Case Reports/Case Studies

Case report: Epidural blood patch in the treatment of abducens palsy after a dural puncture

[Présentation de cas : La péridurale avec sang autologue dans le traitement d'une paralysie du nerf moteur oculaire externe après une ponction de la dure-mère]

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Purpose: To describe a case of iatrogenically induced abducens nerve palsy following a diagnostic lumbar puncture, and to review the evidence for blood patching in the management of sixth cranial nerve palsy after dural puncture.

Clinical features: A 45-yr-old woman developed post-dural puncture headache with bilateral abducens palsy following a diagnostic lumbar puncture. Magnetic resonance imaging showed findings compatible with intracranial hypotension. An epidural blood patch was performed five days after the onset of diplopia and ten days following the dural puncture. After blood patching, the patient reported relief of the headache, but still complained of diplopia. The palsies recovered spontaneously 21 months after the dural puncture.

Conclusion: Experience from this case as well as other case report evidence suggest that an epidural blood patch performed more than 24 hr after the onset of a sixth cranial nerve palsy consistently fails to relieve diplopia. An epidural blood patch executed within 24 hr from the onset of diplopia could possibly lead to partial improvement and/or earlier resolution of symptoms.

Objectif : Décrire un cas de paralysie du nerf moteur oculaire externe provoquée iatrogéniquement suite à une ponction lombaire diagnostique, et passer en revue les preuves de l'efficacité du colmatage sanguin dans le traitement d'une paralysie du sixième nerf crânien suite à une ponction de la dure-mère.

Éléments cliniques : Une femme âgée de 45 ans a développé une céphalée post ponction de la dure-mère accompagnée d'une paralysie bilatérale des nerfs moteurs oculaires externes suite à une ponction lombaire diagnostique. L'imagerie par résonance magnétique a démontré des résultats compatibles avec une hypotension intracrânienne. Une péridurale avec sang autologue a été administrée cinq jours après l'apparition de diplopie et dix jours après la ponction de la dure-mère. Suite à cette péridurale, la céphalée fut soulagée, mais la patiente se plaignait encore de diplopie. Les paralysies disparurent spontanément 21 mois après la ponction de la dure-mère.

Conclusion : Ce cas clinique s'ajoute à plusieurs autres qui suggèrent qu'une péridurale avec sang autologue effectuée plus de 24 h après l'apparition d'une paralysie du sixième nerf crânien est inefficace pour soulager la diplopie. Une péridurale avec sang autologue exécutée dans les 24 h après l'apparition de diplopie pourrait peut-être l'améliorer partiellement et / ou permettre une résolution plus précoce des symptômes.

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WEAKNESS of the external rectus muscle of the eye is an uncommon complication of lumbar puncture or spinal anesthesia. Epidural blood patch (EBP) is a well accepted treatment for post-dural puncture headache (PDPH) but little is known about its efficacy in the treatment of iatrogenic abducens nerve palsy. This case report describes a patient who developed a PDPH with bilateral sixth cranial nerve palsy following a diagnostic lumbar puncture. An EBP relieved the headache but failed to resolve the diplopia. Complete spontaneous recovery was achieved 84 weeks later. The literature was reviewed regarding the efficacy of blood patching in the management of abducens palsy. The possible relationship between the timing of the EBP in relation to the onset of visual symptoms and the efficacy of blood patching was also assessed. Consent for publication of this report was obtained in accordance with the institutional guidelines of the Hôtel-Dieu de Lévis Hospital, affiliated center to Laval University.

Case report

A 45-yr-old woman without any significant past medical history presented to the emergency room two days after the onset of a severe headache associated with nausea and vomiting. A cerebral computed tomogram (CT) was normal and a diagnostic spinal puncture with a 22G Quincke needle was undertaken. The CSF opening pressure was not estimated. The CSF microscopy and bacteriology examinations were normal. The headache subsided with oral hydromorphone and the patient was discharged with a diagnosis of migraine. The following day, the headache became worse and developed a postural character. Five days after her lumbar puncture the patient developed diplopia with horizontal gaze. She returned to the emergency room where she was admitted to the neurology ward for further investigation. The physical examination at that time revealed evidence of a postural headache associated with an abduction limitation of both eyes, more prominent on the left side. Magnetic resonance imaging (MRI) showed small ventricles. Meningeal thickening was apparent in both infratentorial and supratentorial regions. The signal was hyperintense in the T2-weighted spin-echo sequence. A gadolinium injection demonstrated non-nodular diffuse meningeal enhancement in the T1-weighted spin-echo sequence (Figure). There was no other abnormality on the MRI. The diagnoses of intracranial hypotension, PDPH and secondary bilateral abducens palsy were made.

Five days after the onset of diplopia, the anesthesia department was consulted for consideration of an EBP. After reviewing the case and obtaining informed

FIGURE Diffuse meningeal thickening in the T2-weighted spin-echo sequence (A) and diffuse non-nodular meningeal enhancement in the T1-weighted spin-echo sequence after gadolinium injection (B) five days after the lumbar puncture. Normalization of the magnetic resonance imaging four months after the onset of diplopia before (C) and after (D) gadolinium injection.

consent from the patient, the anesthesia consultant agreed to perform an EBP. With the patient lying in the lateral decubitus position, 25 mL of autologous blood was injected using standard aseptic procedures into the epidural space at the L4–L5 level with an 18G Tuohy needle. The L4–L5 level was selected since the diagnostic spinal puncture was carried at this level. The patient reported relief of the headache within two hours of the EBP, but was still complaining about double vision. An ophthalmology consultation confirmed the presence of persistent bilateral sixth cranial nerve palsy.

The patient was discharged on the third day following her admission with a patch over her left eye. The two-month orthoptic follow-up examination showed some clinical improvement and a prism glass was prescribed to the patient. Four months after the onset of diplopia, a repeat MRI documented normal meninges with normalization of the post-gadolinium meningeal enhancement. The left eye recovered more rapidly since the orthoptic examination showed similar abnormalities in both eyes 17 months after the onset of diplopia. Abducens palsies completely recovered simultaneously 21 months after the dural puncture, with full restoration of visual fields.

Discussion

Transient abducens nerve palsy associated with lumbar puncture was first reported in the early 1900s.¹ A review of the neurological hazards of dural puncture reports an incidence of sixth cranial nerve palsy following lumbar puncture or spinal anesthesia with various needle sizes, of one in 400 (0.25%) procedures.² Similar to the occurrence of PDPH, there appears to be a relationship between young age, needle gauge and the incidence of abducens palsy.^{2,3} In a large series of more than 6,000 lumbar punctures, a 16G needle was used in 637 patients.³ Twenty-two percent of these subjects presented with PDPH and five individuals developed abducens palsy (0.78%). However, sixth cranial nerve palsy has also been reported in association with small atraumatic needles (25G) used for spinal anesthesia.^{4,5}

In the series of Thorsen² and Hayman *et al.*,⁶ the ocular palsy was almost always preceded by PDPH. It is typically unilateral (75% of cases), and in approximately 75% of patients, the onset of palsy occurs within ten days of the procedure. In a recent review by Nishio *et al.* on diplopia associated with dural puncture, the window of time for extraocular muscle paralysis to manifest was one day to three weeks (mean seven days; median six days) following dural puncture.⁷ Spontaneous recovery was observed in more than 80% of patients two to eight months after the onset of diplopia. Palsies which lasted more than eight months were found to be permanent. However, a few patients may still experience an improvement in symptoms after 12 months,⁷ as in the case we present. Strabismus surgery may be required for a small subset

of symptomatic patients after a minimum period of eight months of conservative management.⁷⁻⁹

Sixth nerve palsy has been observed in various conditions associated with loss in CSF pressure. In addition to diagnostic lumbar puncture, neuraxial anesthesia, contrast myelography,¹⁰ intrathecal glucocorticoid injection,¹¹ ventricular shunting for hydrocephalus,¹² spontaneous intracranial hypotension¹³ and implantation of an intrathecal drug delivery device¹⁴ may all lead to abducens nerve palsies.

A constant leak of CSF through the dura leads to intracranial hypotension. As a result, the brain and the brainstem are drawn caudally, thereby stretching the cranial nerves. Preferential damage of the abducens nerve can be explained by its anatomic course. The sixth cranial nerve negotiates a 90° bend at the apex of the petrous bone, extends through the petroclinoid ligament, and then courses horizontally along the intracranial carotid artery, which it accompanies into the cavernous sinus.¹⁵ Thus, a caudal displacement of the brain could exert a traction stress on the nerve, especially at the site where it courses over the petrous bone.⁸ The wide variation in duration of the abducens palsies could be explained by varying degrees of nerve abnormality, ranging from mild neuropraxia to severe axonotmesis with extensive degeneration.⁷

Few MRI scans have been described in the context of iatrogenic induced abducens nerve palsy.^{8,11,16} The characteristic MRI findings are typical of intracranial hypotension. They consist of small ventricles, diffuse post-gadolinium meningeal enhancement, downward displacement of the brainstem and subdural fluid collections. It has been suggested that the meningeal

TABLE Efficacy of epidural blood patch in treating abducens nerve palsy

Author	Sex	Age	Needle gauge for DP	Onset of diplopia after DP (days)	Subdural hematoma	Timing of EBP after DP (days)	Resolution of PDPH after EBP	Early improvement of diplopia after EBP	Resolution of abducens palsy (weeks)
Heyman 1982 ²⁰	F	34	17	3	NA	4	yes	no	6
De Veuster 1994 ²¹	F	47	NA	7	no	7 and 13*	no	no	8
Dunbar 1994 ²²	F	26	17	9	NA	10	yes	no	12
"	M	31	20	11†	no	14	yes	no	16
Dumont 1998 ¹¹	F	38	20	8	no	NA	yes	no	16
Szokol 1999 ¹⁸	F	32	17	4	no	4	yes	no	8
Vial 2000 ⁴	F	26	25	3	no	6‡	yes	no	32
Velarde 2000 ¹⁴	M	58	14	6	yes	11	yes	no	2
Follens 2001 ⁸	M	37	NA	5§	yes	NA	yes	no	80¶
Chohan 2003 ⁵	F	27	25	5	no	5	yes	yes	12
Arcand 2004 ²³	F	40	17	10	no	10	yes	yes	5
Béchar 2007	F	45	22	5†	no	10	yes	no	84

DP = dural puncture. EBP = epidural blood patch. PDPH = post-dural puncture headache. NA = not available. *Recurrence of PDPH necessitating a second EBP. †Bilateral abducens palsy. ‡A second EBP was performed later without improvement in diplopia. §Left sixth and right fourth cranial palsies. ¶Strabismus surgery was required.

abnormality may reflect compensatory vasodilatation or tearing of small meningeal vessels.¹⁷ Meningeal enhancement and downward displacement of the brain have been reported to improve or resolve as clinical symptoms of PDPH disappeared.^{11,17,18} In the patient we report, the MRI was normal despite the persistence of diplopia four months after the resolution of the PDPH.

The concept of EBP for treating PDPH was developed by Gormley in 1960.¹⁹ The EBP has proven to be an effective treatment for PDPH but little is known about its efficacy in the management of iatrogenic induced abducens nerve palsy. Effectiveness of an EBP to reverse an established diplopia secondary to sixth cranial nerve palsy has been reported rarely since 1980. In addition to our case, there are 11 other cases reported in the literature (Table). These cases show no effect of EBP administration in the treatment of abducens nerve palsy when the EBP was performed more than 24 hr after the onset of diplopia.^{4,8,11,14,18,20–22} However, blood patching within 24 hr of the onset of sixth ocular nerve palsy may produce partial improvement and/or earlier resolution of the diplopia.^{5,23} Due to the relative infrequency of the problem, it would be very difficult to verify this observation through clinical trials. Mechanistically, it is appealing to hypothesize that clinical improvement after an early EBP might result from a pre-emptive halt in the neurological degenerative process by restoration of normal CSF pressures. Once pathological nerve injury is well established, it is probably too late for an EBP to relieve the diplopia.

Early restoration of normal CSF pressures by an EBP could also have a prophylactic effect in preventing the occurrence of extraocular muscle paralysis in patients with PDPH but without diplopia. There are two published case reports describing extraocular muscle paralysis following an EBP which could invalidate this hypothesis. In the first case, an EBP was used to treat PDPH after inadvertent dural puncture in the context of an urgent Cesarean delivery.⁹ The EBP initially relieved the headache, but it recurred in a milder form two days later. A sixth cranial palsy appeared on the tenth postoperative day, and the headache resolved by the following day. After one year of clinical diplopia, the patient finally required strabismus surgery. Since the EBP appeared to be ineffective in restoring CSF pressure and resulting traction on the sixth cranial nerve, it was not surprising to observe the occurrence of abducens palsy in this case. In the second case, an EBP was used to treat a postural headache secondary to spontaneous intracranial hypotension with bilateral chronic subdural hematomas.²⁴ Following the EBP, left oculomotor nerve

palsy developed in association with an enlargement of the left chronic subdural hematoma. It was postulated that the cerebral mass effect of the chronic subdural hematoma was amplified by the administration of an EBP and closure of the dural leakage. Those two cases do not invalidate the hypothesis of a potential prophylactic benefit of early EBP since the occurrence of ocular nerve palsy could be explained in the first case by the ineffectiveness of the EBP, and in the second case, by progression of the cerebral mass effect in a patient with chronic subdural hematomas.

Dunbar *et al.* suggested that conservative therapy be abandoned after four days of a continuing PDPH, and that an EBP be performed.²² However, diplopia may appear as soon as 24 to 48 hr after a dural puncture.⁷ Thus, it seems reasonable to expect fewer cases of abducens nerve palsies if an EBP is performed early (24 to 48 hr) after a dural puncture in the presence of a PDPH. Nevertheless, the optimal timing for an EBP should be dictated by the individual clinical presentation, since most patients are unlikely to develop palsy after a PDPH.

In summary, neuraxial instrumentation for diagnostic procedures, regional anesthesia or therapeutic interventions can occasionally result in sixth cranial nerve palsies which may be prolonged and cause significant patient discomfort. Case report evidence suggests that an EBP performed more than 24 hr after the onset of diplopia systematically fails to relieve the palsy. An EBP executed within 24 hr of the onset of diplopia might possibly lead to partial improvement and/or earlier resolution of symptoms.

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