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A review of current medical knowledge on post-dural puncture headache**Stella Mieruszyńska¹, Jagoda Mikołajczyk², Artur Hawajski³, Weronika Mielnicka⁴, Jan Nowak⁵, Julia Sławińska⁶, Olga Szeidl³, Maja Kołodziejewska⁷, Marcin Lewandowski⁷, Anna Cupiał⁸**¹ Franciszek Raszeja Municipal Hospital, Poznań² Department of Emergency Medical Services, Medical University of Warsaw³ National Medical Institute of the Ministry of the Interior and Administration, Warsaw⁴ University Clinical Hospital in Białystok, Białystok⁵ Dr Emil Warmiński Clinical Hospital of the Bydgoszcz University of Technology – Independent Public Health Care Facility, Bydgoszcz⁶ Medical University of Lublin, Lublin⁷ Provincial Polyclinical Hospital in Toruń, Toruń⁸ Greater Poland Cancer Center, Poznań**Abstract**

Post-dural puncture headache (PDPH) is a type of headache that occurs after procedures such as lumbar puncture, epidural anesthesia, and subarachnoid anesthesia. The prevalence of this complication varies and depends on many factors. It should be noted that since the introduction of atraumatic needles, the risk of PDPH has significantly decreased. Ailments are rather mild and self-limited. However, if the headache persists, conservative treatment is often insufficient, and an epidural blood patch (EBP) is essential. The medical literature also mentions that a blockade of the greater occipital nerve (GON) and the sphenopalatine ganglion (SPG) is also used. This paper aims to summarise current medical knowledge about PDPH, including available therapeutic options. *Anestezjologia i Ratownictwo 2026; 20: 148-153. doi:10.53139/AIR.20262013*

Keywords: post-dural puncture headache, blood patch, epidural, intracranial hypotension

Introduction

PDPH is associated with deliberate or accidental dural puncture. As a consequence of these actions, cerebrospinal fluid (CSF) leaks out, and subsequent decreased intracranial pressure occurs [1-3].

The review of the medical literature shows that the incidence of this condition ranges from 1 to 85% [2,4-7]. Based on the definition of PDPH provided by the third edition of the International Classification of Headache Disorders (ICHD-3), this is a type of headache that emerges within 5 days after lumbar puncture

and usually disappears within 14 days or after conducting an epidural blood patch (EDP) [2,8,9]. This pain is also connected with neck tightness and/or subjective auditory symptoms. The manifestations of PDPH can resemble those that accompany subdural haematoma or cerebral venous sinus thrombosis. Therefore, it is crucial to remain vigilant if previous treatment has not been effective [10]. Other diseases considered in the differential diagnosis are meningitis, sinusitis, arterial dissection or aneurysm, pneumocephalus, intracranial tumour, pituitary apoplexy, migraine, brain edema, and so on [11,12].

Most authors conclude that headache after dural puncture usually occurs within 72 hours after the procedure and resolves after a few days [9,13,14]. However, a review of the medical literature increasingly shows that the symptoms may persist much longer than 14 days. Additionally, these ailments are not self-limited and do not disappear after one EDP procedure [2,8,15]. Such a prolonged headache may have severe consequences for patients' functioning and lead to social and occupational disability [2,16,17]. Moreover, there are more implications, such as deterioration of interpersonal relations or the necessity to give up one's profession [2,15].

It should be emphasized that appropriate equipment, correct patient position during the procedure, and relevant operator experience decrease the risk of this complication [3,18].

Aim of the work

This study aims to submit current medical knowledge about PDPH. Therefore, between the 21st and 26th of December 2025, the literature review of medical articles published between 2015 and 2025 was performed. Access to these papers was obtained from the PubMed database. In this article, descriptors from the MeSH (Medical Subject Headings) thesaurus were applied: "Post-Dural Puncture Headache"; "Blood Patch, Epidural"; "Intracranial Hypotension".

Risk factors

The occurrence of PDPH may be connected with the type, thickness, and orientation of the needle cut used during the puncture [19]. A review of the medical literature demonstrates that atraumatic needles and small-diameter cutting needles reduce the risk of this complication [11]. However, a thicker needle enables a faster procedure because the flow of PMR through this implement is more rapid [19]. Studies have shown that the Sprotte or Whitacre spinal needles, which are atraumatic, have a lower chance of this headache, in comparison with the Quincke spinal needle [20]. The cutting needles cause less damage to dura mater fibres, so CSF leaks more slowly and there is an opportunity that the leak will seal itself [5]. Reduced fluid loss during the puncture reduces headache severity [5,21]. Additionally, in a few studies, parallel orientation of the needle cut seems to reduce the appearance of PDPH [22]. More than one lumbar puncture or epi-

dural anaesthesia attempt also increases the risk of this complication [9]. In one study, it was confirmed that the best option is a 26-G atraumatic needle [5].

The impact on the PDPH occurrence also includes younger age, low body mass index (BMI), repeated headache attacks, history of PDPH, doctor experience, and female gender [20,23]. Autopsical examinations show that a thin dura mater in women promotes the outflow of CSF [3]. Moreover, the dura mater in younger people is more susceptible to stratification because of its greater elasticity [22]. On the contrary, elderly people have less flexible dura mater due to arteriosclerosis, which limits the formation of leaks [3]. Consequently, higher BMI is associated with increased intra-abdominal pressure and, subsequently, hypertension in the epidural space. As a result, it generates a benign gradient between the subarachnoid and epidural space [11,22]. Otherwise, pregnant women have a higher probability of severe PDPH [7,24]. During pregnancy, estrogen levels increase, and as a consequence, there is a greater sensitivity to fluctuations of CSF pressure and, in effect, pain [22]. Some authors suggest that PDPH is less common in people who smoke cigarettes than in non-smokers [22,24]. However, it is not unambiguous [11].

Additionally, epidural anaesthesia conducted at the level of the thoracic spine was associated with more frequent headache than that performed in the lumbar spine. It is believed that in the thoracic spine, the epidural space is thinner and the inclination of the spinous processes is greater. Therefore, ultrasound may be beneficial [1]. It should be emphasized that it is more profitable to perform the procedure while lying on the side than sitting. When sitting, there is a higher pressure, which promotes the formation of a larger-diameter foramen and, as a result, prolonged PMR leakage [22]. Some data also highlight that performing the EDP procedure may be associated with further headaches [4,7].

Pathomechanism

The pathomechanism of PDPH is unclear and appears multifactorial. The choroid plexus produces 500 ml of CSF daily, which circulates within the subarachnoid space and ventricles [16]. In these areas, an average volume of that fluid constitutes 150 ml [12].

It is believed that the primary mechanism of PDPH onset is connected with CSF loss from the subarachnoid space to the epidural space. This outflow results from

a dural leak caused by accidental or intentional puncture [16,24,25]. Then the vasodilation occurs, which leads to an increase in blood volume circulating in the brain and afterwards results in restoration of volume balance in the skull [24,26].

Another theory proposes that, as a consequence of intracranial hypotension, there is a mechanical downward displacement of structures towards the foramen magnum, including the meninges, cerebellar tentorium, sinuses, cranial or cervical nerves, and cranial vessels [24,27]. This phenomenon is promoted by standing or sitting because of gravity [4,24,27]. Structures mentioned above are sensitive to pain stimuli and provoke headache [26,28].

Symptoms such as nausea or vomiting may result from activation of chemoreceptors in the medulla oblongata. Dysfunction of the trigeminal nerve can induce photophobia. Finally, the extension of nerves located in the neck leads to neck pain [3].

Finally, the significance of substance P should also be noted, as its decreased CSF levels may contribute to the development of PDPH by altering pain signaling [26,29].

Clinical picture

Diagnosis of PDPH is mainly based on the history of dural puncture and the patient's clinical symptoms [3]. Typically, PDPH manifests as an orthostatic headache located in the occipital or frontal region [16,30]. The authors describe this pain as strong, positional, and generally dull or pounding [9,22]. This headache intensifies while standing, sitting, or coughing, whereas it recedes while lying down [20,30]. Other symptoms involve pain in the cervical spine, tinnitus, neck stiffness, photophobia, dizziness, nausea, vomiting, and problems with reception of auditory or visual stimuli [3,6,30]. Moreover, patients sometimes complain about diplopia. Visual disorders may be associated with straining of the IV, VI, and VII cranial nerves [11,22]. However, PDPH rarely coincides with neurological ailments, fever, or impaired consciousness [11]. These symptoms can reflect other, life-threatening diseases [3]. Additionally, there is data in the medical literature about convulsions connected with PDPH because of vasoconstriction [11]. Headache usually subsides due to painkillers such as nonsteroidal anti-inflammatory drugs (NSAIDs) or paracetamol, though this pain may recur despite previous improvement [16,21].

Non-pharmacological treatment

The main therapeutic methods used in clinical practice for PDPH include post-procedural bed rest, rapid and appropriate hydration, and restriction of physical activity [4]. However, it should be remembered that prolonged lying in bed might be a risk factor for venous thromboembolism [3]. Unfortunately, sometimes the actions mentioned above do not have the intended effect [4]. At that point, conducting the EBP procedure can be beneficial, especially since its efficacy is correlated with the speed of its execution [1].

Pharmacological treatment

The most commonly used painkillers for PDPH are paracetamol and nonsteroidal anti-inflammatory drugs, which provide only symptomatic relief of headache [12]. However, opioids should not be applied until other pain relievers are ineffective, because extended use of opioids involves serious adverse effects such as respiratory depression [11,22].

Pregabalin and gabapentin are antiepileptic drugs that cause a loss of pain sensitivity by suppressing calcium channel action through linking with $\alpha 2\delta$ subunits. This action decreases the release of stimulating neurotransmitters and diminishes the transmission of pain stimuli. Additionally, these drugs inhibit excessive neuronal activity in the brain [25].

Some authors claim that caffeine may successfully limit PDPH. The mechanism of action of this substance consists of blocking adenosine receptors and the synthesis of prostaglandins and leukotrienes. Consequently, dilatation of cerebral vessels is constrained, which leads to a decrease in blood flow. In addition, due to stimulation of the sodium-potassium pump, CSF production increases [12,24]. Furthermore, there is some information in the medical literature that intravenous infusion of caffeine, sodium benzoate, or oral caffeine may moderate a headache [12]. Unfortunately, its action is not sustained [3]. It should also be mentioned that high doses of this substance might cause side effects such as anxiety, tremors, insomnia, or tachycardia. Therefore, before using caffeine, an individual's medical history and existing diseases, such as hypertension, cardiac arrhythmias, and seizure disorders, should be consulted [24]. Nevertheless, the usefulness of caffeine remains questionable, as other data suggest no beneficial effects [31].

Epidural blood patch

EBP is considered to be the gold standard for PDPH when conservative treatment is ineffective [31,32].

It consists of 5-25 ml of autologous blood injection to the epidural space through the puncture at the level of the L3-L5 vertebrae [16,22,32]. Most commonly, this value hovers around 15-20 ml, and more than 30 ml does not lead to an increase in procedural efficacy [10]. Lower blood volume administration is connected with a higher intensity of adverse effects [11].

As a result of EBP, the patient's symptoms progressively decrease as the leak is enveloped by a blood clot and healing progresses [16,22]. Subsequently, this process leads to increased pressure and CSF volume in the lumbar epidural space, which in turn is associated with a return of tension and stability of the structures that are sensitive to pain. Furthermore, cerebral veins dilate, which helps alleviate the symptoms [3,22].

EBP brings relief to 52-98% patients, and when it turns out that it is ineffective, it is possible to perform it again [28,32]. The efficacy of this procedure depends on the volume of injected blood, the time when it will be executed, and the individual patient's profile [8,21]. In case of no contradictions, it is necessary to perform EBP as soon as possible [30]. There is also a possibility of conducting ultrasonography, computed tomography with contrast, or fluoroscopy before EBP. It allows to check where the outflow exists [10,11]. Thereby, this action reduces the risk of a situation where the leak is located in a less typical place and will not be covered [15]. Moreover, if the leakage location is known, it is recommended to perform the procedure at this level of the spine or at the level below [10].

The complications of EBP include paresthesia, convulsions, stiffness, severe back pain, hypoacusis or amblyopia, bleeding, epidural abscess, pneumocephalus, meningitis, arachnitis, or nerve damage [16,28,32].

EBP should not be performed if the patient has a local or systemic infection, reduced spinal canal, bleeding disorders, leukaemia, lymphoma, or if the woman is pregnant [11,16]. Additionally, before the procedure, the patient should also stop taking anticoagulants [22].

During EBP, blood injection ought not to be rapid, and if any adverse effects occur, it has to be ceased [10,11]. After the procedure, resting on the back is desirable. Afterwards, the patient should slowly raise his head every several minutes, if it is not uncomfortable for him [22].

Greater occipital nerve block

Another therapeutic option for PDPH might be a greater occipital nerve block (GONB). Some data suggest that it is beneficial [33].

This procedure involves the injection of local anesthetics, typically laterally to the external occipital tuberosity, above the area of greatest tenderness. Drugs used in GONB include lidocaine, bupivacaine, prilocaine, ropivacaine, or levobupivacaine [14]. In addition, ultrasonography is the safest and most accurate method for localizing the greater occipital nerve, which has a variable position among patients [3,22].

As a result of GONB, the excitability of the neurons in the trigeminocervical complex decreases. This blockade limits the flow of afferent pain stimuli from cervical segments of the spine and the area innervated by the trigeminal nerve to the caudal part of the trigeminal nucleus and the posterior horn of the spinal cord. Local anaesthesia additionally inhibits the transmission of pain stimuli by reversibly blocking sodium channels in neurons [3,14].

In the medical literature, among eventual complications are paresthesia, infection, haematoma, pain, dizziness, nausea, cardiac arrhythmias, respiratory depression, and vasovagal syncope [3,11,22].

GONB can not be executed if the patient is allergic to local anaesthesia, has cardiac disorders, liver failure, a defect in the skull, local infection, or congenital malformation. Furthermore, anticoagulants or bleeding disorders at the procedure site [22,33]. Besides, it should not be conducted in pregnant or breastfeeding women [22].

Unfortunately, the patients sometimes need another GONB because symptom relief is not particularly spectacular [8]. It should also be noted that the procedure's efficacy depends on factors such as rest in bed after accidental or intentional dural puncture [14]. Further research is required to measure the effectiveness of GONB [33].

Summary

Although the prevalence of PDPH is diverse, the patient's ailments are often so nagging that they constitute a clinically significant problem. The occurrence of this complication is associated with different risk factors such as the type, thickness, and orientation of the needle cut used during the puncture, younger

age, low body mass index (BMI), repeated headache attacks, history of PDPH, doctor's experience, female gender, technique, and finally the procedure type itself. Therapeutic management of PDPH consists of conservative treatment based on bed rest, appropriate hydration, and drugs that reduce the symptoms. The gold standard in the event of no response to the actions mentioned above is EBP. The authors note that GONB can also be used, but this method requires further research. Early diagnosis of PDPH and appropriate treatment can help mitigate persistent symptoms and reduce recovery time.

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Conflict of interest

None

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