Injury, Int. J. Care Injured 45 (2014) 1327–1331

Contents lists available at ScienceDirect

Injury

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

Volume of chronic subdural haematoma: Is it one of the radiographic factors related to recurrence?

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ARTICLE INFO

Article history:
Accepted 16 February 2014

Keywords:
Chronic subdural haematoma
Volume
Burr hole
Computed tomography
Recurrence

ABSTRACT

Background: Recurrence of chronic subdural haematoma (CSDH) is a significant issue in neurosurgical practice, and to distinguish individuals at high risk is important. In this study, we aim to clarify the relationship between quantitative haematoma volume and recurrence of CSDH.
Methods: For this two-year retrospective study, 94 patients with CSDH were enrolled and all underwent burr-hole craniostomy with closed-system drainage. The volume of haematoma before surgery was quantitatively analysed by computed tomography (CT) of the brain. The patients were subdivided into 2 groups based on whether recurrence of CSDH was present or not. We investigated the intergroup differences in the volume of haematoma and other radiographic parameters.
Results: Recurrence of CSDH was identified in 13 of 94 patients (14%). Univariable analysis of CT features revealed significant differences in the volume of haematoma, bilateral cerebral convexity, and layering of the haematoma. To adjust for the confounding effect, these 3 parameters were entered into multivariable logistic regression analysis. Ultimately, neither the volume of haematoma ($p = 0.449$) or bilateral cerebral convexity ($p = 0.123$) was relevant in this model. Only the presence of layering of the haematoma was independently associated with recurrence of CSDH ($p = 0.009$).
Conclusion: The volume of CSDH is not related to recurrence in patients undergoing burr-hole craniostomy with closed-system drainage. Layering of the haematoma was the only independent risk factor on CT images for recurrence of CSDH in our series.

Introduction

Chronic subdural haematoma (CSDH) is a common form of intracranial haemorrhage that is often preceded by minor head trauma, resulting in a collection of subdural blood. Treatment for this condition is generally surgical evacuation, for which, burr-hole craniostomy with closed-system drainage is the most commonly used technique worldwide [1–3]. Improvement in the prognosis of CSDH can be achieved after surgery, and this surgical condition is considered to be a relatively benign entity of neurotrauma. However, a significant recurrence rate, ranging from 10% to 20%, is still reported [3–5]. Thus, the ability to distinguish individuals at risk of recurrence is important for informing further follow-up and management.

Computed tomography (CT) of the brain, as the first choice of examination in patients with CSDH, provides essential diagnostic details with therapeutic implications. Several radiographic factors associated with recurrence of CSDH have been documented [5–7]. Quantitative analysis of intracranial haematoma volume can be accomplished using current imaging methods. This raises the issue of whether the volume of CSDH is relevant to recurrence following surgical drainage.

In this study, we retrospectively collected the clinical and radiographic parameters of patients undergoing burr-hole evacuation with closed-system drainage for CSDH. Our goals were to characterise the relationship between volume of CSDH and recurrence, and also identify other CT factors that carry a potential risk of recurrence.

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http://dx.doi.org/10.1016/j.injury.2014.02.023
0020–1383/

Materials and Methods

Data collection

This retrospective cohort study was carried out at Kaohsiung Chang Gung Memorial Hospital, a medical centre in Taiwan. After obtaining consent from the institutional review board, we reviewed the records of patients that had undergone burr-hole craniostomy with closed-system drainage for CSDH from January 2005 to December 2006. Inclusion criteria for CSDH were as follows: CT scan showed isodense to hypodense haematomas with respect to the adjacent brain; and when the haematoma was fluid identified at the time of surgery [8]. Ninety-four patients were enrolled for analysis. Trained research staff collected detailed clinical data, including the patients' demographic information, underlying medical diseases, Glasgow Coma Score (GCS), and Markwalder Subdural Haematoma Grade [9].

CT studies and features

The patients received a CT scan of the brain at admission. We measured the volumes of haematoma from the CT scans; all of these measurements were performed using the PACS imaging display software (Centricity RA1000, GE Healthcare, Taipei, Taiwan). The volume measurement was hand-traced by the radiologist on each axial image, and then these areas were added together and multiplied by the slice thickness. Other CT features that were evaluated included: the site of the haematoma (unilateral or bilateral cerebral convexity); midline shift identified as deviation of the septum pellucidum by more than 1 cm from the central position; layering of the haematoma, defined as containing 2 components of different densities with a clear boundary between them; and multiplicity of haematoma cavities, defined as a haematoma with inhomogeneous content and a high-density septum running between the inner and outer membranes [10]. Brain atrophy was classified into 3 stages: no or mild atrophy, definite atrophy such as dilated sulci, and severe atrophy such as widely dilated sulci and subdural space [11]. We also measured the Hounsfield units (HU) of the haematomas at the sites of highest density.

Surgical techniques

The surgical procedure was performed using 1 or 2 burr holes at each affected side of the CSDH for irrigation of the haematoma. All the patients underwent closed-system drainage. The drains were removed once drainage had stopped or the patients showed improvement in initial symptoms. Craniotomy was reserved for patients in whom the subdural haematoma was recurrent and the underlying membranes prevented adequate re-expansion of the brain.

Recurrence of CSDH

The patients were followed up at the outpatient department after discharge. The clinical and radiological criteria were integrated to evaluate CSDH recurrence. Reappearance of symptoms such as haemiparesis, headache, or change in consciousness indicated the accumulation of subdural haematoma. The radiological criteria consisted of an increase in the thickness of the haematoma and a change in the density of the haematoma on the treated side in follow-up CT scans within 3 months postoperatively [12]. Neurological outcome was assessed at the end of the follow-up period using the Glasgow Outcome Scale (GOS).

Statistical analysis

Data were analysed using SPSS version 20.0 (IBM SPSS Statistics). Descriptive statistics were presented as frequencies (percentages) or as mean and standard deviation (SD). Categorical variables were compared using the chi-square test or Fisher's exact test. Continuous variables were assessed using the Student's *t*-test or Mann–Whitney *U*-test. Multivariable logistic regression was performed to adjust for independent risk factors of recurrence of CSDH, and the results were expressed as odds ratios with 95% confidence intervals. A p value of less than 0.05 was considered statistically significant.

Results

The 94 patients who underwent burr-hole craniostomy for CSDH included 79 (84%) males and 15 (16%) females. The mean age was 69.4 (SD 12.9) years (range, 29–93 years). Seventy (75%) patients had a history of head injury. With regard to underlying medical diseases 27 (29%) of the patients had diabetes mellitus, 47 (50%) had hypertension, 2 (2%), end stage renal disease, 8 (9%), coronary artery disease, 16 (17%), stroke, 7 (7%), dementia, and 14 (15%) patients had alcoholism. Twelve (13%) and 2 (2%) patients received antiplatelet and anticoagulant therapy, respectively. The presenting symptoms included 38 (40%) cases of headache, 23 (25%) of nausea or vomiting, 50 (53%) of haemiparesis, 45 (48%) of mental change, and 4 (4%) of seizure. At admission, neurological assessment before surgery showed 90 (96%) patients with a GCS of 9–15, 3 (3%) with a GCS of 6–8, and 1 (1%) with a GCS of 3–5. The number of patients with Markwalder Subdural Haematoma Grade 0, 1, 2, 3, and 4 was 5, 13, 71, 4, and 1, respectively.

Fig. 1 shows the distribution of the volume of CSDH for the 94 patients. The mean volume of CSDH was 119.6 (SD 62.2) ml (range, 19.5–343.8 ml). The mean density of the haematoma was 35.2 (SD 11.3) HU (range, 11.0–57.0 HU). The individual CT scan characteristics included 24 (26%) bilateral CSDH, 39 (42%) midline shifts, 20 (21%) layering of the haematoma, and 35 (37%) multiplicity of haematoma cavities. The status of brain atrophy was no or mild, definite, and severe in 31 (33%), 42 (45%), and 21 (22%) patients, respectively. The feature-specific number and frequency of CT scans are summarised in Table 1.

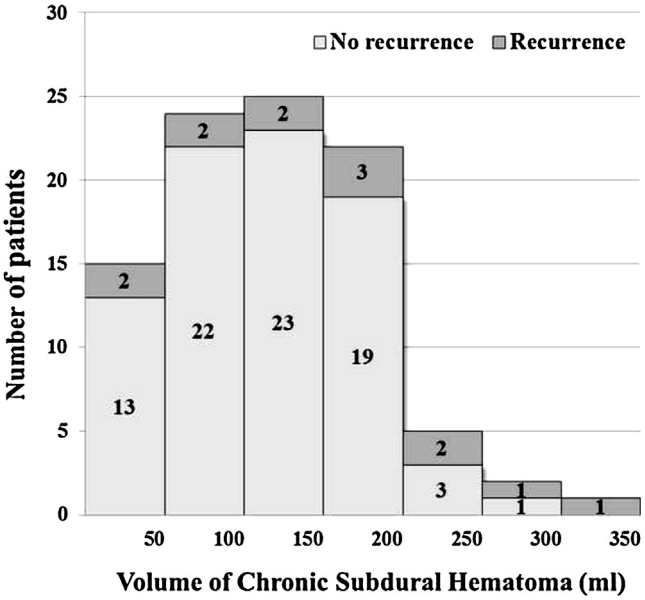

Fig. 1. Distribution of volume of chronic subdural haematoma.