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Early diagnosis and management of traumatic dura tear with brachial plexus injury without spinal lesions in childhood

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Abstract

Although the dura is a thick membrane, it could be severed in spine surgery and less frequently by a traumatism (7,8,10); in this case, it is usually accompanied with bone or ligamentous injury (2). Rare cases are reported of a traumatic dura tear without spinal lesion and would suspect in the first place a brachial plexus injury (2,8). Dura tears are rarely seen in childhood (3). We report a case of early diagnosis of dura tear in brachial plexus injury without bone or ligamentous lesions on a child of 4 years old and we discuss the diagnostic and treatment modalities.

Keywords
dura tear,
paediatric spinal trauma,
brachial plexus injury

Introduction

Although the dura is thick membrane it could be severed in spine surgery and less frequently by a traumatism (7,8,10), in this case it is usually accompanied with bone or ligamentous injury (2). Rare cases are reported of a traumatic dura tear without spinal lesion and would suspect in the first place a brachial plexus injury (2,8). Dura tears are rarely seen in childhood (3).

Case presentation

The patient is a 04 years old girl without past medical history; victim of traffic collision accident; clinically the patient was conscious presenting a left upper limb monoparesis. Simple X-ray, CT, and then dynamic X-rays found no more than a simple straightening of the cervical spine (figure 1). We complete by a cervical MRI witch objectified a left epidural collection expanding from C2 to C5, hypointense on T1 weighted images hyperintense T2 weighted images causing spinal cord and roots compression (figure 2). We operate the patient approaching the collection through a laminoplasty from C3 to C7. The collection appeared to be a CSF leak through a dura tear which was repaired with a watertight closure. In post-operative the patient was oriented to physical medicine where she recovered totally from her motor deficit in two months.

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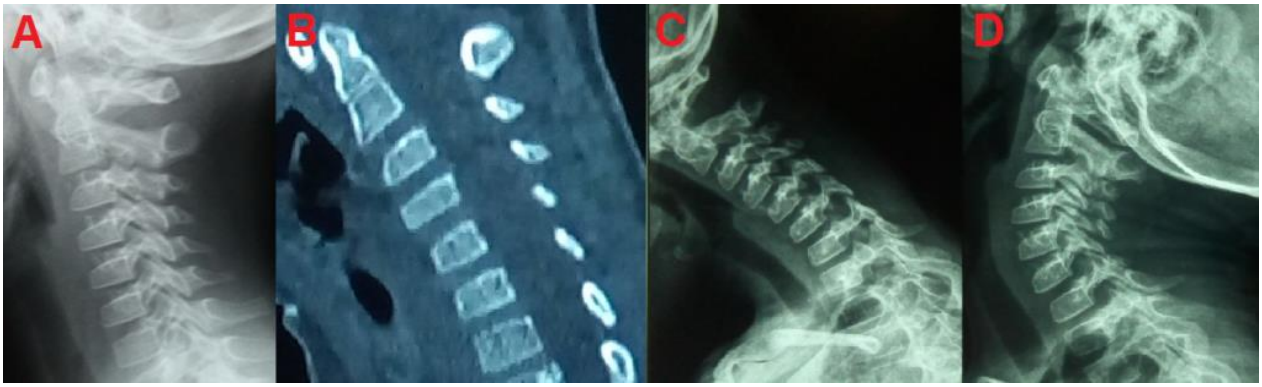

Figure 1. A: simple spine X-Ray. B: cervical spine CT (bone window). C: Dynamic X-Ray on flexion. D: Dynamic X-Ray on extension; those images showed a straightening of the cervical spine without bone lesions or instabilities.

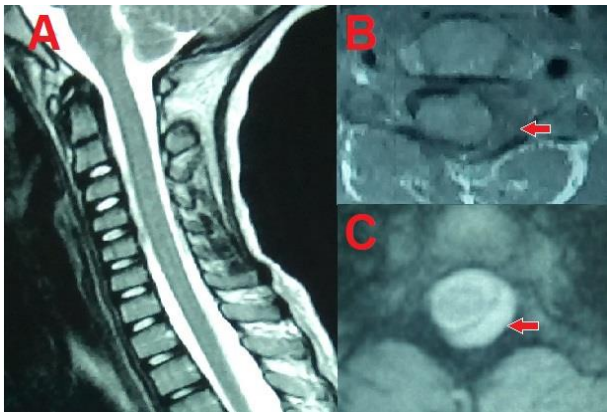

Figure 2. Preoperative MRI showing an epidural collection (the arrow). A: Sagittal T2 weighted image, B: Axial T1 weighted image, C: Axial T2 weighted image.

Discussion

The dura mater is a thick membrane of connective tissue that covers the brain and the spinal cord composed of collagen and elastin fibers, it's biomechanical proprieties was frequently studied especially in the lumbar region, but there is no available study of the difference in those proprieties between adults and children (1).The dura tear (DT) can be in the first place iatrogenic and less frequently traumatic or congenital. In fact DTs have an incidence that could reach 17% of all spine surgeries according to some series (2,4). A large study held by Hiroyuki Yoshihara and Daisuke Yoneoka in 2009 included 190,021 patients who underwent a cervical spine surgery a DT was found during surgery in 855 patients (0.45% of all patients), this sample include 880 patients under 17 years old and no one was diagnosed with DT (3). Traumatic DTs are rarer than iatrogenic (7,8,10), even though they still complicate 18% to 36% of all spine injuries (2). Traumatic DT can be divided into penetrating and blunt traumas. Burst fractures associated with laminar fracture are predictive 100% of sensitivity and 74% of specificity to a DT (6). Luszczyk et al published a study including 1615 spinal traumas, 187 patients of theme was diagnosed with traumatic DT; 36% (67 patients) of these DTs were in the cervical spine; 26.2% are burst fractures (AO Type A3), 16% flexion distraction lesions (AO Type B), and 36.4% are fracture dislocations (AO Type C); other lesions included atlanto axial dislocations, flexion compressions lesions, extension lesions, and sacral fractures; the study did not report DTs without spinal lesion (2). In absence of spine lesion traumatic DT can complicates brachial plexus injuries, in fact DT can be the result of the stretching of spinal roots between two mobile parts (8,10). DT resulting of brachial plexus injuries are rarely reported (8). In those cases the DT is located in the transition zone (11). According to Bonney's classification of the pregonglionar injuries of the brachial plexus, roots lesions distal to the transition zone (type B) could be complicated by an intra or extra spinal DT (13). The DT will allow under hemodynamic pressure the CSF leakage along the nerve course and in the epidural space (11). The DT by itself doesn't present a clinical problem (6) and it could heal spontaneously (11). But in some cases this collections will spread and gain an arachnoid covering forming what most authors call pseudomeningocele (2,3,5,7,8,10,11) causing compression of nerve structures and responsible of neurologic deficit appearing months or years after the traumatism (8,10). Other complications are seen: spinocutaneous fistula (2,3,4 ,6,7,8), meningitis (2,3,4,8), arachnoiditis (2,7,8), epidural abscess (2,7), and intracranial hypotension (2,7,8,9,10). Large part

of DTs could pass asymptomatic (8,10). Neurologic deficit could happen due to the compression or even the entrapment of the roots or nerves by a pseudomeningocele, appearing months or years after the traumatism (6,7,8,10,11); other clinical presentations could include: subcutaneous palpable masse that might be painful, collection or fistula (7,8,10), cervical pain, headache, or sciatalgia (7,8). As in our case, conventional CT is unhelpful to the diagnosis and MRI should be performed in presence of neurologic deficit non explained by the CT. MRI sensitivity could reach 97% and 100% in some studies (7,9), it shows an epidural collection hypointense in T1 weighted images and hyperintense in T2 weighted images. That collection is considered a diminution of dura sac volume rather than an epidural fluid, T.Hosoya et al proposed to call it "the floating dura sign" (9,12). T. YAGI et al classified epidural fluid collections in three types according to their relation with the dural sac: type V, for ventral location; type C, for circularly; and type D for dorsally (9). Fat suppression sequences are very helpful to differentiate the collection from the epidural fat (9,12). When a DT is highly suspected invasive imaging modalities might be performed like CT myelography or Retrograde Radionuclide Myelography (7,8,10,11,12). The management of patients with dura tears differs whether the dura tear was diagnosed in pre, per, or in post-operative. Away from the operating room, in pre- or post-operative; if a CSF leak was found, the bed rest in the Trendelenburg position could be effective; the body is laid supine, or flat on the back with a 15 to 30-degree inclination and the feet elevated (3,8,9,10). Another option that showed to be effective is to put a subarachnoide lumbar drain for 4 days collecting from 200 to 300 ml per 24 hours (2,3,4,7,8). Recently blood patch has been reported as very effective technique, by injecting 20 ml of precubital venous blood in the epidural space and in contact with the CSF it will form a clot that obstructs the DT (7,8,9,10). With an intraoperative DT and in any case a watertight closure should be tented as long as possible and a in addition gelfoam and surgicel are recommended (2,3,4,7,8,10). Hermetic fascia closure is mandatory (7).In case of brachial plexus injury the dura tear could be far lateral and thus a direct closure is difficult, in such cases Mayfield and Kurokawa proposed to open the dura medially and plunge a piece of fat or muscle with witch the lateral tear is obstructed from the intradural space (7). The fibrine glue is an easy effective complement or alternative if the suture is not possible (2,4,5,7,8). A subfascial drain is preferred (7).

Conclusion

Dura tear is an unfortunate accident that could happen in several conditions including spinal traumatism. Although it's not a problem by itself and could heal spontaneously or stay asymptomatic, some complications could appear later, though spinal MRI with adequate sequences should be a part of the diagnosis protocol even if the lesion is well defined by the spinal CT.

Declarations of interest

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