

# There is room for improvement in the prevention and treatment of headache after lumbar puncture

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## ABSTRACT

**INTRODUCTION:** The incidence of post dural puncture headache (PDPH) after lumbar puncture (LP) can be reduced from 36% to 0-9% by use of an atraumatic needle size 24 gauge (G)/0.56 mm rather than a traumatic needle size 22 G/0.7 mm. The evidence supporting some of the prophylactic and therapeutically treatments of PDPH is sparse. The objective of this study was to clarify which needles doctors at neurological departments in Denmark use for LP and how they treat and prevent PDPH.

**MATERIAL AND METHODS:** The present study is a questionnaire survey among doctors employed at the 13 neurological departments in Denmark.

**RESULTS:** A total of 161 (51%) returned the questionnaire. As for needle size, 78% stated that they used needle size 22 G, 5% used 21 G, 13% used 20 G and 3% used 18 G. Overall, 74% used traumatic needles, while 18% were unaware of the needle type used. Prophylactic bed rest was prescribed by 44%. Prescribed treatments of PDPH were caffeine, analgesics/fluid therapy and epidural blood patch (EBP).

**DISCUSSION:** Surprisingly many of the doctors used relatively thick and/or traumatic needles although PDPH is significantly reduced when smaller atraumatic needles are used. 90% prescribed fluid therapy, but the role of fluid therapy as well as that of analgesics in the treatment of PDPH remains uncertain. There was no difference in the incidence of PDPH using prophylactic bed rest versus early mobilization. Caffeine can reduce the number of patients with persisting PDPH, while EBP is the most effective treatment for PDPH.

**CONCLUSION:** Atraumatic needles for LP have not become standard in Danish neurological departments. Knowledge about the treatment and prevention of PDPH seems insufficient.

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Post dural puncture headache (PDPH) is a frequent complication of lumbar puncture (LP). In the literature, the incidence of PDPH ranges from < 1% to > 80% depending on the population studied, the needles used and the presence of risk factors such as low age, female sex, previous PDPH, low Body Mass Index and a history of chronic headache [1, 2]. PDPH can be very painful and can reduce the ability to perform everyday

activities, require bed rest and may prolong hospitalization [3].

The larger the diameter of the needle used for LP, the greater the risk of PDPH [4]. Furthermore, the risk of PDPH is larger when a traumatic (Quincke) rather than an atraumatic (pencil point) needle is used [5, 6]. The incidence of PDPH may be reduced from 36% to 0-9% by using atraumatic needles size 24 gauge (G)/0.56 mm rather than traumatic needles size 22 G/0.7 mm [4, 7].

The conventional treatment of PDPH is bed rest, fluid therapy, analgesics, caffeine and an epidural blood patch (EBP). EBP should be performed more than 24 hours after LP [8]. The evidence supporting the effect of several of these treatments is sparse or non-existent [9], and the treating physician should focus on choosing the best needle to reduce the risk of PDPH.

The purpose of this study was to examine which needle size and needle type is used for LP in neurological departments in Denmark and to determine which treatments doctors at Danish neurological departments are using for PDPH.

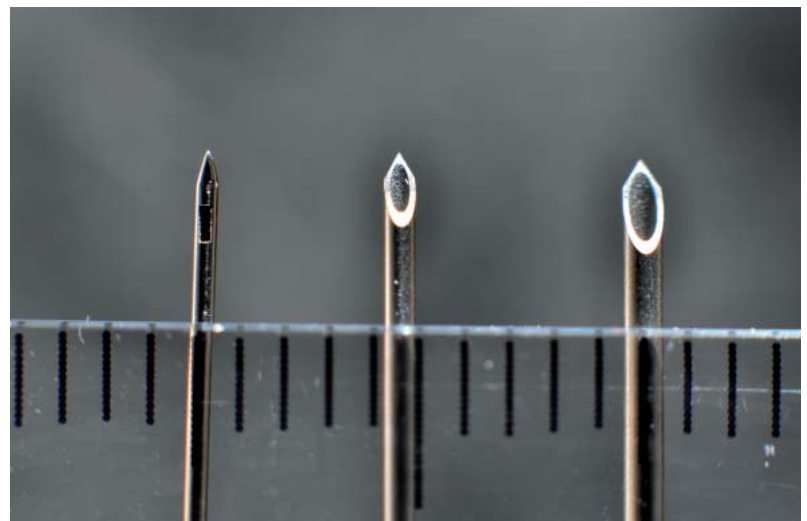
## MATERIAL AND METHODS

A questionnaire survey was conducted in June-November 2010 among doctors working in the 13 neurological departments in Denmark (**Figure 1**). The executive con-

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1) East Danish Cochlear Surgery and Anaesthesiology Department Y, Glostrup Hospital

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Starting from the left: an atraumatic needle 25 G, a traumatic needle 22 G and a traumatic needle 20 G. Photo: Gert Koldbro Jensen.


**FIGURE 1**

Questionnaire sent to all doctors in neurological departments in Denmark.

Name:  
Department:  
Hospital:

For all questions please tick the option that fits best.

**1) In what position are you employed?**

Resident  
 First junior  
 Consultant

**2) How many lumbar punctures do you perform a month?**

0 (stop response)  
 1-5  
 6-10  
 11-20  
 > 20

**3) What size needle do you use when performing lumbar puncture in adults?**

18 G/1.19 mm  
 20 G/0.90 mm  
 21 G/0.80 mm  
 22 G/0.70 mm  
 23 G/0.60 mm  
 25 G/0.53 mm  
 27 G/0.42 mm  
 Other  
 Do not know

**4) Does the choice of needle size depend on ...**

Age?:  Yes  No  
Sex?:  Yes  No  
Indication?:  Yes  No

**5) Do you use a cutting or a non-cutting needle?**

Cutting (Quincke)  
 Non cutting/pencil-point (e.g. Whitacre)  
 Do not know

**6) Do you prescribe bed rest to prevent PDPH?**

Yes. If yes, do you prescribe:  ≤ 2 hours  > 2 hours  
 No

**7) Which treatment do you initiate on suspicion of PDPH? You may tick several answers.**

a. None  
 b. Analgesics  
 c. Analgesics and fluid therapy  
 d. Fluid therapy  
 e. Analgesics and bed rest  
 f. Fluid therapy and bed rest  
 g. Bed rest  
 h. Blood patch  
 i. Caffeine  
 j. Other  
 k. Do not know

**8) When do you find that there is indication for initiating blood patch for PDPH?**

a. When there is no doubt about the presence of a position-dependent headache after lumbar puncture  
 b. If, within 24 hours, there is no effect of other treatments  
 c. Other, describe  
 d. Do not know

PDPH = post dural puncture headache.

partments accepted the invitation to participate. The executive consultant or a department secretary distributed the questionnaire among doctors by email or letter, and pressed for a reply one or several times, depending on the response rate. The questionnaire was returned to us by email or letter. We were given the exact number of doctors employed in the departments at the time of distribution. The questionnaire was not distributed among doctors who were employed after June 2010. In case of insufficiently filled out questionnaires, we wished to be able to contact the respondents, and they were therefore asked to state their name.

The questions focused on the size and type of needle used and the use of prophylactic bed rest and treatments initiated in case of PDPH.

*Trial registration:* not relevant.

## RESULTS

The questionnaire was sent to 314 doctors in 13 neurology departments. A total of 161 doctors answered the questionnaire (51% response rate). The average response rate at the 13 neurological departments was 54%. Five of the questionnaires were insufficiently filled out, but questions were answered sufficiently after telephone contact.

46% of the 161 respondents were specialists in neurology. A total of 11 respondents reported that their duties did not include the performance of LP, wherefore they only answered the questions concerning PDPH treatment.

A considerable proportion of doctors used needle size 22 G or larger (**Figure 2**) and 74% used traumatic needles. 18% did not know whether they used traumatic or atraumatic needles. Some stated that they used two different needle sizes, depending on the indication for LP. There was considerable disagreement among respondents as to whether the indication for LP should determine the needle size (33% said yes and 59% said no).

Bed rest as a prophylactic measure after LP to prevent PDPH was prescribed by 44% of the doctors. 19% of the doctors found that patients who without any doubt had position-dependent headache should receive EBP.

The answers regarding which treatments were initiated when PDPH was suspected are summarized in **Table 1**. Caffeine, analgesics and fluid therapy and EBP were the most commonly used treatments.

## DISCUSSION

### Post dural puncture headache

PDPH may develop from a few hours to several days after LP. The headache is burning, dull or throbbing, postural in nature and it is frequently localized frontally or occipitally. The symptoms may radiate down to the

sultants were contacted by telephone and invited to participate in the survey. All of the 13 neurological de-

neck and shoulders and are aggravated by any activity that increases intracranial pressure, e.g. coughing or sneezing [2]. PDPH may be accompanied by several other symptoms.

The pathophysiology of the PDPH has not been fully elucidated. Two theories have been proposed concerning leakage of cerebrospinal fluid (CSF) through a hole in dura [2]:

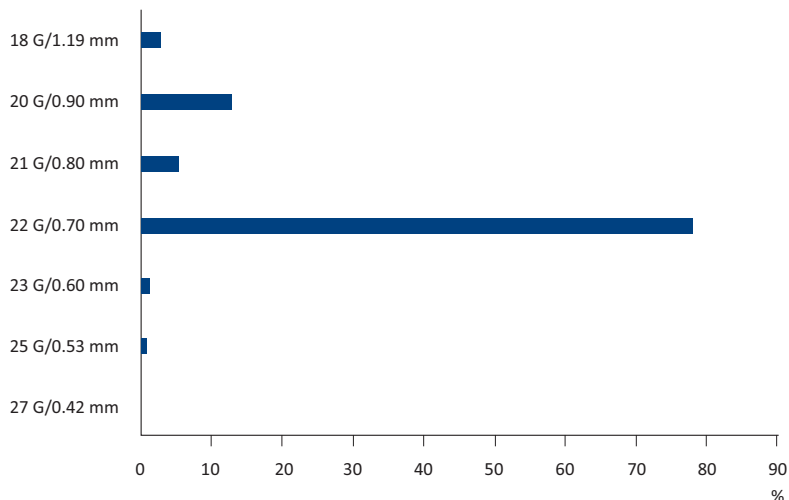
1. The CSF pressure is lowered relatively, and tension on the brain, meninges and other pain-sensitive structures in caudal direction causes pain when the patient sits up.
2. The intracranial vessels dilate to keep the intracranial volume constant.

It was demonstrated that the incidence of PDPH is reduced significantly when atraumatic needles are used instead of traumatic needles [4]. In addition, fewer patients are affected by vestibulocochlear dysfunction/hearing loss after LP when an atraumatic rather than traumatic needle is used [10]. Despite this, our study shows that the majority (74%) of the doctors used the traumatic needle type when performing LP, while 18% report not knowing whether they used a traumatic or an atraumatic needle. Although some minor drawbacks are associated with the use of atraumatic needles (eg. minor reduction of success rate and the need for an introducer needle), at present the use of traumatic needles seems obsolete. In 2001, Birnbach et al found that the use of atraumatic needles was not standard for LP among American neurologists. This was mostly so either due to ignorance about the existence of atraumatic needles or to lack of atraumatic needles at the hospital [11]. This may also be the case for Danish doctors.

The frequency of PDPH may be reduced by using needles with smaller diameters [4, 12]. It is generally recommended to use an atraumatic needle size 22 G or less, but it is also argued that it may be inconvenient to use a needle smaller than 22 G, as the sampling of the CSF will be "unacceptably slow" and measurement of CSF pressure will be slow and imprecise [13, 14]. Carson & Serpell studied various needle types and sizes to identify which needle should be used for LP [14]. They argued that the CSF flow rate and the time needed for accurate measurement of CSF pressure were the factors of primary importance. Carson & Serpell defined an acceptable CSF flow rate as a minimum of 2 ml/min. The Spotte atraumatic needle 20 G and the Spinocan traumatic needle 20 G showed the best characteristics of all needles as they can provide a flow of more than 2 ml/min and rapid CSF pressure transduction [14]. Nevertheless, to reduce patient morbidity, a needle larger than 22 G should not be used, and a less than optimal CSF flow rate should be accepted.

FIGURE 2

Needle size used for the lumbar puncture? Percentage distribution of respondents choosing each needle size.



Carson & Serpell showed that Vygon atraumatic needle size 22 G can provide a CSF flow which is three times higher (1,6 ml/min) than that of a Spinocan 22 G traumatic needle. The Vygon atraumatic 22 G can also provide an accurate transduction of CSF pressure in less than one minute [14]. Thus, it is apparently possible to obtain a satisfactory CSF flow and CSF pressure transduction with a 22 G needle by changing from a traumatic (Spinocan) to an atraumatic needle (Vygon) [4, 14].

In the light of these facts, it should be considered to individualize the choice of needle depending on the indication for LP. Furthermore, using a size 22 G for measuring CSF-pressure and a needle with an even smaller diameter for patients in whom only a CSF sample is needed may be considered. When meningitis purulenta is suspected, a needle size no smaller than 22 G should

TABLE 1

Percentage distribution showing treatments initiated by respondents in response to post dural puncture headache.

Treatment	%
No treatment	1
Analgesics	22
Analgesics and fluid therapy	44
Fluid therapy	14
Analgesics and bed rest	20
Fluid therapy and bed rest	31
Bed rest	37
Epidural bloodpatch	53
Caffeine	65
Other	1
Do not know	0



## TEXT BOX

Diagnostic criteria for post dural puncture headache.

**Diagnostic criteria**

- A. Headache that worsens within 15 minutes after sitting or standing and improves within 15 minutes after lying down, with at least one of the following and fulfilling criteria C and D:
  1. Neck stiffness
  2. Tinnitus
  3. Hypacusia
  4. Photophobia
  5. Nausea
- B. Dural puncture has been performed
- C. Headache develops within five days of dural puncture
- D. Headache resolves either:
  1. spontaneously within one week or
  2. within 48 hours after effective treatment of the spinal fluid leak (usually by epidural blood patch)

Source: International Classification of Headache Disorders. 2nd ed., 2004.

be used as it is uncertain whether purulent CSF may be tapped through a needle with a smaller diameter.

PDPH resolves spontaneously in the majority of patients. The estimated remission rate after 5-7 days is 72% [4]. Analgesics such as paracetamol and nonsteroidal anti-inflammatory drugs have been said to reduce the need for more aggressive therapy [4], but there is no evidence to support the efficiency of such drugs in the current literature.

Although there is no evidence that increased fluid intake has a role in the prevention or treatment of PDPH [9], 90% of doctors prescribe fluid therapy.

A recently published Cochrane review concluded that caffeine has proven effective in the treatment of PDPH and in reducing the number of patients with persistent PDPH [15]. This conclusion, however, should be interpreted with caution as it is based on relatively small studies dealing mostly with postpartum women. Nevertheless, treatment with caffeine seems to be an established treatment in neurological departments in Denmark (Table 1).

EBP is a far more effective treatment for PDPH than other conventional treatments [1]. An EBP completely removes the headache in a large proportion of patients, and the headache in the remaining patients is reduced to such an extent that they can return to their daily activities [16]. An EBP has a success rate of 70-98% if performed more than 24 hours after dural puncture [4]. If EBP is repeated due to lack of effect of the first EBP, the success rate is 98%. Despite this, only 53% of the doctors in our study saw EPB as a treatment option.

There is no significant difference in the incidence of PDPH whether prophylactic bed rest or early mobilization is used [9, 12, 17]. Despite this, 44% of the doctors in our study prescribe prophylactic bed rest. In 1999,

Winge & Michelsen noted that more than 56% of the neuromedical, neurogeriatric and neurosurgical departments in Denmark had included bed rest as part of their instruction for LP [18].

The relatively low response rate is a limitation of our study.

When answering question seven, only 53% of the respondents ticked off a blood patch as being one of the treatments of choice when PDPH is suspected. In answering question eight, 100% reported that they would initiate treatment with EBP when a patient definitely has position-dependent headache after LP. There seems to be some inconsistency in the answers which might be due to the wording of the question.

**CONCLUSION**

We conclude that the use of atraumatic needles with a small diameter for LP has not yet gained widespread acceptance in the neurological departments in Denmark. Prophylactic bed rest and therapeutic fluid therapy are often prescribed despite lack of efficacy. Future training of doctors in neurological departments should be upgraded by teaching these issues. Using optimal methods for LP would probably yield a significant decrease in the number of patients with PDPH. It should therefore be ensured that doctors have access to and use atraumatic needles in the minimum acceptable size.

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**CONFLICTS OF INTEREST:** Disclosure forms provided by the authors are available with the full text of this article at [www.danmedj.dk](http://www.danmedj.dk).

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