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Technique

Endoscopic evacuation of putaminal hemorrhage: how to improve the efficiency of hematoma evacuation

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Abstract

Background: A unique method of evacuation of hypertensive putaminal hemorrhage (HPH) using a stainless steel tube as a corridor under the assistance of a rigid endoscope is described. A simplified method to determine the precise location for burr hole placement is also reported.

Methods: From May 2003 to April 2004, 9 patients with HPH underwent endoscopic surgery in our hospital. Two different entry sites (temporal and frontal) were used to approach the hematoma in our series.

Results: The hematoma evacuation rate was more than 90% (median 93%) with the frontal approach and 84% with the temporal approach.

Conclusions: Using a combination of a stainless steel tube, rigid endoscope, and coagulation suction with a frontal approach can facilitate optimal evacuation of HPH.

Keywords: Putaminal hemorrhage; Endoscopes; Hematoma; Hypertension; Craniotomy; Computed tomography; Stereotactic radiosurgery

1. Introduction

Primary intracerebral hemorrhage is a common condition often encountered in daily clinical practice accounting for 22% of all strokes in Taiwan [3]. Craniotomy evacuation of hematoma continues to be controversial because of its higher mortality and morbidity. To minimize injuries, endoscopic surgery has been introduced to evacuate intracerebral hemorrhage [1,2,7,8]. Although it has the advantage of being less invasive than craniotomy, the low efficiency of hematoma evacuation is still of concern [1].

In patients with intracerebral hemorrhage at our institution, we used a stainless steel tube to guide an endoscope for the evacuation of thalamic hematoma with satisfactory results [2]. Therefore, we adopted the same tool to evacuate hypertensive putaminal hemorrhage (HPH). Different entry sites to place the burr hole were selected according to the shape of the hematoma to increase the efficiency of hematoma evacuation. Preliminary results of its application in evacuation of HPH are reported.

2. Methods

Between May 2003 and April 2004, endoscopic evacuation of hematoma was performed in 9 patients with HPH at China Medical University Hospital, Taichung, Taiwan. Demographic data including age, sex, preoperative and postoperative hematoma volume, method of approach, operation time, and Glasgow Coma Scale (GCS) on admission (day 0) and at 72 hours postoperatively (day 3) were collected (Table 1). We also evaluated whether the patients could follow orders by asking patients to move nonparalyzed limbs at 72 hours after surgery. All 9 patients were taken to the operating room as soon as possible once computed tomography (CT) scan confirmed putaminal hemorrhage. The median time from presentation at the hospital to surgery was 1 hour and 40 min.

2.1. Estimation of hematoma volume

The hematoma volume was estimated by CT scan data with the formula $A \times B \times C / 2$ described by Kwak et al [5].

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Table 1
Summary of patients with hypertensive putaminal hemorrhage

Case	Age/sex	Preoperative/postoperative hematoma volume (mL)	Hematoma evacuation rate (%)	Approach	Operation time (min)	Day 0 GCS*/ day 3 GCS	Day 3 following orders
1	70/F	120/40	67	Temporal	80	3/8	No
2	69/F	160/14	91	Frontal	110	7/11	Yes
3	55/F	30/2	93	Frontal	65	9/11	Yes
4	65/M	20/2	90	Temporal	85	9/11	Yes
5	55/F	36/2	94	Temporal	95	6/9	Yes
6	69/F	180/16	91	Frontal	140	6/6	No
7	45/F	20/2	90	Frontal	90	11/11	Yes
8	65/F	100/3	97	Frontal	170	7/15	Yes
9	52/M	55/2	96	Frontal	150	6/11	Yes

* GCS indicates Glasgow Coma Scale.

The slice containing the maximal hematoma diameter was selected. The maximal linear length (A) is measured in centimeters. The perpendicular width (B) was measured as the maximum extent of the hematoma in a perpendicular plane to A. The variable C is defined as the depth of the hematoma and calculated as the number of slices in which the hematoma is visible multiplied by the slice thickness.

2.2. Hematoma evacuation rate

The hematoma evacuation rate is defined as (preoperative hematoma volume − postoperative hematoma volume) / preoperative hematoma volume × 100%.

2.3. Stainless steel tube and endoscope

We used a custom-made stainless steel tube with an attached handle as a corridor (Fig. 1). A 4-mm, 0-degree-rod-lens endoscope (Karl Storz GmbH & Co, KG, Tuttlingen, Germany) was inserted into the tube for visualization and magnification. A 2.5-mm straight suction tube was also inserted and manipulated through the remaining space within the tube (Fig. 2). The bleeding vessel was cauterized by using a 3-mm unipolar suction-coagulation tube (Karl Storz GmbH & Co).

2.4. Endoscopic techniques

The surgical procedure is performed under general anesthesia with the patient in the supine position. A 3-cm incision is made at the entry site. The first important step is the placement of the trephination. Although stereotaxis can be used for precisely targeting the hematoma, it is time-consuming, especially for a patient in a critical neurological condition. Therefore, we devised a simple and rapid method to determine the entry site (Fig. 3).

First, we measure the height of the hematoma plane by calculating the number of CT slices between the hematoma plane and the orbitomeatal (OM) plane then multiplying by slice thickness. The hematoma plane is defined as the CT slice with the maximal hematoma diameter. The OM line is drawn on the skin of the patient and a perpendicular line is extended from the OM line to the height of the hematoma plane. The hematoma plane is then drawn parallel to the OM line. We then select the entry site on this plane.

In our first patient (case 1) with large hematoma (>50 mL), the entry site with the shortest distance between the hematoma and skull surface was selected. (We call this the "temporal approach").

As the hematoma evacuation rate was not satisfactory in this patient, we selected an entry site from the frontal area ipsilateral to the hematoma in the other 4 patients with large hematoma. (We call this the "frontal approach"). This frontal entry site is determined by drawing a line parallel to the midline from the frontal part of the hematoma to the skull surface. The actual distance from the midline to the entry site is then calculated. The precise site to place the burr hole is marked on the skin by measuring this distance from the midline of the hematoma plane. After the burr hole is drilled, the stainless steel tube is tapped into the hematoma along the hematoma plane and parallel to the midline to the depth of the frontal part of the hematoma. After the tube reaches the hematoma, the stylet is removed and the tube is mounted on a scope holder. The endoscope is then introduced.

The hematoma is evacuated by manipulating the suction tube through the remaining space within the tube. Once a bleeding vessel is encountered, the suction is changed to a

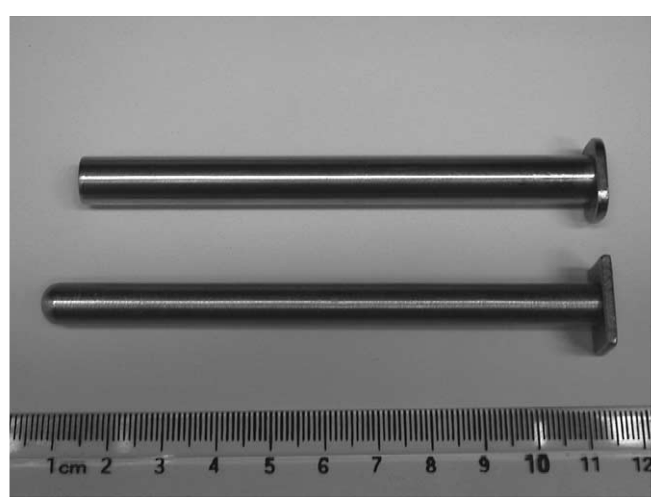

Fig. 1. Stainless steel tube with a stylet used to guide endoscope. A handle is attached to the tube. The inner diameter of the tube is 8 mm; the outer diameter is 10 mm.