempts), the females are more common than males to have PDPH. Furthermore, the percentage of PDHP is increasing at the early age group.

Conflict of interest. Nil

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معدلات الإصابة وعوامل الخطر لصداع ما بعد ثقب الجافية بعد التخدير الشوكي في مستشفيات طرابلس

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قسم التخدير والعناية الفائقة، كلية التقنية الطبية، جامعة طرابلس، طرابلس، ليبيا

المستخلص

لا يزال صداع ما بعد ثقب الجافية مصدر قلق سريري بارز حتى يومنا هذا ومن المضاعفات الشائعة التي تظهر في مجال التخدير وطب الألم. يعد تحديد عوامل الخطر هذه خطوة حاسمة في التعديل العقلاني لممارسة التخدير وتقييم التدخلات العلاجية. أجريت هذه الدراسة لتوضيح مدى حدوث وعوامل خطر الإصابة بصداع ما بعد ثقب الجافية في المرضى بعد التخدير النخاعي خلال ثلاثة أيام بعد العمليات في المستشفى العام في طرابلس، ليبيا. في هذه الدراسة، قد ترتبط بعض العوامل المتعلقة بتاريخ المريض أو الحالة السريرية الأساسية أو تقنية التخدير بزيادة خطر هذا التأثير الجانبي، لذلك تم جمع البيانات التاريخية والفسيولوجية والتقنية لتحديد ارتباطها بصداع ما بعد ثقب الجافية .من بين إجمالي 100 مريض موزعين على 5 مستشفيات مختلفة تم قبولهم خلال فترة (من نوفمبر 2020 إلى أبريل 2021)، 27% منهم مصابون بصداع ما بعد ثقب الجافية ، في حين أن 92.5% من حالات صداع ما بعد ثقب الجافية هم من الإناث، وأن 55.6% من حالات صداع ما بعد ثقب الجافية تتراوح أعمارهم بين 20 عامًا. و25 سنة، وتقل هذه النسبة مع تقدم السن، وكانت معظم العمليات قيصرية بنسبة 58%، تليها جراحات أسفل البطن بنسبة 19% من الحالات، وجراحات العظام بنسبة 17% من الحالات، بينما كانت أقل نسبة لعمليات جراحة المسالك البولية. 55% من حالات صداع ما بعد ثقب الجافية تصنف على أنها (الحالة الأولى)، و44% منها تصنف على أنها (الحالة الثانية)، 81.5% من حالات صداع ما بعد ثقب الجافية تستخدم إبر غير قابلة للقطع. في هذه الدراسة، يظل صداع ما بعد ثقب الجافية هو المشكلة الأكثر لدى المرضى في المستشفى بعد التخدير النخاعي في مستشفيات طرابلس يمكن أن يكون ناجمًا عن مجموعة متنوعة من عوامل الخطر، المرتبطة بالحالات الفيزيائيةASA ، والتقنيات غير المهنية، وتكون الإناث أكثر شيوعًا من الذكور وتزداد النسبة في سن مبكرة. مجموعة.

الكلمات الدالة. الصداع بعد ثقب الجافية، البزل القطني، التخدير الشوكي، العمليات الجراحية، مرضى ما بعد الجراحة.