A NOVEL CAUSE FOR CAUDA-EQUINA SYNDROME WITH A NEW RADIOLOGICAL SIGN

W Singleton, D Ramnarine, N Patel, C Wigfield

Department of Neurological Surgery, Frenchay Hospital, Bristol, UK
Introduction

We present a case series of symptomatic, post lumbar surgery cauda equina compression due to formation of a dissecting subdural extra-arachnoid CSF collection (hygroma) under tension. Surgical re-exploration and formal durotomy confirmed a tension subdural extra-arachnoid hygroma due to one-way flow of CSF through a pinhole puncture in the arachnoid. The diagnosis was made surgically and is associated with a new clinically important and pathognomonic radiological sign. The cases are presented, treatment described and a potential anatomical explanation of how this rare surgical complication could occur without durotomy is discussed.

Results

In 3 of the 4 cases a small inadvertent durotomy was sustained during the initial surgery, which was repaired with a single suture. In all 4 cases the MRI findings were identical and unique to this condition. Axial images showed central clumping of the nerve roots surrounded by a normal CSF signal. The roots were gathered along a horizontal plane due to lateral tethering of the dentate ligament. Surgical exploration was successful in all cases with normal post-operative nerve function and restoration of normal radiological anatomy.

Case 1

A 71-year-old male presented with a long history of neurogenic claudication and underwent lumbar microsurgical decompression with complete resolution of his symptoms.

An inadvertent 2 mm dural laceration was sustained at L4/5 but the arachnoid remained intact and no CSF leakage was seen. The small dural defect was sealed with a single nonabsorbable suture. Within 24 hours of surgery, he developed progressive and diffuse bilateral leg pain. Post-operative MRI revealed central clumping of the cauda equina from L4 to S2 (Fig. A). This was initially reported by the Neuroradiologist to signify post-surgical arachnoiditis. However, the aetiological basis of this diagnosis was questioned as intradural surgery had not been undertaken. The possibility of a dissecting extraarachnoid cyst resulting from an occult pinhole breach of the arachnoid at the time of suture repair of the dura was then considered.

(A) Sagittal and axial T2 MRI scan of 71-year-old male with post-operative central cauda equina syndrome nerve root compression caused by a subdural extra-arachnoid hygroma (white arrows)

(B) After surgical decompression of the hygroma and wide opening of the arachnoid layer.

Case 2

A 31-year-old female was admitted for a revision L5/S1 microdiscectomy. Surgery was uncomplicated other than a small pinhole durotomy, with no CSF leak. The patient had an immediate post-operative improvement of her radicular pain. Twenty-four hours post-operatively, she developed symptomatic cauda equina compression.

Fig A: Sagittal and Axial T2 MRI showing characteristic horizontal tethering of the cauda equina nerve roots in the horizontal by the dentate ligament due to a subdural extra-archnoid CSF hygroma under tension.

Wide longitudinal incision of the arachnoid allowed CSF to fill the subarachnoid space from above, and the cauda equina nerve roots were observed to freely separate from one another. The arachnoid and dural layers were closed together with a single continuous watertight suture.

The patient’s neurologic symptoms resolved over 3 days. A post-operative MRI scan showed separation of the cauda equina roots with resolution of CSF in the extra-arachnoid dead-space (Fig. B).
Case 3

A 54-year-old female was admitted for a primary lumbar intersegmental decompression. Surgery was again uncomplicated other than a small pinhole durotomy, with no CSF leak. The patient had an immediate post-operative improvement of her radicular pain.

Twenty-four hours post-operatively, she developed symptomatic cauda equina compression with urinary retention.

MRI showed the pathognemonic signs of a subdural extra-archnoid CSF dissection with resultant cauda-equina compression (A). Urgent microsurgical intervention was again successful with complete resolution of symptoms and radiological signs (B).
Case 4

A 48-year-old female was admitted for a L4/5 instrumented fusion and decompression for a grade 1 spondylolisthesis with neurogenic claudication.

Surgery, unlike the previous cases, was not complicated by durotomy or CSF leak. Post operatively she developed cauda equina syndrome secondary to a extra archnoid CSF collection. (Fig A)

Surgical decompression again involved wide durotomy and formal decompression of the cyst. The arachnoid was observed to have dissected into two planes, with CSF passing into an inter-arachnoid plane. Post operatively she again made a full neurological recovery with restoration of normal cauda equina anatomy as demonstrated by MRI (Fig B).

The possible pathophysiology of this entity without durotomy at the index case is discussed below.
Surgical management

All 4 cased were treated in a similar fashion. At surgical re-exploration, laminectomy and wide midline durotomy revealed a tense CSF-filled subdural extra-arachnoid hygroma. The arachnoid layer had dissected off the dura and was held firmly against a central clump of cauda equina nerve roots. A pinhole in the arachnoid, corresponding to the location of the dural suture was noted in 3 of the cases and CSF was seen to pass one way into the subdural extra-arachnoid space with each pulsation. Wide longitudinal incision of the arachnoid allowed CSF to fill the subarachnoid space from above, and the cauda equina nerve roots were observed to freely separate from one another. The arachnoid and dural layers were closed together with a single continuous watertight suture

Conclusions

Inadvertent durotomy during routine lumbar spinal surgery is often uncomplicated if successfully repaired. However, if a patient develops post operative diffuse lower limb or cauda equina neurological symptoms, the rare entity of a dissecting subdural extra-arachnoid tension hygroma should be considered in the differential. The MRI appearances of this condition are unique and not previously described by another group\(^1\). If the diagnosis is suspected, surgical exploration to decompress the cyst through wide opening of the arachnoid should be considered and in this series proves successful.

Discussion

In three of the four cases presented there was a pinhole defect in the arachnoid caused by the initial dural repair which caused a one-way CSF leak and subsequent arachnoid dissection. In Case 4 there was no inadvertent durotomy during the 1st operation.

We propose a mechanism that could explain the aetiology of a tension extra arachnoid CSF hygroma without dural or arachnoid injury. The spinal arachnoid is known to consist of two distinct layers; the outer of which is tightly adherent to the dura. We hypothesise that decompression of a tight lumbar stenosis could result in sudden re-expansion of an elastic dura, leading to internal disruption of the closely applied arachnoid layer resulting in arachnoid dissection without any corresponding dural defect.

References


None of the authors have any disclosures to declare