Journal of Clinical Neuroscience 22 (2015) 1895–1900

Contents lists available at ScienceDirect

Journal of Clinical Neuroscience

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

Clinical Study

Predictors of functional outcomes and recurrence of chronic subdural hematomas

Henri-Arthur Leroy [a,*], Rabih Aboukaïs [a], Nicolas Reyns [a], Philippe Bourgeois [a], Julien Labreuche [b], Alain Duhamel [b], Jean-Paul Lejeune [a]

[a] Department of Neurosurgery, Lille University Hospital, Rue Emile Laine, 59037 Lille Cedex, France
[b] Department of Biostatistics, University of Lille Nord de France, Lille University Hospital, France

ARTICLE INFO

Article history:
Received 12 January 2015
Accepted 18 March 2015

Keywords:
Chronic
CT scan
Functional outcome
Recurrence
Subdural hematoma

ABSTRACT

We aimed to evaluate the functional outcome and risk factors of recurrence in patients operated on for a chronic subdural hematoma (CSH), and discuss systematic early postoperative CT scans. CSH is a very common disease in neurosurgical practice, especially in elderly patients who are treated with anticoagulation. The challenge is to rapidly restore the independence of these patients. We retrospectively analyzed data from 164 consecutive surgical procedures performed on 140 CSH patients, including recurrent surgery, at our institution from June 2011 to June 2012. Pre- and postoperative CT scans, and medical records, were systematically reviewed using the institutional computing database. A poor functional outcome was defined by a modified Rankin scale (mRS) score > 2 at 3 months. Among the 140 patients (mean age 76 years; 64% men), a single burr hole craniostomy was performed in 122 patients, and a craniotomy in 18. A poor functional outcome was recorded in 39 patients (28%; 95% confidence interval [CI] 20–35%). In multivariate analyses, an increased risk of poor functional outcome was associated with age >75 years (odds ratio [OR] 5.88; 95% CI 1.96–17.63), residual hematoma thickness >14 mm (OR 3.79; 95% CI 1.47–9.77), and GCS < 15 (OR, 2.96; 95% CI, 1.18–7.40). Recurrences occurred in 24 patients (17%; 95% CI 11–23%), with a median delay to reintervention of 13 days. The independent predictors of CSH recurrence were preoperative anticoagulant therapy (OR 3.68; 95% CI 1.13–12.00), and persistence of mass effect on the postoperative CT scan (OR 5.61; 95% CI 1.52–20.66). Three months after surgical treatment, more than one quarter of the CSH patients had a mRS ⩾ 3. The loss of independence was associated with older age, initial GCS < 15, and residual hematoma thickness postoperatively. Anticoagulant therapy and persistence of postoperative mass effect heightened the risk of recurrence.

1. Introduction

Chronic subdural hematoma (CSH) is a very common disease in neurosurgery, especially in elderly patients who are on anticoagulation treatment [4]. The incidence of this pathology is rising because of an ageing population [6]. In the USA, 286 per 100,000 people over the age of 80 years are affected [19]. CSH surgery is one of the most frequent procedures in daily neurosurgical practice. However, more guidelines are required to improve the management of this disease. The challenge is to rapidly restore the functional independence of these fragile patients in order to avoid prolonged institutional stays. With cost efficiency in mind, the role of early postoperative CT scans is still to be evaluated for the management of CSH patients. Planning for follow-up imaging should be considered, because of the high recurrence rate. Our study aimed to evaluate the predictive factors of a poor functional outcome and recurrence in CSH patients.

2. Materials and methods

2.1. Patient consent

Patients were informed that their clinical data could be used for medical research. Our Institutional Review Board for protection of patients approved this study.

2.2. Patient selection

We retrospectively reviewed all patients who were operated on for CSH at our institution between June 2011 and June 2012. Our university hospital is the main referral center for neurosurgery in

* Corresponding author. Tel.: +33 3 20 44 54 55; fax: +33 3 20 44 66 23.
E-mail address: henriarthurleroy@gmail.com (H.-A. Leroy).

http://dx.doi.org/10.1016/j.jocn.2015.03.064
0967-5868/

the north of France, serving a population area of 4 million. The institutional computing database was used to identify patients who received operations during the specified period, based on the International Classifications of Diseases coding system. All patients operated on for a CSH, unilateral or bilateral, were systematically included. The patients who had subacute subdural hematomas were not included. Any patients under 15 years of age, or with preoperative coagulopathy (advanced cirrhosis), severe neurodegenerative diseases, or initial modified Rankin scale (mRS) scores of 5, were not included. Surgical intervention was considered when mass effect on the surrounding brain tissue resulted in symptomatology. Before surgery, the patients were systematically evaluated for coagulopathies with standard bioassays including: prothrombin time, activated partial thromboplastin time, and the international normalized ratio (INR) test if the patient was on oral anticoagulation therapy. For patients on platelet inhibition treatment, a delay of 4 to 5 days was made before surgery. Among this specific group of patients, when rapid neurological deterioration occurred, platelet transfusions were administered. A single burr hole craniostomy under local anesthesia, or a craniotomy under general anesthesia, was performed. The same closed drainage system was used in both treatments. All patients received preoperative antibiotic prophylaxis based on a second generation cephalosporin. A non-suction subdural drain was left in place for 48 hours after surgery, following our standard of care [25].

2.3. Data collection

The demographic and medical history data, clinical presentation (recent head trauma, Glasgow coma score at admission, focal neurologic deficit, and seizure) were extracted using our institutional computing database. All preoperative CT scans and early postoperative CT scans (prior to postoperative day 5) were retrospectively reviewed by one neurosurgeon (H-A.L.). On the preoperative CT scans, mass effect, defined as a midline deviation; homogeneity (single density without partitioning) and laterality of hematoma, was recorded, and we specified the operated side in patients with bilateral CSH. On the early postoperative CT scans, the maximal thickness of the residual hematoma, the presence of rebleeding, the persistence of mass effect and partitioning membranes were recorded. The persistence of mass effect refers to a residual hematoma, causing mass effect on the cortex, with or without midline shift. A sunken hemisphere without appreciable residual hematoma was not considered as persistence of mass effect. The clinical outcome was assessed by a neurosurgeon, using the mRS, during the 3 month follow-up examination (H-A.L.).

2.4. Outcome definitions

The primary end point of this series was the percent of patients with a poor functional outcome, defined as a mRS score $\geqslant 3$. The secondary end point was the recurrence of CSH, defined as surgical reintervention during follow-up.

2.5. Statistical analyses

Data are presented as the mean ± standard deviation, or median (interquartile range) for continuous variables, and number (percentage) for categorical variables. Bivariate comparisons between patients, with and without poor functional outcome, were made using chi-squared tests (Fisher's exact test was used when the expected cell frequency was <5) for categorical variables, and Student's t-test for continuous variables. Receiver operating characteristics (ROC) curve analyses were carried out to estimate the optimal cut-off value of continuous factors (age and residual hematoma thickness) for discriminating outcome. We determined the optimal thresholds by maximizing the Youden index. The factors associated with poor functional outcome in the bivariate analysis ($p < 0.10$), were implemented in multivariate logistic regression analysis. Using the same approach, we studied the independent predictors of CSH recurrence. Statistical testing was done at the two-tailed α level of 0.05. The data were analyzed using the SAS software package (release 9.3; SAS Institute, Cary, NC, USA).

3. Results

During the study period, 164 surgical procedures were performed for 140 consecutive patients, of whom 64% were men, and the mean age at diagnosis was 76 years (range: 42–95). Anticoagulant and antiplatelet therapies were being used by 20 and 29% of patients, respectively. A recent trauma was recorded in 61% of patients, and an abnormal GCS (<15) in half. A homogeneous hematoma and midline deviation were noted on the preoperative CT scans of 78% and 74% of patients, respectively. There were bilateral hematomas in 37 patients (26%), of whom, 13 were treated on only one side. A single burr hole craniostomy was performed in 122 patients (87%), and a craniotomy in 18 (13%). On the postoperative CT scan, persistent mass effect was documented in 49% of patients, rebleeding in 18%, and partitioning membranes in 6%. The mean residual thickness of the hematomas was 15.5 mm (range: 2.3–32.5).

After a median follow-up of 83 days (range: 47–122), 39 patients (28%; 95% confidence interval [CI] 20–35%) had a poor functional outcome. The patients with poor outcomes were significantly older, more often had preoperative GCS scores <15, and a greater residual hematoma thickness than the patients with good outcomes (Table 1). The rate of poor outcomes increased gradually with quartiles of age and residual hematoma thickness (Fig. 1). The ROC analyses showed that the optimal threshold to predict poor functional outcome was age >75 years (sensitivity 85%; specificity 51%), and residual hematoma thickness >14 mm (sensitivity 74%; specificity 54%). In the multivariate analyses, age >75 years, residual hematoma thickness >14 mm, and a GCS score <15 remained to be significantly associated with poor outcomes (Fig. 2A). Similar results were found when age and residual hematoma thickness were introduced as continuous variables (data not shown). No difference in outcomes was found between unilateral or bilateral CSH ($p = 0.15$), or between single burr hole treatments and craniotomies ($p = 0.57$; Table 1). Concerning the presence of partitioning membranes, no difference in outcomes was observed ($p = 0.69$).

During the follow-up period, 24 patients (17%; 95% CI 11–23%) had a recurrence of CSH, which was treated within a median delay of 13 days after the initial surgery (range: 7–32). Among these 24 patients, a craniostomy or craniotomy was performed in 12 patients each. Table 2 shows the baseline characteristics, and the pre- and postoperative CT scan findings in patients with and without CSH recurrence. CSH recurrences were significantly more frequent in the patients who had persistent mass effect on their postoperative CT scan, than in those without (77% *versus* 43%; $p = 0.004$). In addition, there were more men with recurrent CSH, and the men were also more frequently on preoperative anticoagulant therapy and had higher residual hematoma thickness (Table 2). In the multivariate analyses, mass effect and preoperative anticoagulant therapy were associated with an increased risk of recurrence; for mass effect (odds ratio [OR] 5.61; 95% CI 1.52–20.66; $p = 0.01$), and for preoperative anticoagulant therapy (OR 3.68; 95% CI 1.13–12.00; $p = 0.03$). A borderline association was found with sex (OR 2.92; 95% CI 0.93–9.15; $p = 0.07$), but not with residual hematoma thickness ($p = 0.77$). The patients with CSH recurrence had poor outcomes more often than the patients