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Spontaneous Intracranial Hypotension Associated with Subdural Hematoma: Diagnostic Usefulness of Percutaneous Subdural Tapping and Magnetic Resonance Imaging

N. Aoki, T. Sakai, and **A. Oikawa**

Department of Neurosurgery, Tokyo Metropolitan Ohkubo Hospital, Tokyo, Japan

Summary

A 55-year-old woman presented with headache which was characterized by aggravation in the upright position and relief in recumbency. Although intracranial hypotension syndrome was condidered to be the most-likely possible entity, computed tomography (CT) scans demonstrated subdural fluid collections associated with findings reminiscent of transtentorial herniation. Because of these CT features, cerebrospinal fluid pressure measurement by a lumbar puncture was not performed. Instead, as an alternative method, she underwent percutaneous subdural tapping, which failed to obtain spontaneous drainage of liquid haematoma, indicating intracranial hypotension. In addition, gadolinium-enhanced magnetic resonance imaging study performed later supported the diagnosis of spontaneous intracranial hypotension. Thus, the usefulness and safety of percutaneous subdural tapping for the diagnosis of spontaneous intracranial hypotension is stressed.

Keywords: Spontaneous intracranial hypotension; percutaneous subdural tapping; subdural fluid collection; subdural hematoma.

Introduction

Spontaneous intracranial hypotension (SIH) is a well documented syndrome, which is characterized by postural headache, and has been traditionally diagnosed by measurement of intracranial pressure by a lumbar puncture [6, 10]. Recently, however, neuroimaging studies in patients with SIH disclosed unique appearances, showing dural enhancement and tight posterior fossa [3, 5]. For this reason, after the advent of computed tomography (CT) scanning and magnetic resonance (MR) imaging which show features reminiscent of brain herniation, lumbar puncture is not the diagnostic method of choice for intracranial pressure measurement. Additionally, this syndrome is occasionally associated with supratentorial subdural haematoma or effusion [8, 10, 11], causing a dilemma regarding lumbar puncture. In this situation, i.e. clinical symptoms suggestive of SIH, together with neuroimaging features showing subdural fluid collections and possible brain herniation, measurement of intracranial pressure by percutaneous subdural tapping is considered to be reasonably useful and safe for the diagnosis of SIH. Details of a patient who underwent the above-described diagnostic method are presented.

Case Report

This 55-year-old housewife without any remarkable past history experienced an abnormal feeling around her neck on the right side just after lifting a heavy object on September 5, 1995. Soon thereafter, she suffered transient, mild headache, and visited a nearby hospital, where no neurological abnormalities were detected. Since September 7, however, she had persistent headache without relief. Her headache was characterized by worsening in the upright position, and was alleviated by recumbency. Because of the occurrence of intolerable headache, she was brought to our emergency room by ambulance on October 5. On arrival, although the patient complained of severe pain all over the head, her physical and neurological examinations were normal. No meningeal signs were evident. Funduscopic examination was normal. The results of laboratory data were within normal limits. A CT scan without contrast infusion demonstrated thin subdural fluid collections on both sides, and obliteration of the perimesencephalic cistern, suggesting downward displacement of the supratentorial structures (Fig. 1).

Clinical Course after Admission: Considering the CT findings and clinical features, it was difficult to determine definitely whether her severe headache was caused by intracranial hypertension due to subdural fluid collection or, in contrast, by SIH. To differentiate these two clinical entities without eliciting symptomatic cerebral herniation, percutaneous subdural tapping was adopted as an alternative to a lumbar puncture. The subdural tapping using the needle devised by the authors [1, 2] did not yield spontaneous drainage of fluid even by tilting the patient's head to the left side. Thin bloody, xanthochromic fluid was obtained by gentle aspiration with a

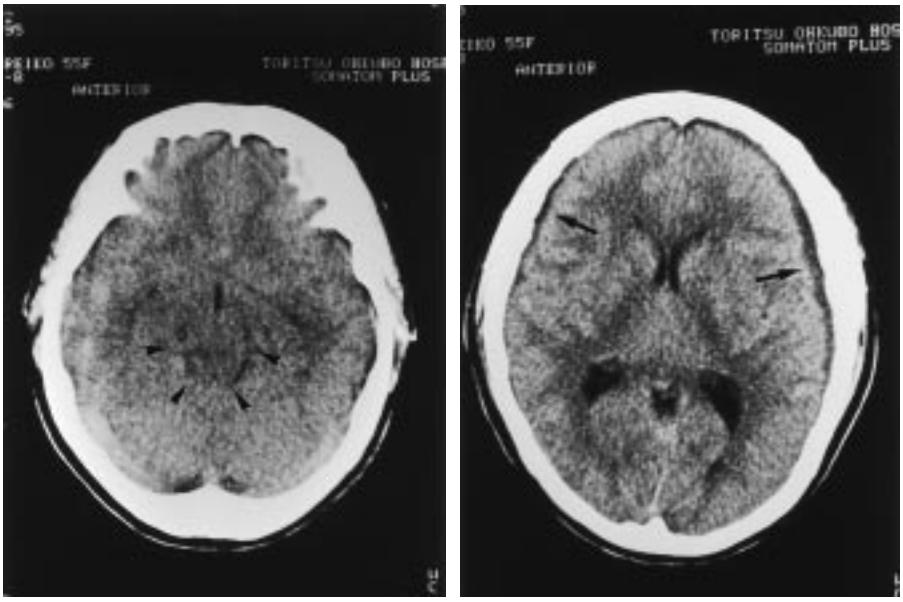

Fig. 1. Computed tomography scans without contrast infusion show obliteration of the perimesencephalic cistern (arrowheads) and of the Sylvian fissures (left), and the presence of subdural fluid collections (arrows) on both sides (right). The computed tomography density of the subdural fluid is high relative to that of cerebrospinal fluid

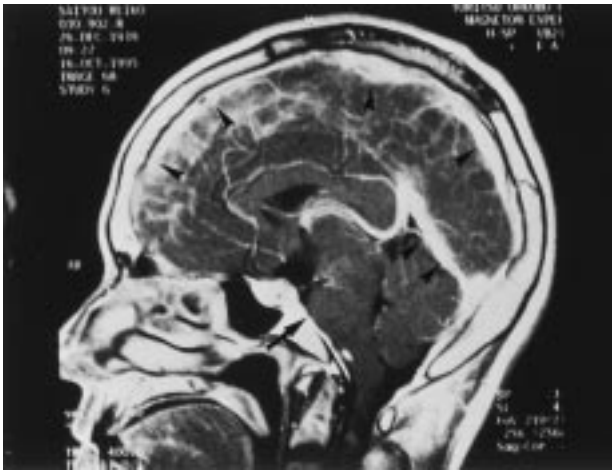

Fig. 2. A gadolinium-enhanced T1 weighted image, a sagittal view, on October 16, demonstrates intense enhancement of the supratentorial meninges and the tentorium (arrowheads). Note the pons strikingly displaced anteriorly against the clivus, resulting in obliteration of the basal cistern (arrow)

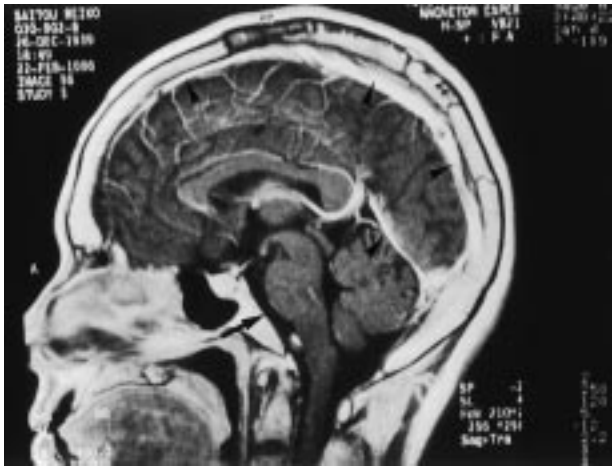

Fig. 3. A gadolinium-enhanced T1 weighted image, a sagittal view, obtained 3 months after discharge, shows remarkable reduction of meningeal enhancement (arrowheads), and return of the pons to the normal position (arrow)

syringe, suggesting a diagnosis of SIH associated with chronic subdural haematoma. MR imaging after contrast injection on October 16, demonstrated remarkable enhancement of the supratentorial meninges and the tentorium. In addition, the pons was strikingly displaced anteriorly against the clivus, resulting in obliteration of the basal cistern (Fig. 2). Although radio-isotope cisternography was not performed, no abnormalities were noted over the whole spinal MR imaging study. Because of persistent, severe headache despite bed rest, analgesics and hydration, she was scheduled to undergo epidural saline infusion therapy according to Gibson *et al.* The treatment was instituted with injection of a 10 ml bolus of normal saline through a lumbar epidural catheter, and then normal saline was continuously infused at a rate of 20 ml/hr for 48 hours [4]. During the infusion, the patient remained supine. After completion of the treatment, on October 18, her headache was remarkably reduced, and she was able to ambulate with only mild bifrontal headache. Then, resolution of her symptoms was obtained at the time of discharge from our hospital on November 2. Serial CT scans after the treatment revealed gradual regression of bilateral subdural fluid collections. No recurrence of headache was observed when reviewed 3 months later. In addition, gadolinium-enhanced MR imaging study obtained at that time revealed remarkable

reduction of meningeal enhancement and return of the pons to its normal position (Fig. 3).

Discussion

The authors have long adopted percutaneous subdural tapping for the treatment of chronic subdural haematoma [1, 2]. One patient, though a case before the advent of MR imaging, with CT features mimicking transtentorial herniation seemingly due to chronic subdural haematoma underwent percutaneous subdural tapping. Unexpectedly, however, measurement of the subdural pressure showed it to be negative, resulting in influx of air into the haematoma cavity. The clinical features associated with low intracranial pressure in this patient enabled one to make a diagnosis of SIH [8]. Based on this experience, the present patient underwent percutaneous subdural tapping as the diagnostic method of choice for measurement of intracranial pressure. Because there is no significant difference between subdural pressure and intracranial pressure, a lumbar puncture was not necessary to make a diagnosis of SIH. Recent reports documented characteristic MR findings, which included remarkable dural enhancement and obliteration of the basal cistern [3, 5]. Thus, a diagnosis of SIH may be made by MR imaging studies. Even if a diagnosis of SIH is most likely on clinical grounds, however, we are hesitant to proceed a lumbar puncture, because obliteration of the perimesencephalic and basal cisterns on CT or MR imaging generally indicates cerebral herniation [6, 12]. To our knowledge, there have been no MR imaging reports of SIH in neurosurgical journals. In the present patient, a gadolinium-enhanced MR imaging study was performed later in order to rule out other pathological processes and for re-evaluation of MR evidence illustrated recently [3, 5]. MR features were consistent with those documented in recent reports [3, 5]. In possible SIH patients with subdural fluid collections, subdural tapping makes a safe and definitive diagnosis; however, in patients without associated fluid collections, gadolinium-enhanced MR imaging can be an additional useful diagnostic method. To summarize, in patients with postural headache, CT and MR imaging may show unique appearances mimicking cerebral herniation, to carry out a lumbar puncture is not indicated. When subdural fluid collection is associated in such patients, percutaneous subdural tapping may safely and definitively contribute to establishing a diagnosis of SIH without possible risk developing symptomatic cerebral herniation.

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Comment

Spontaneous intracranial hypotension is being increasingly recognized as a clinical syndrome. The characteristic symptomatology includes head and/or neck pain on standing, which is relieved by lying down, and more unusually, abducens nerve paresis. Causes of the phenomenon include spinal arachnoidal diverticular rupture during stress or CSF leak following lumbar punctures.

In the presence of subdural effusions, the differentiation of this syndrome from intracranial hypertension has important therapeutic consequences. The authors describe their technique for subdural pressure tapping, which confirms the clinically suspected diagnosis. The MRI picture of brainstem crowding, meningeal, and tentorial enhancement is becoming increasingly recognized as signs of intracranial hypotension. Meningeal biopsies in this condition have revealed secondary phenomena related to venous engargement following the CSF hydrostatic changes (Mokri B et al.: Meningeal biopsy in intracranial hypotension: meningeal enhancement on MRI. Neurology 45: 1801–1807, 1995). These changes must be differentiated from meningeal carcinomatosis. The post-treatment MRI shows a spectacular resolution of the abnormal findings.

This case report emphasizes the clinical and radiological picture

of spontaneous intracranial hypotension, which has not been widely disseminated in the neurosurgical literature.

Z. H. Rappaport

The first author, Dr. Aoki, has shown interest for the condition of chronic subdural haematoma and has published several articles. In 1984, in Neurosurgery, he reported on the treatment of chronic subdural haematoma by subdural tapping and irrigation using a special needle which was devised by himself. This seemed an elegant method which could be performed at the bedside and it was applauded by two reviewers: Russel Patterson and Howard Kaufman.

Rappaport states that the condition of spontaneous intracranial hypotension has not been widely disseminated in the neurosurgical literature. One of the best review articles that I know of is that by Rando and Fishman (Neurology 1992; 42: 481–487) which is quoted by the present authors (reference no. 10). I can really recommend reading this article. The condition was first described by Schaltenbrand, in 1938. Several explanations have been proposed, but the most likely one is CSF leakage along the spinal nerve roots. Evidence for this can be provided by radionuclide cisternography, which shows rapid disappearance from the subarachnoid space with early uptake into the bladder and sometimes diffusion of the tracer can be seen into the extra-arachnoid space in the region of the affected root. This can also be shown by MRI. The condition can be associated with subdural fluid collections as have been documented by several authors. The most characteristic feature is orthostatic headache. Rando and Fishman state that patients with subdural haematomas may also complain of orthostatic headaches and that if there is no identifiable risk for intracranial haemorrhage and no previous dural puncture, spontaneous intracranial hypotension should be considered as the cause of both the headache and the subdural haematoma. They emphasize the occurrence of subdural fluid collections as a secondary phenomenon in this condition to urge caution in identifying the collections as the cause of the headache. It is important to recognize this condition, as it has important implications for the therapeutic approach.

The patient reported by the authors experienced some complaints just after lifting a heavy object. Several authors have argued that small dural tears can occur at the nerve roots from even minor stresses and often there is a history of a trivial fall, vigorous exercise or violent cuffing preceeding the onset of the headache.

A reviewer argues that the authors failed to measure intracranial pressure. However, in none of the previously mentioned articles ICP had been continuously measured. This is not so easy in the presence of bilateral haematomas or hygromas without disturbing the haematomas. Rando and Fishman state that a carefully performed lumbar puncture is critical for the diagnosis, which is based on a CSF-pressure of about 6 cm H_2O or less. In many cases the pressure is so low that there is no spontaneous drainage of CSF. Aoki *et al.* clearly state why they have refrained from doing a lumbar puncture. The reason is that they also considered the possibility of common chronic subdural haematoma, just as Neil-Dwyer has argued. I cannot blame the authors for not doing the LP. It is a pity that they did not perform radio-isotope cisternography, but they did carry out a whole spinal MRI-sudy.

Reviewer X is of the opinion that the condition should be treated as a chronic subdural haematoma until proved otherwise, and this is just what the authors did, namely, they used their special needle devised for percutaneous subdural tapping. Since this is such an easy method they argue for this procedure in their article as a method for measuring the pressure. But, if it had been an ordinary subdural haematoma, the fluid would have drained from the needle and the condition would have been treated according to the wish of Reviewer X. In this case, no fluid came out thereby confirming the suspicion of the authors of a low pressure syndrome.

As shown by Fig. 1, the subdural fluid collections are rather small, even so small that, in our clinic, we would not have rushed to evacuate these collections. In contrast to the small volume of the hygromas is the MRI-picture which, according to Rappaport, is increasingly recognized as typical of intracranial hypotension.

The authors treated their patient in the usual way by bedrest, analgesics and hydration, before they finally resorted to the method of epidural saline infusion as described by Gibson *et al.* in 1988 and reviewed by Rando and Fishman.

C. Avezaat

Correspondence: Nobuhiko Aoki, M.D., Department of Neurosurgery, Tokyo Metropolitan Ohkubo Hospital, 44–1, Kabuki-cho, 2-chome, Shinjuku-ku, Tokyo 160, Japan.