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Subdural hemorrhage of the cauda equina. A rare complication of cerebrospinal fluid shunt. Case report

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Abstract

We describe the case of a 16-year-old boy with idiopathic hydrocephalus, who developed cranial subdural hygromas and subsequent cranial subdural hemorrhage after a shunting procedure. Sciatica and radicular lumbar pain initially seemed to be unrelated to the preceeding implantation of a ventriculoatrial shunt. CT scan revealed a sharply demarcated hyperdensity in the lumbar subdural space with compression of the cauda equina. Differential diagnosis considerations included vascular malformations, vascular tumors, benign tumors of meninges or nerve sheets, ependymoma, lymphoma, and metastases. MR investigation did, in fact, clearly recognize this hyperintense space-occupying lesion as blood in the subdural space which outlined the cauda equina. We believe that the spinal subdural hematoma in our case represented an extension of intracranial subdural haemorrhage fluid into the spinal subdural space.

Keywords: Cauda equina, neuroshunt complications, subdural hemorrhage.

1 Introduction

Hydrocephalus is a term used to describe a condition in which excessive cerebrospinal fluid (CSF) accumulates in one or more ventricles and subarachnoid spaces. Increased CSF volume, however, is not always due to hydrocephalus; it also occurs in cerebral atrophy. Active hydrocephalus is a clinical entity distinguished by three characteristics: increased intraventricular pressure, increased CSF volume, and dilatation of CSF spaces [18]. Etiologic conditions take many forms: defective resorption of CSF, obstruction of the CSF pathways, and overproduction of CSF. Sometimes several mechanisms may be associated [6].

Indications for surgical shunting are such that a careful case-to case analysis of each patient is required. In rapidly progressing hydrocephalus, clinical signs occur either simultaneously or in succession; they force the surgeon to perform a shunting procedure promptly. On the other hand the indications for shunting a low-pressure or a normal-pressure hydrocephalus are not clear-cut. Recent experimental studies show that ventricular dilatation can be caused by high-amplitude CSF-pulse pressure even when mean CSF pressure is normal [18]. The complication-rate in these patients can be high; in particular subdural hemorrhage can be most troublesome.

Various types of shunt systems have been used, but only two types, ventriculoperitoneal and ventriculovenous, are currently performed. Common complications of these devices are largely well documented. The most common complication of shunt operation is infection; even with the most meticulous care, infection rate occurs in between 1 and 20% of cases [1, 5, 7, 18]. Another common shunt complication is shunt dysfunction. Hemorrhage can occur in the ventricles, intracerebrally, or in the cranial subdural space. If shunting is performed after closing of the sutures, massive subdural hygroma or hematoma may occur, presumably secondary to shunt-induced craniocerebral disproportion [6, 23]. Wellknown complications include also slitlike ventricles, an isolated fourth ventricle, post-shunt premature craniosynostosis [6, 18], decubitus ulcer on the flushing device, and suture abscess. While neurosurgeons are aware of the common complications, they are sometimes confronted with patients developing symptoms and signs that initially seem to be unrelated to the shunt. There are cases in the literature of perforation of the bowel by a peritoneal catheter, perforation of the vagina [20], bladder [9], or gall bladder [21], migration of a peritoneal catheter into a hydrocele [13], perforation of the atrial wall into the pericardium [13], intracranial migration of the valve reservoir [16], and pneumosinus dilatans [26].

2 Case history

A 16-year-old boy was suffering from internal hydrocephalus of unknown genesis. He had been asymptomatic until two weeks prior to admission. Because he showed clinical symptoms of raised intracranial pressure (headache, vomiting, intermittent gait disturbances, lethargy, recurrent diplopia), papilledema on fundoscopy, and signs of ependymal disruption in the superolateral angle of the frontal horns in CT scan, he was provided with a ventriculoatrial shunt. A ventriculoperitoneal shunt could not be performed because the boy had suffered from peritonitis some years before.

The postoperative course was uneventful: dilatation of the ventricular system rapidly regressed and peribventricular edematous areas disappeared. However, a CT scan control four weeks later revealed space-occupying bilateral hygromas secondary to ventricular collapse. This required clamping of the catheter. In spite of the fact that the hygromas regressed and the ventricles returned to their former size, the young patient developed small bilateral subdural hematomas, that were expected to disappear spontaneously. Three weeks later, the patient presented with sudden onset of lumbago and pain radiating into both legs with sensory disturbances. CT scan (Figure 1) demonstrated a hyperintense intraspinal lesion mimicking intradural extramedullary tumor at the level of L3 to S2. Magnetic resonance images, however, (T1- and T2-weighted images) revealed a subacute hematoma compressing the cauda equina (Figures 2 and 3); no evidence of tumorous tissue nor abnormal vessels was seen; no other source of spinal subdural hemorrhage (Table I) could be found.

The patient recovered, without surgical intervention. He was discharged with slight hypesthesia of the dermatome of left S1, and two months later lumbar symptoms were completely resolved.

3 Discussion

Post-shunt complications are generally categorized as those due to infection, those caused by dysfunction, and those related to overdrainage. It appears, however, that the mechanisms of overdrainage are still poorly defined and understood. Subdural hygromas or hematomas are secondary to ventricular collapse in patients with fixed head size, and thus more frequent in older children and adults than in

Figure 1. CT scan demonstrating a hyperintense intraspinal lesion.

Figure 2. Axial magnetic resonance image revealing a subacute hematoma (hyperintense on T1) compressing the cauda equina.

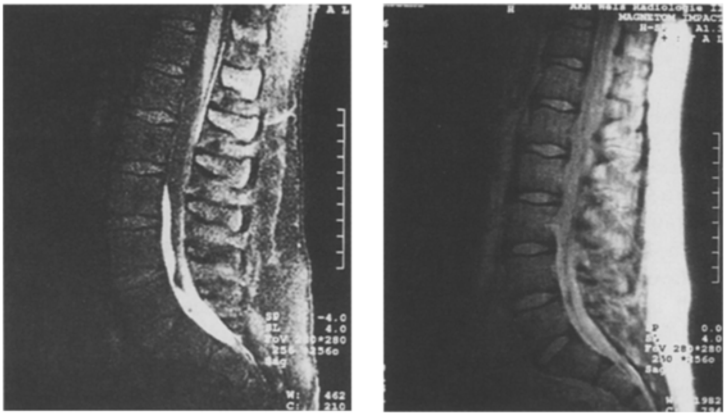

Figure 3a, b. Sagittal MR investigation revealing blood (a) in T1- and (b) PD- weighted images.

infants [6, 23]. Usually they are small and disappear spontaneously. Sometimes, however, they grow to space-occupying lesions, and they may even calcify with time [18].

It is of considerable importance to differentiate between various forms of hydrocephalus, since the indications for surgical shunting vary, and only the active hydrocephalus requires a shunting procedure. Bulk flow due to a change in ependymal permeability is a useful CT-finding in determining increased intraventricular pressure, and thus the potential efficiacy of a shunting procedure. Intracranial pressure monitoring may be valuable in evaluating normalpressure hydrocephalus: pressure waves in the normal baseline pressure can usually be observed [18].

In our patient, active hydrocephalus seemed to be proven by clear clinical symptoms and neuroradiological results. In the postoperative course, however, the question arose, why this boy developed complications of overdrainage subsequent to the shunting procedure. The symptoms might have been caused by a transient pressure crisis in an arrested hydrocephalus; especially since the patient had been shunt-independent until presentation and has shown no clinical signs of increased intracranial pressure, although the shunt is still clamped and CT scan still shows the enlarged ventricles, but without bulk-flow.

There is an increasing number of hydrocephalic patients with CSF shunts. While common complications are well-known, these patients may present

Table I. Published sources of spinal subdural hemorrhage

FODY [8]	1980:	Systemic lupus erythematodes
NEWTON [19]	1983:	Spinal vascular malformation
SCOTTI [23]	1987:	Meningeoma
KULALI [15]	1989:	Intradural angioblastic meningeoma
MODIC [17]	1989:	Embryonal tumours, lymphoma, metastases
HERB [12]	1990:	Ependymoma
BRUNI [4]	1991:	Iatrogenic (lumbar puncture)
HANAKITA [11]	1992:	Neurinoma
SCHMID [21]	1992:	Ruptured aneurysma

symptoms with no obvious relation to the hydrocephalus. A survey of the literature has shown that our case is the second report of a subdural spinal hematoma causing compression of the cauda equina following a shunting operation. There was a very interesting report by SILVER in 1991 [25], who described the first case of a 14-year-old girl who developed spinal subdural hematoma after placement of a ventriculoperitoneal shunt.

We believe that the lumbar subdural hemorrhage represented an extension of intracranial subdural blood into the spinal subdural space [25]. On the other hand we should take into consideration that the hemorrhage may have occured in the lumbar region independently of the cranial subdural blood accumulation; which was caused by low pressure in the whole craniospinal subdural area after overdrainage.

In 1993 HAINES [10] examined the dura-arachnoid junction at the electron microscopic level. He found that under normal conditions there is no evidence of a naturally occuring space at the dura-arachnoid junction, and, furthermore, that, when a space does appear subsequent to pathological or traumatic processes, it is not "subdural" in location, but rather within a morphologically distinct cell layer. He concludes that subdural fluid may result after tissue damage, but is not simply the filling of an existing space. However, the so-called subdural space is frequently described as a "potential space".

In 1987 BLOMBERG et al [3] examined the lumbar subdural space in autopsy subjects. They were able to open the space with ease in 66% of the cases, whereas in 7% it was not possible to establish a subdural space at all.

Spinal subdural hematoma is an unusual cause of spinal cord or cauda equina compression [14, 19]. It mainly occurs in patients with bleeding diathesis or after lumbar puncture [2]. Various differential diagnoses have to be taken into consideration: spinal subdural and extradural hematomas are a rare complication of spinal vascular malformations [19, 21] and of systemic lupus erythematodes [8]. Not only vascular tumors such as the capillary hemangioblastoma or the hemangiopericytoma but also other kinds of tumors such as meningeomas [15, 24], nerve sheet tumors [4, 11], ependymomas [12], embryonal tumors, lymphomas and metastatic tumors [17] may cause a spinal bleeding. In 1987 DIEBLER reported [6] on five children suffering from apparent idiopathic communicating hydrocephalus, in whom subsequently a spinal tumor was discovered as the underlying disease. Table I shows a review of sources of spinal subdural hemorrhage in literature.

Our findings in this case prove the value of MRI examination in lesions concerning the conus medullaris and the cauda equina, the latter appears to be more sensitive than CT scan or myelography [14]. In CT scan discrimination of nerval structures from the dural sac and other intraspinal soft tissue structures is not possible, these problems could be clarified by MRI, so that appropriate therapy could be planned.

As neurologic symptoms produced by compression of the cauda equina by subdural hemorrhage were mild in our patient, surgery for evacuation of the hematoma was judged to be unnecessary. The patient recovered completely after conservative treatment. There were no further complications such as chemical meningitis or arachnoiditis [19].

Three main points are evident from our study. First, overdrainage of CSF fluid may lead to a collection of blood or CSF fluid in the meninges, especially in patients with fused sutures and large heads in presence of significant hydrocephalus. Second, although there is no naturally occuring biological space at the dura-arachnoid junction, persuant trauma or disease processes may result in collection of fluids within a distinct layer of dural cells. Finally, and perhaps most importantly, we should be aware of uncommon post-shunt complications that may produce signs initially seeming to be unrelated to the shunt.

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