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Case study

Chronic subdural hematoma: Differences between unilateral and bilateral occurrence

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ABSTRACT

Chronic subdural hematoma (CSDH) is one of the most common neurological diseases. However, bilateral CSDH is more infrequent than unilateral CSDH, and the clinical and radiological characteristics are not well-defined. We aimed to investigate the clinical and radiological differences between bilateral and unilateral CSDH. A retrospective study was performed on 75 surgically-treated CSDH patients from January 2011 to December 2015. These patients were divided into unilateral and bilateral CSDH groups. The clinical features, radiological findings, surgical outcome, occurrence of postoperative intracranial bleeding, and recurrence were analyzed. 30.7% of patients had bilateral CSDH. The mean age was 79 years and 68.8 years for the bilateral and unilateral CSDH patients, respectively ($p = 0.001$). The presence of a history of alcohol abuse was 8.7% and 32.7% in the bilateral and unilateral CSDH patients, respectively ($p = 0.028$). The patients with bilateral CSDH were more likely to present with nausea or vomiting ($p = 0.048$). A lesser degree of midline shift on computed tomographic (CT) scan was also observed in the bilateral group ($p = 0.001$). Most patients had a favorable postoperative outcome, even with bilateral CSDH. In this study, we found that the patients with bilateral CSDH were older, had a lower prevalence of a history of alcohol abuse, presented more commonly with nausea or vomiting, and had a lesser degree of midline shift on CT. Burr-hole craniostomy with a closed-drainage system is a feasible and effective surgical technique for the treatment of unilateral or bilateral CSDH.

1. Introduction

Chronic subdural hematoma (CSDH), a progressive collection of unabsorbed and liquefied hematoma in the subdural space, is one of the most common diseases requiring neurosurgical intervention [1]. Generally, CSDH is considered a delayed manifestation of head trauma and is mostly encountered in older patients [2–4]. However, the presence of head trauma is only identified in 50–80% of patients with CSDH [1–3,5–7]. Other predisposing factors, including antiplatelet/anticoagulant therapy, a history of alcohol abuse, liver disease, and renal disease with hemodialysis, have been thought to contribute the development of CSDH [2,6,7]. Although various surgical techniques, such as twist-drill craniostomy, burr-hole craniostomy, an endoscopic approach, and minimally-open or open craniotomy, have been introduced to treat symptomatic CSDH, and favorable outcomes have been reported in the main in terms of postoperative neurological performance [6,8–10].

CSDH is commonly associated with brain atrophy, and is attributable to hemorrhaging from a tear in the bridging vein after initial head trauma [11]. Although osmotic theory and the theory of recurrent bleeding from the capsule of the hematoma are generally hypothesized to promote CSDH formation [4,12], the true pathophysiological mechanism remains unclear. The annual incidence of CSDH has been estimated to be approximately 1.7 to 18 per 100,000 in the whole population, and the incidence greatly increases with age, from 3.4 per 100,000 in patients younger than 65 years to 8–58 per 100,000 in patients older than 65 [2,9,13–15].

Bilateral CSDH, which accounts for approximately 14–25% of all CSDH, is thought to be a distinct entity from unilateral CSDH [16,17]. However, their differences have rarely been discussed in the literature, and only five retrospective studies have been reported [5,16–19]. Therefore, in this study, we aimed to clarify the differences between unilateral and bilateral CSDH with regards

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to predisposing factors, clinical presentation, radiological findings, neurological outcomes, and recurrence.

2. Material and methods

2.1. Patient selection

In this retrospective study, we reviewed the medical charts from January 2011 to December 2015 of patients who underwent surgical treatment for CSDH in our institute. Our study was approved by the Institutional Review Board of Cathay General Hospital (CGH-P105023). The inclusion criteria were as follows: (1) CSDH confirmed by computed tomographic (CT) scan of the brain without contrast; and (2) hematoma was surgically treated using burr-hole craniostomy with a closed-drainage system. The exclusion criteria included (1) concomitant occurrence of other types of traumatic brain injury; (2) performance of previous neurosurgical procedures such as craniotomy or shunting; and (3) missing data or images. In total, 75 patients were enrolled in this study.

2.2. Clinical assessment

The clinical demographics of the 75 patients were documented, including occurrence of head trauma event, underlying disease, and current anticoagulant or antiplatelet therapy. Clinical presentations, such as headache, dizziness, nausea, vomiting, consciousness change, motor dysfunction, seizure episode, unsteady gait, or speech problem, were recorded. Preoperative neurological function was determined using the Glasgow Coma Scale (GCS) and the Markwalder grading scale, a neurological grading system specifically designed for patients with CSDH [20]. The postoperative neurological performance of the patients was evaluated using the Glasgow Outcome Scale (GOS) [21], modified Rankin Scale (mRS) [22], and Markwalder grading scale at the final clinic visit. Occurrence of postoperative acute intracranial bleeding following surgical treatment for CSDH was recorded. Recurrence of CSDH following initial treatment was defined as patients who experienced symptomatic worsening attributable to CT-confirmed reaccumulation of ipsilateral CSDH after the initial surgery, and those who required repeat surgery.

2.3. Radiological assessment

All patients underwent brain CT scan to confirm the diagnosis of CSDH. The following CT findings were recorded: (1) the unilateral or bilateral location of the hematoma; (2) the maximal thickness of the unilateral or bilateral CSDH; (3) the midline shift, as measured from the deviation of the septum pellucidum from the central position, a "marked midline shift" being defined as a central deviation greater than 5 mm; (4) the CT density of the hematoma, classified as hypodensity, homogenous isodensity, layered type, or mixed type [23].

2.4. Surgical procedure

Under local or general anesthesia, all patients underwent burr-hole drilling to the side of the CSDH and at the central location of maximal thickness of the hematoma. After opening the dura and outer membrane of the hematoma, the subdural compartment was irrigated with normal saline and a closed drainage system was placed within the subdural space. The drainage tube was removed when drainage fluid no longer drained out or when the amount decreased to fewer than 50 ml per day.

2.5. Statistical methods

Statistical analyses were performed using SPSS version 22.0 software. The patients were divided into two groups: unilateral and bilateral CSDH occurrence. Comparisons between the two groups were made using the independent-sample Student *t*-test, Fisher's exact test and cross-table analysis. Differences were considered statistically significant if the p value was less than 0.05.

3. Results

3.1. Predisposing factors

Among the 75 enrolled patients, unilateral and bilateral CSDH occurred in 52 (69.3%) and 23 (30.7%) patients, respectively. Their demographic data and clinical characteristics are summarized and analyzed in Table 1. The mean age of the entire study population was 71.9 ± 12.5 years. The mean period of postoperative follow-up was 8.25 ± 11.8 months. The ratio of male to female patients was 2.41. Thirty-eight patients (50.7%) had suffered a definite head trauma event, the majority of which were accidents in which the patient fell down. Hypertension was the most common co-existing systemic disease, which was present in 45 patients (60%). 13 (24%) and 7 patients (30.4%) had been prescribed antiplatelet/anticoagulant medication in the unilateral and bilateral CSDH groups, respectively. However, statistically significant differences between the unilateral and bilateral CSDH groups were observed in terms of age and the presence of a history of alcohol abuse. Compared with the unilateral group, the patients with bilateral CSDH were older (79 years vs. 68.8 years, $p = 0.001$), but alcohol abuse was less prevalent (8.7% vs. 32.7%, $p = 0.028$). Other clinical demographic characteristics, including gender, head trauma history, and antiplatelet/anticoagulant therapy, did not present a statistically significant group difference.

3.2. Clinical presentation

Among the entire study group, the most common clinical presentations included disturbed consciousness (36%), motor weakness (36%), and headache (21.3%) (Table 2). The majority of patients exhibited a preoperative neurological performance of a GCS of 13–15 (69.3%) and grade 0–2 on the Markwalder grade scale (78.7%). All clinical presentations and neurological performances in the two groups were similar, the only exception being that the patients with bilateral CSDH were more likely to present with nausea or vomiting (13% vs. 1.9%, $p = 0.048$).

3.3. CT scan

The CT scan findings are summarized in Table 3. Among all 75 patients, a marked midline shift was present in 41 patients (54.7%). 33 patients (44%) had a mixed-type CSDH, and the mean maximal thickness of the hematoma was 20.19 ± 7.28 mm. Comparing the two groups, the mean midline shift was much more obvious in the unilateral group (8.7 ± 5.2 mm vs. 4.1 ± 5.2 mm, $p = 0.001$), and a marked midline shift was also much more prevalent in the unilateral group (69.2% vs. 21.7%, $p < 0.001$). The density types of the hematoma and the mean maximal thickness of the hematoma did not differ in terms of statistical significance between groups.

3.4. Postoperative recovery

Postoperative neurological function, as measured using the GOS, mRS and the Markwalder grade scale, in the unilateral and