**Review Article**

# Post Dural Puncture Headache

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## Introduction

Dural puncture is a commonly performed invasive procedure for various indications like diagnostic lumbar puncture, spinal anaesthesia, myelography and intrathecal chemotherapy. However, in anaesthesia practice apart from intentional dural puncture as in spinal anaesthesia, unintentional dural puncture can also occur while performing epidural anaesthesia or analgesia for various indications, including postoperative and labour pain relief.

Carrie and Collins define post dural puncture headache (PDPH) as "a headache occurring after dural puncture and has a significant effect on the patients post operative well being i.e. headache which is not only postural but also continues for more than 24 hours at any level of intensity or so severe at any time that the patient is unable to maintain upright position.[1]

When headache appears in the postoperative or postpartum period after regional anaesthesia it can be due to many reasons, rather as a complication of dural puncture during regional anaesthesia. However the most common cause of an anaesthesia induced headache is PDPH.

This review attempts to address several clinical pertinent questions surrounding this topic. Careful review of literature suggests that PDPH has many other reasons besides dural puncture, but there is a definite relationship between a dural puncture and PDPH, a fact which can not be ignored.

### Historical Background

Historical reference to PDPH was recorded by August Bier in 1899, when he gave a personal account of his headache, he suffered after spinal anesthesia given to him on his request by his assistant.[2]

Dr. Bier described the headache as a feeling of very high pressure in the head, accompanied by light dizziness when raising quickly from the chair. He also described the most important sign of PDPH as follows: "all symptoms disappeared immediately when I laid horizontally but came back when I got upright". Dr. Biers suggested that CSF loss caused the symptoms he experienced and his advise is to prevent the loss of CSF as much as possible, as he lost excessive CSF while receiving the experimental spinal block by his assistant who was unable to fit the syringe to the needle during the procedure.

### Incidence

Overall incidence of PDPH after intentional dural puncture varies form 0.1-36%, the highest incidence of 36% is found after ambulatory diagnostic lumbar puncture using a 20 or 22 guage standard Quincke spinal needle.[3] Unintentional dural puncture with large tuohy needle (16 and 18 guage) is associated with high incidence of 70-80% PDPH. In obstetric population unintentional dural puncture is one of the common major complication.

The Incidence of dural puncture in obstetrics practice in UK is 0.18 - 3.6%. Eighty percent of these patients suffer from PDPH.[4] It is suggested that the incidence in teaching centres should be less than 1%.[4]

A study of malpractice claims filed against anesthesiologists providing obstetric anesthesia care, showed 12% of the claims were because of post delivery headache in patients who received epidural analgesia and

possibly a dural puncture. This was the 3rd most common claim filed, the other injuries being maternal death and newborn brain injury.[5]

The incidence of course greatly varies with the technique and equipment used. Major factors influencing the incidence are discussed later in the reviews.

**Pathophysiology**

Almost a century has passed after first report of PDPH in literature but exact mechanism of PDPH is still not known. Leakage of cerebro-spinal fluid (CSF) through dural puncture appears to be the main cause of PDPH and was first proposed in 1902.[6] This leakage theory however is not universally accepted but still majority of investigations favour this "leakage theory", as an explanation for PDPH. This theory states that leakage of CSF through the dural hole causes decreased CSF pressure and volume, followed by gravity dependent downward sagging of the brain resulting in traction on the pain sensitive structure around the brain.[7,8] Recently however multi-slice sagittal magnetic resonance imaging (MRI) studies failed to show any evidence of such sagging.[9] Furthermore, patients with typical features of PDPH and normal CSF pressure have been reported by Mokri et al.[10] A consistent feature of PDPH is that jugular vein compression (which causes high CSF pressure) increases the severity of PDPH.[11] Intravenous caffeine and theophylline both adenosine antagonist and potent cerebrovascular constrictors relieve PDPH in upto 70% of cases.[12,13] If low CSF pressure is the reason of causing PDPH then cerebrovascualr constrictors should have increased the severity of PDPH rather than decrease it.

CSF is produced at an average rate of 500 ml/day, and approximately 150 ml is circulating at any given time around the brain and spinal cord. Excess fluid may be excreted via arachnoids Villi however body cannot immediately compensate for loss of CSF (as happened after dural hole) and to restore the intracranial volume, dilatation of intracranial vessels occur. Throbbing and orthostatic nature of headache constitutes an important symptom of cerebral vasodilatation and intracranial congestion of blood and supports the hypothesis that the loss of CSF causes compensatory cerebral vasodilatation resulting in PDPH.[14]

In a recent study, Andra P proposes that PDPH is probably a vascular type headache and epidural blood patch relieves the headache by its vaso-constrictive action.[15] This cerebral vasoconstriction may be caused by subarachnoid spread of the injected blood. The possible role that the rich innervations of the dura matter with adrenergic, cholinergic, and peptidergic fibers may play a role in PDPH and its management with epidural blood patch requires further research to know the exact mechanism of PDPH.

**Symptoms**

Postdural puncture headache is characteristically located in the frontal and or the occipital region, aggravated by the upright position and relieved by recumbency. It may be associated with nausea and vomiting, auditory and visual symptoms. Pain may radiate to the neck and neck stiffness may be present.[16] The diagnosis is mainly based on the relationship of headache and patient position. In the absence of postural contribution to symptoms, the diagnosis may be questioned.

PDPH occurs immediately if the patient is in the sitting position and it has been demonstrated that drainage of 20 ml of CSF from a subject in the upright position with a 16g tuohy needle resulted in an immediate headache.[17] Typically, the patient complains of a severe headache with change in position (upright), pain is incapacitating, throbbing in nature accompanied by photophobia, double vision, blurred vision, dizziness, tinnitis, decreased hearing, nausea, vomiting and not responding to minor analgesics.

For the majority of patients who develop PDPH, the syndrome resolves spontaneously in a few days to a week. However there are reports of PDPH persisting for months to a year.[18]

**Complications of PDPH**

Neurological sequelae, following dural puncture are well recognized, the most serious although rare complication is the occurrence of transient cranial nerves palsy, almost all cranial nerve have been implicated. Usually a single nerve palsy has been reported, the nerves effect are 3rd, 4th, 6th, 7th, and 8th. Reported incidence of cranial nerve palsies is 1 : 100,000 to 3.7 in 100,000 cases. The 6th nerve is said to be most susceptible, but length alone is not the sole factor as the 4th cranial nerve is longer than the 6th cranial nerve, but is rarely affected. The abducent nerve is suggested to be vulnerable because it is relatively fixed at its entry into the cavernous sinus and at its attachment to the Pons. This nerve is most likely to be stretched due to sagging of the brain because of CSE leak.[19]

Blindness following spinal analgesia has been reported in a young healthy primigravida, who developed blindness on 1st post partum day. The blindness resolved within 48 hours. And recovered completely within 7 days.[20]

Cases of subdural haematoma or cerebral haemotoma have also been reported in literature. Although rare subdural haematoma or cerebral bleed can occur in previously fit, healthy patients after spinal puncture even when it was performed with a small guage needle. The cause proposed is a constant leak of CSF, or reduction in CSF, volume could lead to brain sagging, with traction on the delicate blood vessels, causing them to rupture and later formation of a haematoma.[21]

**Differential Diagnosis of PDPH**

Diagnosis of PDPH should only be made when other causes of headache are ruled out. When a headache occurs after spinal or epidural anaesthesia it must be considered potentially serious and should be differentiated from other causes of headache. Awareness must be cultivated that dural puncture headache is only one of the many causes of headache in postoperative and postpartum period.

**Tension Headache**

It is typically a dull, persistent pain that extends over the entire head. Onset is gradual and the headache may persist for a long time. There is no relation to the position of the patient, lying for upright. Tension headache rarely effects obstetric and anesthetic management, but may signal an increased risk of post partum depression.

**Migraine Headache**

Migraine headache is classically described as unilateral throbbing headache, sometimes accompanied by nausea and vomiting and there is no relief in the supine position. Careful questioning and physical examination needs to be done for other causes of headache.[22]

**Caffeine Withdrawal**

It may lead to headache in a moderate regular consumer; this could be a cause of PDPH, though appears to be overlooked. It should be considered in the differential diagnosis .

**Lactation Headache**

After child birth, headache is associated with increased plasma vasopressin concentration. This gives rise to episodes of intense headache during breast feeding, especially in those women who are known to suffer from migraine.[23]

**Brain Tumour**

The headache is dull in character rather than throbbing, is mostly accompanied by nausea, vomiting, seizures may also occur. There are usually focal signs and there is evidence of increased intra-cranial pressure.[24]

**Subdural Haematoma**

In rare instances dural puncture is associated with the subsequent development of subdural haematoma which is followed by symptoms of PDPH. Leakage of CSF and decreased ICP causes stress on the cerebral vessels which can precipitate bleeding. Neurological signs include evidence of raised ICP i.e. headache, somnolence, vomiting and confusion with focal abnormalities.[25]

**Subarchnoid Heamorrahge**

Headache produced by SAH is sudden, severe and mainly in the occipital region, the symptoms include vomiting neck stiffness and decreased level of consciousness or coma.

**Cortical vein thrombosis (CVT)**

Headache may be caused by cortical vein thrombosis. The headache is severe and throbbing in nature, there may be focal signs with, seizures and coma may follow.[26]

**Hypertension**

Eclampsia is a form of hypertensive encephalopathy which includes, headache, visual disturbances, nausea, vomiting, seizures, stupor and sometimes coma.

**Meningitis**

There is severe headache in meningitis, and this is accompanied by fever, neck stiffness, and a positive kernig sign. There is lethargy, confusion, vomiting, seizures and skin rash may occur.

**Pneumocephaelus**

The subdural injection of air used for identification of epidural space may cause sudden headache, accompanied by neck and back pain. It is also positional in nature, worse on sitting-up and relieved by lying down.

**Spontaneous Intracranial Hypotension(SIH)**

Spontaneous Intracranial hypotension is a condition with symptoms and pathophysiology indistinguishable from the PDPH. This is a rare clinical entity and is thought to be due to rupture of a perineural cyst of the spine.[27]

Whenever headache after regional anesthesia does not present the classic symptomtology, of which postural character is essential or does not present with classic evolution, neurological evaluation must be undertaken without delay. A contrast CT or MRI scan is some times necessary before therapeutic measures can be adopted.

**Factors influencing PDPH**

The main factors influencing PDPH can be categorized as :

1. Characteristics of patient population
2. Characteristic of needle used
3. Puncture technique

1. Characteristic of Patient Population

**Age**

Certain patient population are at an increased risk for development of post dural puncture headache. Patients age 20-40 years are most susceptible whereas the lowest incidence occurs after fifth decades.[28,29] The lesser incidence of PDPH in elderly individual is due to decrease in the elasticity of cranial structures, which occurs in the normal aging

elasticity of cranial structures, which occurs in the normal aging process, and reduction in overall pain sensitivity. Definitive statements about PDPH in patients younger than 10 years of age are not possible. In this patients population PDPH is rarely reported suggesting a lower incidence compared with adults.[30] This could be explained by lower CSF pressure in infants and children than adults and also the lower hydrostatic pressure in lumber regions generated by the upright position in children.[31]

**Sex**

Women are more likely to be affected than men when risk is adjusted for age. In the series reported by Vandane and Dripps women had twice the incidence i.e., 14% of PDPH compared with men i.e., 7%.[18] Some suggested that this difference was because of a large number of obstetric patients in the women's group. Nevertheless even after removal of these cases women still had higher (12%) incidence compared to men (7%).[32] Others suggested that generally lower age of female patients compared with male patients accounts for the association between PDPH and gender.[33] Kang et al reported twice the incidence of PDPH in women (13.4%) compared with men.5.7% This difference was not valid for smaller needle sizes.[34]

**Obstetric patients**

Parturition constitutes the highest risk category for PDPH, to which a number of factors contribute. Generally accepted incidence in these patients have been reported upto 38% but in some studies vary between 0%-30%.[32] Increase in CSF pressure from bearing down during vaginal delivery and postpartum decreases in intra abdominal and peridural pressure may all contribute to increase in the incidence of PDPH in this patient population. However, Ravindran et al suggest that bearing down at the time of delivery is not a factor for high incidence.[35] The concept that pregnancy is a risk factor for PDPH is not supported by contemporary practice. After spinal anesthesia the incidence of PDPH in the parturient currently is similar to that reported in young men and non-pregnant women.[36] This issue is unlikely to be resolved by a randomized prospective trial because of a large number of subjects needed for this study.

**Characteristic of Needle Used**

There is direct correlation between needle size and risk of PDPH. Vandam and Dripps noted that the incidence ranged from 18% with a 16 guage needle to 5% with 26 guage needle whereas the overall risk of PDPH was 11% in 11000 cases of spinal anesthesia.[18] There are enough evidences that both needle size, and tip design impact the incidence of PDPH. The results of a meta analysis of 450 articles showed reduction of PDPH when: (a) small spinal needle was used compared with a large needle of the same type and (b) non-cutting spinal needles rather than cutting needles were used, unless the discrepancy in needle size is very large.[37] With quincke needle the incidence of PDPH is directly related to the size of the needle used.[38] The pencil point or blunt tip needles like whitacre needle are associated with lower PDPH rates because they are less traumatic to the longitudinal fibers of dura, separating them and this produces a small rent with reduced CSF leakage. Lambert et al reported the rate of PDPH with 25 guage whitacre needle as 1.2% in comparison to 27 guage cutting needle as 2.7%.[39] A randomized comparison of 25 guage Whitacre and Quincke needle revealed a significantly lower incidence of PDPH in the whitacre group 8.5% versus 3%.[40] Some evidence in vitro suggests that fluid leak through a dural hole is lower with pencil point than with beveled needles. Cesarini et al performed a randomized trial of 24 guage sprotte and 25 guage quincke needle in patients receiving spinal anaesthesia for cesarean section. There were no cases of PDPH in the sprotte group but there was 14.5% incidence of PDPH in the quincke group.[41] Recently a modification of the Quincke needle has been made available, known as atraucan needle. It has a cutting point and double bevel which are intended to cut a small dural hole and then dilate it.[42] In current practice its role has not been clear.

**Puncture Technique**

Orientation of needle bevel piercing the dura, angle of insertion and number of punctures are important factors in puncture technique. The orientation of the bevel of a spinal needle parallel to the long axis of the spine produced less dural trauma than occurred when the bevel is inserted perpendicularly.[43] The dura has been described as longitudinal in direction, however recently electron microscopy has revealed that the dural structure is far complex than was originally was supposed. Fink and Walker noted that the dura consists of multidirectional interlacing collagen fibers and both transverse and longitudinal elastic fibres.[44] The insertion of the needle with the bevel parallel to the long axis of the spine most likely results in less tension on the dural hole.

Norris et al investigated unintentional dural puncture occurring during the identification of the epidural space in 1558 women and the bevel of the epidural needle was randomly oriented either parallel or perpendicular to the longitudinal dural fibers during epidural cannulation. Accidental dural puncture occurred in 41 women (2.63%). Twenty women with the needle bevel oriented perpendicular and 21 with the needle bevel inserted parallel to the longitudinal dural fiber. Fourteen women out of 20 (70%) developed PDPH in perpendicular group and 5 out of 21 women (24%)

(70%) developed PDPH in perpendicular group and 5 out of 21 women (24%) suffered PDPH in the longitudinal group. These data suggest that the orientation of the epidural needle is not a factor in avoiding an accidental dural puncture but is crucial in diminishing the resultant PDPH.[45]

**Angle of insertion**

At least one in vitro study suggests that the insertion of the needle at an acute angle results in decreased leakage of CSF.[46] An oblique angle of penetration theoretically creates a flap valve that tends to seal the perforation in dura but important clinical studies substantiating this point are lacking.

**Number of puncture**

There are reports available addressing the issue whether multiple dural punctures influences the frequency of PDPH. Lybecker et al did not find a significant association between the number of punctures and the frequency of PDPH after multivariate analysis.[34] However recent analysis of prospective data on 8,034 spinal anesthetic patients showed increase in the incidence of PDPH with repeated dural puncture, this confirms the assumption that a second dural puncture increases the risk of PDPH.[47]

**Management**

PDPH is usually self limiting and lasts only a few days. However early treatment is indicated if symptoms persist. This will not avert the vicious cycle of immobility, weakness and depression but it may help to prevent rare cases of subdural hematoma or cranial nerve palsy in patients with persistent PDPH.

Once a PDPH is suspected a number of treatment options are available ranging from non-invasive pharmacologic approaches to invasive approaches. Because the natural history is one of spontaneous resolution many authors recommended approximately 24h of conservative therapy.[6]

**Conservative Measures**

PDPH developed in postoperative / postpartum period is always troublesome for anaesthetists as patient does not expect extreme physical limitation because of postural effect. During the postpartum period, parturients are at risk for depression. The occurrence of PDPH may interfere with baby care that may make her more depressed. In addition child bearing age women are usually healthy and do not expect to feel sick after child birth. A retrospective study of 43 obstetric patients with PDPH showed not surprisingly that this complication leads to a negative attitude towards epidural anesthesia.[48] It is essential to visit the patient at least once daily to explain symptoms and prognosis, give support and offer various therapeutic options available.

**Bed Rest**

Conservative measures usually start with asking the patient to observe bed rest and avoid the discomfort associated with an upright position. Lateral horizontal position produces less tension on the dural rent than supine, and results in less leakage of CSF.[49]

**Hydration**

Enhanced oral hydration remains a popular therapy for PDPH but there is no evidence that vigorous hydration has any therapeutic benefit in a patient with normal fluid intake.[50] However, no patient with PDPH should be allowed to become dehydrated. In case when patient is unable or unwilling to take fluids orally, intravenous fluid should be given.

**Analgesics**

Simple analgesics such as acetaminophen and nonsteroidal anti-inflammatory drugs may provide some benefits. Many post surgical patients are already receiving mild opiates to treat postoperative pain that would help in PDPH. It is controversial whether addition of opioids to single local anesthetic solution decreases the incidence of PDPH.[51]

**Other Drugs**

In the past a variety of drugs like steroids, vasopressor, alcohol and ergotamine have been used to treat PDPH.

Caffeine has been used to treat PDPH for many years. Its efficacy have been assessed in a randomized double blind trial by Sechzer and Abel.[52] In this trial patients who received caffeine sodium benzoate 500mg intravenously had better relief of PDPH than those who received a placebo. Camann et al. observed that oral caffeine 300mg is superior to placbo for the relief of PDPH.[53] Caffeine is a cerebral vasoconstrictor and one study has demonstrated a reduction of cerebral blood flow after intravenous administration of caffeine sodium benzoate for PDPH.[54] Caffeine is also a potent CNS stimulant. There are published case reports of seizures after intravenous administration of caffeine used for treatment of PDPH.[55]

Because caffeine is inexpensive, easy to obtain and fairly risk free, it could be a reasonable first option in the treatment of PDPH. As noted before both oral and intravenous forms of caffeine having being successful in treating post dural puncture headaches can be used as first option in conservative therapy.

Another methyl-xanthene, theophylline also a cerebral vasoconstrictor has been demonstrated to be more effective than placebo.[56]

Two novel alternatives for treatment of PDPH have

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Two novel alternatives for treatment of PDPH have appeared in literature, sumatriptan and ACTH harmone. Carp et al reported the administration of sumatriptan 6mg to six patients with PDPH with complete resolution of headache in four hours.[57] This drug is expensive and must be given by subcutaneous injection. Controlled trials of this drug is needed before it is used in practice for treatment of PDPH.

Collier described the anecdotal use of long acting ACTH for PDPH in six patients.[58] Recently its use as single intravenous infusion of ACTH 1.5u/kg in 250 ml of normal saline has been reported to provide effective relief in 2 cases.[59] This drug also requires further investigations before considering it as an option for PDPH.

**Other conservative measures**

A tight abdominal binder as well as the prone position causes increased intra abdominal pressure which my result in an increase in CSF. This method is very uncomfortable and is rarely used in modern practice.

**International Management of PDPH**

Interventional pain management has been in practice for treatment of PDPH for last many decades.

**Epidural Saline**

Epidural administration of saline has been used to relieve headaches after dural puncture for 40 years.[60] Lumbar injection of 20ml of saline may temporarily relieve the pain due to increased lumbar CSF pressure and therefore decreased intracranial traction. The benefit of single and continuous infusion has been proposed.[61] Some anesthesiologist have reported the successful use of saline infusion for 24 hours to treat PDPH patients with failed epidural blood patch.[62]

**Epidural Dextran**

Epidural dextrans 40 or gelatin have also been found effective in management of PDPH. Administration of 30-40ml provided good pain relief in all patients treated with gelatin.[63] Dextran has been reported as an alternative to blood patch when safety of epidural blood patch is questioned e.g. patient unwilling to use own blood (Jehovah witnesses) or patient with bacteremia and HIV infection.

**Epidural blood patch**

Gormley in 1960 reported the successful treatment of post spinal headache after the administration of 2-3 ml of blood in epidural space.[64] Later on its efficacy had been reported with 10ml of blood in epidural space.[65] These early reports led to the widespread practice of epidural blood patch for management of PDPH.

The optimum volume of injected blood remains controversial. Crawford in his study found better results with 20ml of blood than the volumes previously reported.[66] Controversy also exists as to the time of placement of epidural patch whether or not to carry it out early or even prophylactically.

Two mechanism may explain the therapeutic effect of blood patch. MRI imaging, radioactively labeled red blood cell injections and animal studies have contributed to the comprehension of these 2 mechanisms.[67-69] Blood exerts a mass effect in the epidural space compressing the dural sac and displacing the conus medularis, cauda equina and some times also the nearby nerve roots. This mass effects lasts up to 3 hours and causes immediate relief of symptoms. From 7 hours onwards the mass effect disappears and the blood forms a thin layer adherent to the dural sac extending cephalad rather than cauded. After 8-18 hours a significant leakage of blood into the dorsal facial planes and between subcutaneous fat was observed. It is interesting to note that laboratory studies have reported the possibility of accelerated coagulation occurring in the presence of CSF, however MRI investigation demonstrated a clot extending through the puncture site into the subarachnoid space. Cook et al. have demonstrated that a clot will form in 22 seconds by mixing blood and CSF.[70]

In animal studies clot organization with intense fibroblastic activity has been described at 4th day. Collagene deposition had commenced by 2 weeks and fibro-elastic activity was most marked at 3rd week, at which time the patch was five times more thick than the dura to which it was adherent and by 3rd month it was as thick as the underlying dura.[71]

Most authors agree that whatever the mechanism the epidural blood patch is the most reliable cure for PDPH. It is estimated that a 96% to 98% success rate can be expected from a properly executed blood patch.[72] The blood patch should ideally be performed at 24 hours after puncture to be more effective. For epidural blood patch two persons are required to perform the procedure. One person gains access to the epidural space and the other obtains the blood in a sterile fashion. 15-20ml seems to be the amount that has a high cure rate. The blood should be injected at a rate of 1.0ml over 3 seconds so as not to cause lyses. The blood will not form a proper clot to seal the dural tear if it is injected too quickly and the patient may complain of increasing pressure and discomfort in the back, buttock or legs. In this case, the injection should be slowed or stopped. The patient

The patient should remain supine and immobile for 30 minutes to 1 hour to allow the blood to form a clot.

Major complications from an epidural blind patch are rare. Many patients complain of backache which occurs in approximately 16% of patients and may last for upto 3 months.[73] Other complications include bleeding, infection, arachnoiditis and failure to relieve the headache. Two cases of facial nerve palsy have been reported, both of which resolved spontaneously and one case was reported of a patient who complained of intractable dizziness, vertigo, tinnitus and ataxia.[74]

**Prevention of PDPH**

The prevention of headache after dural puncture revolved around minimizing the post puncture leakage of CSF. Traditional approaches have ranged from restricting activity to complete bed rest. Application of abdominal binders have also been tried with controversial results.

Studies have shown that bed rest on recumbent position may delay the onset but does not decrease the incidence of PDPH.[75,76] Other postural maneuvers like head-down or prone position are also not helpful. Patient however should be instructed to lie in the supine position, merely because this is the position in which they are most comfortable and not because it is a prophylactic measure.

Other measures are related to needle size, shape and bevel orientation. In general the relative risk of PDPH decreases with each successive reduction in needle diameter. Many clinical trials investigated the relation between size and design of spinal needle and incidence of PDPH. The literature regarding size and shapes of needle has already been reviewed.

The conclusion of these studies showed that needle size is of primary importance in preventing headache but shape of the needle also has an influence on incidence of PDPH. In general non-cutting needle and smallest gauge needle should be used in order to prevent PDPH.

It has also been suggested that an acute angle of insertion of a needle into the dura may produce a flap that can readily close on itself. This "tin lid" flap of dura can close holes made by even large gauge needles.

Some clinicians recommend the use of prophylactic saline infusion in patients with unintentional dural puncture through an epidural catheter in place. Various studies have been done comparing controls to groups with 24 hour continuous infusion of saline.[77] These studies have produced varying results on the efficacy of epidural saline in the prevention of post dural puncture headache.

Digiovanni and Dunbar suggested that prophylactic epidural blood patch might help to prevent PDPH but early studies were disappointing.[65] The following studies reevaluated the use of prophylactic blood and showed the decrease incidence of PDPH after blood patch.[78]

Unintentional dural puncture with 16 or 18 guage epidural needle results in 70-80% incidence of PDPH, so some anesthesiologist believe that prophylactic blood patch is always justified. Others argue that a significant number of patients will receive unnecessary treatment and may suffer the complications associated with blood patch.

In current practice the incidence of PDPH after intentional dural puncture as in spinal is so low that prophylactic blood patch is unwarranted, while in a case of unintentional puncture its role has not been defined clearly.

## Conclusion

Accidental dural puncture is an unfortunate complication of therapeutic anaesthetic procedure and has a significant impact on the health care cost, as it prolongs hospitalization, it often last for several days and may be associated with auditory and visual disturbances, nausea, vomiting and cranial nerve palsy.

Although PDPH is a self limiting and nonfatal condition, its postural nature prevents the patient from performing routine activity and many make them anxious and depressed. Therefore these patients require psychological support and a lot of reassurance in addition to therapeutic measures. Preventive measures like smaller needle size, shape of needles and direction of needle bevel in relation to dural fibers, should always be considered with the hope to decrease the incidence of PDPH. Patients aged 20-40 years have a high incidence of PDPH never precludes the administration of spinal or epidural injection to this group.

Various pharmacological and interventional measures are available to treat PDPH but still the most important measure is its prevention. Novel alternative therapy like Sumatriptan and adrenocorticortico hormone require extensive studies to determine their role in PDPH. In current practice epidural blood patch has the highest cure rate for management of PDPH and is usually very well tolerated by majority of patients.

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