Clinical Neurology and Neurosurgery 114 (2012) 211–216

Contents lists available at SciVerse ScienceDirect

Clinical Neurology and Neurosurgery

journal homepage: www.elsevier.com/locate/clineuro

Treatment of traumatic acute subdural hematoma in adult hydrocephalus patients with cerebrospinal fluid shunt

Katsumi Hoya*, Yoshihiro Tanaka, Takanori Uchida, Issei Takano, Masaya Nagaishi, Kazuma Kowata, Akio Hyodo

Department of Neurosurgery, Dokkyo Medical University Koshigaya Hospital, 2-1-5 Minami-Koshigaya, Koshigaya 343-8555, Japan

ARTICLE INFO

Article history:
Received 3 July 2010
Received in revised form 15 August 2011
Accepted 8 October 2011
Available online 24 October 2011

Keywords:
Head injury
Lumbo-peritoneal shunt
Hydrocephalus
Acute subdural hematoma
Ventriculo-peritoneal shunt

ABSTRACT

Objective: The presence of a cerebrospinal fluid (CSF) shunt is a predisposing factor for the development of subdural hematoma (SDH) in patients with hydrocephalus. However, few reports have addressed how patients with a CSF shunt should be treated in the event of traumatic acute SDH. The purpose of this study was to show how post-traumatic management of CSF shunt affects acute SDH in adult patients with hydrocephalus.
Methods: Twelve patients were studied retrospectively. Pressure settings of shunt valve prior to head injury (HI), severity of HI, treatment on admission, changes in SDH thickness and subsequent hydrocephalus were mainly analyzed.
Results: Ten patients experienced mild HI, with nine showing neurological deterioration until admission. Five patients needed surgical hematoma removal soon after admission. SDH recurred in four cases where shunt pressure levels were kept relatively low. Shunt ligation or raising the pressure level in the programmable valve proved effective for controlling postoperative SDH in such cases. Six of the remaining seven patients underwent only shunt ligation or readjustment of pressure level in the programmable valve on admission. SDH thickness was reduced as ventricles dilated without major neurological complications. Four patients showed delayed development of SDH even though shunts were kept ligated.
Conclusions: Hematoma removal alone may result in hematoma recurrence and require a second treatment comprising shunt management to effectively control hematoma. Using shunt management as the only initial treatment can reduce hematoma volume, but some patients may suffer delayed SDH development and require surgery.

1. Introduction

Patients treated with cerebrospinal fluid (CSF) shunt for hydrocephalus often present with non-traumatic subdural hematoma and hygroma. A number of reports have noted that mild head injuries can give rise to severe intracranial hemorrhage among individuals with CSF shunt [1–7]. This indicates that CSF shunt is a predisposing factor for the onset and development of traumatic intracranial hemorrhage [8]. We have encountered 12 cases of adult traumatic acute subdural hematoma (SDH) in patients with hydrocephalus that had been treated using a CSF shunt. We conducted precise follow-up of SDH and hydrocephalus in these cases using serial examinations with computed tomography (CT), and studied how post-traumatic shunt management affected radiological and neurological manifestations. We also report cases in which development of SDH was delayed once the hematomas were reduced while the shunt was ligated.

2. Patients and methods

We reviewed hospital records between April 1999 and January 2009 from the Department of Neurosurgery at Dokkyo Medical University Koshigaya Hospital for adult traumatic patients with placement of a CSF shunt for hydrocephalus. Twelve patients with acute SDH were identified.

The following data were retrospectively reviewed:

1. Patient background, including age, sex, underlying pathology that had caused hydrocephalus, type of shunt, and pressure level of the shunt valve at the time of head trauma.
2. Causes of head injury (HI), consciousness status just after the injury, duration from injury until admission, neurological manifestations.

* Corresponding author at: Department of Neurosurgery, Teikyo University Chiba Medical Center, 3426-3, Anesaki, Ichihara, Chiba 299-0111, Japan.
Tel.: +81 436 62 1211; fax: +81 436 62 1357.
E-mail address: khoya@med.teikyo-u.ac.jp (K. Hoya).

0303-8467/$ – see front matter © 2011 Elsevier B.V. All rights reserved.
doi:10.1016/j.clineuro.2011.10.002

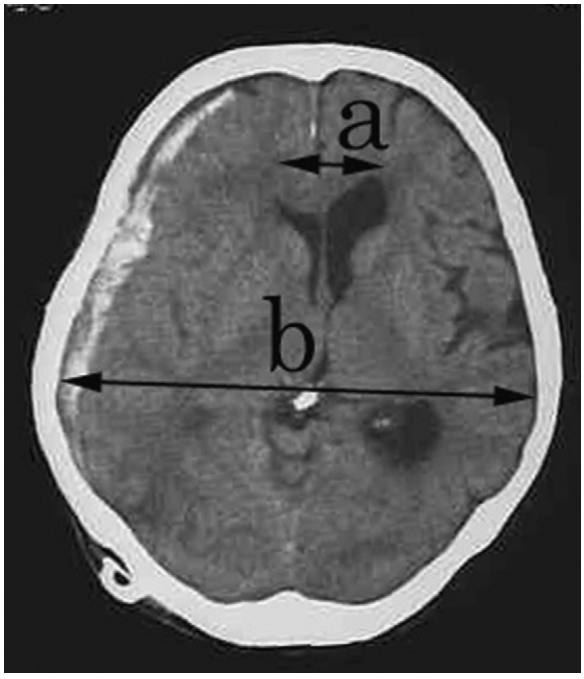

Fig. 1. The method to measure width of the anterior horns of the lateral ventricles in the shifted brain. Evans' score was calculated as *a*/*b*.

3. Treatments performed just after admission.
4. SDH thickness and hydrocephalus evaluated on CT. Hematoma thickness was followed up using the same axial section in which maximal thickness was observed on admission. If the SDH was bilateral, the sum of right and left thicknesses was followed at the section where the sum was maximal on admission. Evans' score was calculated to evaluate hydrocephalus. When the anterior horns of the lateral ventricles were shifted by hematoma, measurement was performed as shown in Fig. 1. Changes in neurological status and additional treatments were also reviewed.
5. Outcomes at discharge evaluated with Glasgow outcome scale (GOS). We analyzed whether performance levels deteriorated by comparing levels before HI and at discharge.

This study was approved by the ethics committee of Dokkyo Medical University and was carried out in accordance with the Declaration of Helsinki. Informed consent was obtained from each patient or their authorized guardian.

3. Results

3.1. Patient backgrounds

Subjects comprised six women and six men, with a mean age of 64.4 years (range, 39–88 years). All cases in the present study had communicating hydrocephalus. Hydrocephalus in nine patients was secondary to subarachnoid hemorrhage or hypertensive intracerebral hemorrhage. Three patients had suffered idiopathic normal pressure hydrocephalus (iNPH). Shunt type was ventriculo-peritoneal (V-P) in 10 patients and lumbo-peritoneal (L-P) in two patients. Devices used and pressure levels of shunt valves at the time of injury are shown in Table 1. Pressure levels were set as low in ten patients. Two patients had other predisposing factors (hemodialysis for chronic renal failure in Case 1; warfarin administration in Case 10).

3.2. Traumatic data

All patients were admitted within 48 h (median, 7 h) after head injury. Two patients (Cases 2 and 8) were found unconscious and thought to have suffered severe head injuries. Conversely, ten patients suffered mild injuries, and did not show any apparent disturbance of consciousness just after the traumatic episode. Nine of the ten showed neurological deterioration during the interval until admission. Data are summarized in Table 2.

3.3. Changes in SDH thickness, hydrocephalus, and neurological status

A flow chart showing the courses of all patients is shown in Fig. 2. Five patients underwent emergency hematoma removal (Cases 1–5). Craniotomy was performed in four cases, and drainage through a burr hole was performed in one case where CT disclosed acute SDH mixed with chronic SDH. These patients did not undergo shunt readjustment or ligation on admission.

Four of the five patients showed hematoma re-enlargement (Cases 1–4), with three needing reoperation after the initial intervention. Shunt ligation (Cases 2–4) or resetting of the programmable valve at the highest pressure level (Case 1) was performed for these four patients. All of these patients showed ventricular enlargement and subsequent hematoma reduction. One patient (Case 5) showed no recurrence of hematoma, but the cerebral hemisphere remained depressed and shifted to the contralateral side even after hematoma removal. Convulsive seizures continued until shunt ligation and ventricular enlargement allowed the brain to recover from the distorted shape.

Table 1
Patient backgrounds.

Case	Age (years)	Sex	Cause of hydrocephalus	Type of CSF shunt	Shunt valve	Pressure level	Predisposing factors
1	58	M	SAH	V-P	Codman Hakim	80 mmH_2O	Hemodialysis
2	64	F	SAH	V-P	Delta	Performance level 0.5	
3	64	M	SAH	V-P	Dual switch valve	Opening pressure 100 mmH_2O	
4	88	F	iNPH	L-P	Strata	Performance level 0.5	
5	67	M	HICH	V-P	Delta	Performance level 0.5	
6	84	F	SAH	V-P	Strata	Performance level 0.5	
7	64	M	SAH	L-P	Strata	Performance level 1.0	
8	61	M	SAH	V-P	Delta	Performance level 0.5	
9	39	F	SAH	V-P	Delta	Performance level 0.5	
10	62	F	HICH	V-P	Strata	Performance level 0.5	Taking warfarin
11	73	M	iNPH	V-P	Strata	Performance level 1.0	
12	49	F	SAH	V-P	Delta	Performance level 0.5	

SAH, subarachnoid hemorrhage; HICH, hypertensive intracerebral hemorrhage; iNPH, idiopathic normal pressure hydrocephalus; CSF, cerebrospinal fluid; F, female; M, male; V-P, ventriculo-peritoneal; L-P, lumbo-peritoneal. Codman Hakim valves are a product of Codman (Raynham, MA). Strata and Delta valves are a product of Medtronic (Minneapolis, MN). Dual switch valves are a product of Kaneka Medical (Tokyo, Japan).