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Subarachnoid fluid collection in infants complicated by subdural hematoma

Koreaki Mori [1], Takashi Sakamoto [1], Kosuke Nishimura [2], Kazushi Fujiwara [3]

[1] Department of Neurosurgery, Kochi Medical School, Kohasu, Okoh-cho, Nankoku City, Kochi Prefecture, 783 Japan
[2] Department of Neurosurgery, Nishimura Memorial Hospital, 3-17-7 Hirai, Edogawa-ku, Tokyo, 132 Japan
[3] Department of Neurosurgery, Fujiwara Hospital, 995 Ohsone Otsu, Nankoku City, Kochi Prefecture, 783 Japan

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Abstract. In the natural history of infantile extracerebral fluid collections, subarachnoid fluid collection itself is regarded as a benign lesion, and surgical treatment is not indicated. As this condition is age-related and self-limiting, spontaneous resolution can be expected in most cases by 2–3 years of age. However, out of 20 cases of infantile subarachnoid fluid collection in an 8-year period, 3 infants developed subdural hematoma. Infantile subarachnoid fluid collection seems to be prone to complicate subdural hematoma. Surgical treatment should be considered when subarachnoid fluid collection is complicated by subdural hematoma due to arachnoid ruptures or tearing of the bridging veins. Therefore, all patients should be observed closely and measures should be taken to prevent head trauma since it may precipitate subdural hematoma.

Key words: Subarachnoid fluid collection – Subdural hematoma – Infant

Introduction

In the 8-year period from 1982 to 1989, we evaluated 20 cases of infantile subdural fluid collections, in 14 male and 6 female patients from 2 to 30 months in age, with a mean age of 8.6 months. Infants with underlying conditions such as infection, anoxia, intracranial hemorrhage, perinatal problems, congenital anomalies, etc., were excluded because these conditions can cause primary brain damage and could confuse findings related only to infantile subarachnoid fluid collection.

Most of the patients were brought for medical attention because of minimal developmental retardation and signs of slightly increased intracranial pressure such as head enlargement, tense fontanels, etc. A few patients also presented with seizures.

A review of the prenatal, perinatal, and postnatal histories of the patients showed no definite causes common to all.

In 17 out of the 20 cases, no surgical procedure was performed during a 6-month to 6-year follow-up period. Low density areas over frontal convexities decreased or disappeared spontaneously. At the same time, head enlargement and tense anterior fontanel returned to within normal ranges. Three patients developed subdural hematoma, which was treated surgically.

The incidence of subdural hematoma in infantile subarachnoid fluid collection in our series prompted us to report this complication.

Case reports

Case 1

This 5-month-old male infant fell from a height of 50 cm and sustained head trauma. Computed tomographic (CT) scans obtained immediately after the head trauma showed enlargement of the subarachnoid spaces. Follow-up CT scans obtained 2 weeks later showed enlargement of the subarachnoid spaces and a subdural hematoma on the left side (Fig. 1). Magnetic resonance imaging (MRI) 3 weeks after the head trauma clearly demonstrated the hematoma in the left subdural space and also some enlargement of the subarachnoid spaces (Fig. 2). Burr hole and irrigation were performed and approximately 40 ml fluid hematoma was evacuated. The postoperative course was uneventful.

Case 2

Subdural fluid collection in this 6-month-old male infant was treated with repeated subdural taps because it was wide in extent. It was, however, followed by the development of a subdural hematoma (Fig. 3). We believe the latter to have been precipitated by the repeated subdural taps, possibly as a result of traumatic arachnoid ruptures. The subdural hematoma was treated by subdural-peritoneal shunt placement.

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Correspondence to: K. Mori

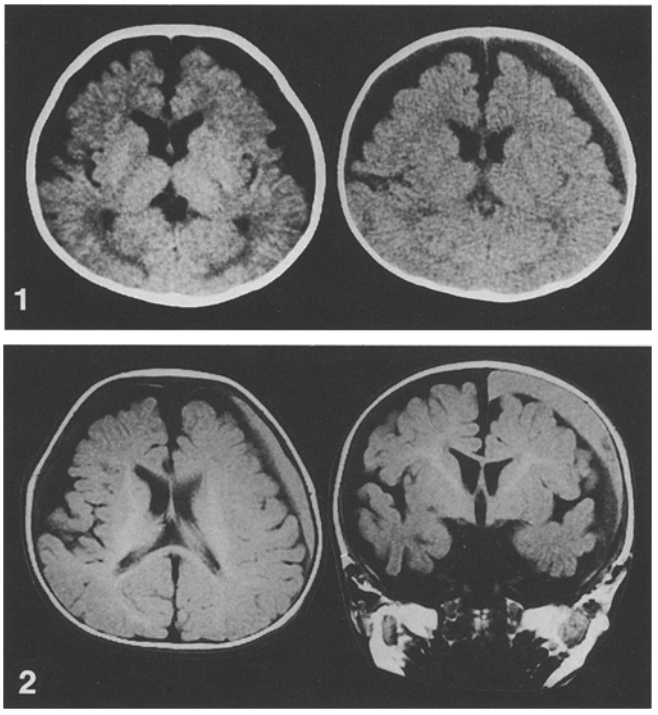


Fig. 1. Computed tomographic (CT) scans showing infantile subarachnoid fluid collection with traumatic hematoma in a 5-month-old male infant. *Left:* CT scan obtained immediately after head trauma. *Right:* CT scan 2 weeks after head trauma shows the development of a subdural hematoma

Fig. 2. Magnetic resonance imaging (MRI) 3 weeks after head tauma in the same patient as in Fig. 1 clearly shows a hematoma in the left subdural space, along with enlargement of the subarachnoid spaces. *Left:* Axial image, *right:* coronal image

Case 3

This female infant aged 1 year 8 months was noticed at the age of 5 months to have delayed milestones and subarachnoid fluid collection, more marked on the right side than on the left. The patient had been followed at the outpatient clinic. Follow-up MRI 2 months later showed development of subdural hematoma on the right side. The hematoma was treated by burr hole and irrigation. Follow-up MRI 1 year later showed development of subdural hematoma on the opposite side. The hematoma was treated again by burr hole and irrigation. The subdural spaces disappeared thereafter (Fig. 4).

Discussion

Various terms have been proposed to describe infantile subarachnoid fluid collection, including "fluid accumulation on the brain surface in children in the first year of life" [15], "benign subdural fluid collection of infancy" [5, 18], "external hydrocephalus" [1, 2, 6, 9, 17], pseudohydrocephalus-megalocephaly" [19], "benign subdural effusion in infants" [13], "extracerebral fluid collections" [11], and "benign enlargement of the subarachnoid spaces in the infant" [10, 14].

The pathological state characterized by excessive cerebrospinal fluid accumulation over the cerebral surface was first reported as "external hydrocephalus" by Dandy and Blackfan [7], and was thought to be a rather rare condition at the time. However, as CT became more common, it proved to be not as rare in infants as previously suggested.

In subdural fluid collection in infants, the low-density area over the frontal lobes eventually disappeared, and almost all patients attained normal developmental milestones with time

Although many studies about the pathogenesis of this condition have been reported, so far no definite theory exists. The etiology of infantile subarachnoid fluid collection over the frontal convexities is not clear. Trauma in the prenatal and perinatal periods may have been responsible in some cases, and prematurity might predispose to the development of this condition. Subarachnoid dilatation may represent an early finding of benign congenital communicating hydrocephalus [8, 12, 16]. Although the terms "external hydrocephalus" and "subdural fluid collection" are clinically used interchangeably, CT scan of the brain in infantile subdural fluid collection reveals fluid in the subarachnoid space. Anatomically speaking, infantile subdural fluid collection is excessive subarachnoid fluid collection or subarachnoid enlargement.

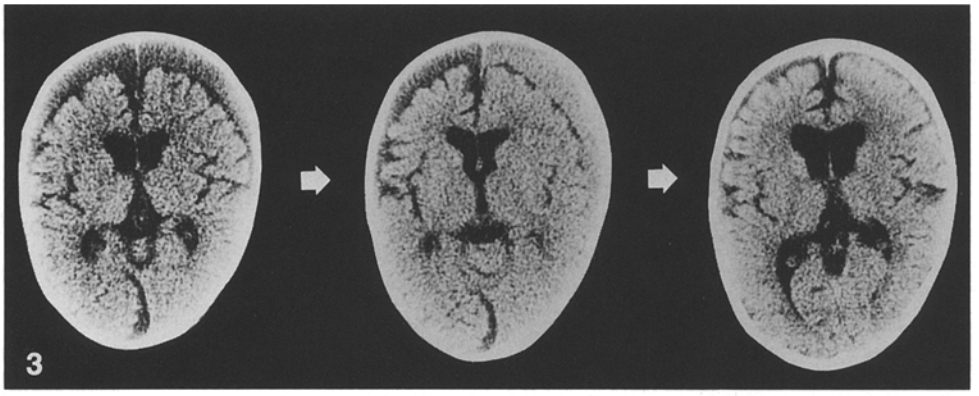
Interestingly, we observed a subdural hematoma in 3 of 20 follow-up patients with subarachnoid fluid collection. This suggests that infants with enlarged subarachnoid spaces may be susceptible to subdural hematoma [3]. Craniocerebral disproportion [4] of any form may favor brain displacement as well as brain and skull distortion, thereby predisposing to the development of subdural hematoma due to arachnoid ruptures or tearing of the bridging vein by rotation of the brain during blunt head injury.

It is well known that head shaking in battered child syndrome often results in subdural hematoma. This may be explained by the facts that subarachnoid fluid collection is a rather common occurrence in infants and that infants with subarachnoid fluid collection easily develop subdural hematoma by head shaking (H. L. Rekate, personal communication).

MRI demonstrates the nature and site of extracerebral fluid much more clearly than CT. Different types of fluid in the subdural and subarachnoid spaces can be shown on MRI. MRI is very useful in the diagnosis of subarachnoid fluid collection complicated by subdural hematoma, and therefore plays a significant role in deciding appropriate management.

In the natural history of this condition, subarachnoid enlargement itself is benign in nature. Surgical intervention is not required, because the condition eventually resolves. However, surgical treatment should be considered when subarachnoid fluid collection is complicated by subdural hematoma due to damage to the arachnoid membrane or tearing of the bridging vein by brain displacement, as can occur in head trauma. Therefore, all patients with infantile subarachnoid fluid collection should be followed by careful clinical observation.

Repeated subdural taps may shorten the time taken for a reduction in size of the enlarged subarachnoid spaces, but it must be remembered that subdural tap may also provoke subdural hematoma due to traumatic sub-



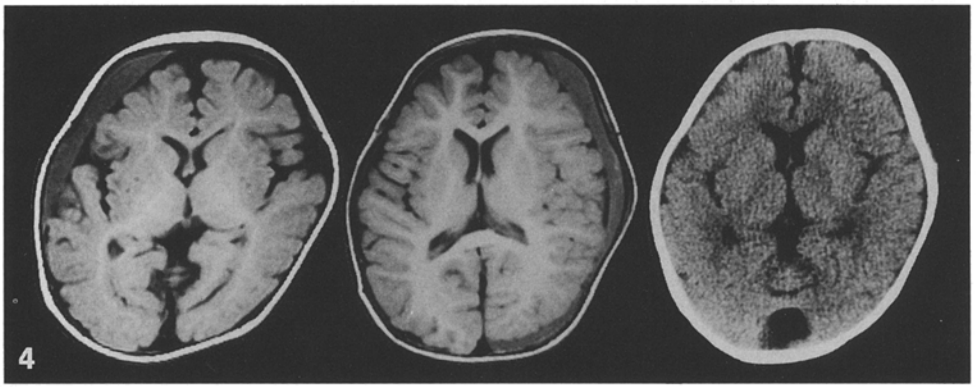


Fig. 3. CT scans showing a subdural hematoma induced by repeated subdural taps in a 6-month-old male infant with infantile subarachnoid fluid collection. *Left:* CT scan at 7 months of age shows infantile subarachnoid fluid collection. *Middle:* CT scan after repeated subdural taps shows a subdural hematoma on the left side. *Right:* CT scan at 11 months of age after subdural-peritoneal shunt shows an improvement of the subdural hematoma and subarachnoid fluid collection

Fig. 4. MRI and CT scans showing subsequent development of subdural hematomas in a female infant aged 1 year 8 months with infantile subarachnoid fluid collection. *Left:* MRI at 7 months of age shows subdural hematoma on the right side. *Middle:* MRI at 1 year and 7 months of age shows subdural hematoma on the left side. *Right:* CT scan after burr hole and irrigation shows disappearance of the subdural hematoma

arachnoid ruptures. During the follow-up period, head trauma must be avoided as it may precipitate subdural hematoma.

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