Local Coagulofibrinolysis in the Postsurgical Recovery of Patients with Chronic Subdural Haematoma

M. Matsumoto, Y. Sakata, T. Yamazaki, G. Endo, H. Ohishi, and N. Takasu

Department of Neurosurgery, Sakura Hospital, Toho University, School of Medicine, Sakura, Japan

Summary

Postoperative recovery of patients with chronic subdural haematoma (CSH) was investigated by comparing pre- and postoperative coagulant and fibrinolytic activity in the haematoma contents of 15 patients with CSH. Patients in this study were treated draining the haematoma cavity without irrigation, a procedure dubbed the closed drainage. Haematomas were collected during, and 24 hrs after, surgery. Postoperative fibrinolytic activity was lower than that observed pre-operatively. In particular, levels of tissue plasminogen activator activity (TPA), and fibrin and fibrinogen degradation products (FDP) all decreased. In contrast, coagulant activity increased postoperatively.

This paper will discuss the role of local coagulofibrinolysis in the postoperative recovery of CSH patients.

Keywords: Chronic subdural haematoma; postoperative recovery local coagulofibrinolysis; TPA; haemostasis.

Introduction

Although the causes of chronic subdural haematoma (CSH) are not well understood, it has been reported that local hyperfibrinolysis prevents haemostasis and results in continued bleeding into the haematoma cavity [1, 2]. Furthermore, this local hyperfibrinolysis is also thought to be induced by a high concentration of tissue plasminogen activator produced within the haematoma capsule [3].

A number of surgical techniques have been utilised in the treatment of CSH, each with advantages and disadvantages, however, most CSH patients recover regardless of the surgical procedure. To our knowledge, there has been no previous report concerning the role of local coagulofibrinolysis in the postsurgical recovery of patients with CSH.

The purpose of the present study was to investigate postoperative changes in the coagulofibrinolytic activity of haematoma contents.

Patients and Methods

Patients

We studied fifteen patients with unilateral CSH who underwent surgery in our hospital between July and December 1997. There were 9 males and 6 females aged from 58 to 86 years (mean 62.7 years). None of the patients suffered from a haemostatic disorder, such as a hepatic disease, a malignant tumour, or any infections.

Operative and Postoperative Management

A closed-system drainage was performed under local anaesthesia. Specifically, the surgical procedure involved only inserting a silicon drainage tube (Creat Medic Corp., 2 mm diameter) into the haematoma cavity through a single burr hole at the site of maximum haematoma thickness, as determined by CT scan. In order to obtain the haematoma contents without any contamination, irrigation with saline, a routine technique in other surgical procedures, was not performed. After surgery, a rubber bag (Hanako Medical Corp.,) was attached to the end of the tube to form a completely enclosed cavity. The bag was kept in place until the haematoma completely disappeared on CT. During this time, while the patient was lying in bed, the bag was positioned at head level. Patients were allowed to walk from the day after surgery, but, during ambulation, the bag was clamped. Haematomas had usually drained completely by the day after surgery, at the time the tube was removed. No patients developed complications such as a pneumocephalus or bleeding, and no haematoma recurrence has been observed in any of these patients up to the time of this report.

Collection of Samples

To measure coagulofibrinolytic activity, the haematoma contents were collected via the drainage tube immediately after insertion of the drainage tube at surgery, and again 24 hours after surgery. Moreover, in order to investigate postoperative serial changes in coagulofibrinolytic activity in greater detail, one patient (a 69-year-old male) was selected as a representative case. In this patient, 30 ml (at each collection) of the haematoma were collected in the manner described previously, at surgery, and at 6 hourly intervals (total 5 times) until 24 hours after surgery. The drainage tube was kept sealed during haematoma collections, a period of 24 hrs. Postoperative morphological changes in a haematoma can be readily observed in the serial CT scans (Fig. 1).
Measurement of Coagulo®brinolytic Activity

The coagulant factors assayed in this study included fibrinopeptide A (FP-A; enzyme-linked immunosorbent assay), fibrinogen (light scattering assay), and thrombin-antithrombin III complex (TAT; enzyme immunoassay). The fibrinolytic factors were fibrinopeptide B (FP-B; enzyme-linked immunosorbent assay), tissue plasminogen activator activity (TPA-activity; synthesized substrate assay), fibrin and fibrinogen degradation products (FDP; latex agglutination turbidimetric assay), D-dimer (latex photometric immunoassay), and alpha 2 plasmin inhibitor complex (α2PIC; enzyme immunoassay).

Statistical Analysis

Coagulo®brinolytic factor values are expressed as mean ± standard deviation. Student’s t-test was used for statistical analysis.

Results

Postoperative Changes in Coagulant Activity

Postoperative changes in coagulant factors included significant increase in FP-A from 101.8 ± 80.2 ng/ml to 298.2 ± 213.2 ng/ml (P < 0.05). Fibrinogen could not be detected either at the time of surgery or 24 hours later. TAT increased from 3046.0 ± 1747.7 ng/ml to 7328.0 ± 3773.7 ng/ml, but this difference was not significant (Fig. 2a).

Postoperative Changes in Fibrinolytic Activity

There was significant inhibition of TPA activity, which decreased from 14.1 ± 9.4 U/ml to 3.5 ± 4.4 U/ml (P < 0.01). FDP significantly decreased from 564.1 ± 380.6 μg/ml to 504.3 ± 326.5 μg/ml (P < 0.01). However, although D-dimer decreased postoperatively from 2043.0 ± 380.6 μg/ml to 1550.6 ± 107.9 μg/ml, and α2PIC from 3.90 ± 2.2 μg/ml to 3.30 ± 1.6 μg/ml, these decreases were not significant (Fig. 2b).

Changes in coagulo®brinolytic factors in a representative case. In a representative patient, the FP-A values at surgery, and at 6, 12, 18, and 24 hours after surgery were 194 ng/ml, 176 ng/ml, 167 ng/ml, 190 ng/ml, and 251 ng/ml, respectively. Although FP-A decreased from the baseline value at surgery in the early postoperative period, it reversed its course 8 hrs after surgery and began to increase. At 24 hours after surgery, FP-A was even higher than at surgery. Fibrinogen could not be detected during the 24-hour period after surgery. The TAT values were 21650 ng/ml, 6100 ng/ml, 7850 ng/ml, 10800 ng/ml, and 12300 ng/ml, respectively. Similar to FP-A, TAT was lower 6 hours after surgery but showed a progressive increase beginning at 12 hours (Fig. 3a).

Regarding fibrinolytic factors, TPA activity levels at surgery, and at 6, 12, 18, and 24 hours after surgery were 7.74 u/ml, 6.28 U/ml, 5.36 U/ml, 4.32 U/ml, and 4.0 U/ml, respectively. Thus, there was a progressive inhibition of TPA activity beginning immediately after surgery. FDP values were 595.0 μg/ml, 605.0 μg/ml, 562.5 μg/ml, 397.5 μg/ml, and 230.0 μg/ml, respectively. D-dimer values were 2417 μg/ml, 250 μg/ml, 2101 μg/ml, 1892 μg/ml, 1434 μg/ml, respectively. α2PIC values were 8.2 μg/ml, 8.6 μg/ml, 6.8 μg/ml, 7.1 μg/ml, 5.0 μg/ml, respectively. All these values were elevated at 6 hours, in comparison with their respective baseline values at surgery. However, beginning at 24 hours, these values all reversed and began to decrease,