ORIGINAL ARTICLE

Removal of Putaminal Hemorrhage by Endoscopy

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Purpose. Endoscopic surgery for evacuating intracranial hemorrhage (ICH) is a minimally invasive method, but is relatively inefficient for evacuating hematoma. To improve the efficiency of endoscopic surgery, we used a stainless steel tube as an endoscope sheath, combined with a working channel endoscope to evacuate hypertensive putaminal hematoma.
Methods. From January 2004 to April 2004, eight patients with putaminal hematoma were treated by endoscopic surgery in our hospital. During surgery, we experimented with two different entry sites (temporal and frontal) to approach the hematomas.
Results. There were no surgical complications. The hematoma evacuation rate via the frontal approach was greater than 90% (median 92%) while the rate via the temporal approach was 66%.
Conclusions. A working channel endoscope combined with a stainless steel endoscopic sheath via a frontal burr hole approach can faciltate the evacuation of putaminal hematoma in endoscopic surgery. **(Mid Taiwan J Med 2005;10:84-9)**

Key words

endoscopy, intracerebral hemorrhage, minimally invasive surgery

INTRODUCTION

Hypertensive intracerebral hemorrhage (ICH) is a common neurosurgical emergency in clinical practice. Evacuation of deep-seated ICH by craniotomy is controversial because of the high rates of mortality and morbidity after surgery. Endoscopic surgery is a less risky procedure [1-4]. Although it has the advantage of being less invasive than craniotomy, many researchers believe that it is relatively inefficient for evacuating hamatoma [1]. One of the reasons for such poor results could be the limited visualization of the surgical field. To increase the field of view and to improve the efficiency for evacuating hematoma during endoscopic surgery, we developed a stainless steel tube to guide the endoscope in order to evacuate putaminal hematoma. We also selected different entry points according to the configuration of hematoma in endoscopic surgery in order to increase the efficiency of hematoma evacuation.

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MATERIALS AND METHODS

Stainless steel sheath and endoscope

The endoscopic sheath comprised an 11-cm-long rigid stainless steel tube (Fig. 1). Its outer diameter was 10 mm and the inner diameter was 8 mm. A round-tipped metal stylet was inserted into this sheath while the sheath was advanced into the brain parenchyma. A 4 mm 0-degree-rod-lens working channel endoscope (Carl Storz Gmbh & Co. KG) was used for illumination. A 2.5 mm diameter suction tube was manually inserted and passed through the remaining space within the sheath.

Table. Patient data of eight patients with putaminal hematoma treated by endoscopic surgery from January 2004 to April 2004

Patients of No.	Age (yr)/sex	Approach	Preoperative hematoma volume (mL)	Postoperative hematoma volume (mL)	Hematoma evacuation rate (%)	Preoperative GCS score	Postoperative 7th GCS score
1	70/F	Temporal	120	40	66	4	6
2	55/F	Frontal	20	2	90	9	13
3	65/M	Frontal	20	2	90	6	13
4	55/F	Frontal	24	2	93	6	15
5	45/F	Frontal	20	2	90	6	13
6	69/F	Frontal	160	14	91	6	12
7	69/F	Frontal	180	16	91	3	6
8	65/F	Frontal	100	3	97	7	14

GCS = glasgow coma scale.

Fig. 1. The rigid stainless steel sheath. Its outer diameter is 10 mm and the inner diameter is 8 mm. A round-tipped metal stylet is inserted into this sheath while the sheath is advanced into the brain parenchyma.

Patients

We performed endoscopic evacuation of hematoma in eight patients with hypertensive putaminal hematoma from January 2004 to April 2004. Demographic data including age, sex, preoperative and postoperative 2nd day hematoma volume, hematoma evacuation rate, glasgow coma scale (GCS) on admission and on the seventh day after surgery were gathered (Table). All patients who underwent surgery presented with putaminal hematoma $\geq$ 20 mL and altered level of consciousness. The volume of the hematoma was assessed on CT scan based on the following equation: V = (length $\times$ width $\times$ thickness)/2. The hematoma evacuation rate (%) was defined as (preoperative volume $-$ postoperative volume)/(preoperative volume) $\times$ 100%.

Surgical procedure

During the surgical procedure, the patient was in a supine position under general anesthesia. A 3 cm incision was made and a burr hole was drilled. The most important step was the correct placement of the trephination. Although a stereotatic procedure could have been used to determine the entry point, we devised a simple method to determine the accurate entry point to facilitate the surgical procedure and shorten the surgical time. First, we calculated the height of the CT plane of the hematoma by calculating the distance between the hematoma plane and the orbitomeatul (OM) plane, as indicated on CT slices. This distance was then translated into an actual distance according to the scale on the CT scan. With a pencil and ruler, we drew the OM line on the skin of the patient. A perpendicular line was then drawn from the OM line to the hematoma plane (Figs. 2A, 2B). After the hematoma plane was determined, we selected the entry point in this plane. In our first patient, the shortest point between the hematoma and the skull surface was selected as the entry point (temporal approach); however, the hematoma evacuation rate was low in this patient, so the frontal area ipsilateral to the hematoma was selected as the entry point in the other patients (frontal approach). After the burr hole was drilled, the stainless steel tube was tapped into the hematoma. After the tube reached the hematoma, the stylet was removed and the endoscope was introduced. The hematoma was removed by manipulating the suction tube through the remaining space within the tube. When bleeding was encountered, suction was changed to a coated suction devise, and monopolar coagulation was applied through the uncoated tip to stop the bleeding while the blood was removed by the suction tube. After sufficient hemostasis was

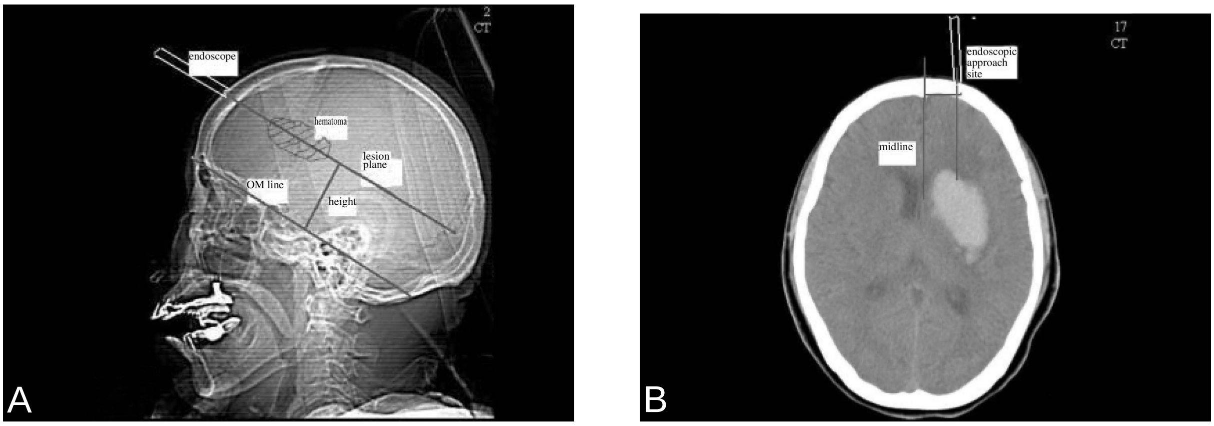

Fig. 2. A: The distance (height) of the hematoma above the orbitomeatal (OM) line. B: The entry point of frontal approach.

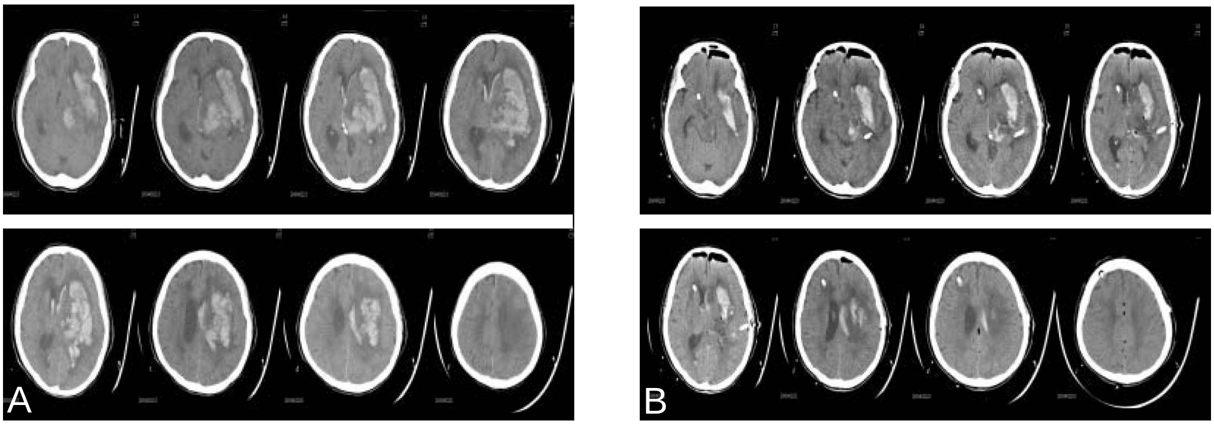

Fig. 3. Patient 1: a 70-year-old woman presented with sudden disturbance of consciousness. A: CT scans at admission show left putaminal hemorrhage; the volume was 120 mL. B: Postoperative CT scans show only 40 mL hematoma remaining. (temporal approach)

obtained, an external drain was placed into the hematoma cavity and left for several days. The tube was then removed and the incision closed.

RESULTS

There were no surgical complications. The time from the onset of symptoms to surgery ranged from 1 to 5 h (median 2 h). The volume of the hematomas ranged from 20 to 180 mL (median 81 mL) preoperatively; the volume postoperatively ranged from 2 to 40 mL (median 10 mL). The evacuation rate in patients in which the frontal approach was used ranged from 90% to 97%. No rebleeding was encountered after surgery in any of the patients. All eight patients showed neurologic improvement at follow up one week after the procedure.

Illustrative cases

Patient 1 (temporal approach). A 70-year-old woman was sent to our hospital because of sudden onset of altered consciousness.On admission, she was comatose (Glasgow Coma Scale 4). CT scan revealed a left-sided putaminal hematoma (Fig. 3A). The volume of the hematoma was estimated to be 120 mL. She underwent emergency endoscopic surgery to evacuate the hematoma. The entry point was selected from the temporal area. Postoperative CT scan revealed that approximately 40 mL of hematoma remained (Fig. 3B). The hematoma evacuation rate was 66%.

Patient 8 (frontal approach). A 65-year-old woman was sent to our hospital because of sudden onset of altered consciousness. On

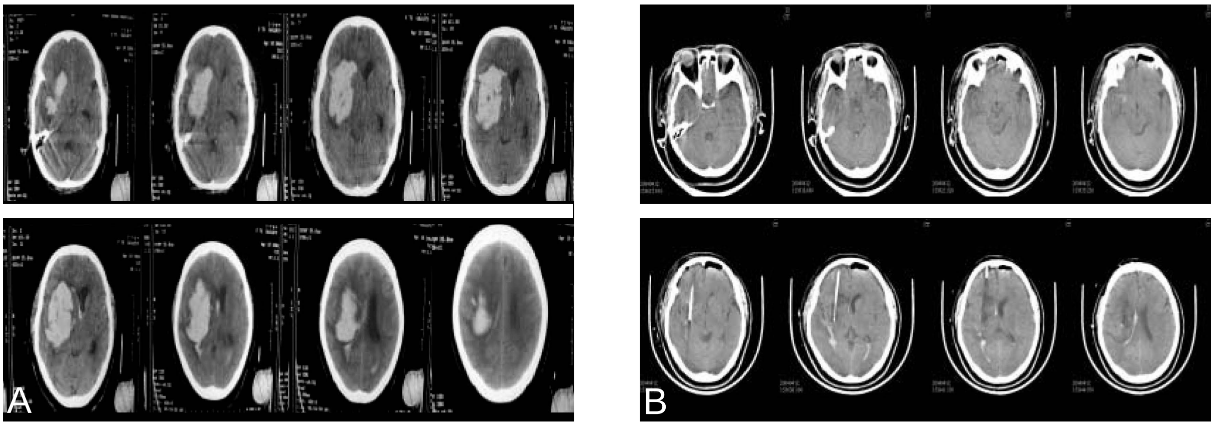

Fig. 4. Patient 8: a 65-year-old woman presented with sudden disturbance of consciousness. A: CT scans at admission show right putaminal hemorrhage; the volume was 100 mL. B: Postoperative CT scans show only 3 mL hematoma remaining. (frontal approach)

admission, she was comatose (Glasgow Coma Scale 6). CT scan revealed a right-sided putaminal hematoma (Fig. 4A). The volume of the hematoma was estimated to be 100 mL. She underwent emergency endoscopic surgery to evacurate the hematoma. The entry point was selected from the frontal area. Postoperative CT scan revealed that approximately 3 mL of hematoma remained (Fig. 4B). The hematoma evacuation rate was 97%. She was awake on the postoperative second day and exhibited hemeplegia on the right side.

DISCUSSION

Hypertensive ICH is a common disease in middle-aged and elderly patients. However, the indication to evacuate ICH, especially for deep-seated hematoma, is still controversial in stroke patients. It is reasonable to assume that brain damage due to ICH will be minimized by removing the hematoma. Hematoma evacuation reduces the mass effect, blocks the release of toxins from the hematoma, and prevents early hematoma enlargement after onset of ICH [5]. Evacuation of deep-seated ICH by traditional craniotomy carries a high mortality and morbidity rate. Endoscopic surgery,on the other hand, is a less invasive method of evacuating ICH and leads to very low morbidity and mortality; however, Auer et al noted that hematoma removed by endoscopy was inefficient [1]. One of the reasons for such poor results could have been the limited field of surgical view. Traditional working channel endoscopy utilizes a water medium during the surgical procedure. Saline irrigation is necessary when cerebrospinal fluid (CSF) becomes turbid due to minor bleeding, thereby decreasing visibility during surgery procedure [6]. We devised a stainless steel endoscopic sheath to serve as a tubular corridor. Endoscopic imaging is done through air, and thus saline irrigation is not required. The tubular corridor allows the hematoma to be sucked out and hemostasis can be maintained by monopolar coagulation easily because the visibility is excellent.

Choosing the appropriate entry site for endoscopic surgery is critical. Since endoscopic surgery is suitable for lengthwise lesions, the endoscope should approach the hematoma on the longitudinal axis. In patient 1, we approached the hematoma from the temporal region because it was the shortest distance between the hematoma and skull surface. However, the hematoma evacation rate was only 66% (Fig. 5A). Therefore, in the other patients, we approached the hematoma from the longitudinal axis, which did not limit the surgeon's field of view during endoscopic surgery (Fig. 5B). This approach resulted in an evacuation rate ranging from 90% to 97% (median 92%). It has been reported that endoscopic surgery is not appropriate for evacuating hematomas greater than 40 mL [3];

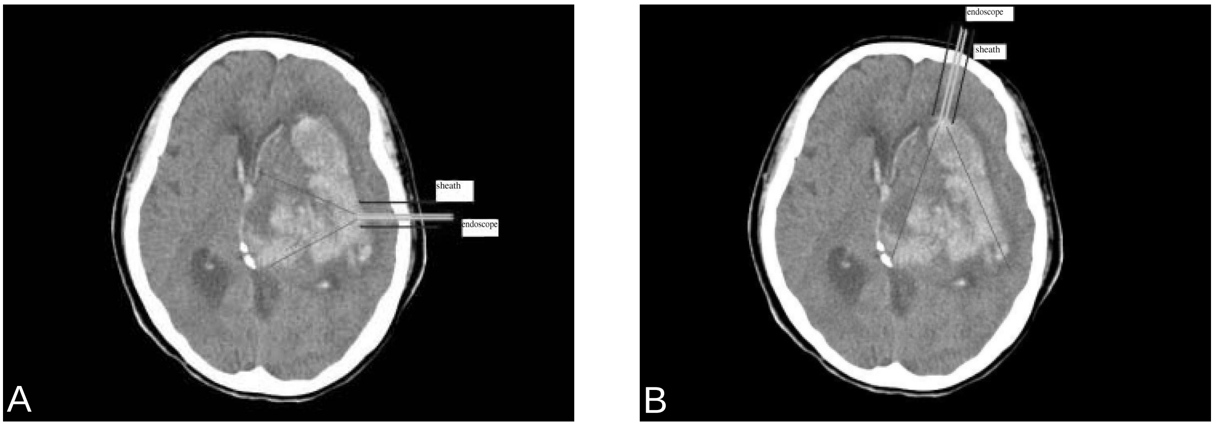

Fig. 5. A: The surgeon's field of view is limited when approaching the hematoma via the temporal skull. B: The frontal approach offers a clearer view of the hematoma.

however, large volumes were successfully evacuated in our series.

Early hematoma growth has been demonstrated in more than one third of ICH patients [7]; therefore, it is rational that the hematoma should be treated as soon as possible. To faciltate evacuation of ICH and to shorten the surgical delay time, we no longer use a stereostatic method to calculate the entry site; instead, we calculate the entry site from the CT scan. Though our method may be less accurate than the stereostatic method, the accuracy for hematoma localization was satisfactory in most cases.

Further studies are needed to understand whether endoscopic removal of ICH improves clinical outcome in patients. Nevertheless, the procedure described here seems to be a viable option for evacuating ICH by endoscopic surgery.

Combining the use of a stainless steel endoscopic sheath, a working channel endoscope and the frontal approach, can faciltate ICH evacuation and increase evacuation efficiency of endoscopic surgery. We also demostrated a reliable, easy-to-perform method for localizing ICH, which facilitates ICH evacuation by endoscopic surgery.

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高血壓性背殼出血之腦內視鏡手術

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目的　我們以一不鏽鋼金屬套管結合腦內視鏡來移除高血壓性背殼出血之血塊，並評估其效果。

方法　從2004年2月到2004年4月，共八位病人接受手術。我們採用一個簡單的方法來定位血塊並決定內視鏡手術鑽孔的位置。在手術中，我們分別採取兩種不同的位置(額部和顳部)來當作內視鏡手術鑽孔的位置。

結果　從額部拿取之血塊清除率超過90%（平均92%），而從顳部拿取之血塊清除率則只有66%，且所有病人且皆未發生併發症。

結論　以不鏽鋼金屬套管結合腦內視鏡來移除高血壓性背殼出血之血塊，是可行的。且從額部拿取能增進血塊清除率。（中台灣醫誌 2005;10:84-9）

關鍵詞

內視鏡，顱內出血，微侵襲性手術

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