

EDITORIAL

Epidural blood patch

Successful treatment of post-dural puncture headache (PDPH) by epidural blood patch (EBP) was first described by Gormley in 1960 [1]. He injected 2–3 mL of autologous blood in seven patients (one of whom was himself suffering from PDPH after a myelogram) producing complete relief of headache within 30 min. The technique was subsequently popularized in the early 1970s by the publication of large numbers of successes in a series of 108 patients by Digiovanni *et al.* [2,3]. Although now a well-accepted technique, it is worth reviewing the indications, limitations and complications.

There is no doubt that PDPH can be (and often is) a very distressing and debilitating symptom. Before considering EBP, a firm diagnosis needs to be made. A careful history is the first step. Has the patient had a procedure done that could have resulted in breach of the dura? This is straightforward when the patient has received spinal anaesthesia or a known dural tap after epidural anaesthesia, which has been administered in the previous 24–48 h. Although not always thought of by physicians or orthopaedic surgeons, it can of course follow diagnostic lumbar puncture and lumbar sympathetic block.

History of the headache itself is helpful. PDPH is typically exacerbated by assuming the upright position and relieved by recumbency. The site of headache is not diagnostic, as it can be occipital, frontal, unilateral or on top of the head. Other associated symptoms include nausea, vomiting, dizziness and photophobia. It can present anything from between a few hours and 2 days after dural puncture. Presentation later than this is unusual and tends to result in a less severe headache, which resolves relatively soon [4].

Sometimes there is doubt about the diagnosis, either because the symptoms are not typical, or because it was thought that there was no breach of the dura during epidural insertion. In this situation, the

test described by Gutsche [5] can be extremely helpful in distinguishing PDPH from a headache from other causes. It is performed thus. While the headache is present, firm continuous abdominal pressure is applied with a hand on the abdomen and the back. If the headache improves (it often dramatically disappears), usually within 30 s, and then rapidly returns on release, it is characteristic of a PDPH. Headaches from other causes are little affected by this manoeuvre.

Without treatment, PDPH persists for several days [4, 6] and, on rare occasions, for weeks or even months [7–9]. The group of patients most frequently focused on are those in obstetrics. Because the symptoms are debilitating at a time when the new mother (who does not have another illness, unlike patients who need a diagnostic lumbar puncture) has no wish to be recumbent in bed, early diagnosis and treatment are imperative. There is usually no real difficulty in following up those patients who are known to have had the dura breached, either by recognized inadvertent dural tap or by the use of spinal anaesthesia. With the increased tendency for early discharge from hospital, this may require either follow-up by telephone or informing the patient to contact the hospital anaesthetic department in the event of a headache. Practical difficulties occur when a dural tap is not recognized and a headache develops after discharge from hospital. Primary healthcare professionals (e.g. family doctors, midwives, community nurses) need to be aware of the association of severe headache and anaesthetic procedures breaching the dura [10].

How does EBP work? Although the exact pathophysiology of symptoms is uncertain, loss of spinal cerebrospinal fluid (CSF) depletes the intracranial CSF 'cushion'. Movement of the brain in the upright posture then causes traction on pain-sensitive intracranial structures. The cure is to seal the hole, which is how EBP works. That it actually seals the hole has been demonstrated by magnetic resonance imaging [11].

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How effective is EBP? Early reports [1,2,12] suggested that immediate and permanent cure rates approached 100%. While success rates can be high, it is important that the patient is warned that there can be failures. Of 118 EBPs applied, Abouleish *et al.* [13] found relief in 105 patients. Similarly, Stride and Cooper [4] found immediate and permanent relief from EBP in only 86 out of 135 patients. Taivainen *et al.* [14] found an excellent initial effect with success in 91% of patients, but a permanent relief of PDPH was only found in 61%. In cases of failure of EBP, a second patch is usually (but not always) successful [4,12].

When should EBP be performed? There has been controversy over whether it should be done prophylactically or only after PDPH develops. In the case of spinal anaesthesia, it is obvious that one should follow up the patient and only perform EBP in the 1% or less who develop severe headache. It is less clear for those who have a dural tap from an epidural needle, because 70% or more are likely to develop PDPH [4]. Some authors [15–18] have found prophylactic blood patches to be effective and are enthusiastic proponents. Others [19,20] have found poor success rates. Possibly, the reality lies between the extremes, as suggested by Colonna-Romano and Shapiro [21] who found that 80% of control subjects developed PDPH compared with 21% who had prophylactic patches. A possible reason for the failure of prophylactic or early patching is the property of lignocaine to inhibit blood coagulation [22]. Whatever policy is pursued, the importance of follow-up is emphasized.

How much blood should be used? The first report of blood patch [1] used only 2–3 mL. Using this small volume, had the blood clot formed in a position that did not seal the dural tear, the benefits of blood patching may not have been evident. Since that time, the need for adequate volumes of blood has been emphasized. Crawford [12] recommended the injection of 20 mL of blood (but less if discomfort is produced). Lower volumes were found to have a higher failure rate. Ostheimer *et al.* [23] and Abouleish *et al.* [13], however, found that volumes of less than 10 mL were associated with higher initial failure or recurrence of PDPH after initial apparent success.

Does EBP work when symptoms have been present for a long period of time? It has been recognized for some time that this is so [24–26]. In this issue, there is

confirmatory evidence [27] of success: Seven months after an unrecognized dural tap, a lady who had received epidural analgesia for Caesarean section had relief of headaches immediately after EBP. The family doctor, ear, nose and throat specialist and ophthalmologist had been unable to make a correct diagnosis, again emphasizing the need to educate those who may be in contact with patients who develop such symptoms.

Where should EBP be inserted? Given that the aim is to seal the dural tear, it seems obvious that it should be near the original insertion. The interspace used originally may be seen from a mark on the skin or can be obtained from the anaesthetic records. The work of Beards *et al.* [11] suggests that the main clot occupies four or five vertebral levels, although a tendency to spread cephalad was noted, suggesting that it is sensible to patch at the same or a lower interspace. However, if there is difficulty locating a suitable space, these findings suggest that it will still be useful to use an interspace up to three spaces distant. There is a worry that CSF may be encountered when trying to perform an EBP. In order to be sure that the blood patch is not inserted intrathecally, Cucchiara and Wedel [28] suggest performing a test dose with local anaesthetic and proceeding with EBP if the result is negative, as they have done on three occasions.

Do patients need to be an in-patient to have an EBP? Our own experience is that EBP can quite safely be done as an out-patient. On occasion, it can hasten discharge from hospital if the PDPH was the only reason for continued admission. This view is echoed by Ravindram [29]. Continued follow-up to ensure permanent success is necessary.

What about unusual successes with EBP? Auditory symptoms after dural puncture have been relieved successfully with EBP [30,31]. A post-laminectomy CSF fistula was successfully treated with EBP after surgical re-exploration had failed [32]. As might be predicted, EBP has been successful in treating PDPH after lumbar sympathetic block [33]. In this case, it was suspected that the dural sleeve had been punctured during needle placement under fluoroscopy. EBP has also been used without ill effect for the treatment of PDPH in a patient with benign intracranial hypertension [34]. The difficulties of reaching the correct diagnosis are illustrated by Yentis and Haire [35] in the face of an atypical headache without a known

dural tap during epidural analgesia. Nevertheless, EBP was partially successful 13 weeks post-epidural with complete resolution of symptoms 2 weeks later.

What about negative aspects of EBP? There is always the worry about maintaining sterility when inserting an excellent culture medium into the back with the possibility of producing an epidural abscess. Fortunately, this is either rare or rarely reported. When blood is injected there is temporary displacement of nerve roots [11], which corresponds to the radicular pain that occasionally accompanies injection of the blood. Usually, this is of short duration, although there are reports of more prolonged radicular pain [36–38], which have nevertheless resolved. A spinal subdural haematoma requiring evacuation has been reported [39,40]. In both cases, this was after six EBP, which leads one to question how many EBP should be performed. Backache frequently follows EBP, which can be explained, on magnetic resonance imaging, by the extensive spread of blood into the subcutaneous fat [11].

Occasionally, cranial nerve palsies accompany PDPH. An EBP does not always reverse the nerve palsy [41,42]. Indeed, in one report [43], a unilateral facial nerve palsy became apparent after EBP. EBP does not always help [44]: an obstetric patient developed PDPH after a prophylactic EBP and received a further EBP 48 h later. There was an immediate and severe exacerbation of symptoms, which were then treated with diclofenac without further sequelae.

The importance of correct diagnosis is highlighted by two cases of acute neurological deterioration after EBP [45,46]. In both cases, a cerebral tumour was present. This event was averted by Boyd and Pigston [47] when a woman presented 2 days after forceps delivery under epidural analgesia, and an astrocytoma was diagnosed. It would have been easy to have performed an EBP not thinking of the more unusual diagnosis. This reinforces the need to consider that a raised intracranial pressure is causing the headache rather than the presence of a low-pressure PDPH.

What about paediatric patients? PDPH is extremely uncommon under the age of 10 years [48,49]. Nevertheless, PDPH can be treated successfully with EBP in children [50].

A review of measures to prevent the development of PDPH is beyond the scope of this editorial. However,

what if an EBP is refused, is unsuccessful, or too many have already been performed? Theophylline and sumatriptan are also potentially promising treatments [51]. Another approach to treatment is the use of intravenous caffeine [52].

In summary, EBP is the most effective treatment of established PDPH. Clinicians need to be aware of the limitations, to inform patients correctly, to be meticulous in the performance of EBP, to maintain utmost sterility and to audit the success or otherwise of their treatment.

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