



Minipterional Craniotomy with Transsylvian-transinsular Approach for Hypertensive Putaminal Hemorrhage: A Preliminary Report

Bon-Jour Lin¹, Chiao-Zhu Li^{1,2}, Tzu-Tsao Chung¹, Chi-Tun Tang¹, Dueng-Yuan Hueng¹, Da-Tong Ju¹, Hsin-I Ma¹, Ming-Ying Liu¹, Yuan-Hao Chen¹

¹Department of Neurological Surgery, Tri-Service General Hospital, National Defense Medical Center, Taipei,

²Department of Surgery, Kaohsiung Armed Forces General Hospital, Kaohsiung, Taiwan, R.O.C.

Background: There is no consensus regarding optimal treatment of spontaneous intracerebral hemorrhage (ICH) till date. The role of surgery in managing spontaneous ICH is debatable because of lacking clear benefit as compared to conservative treatment. The aim of this study is to assess the clinical efficacy of minipterional craniotomy in the treatment of hypertensive putaminal hemorrhage (HPH). **Materials and Methods:** From January 2015 to December 2015, four patients with large HPHs accepting minipterional craniotomies and transsylvian-transinsular (TS-TI) approaches were analyzed retrospectively in terms of hematoma evacuation rate, recovery of consciousness, and short-term functional prognosis. **Results:** The average volume of residual hematoma was 3.68 ml with 93.53% evacuation rate. There was no delayed hemorrhage or newly developed hypodense lesion on postoperative images. Three out of four patients got clear consciousness with improved muscle strength of involved limbs on discharge from our institute. The modified Rankin scale grades were 3 at 3 months postoperatively. **Conclusions:** Minipterional craniotomy with TS-TI approach is a feasible procedure for HPH in selected candidate. The recommendation of this procedure is due to satisfactory hematoma evacuation rate, minimal brain damage, and improved functional outcome.

Key words: Minipterional, transsylvian-transinsular, hypertensive putaminal hematoma

INTRODUCTION

Hypertensive putaminal hemorrhages (HPHs), the most common location of spontaneous intracerebral hemorrhages (ICHs), often result in severe morbidity and high mortality rate.¹ Although the role of surgery in treating spontaneous ICH is controversial, early surgery is beneficial in some selected subgroups.² Among different surgical modalities for hematoma removal, transsylvian-transinsular (TS-TI) approach is surprising because of good functional prognosis as compared with transcortical approach.³⁻⁵ The clinical benefit of TS-TI approach is attributed to shorter intracerebral distance and minimal brain damage using Sylvian fissure as nature pathway to reach the insular cortex. However, complex vascular structure of Sylvian fissure and swollen brain parenchyma, secondary to mass effect of hematoma, may limit its clinical application.

The aim of this preliminary report is to investigate the clinical efficacy of modified TS-TI approach, minipterional craniotomy with TS-TI approach, in managing HPH.

MATERIALS AND METHODS

Ethical approval

The study was conducted in accordance with the Declaration of Helsinki and was approved by the local ethics committee of the institute. Informed written consent was obtained from all patients prior to their enrollment in this study.

Patient demographics

From January 2015 to December 2015, 21 patients diagnosed with HPHs accepted surgical treatments in our

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Corresponding Author: Dr. Yuan-Hao Chen, Department of Neurological Surgery, Tri-Service General Hospital, No 325, Section 2, Cheng-Kung Road, Neihu 114, Taipei, Taiwan, R.O.C. Tel: 886-2-87927177; Fax: 886-2-87927178.

E-mail: coleman0719@gmail.com

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institute. At the time of surgery, all patients had impairment of consciousness with focal neurological deficits. Among these people, four patients accepting minipterional craniotomies and TS-TI approaches for hematomas evacuation were reported retrospectively. The patient presenting with deep coma, fixed dilated pupil, vascular anomaly, or coagulopathy was excluded from candidate selection.

Clinical and radiographic assessments

The level of consciousness (Glasgow Coma Scale score), ICH score, and muscle strength grading (modified Medical Research Council system) of involved limbs were evaluated for each individual patient. Hematoma volume, calculated by utilizing computer-assisted volumetric analysis, and extent of midline shift were recorded from the preoperative computed tomography (CT) images. After emergency surgery, every patient was monitored in the Intensive Care Unit with targeted blood pressure management.

Postoperative CT scan was performed within 48 h to determine residual blood volume, hematoma evacuation ratio, and newly developed lesion. GCS score and muscle strength grading of involved limbs were assessed again while discharge. Evaluation of patient's functional independence was based on modified Rankin Scale at 3 months postoperatively.

Surgical technique

The patient was placed supine with ipsilateral shoulder elevation. The patient's head was extended and tilted 30° away from the side of hematoma [Figure 1a]. Curved skin incision, about 5 cm, was made around the pterion and followed the

lateral hairline curvature. After the elevation of myocutaneous flap, frontotemporal craniotomy was drilled with one bony flap 3 cm in diameter. The sphenoid bony ridge was flattened until exposure of meningo-orbital band as classical pterional approach. Dura was opened with T-shape incision [Figure 1b].

We routinely opened the chiasmatic and carotid cisterns before splitting the Sylvian fissure. Then, the Sylvian fissure was opened from distal to proximal with accompanied mobilization of superficial Sylvian veins to the temporal side. The outside-in and inside-out technique, described by Yasagil, was used. Entire M1 and M2 segments of middle cerebral artery were exposed without any brain retraction after complete dissection of the Sylvian fissure [Figure 1c].

Two large cotton balls were placed over insular surface between frontal and temporal opercula anteriorly and posteriorly. This step could establish larger working space with minimal usage of brain retractor. Linear incision over insular cortex was performed between superior and inferior trunks of an M2 segment of middle cerebral artery. Gentle suction and bipolar cautery were used for hematoma evacuation under microscope. Adequate hemostasis was achieved using offending vessels coagulation, Surgicel packing, and warm water irrigation.

At the end of the hematoma evacuation, we routinely performed external ventricular drainage on the lesion side. Watertight closure of dura and restoration of bone flap were performed before wound closure. The created bony defect was reconstructed by titanium mesh [Figure 1d].

RESULTS

The demographic data of individual patient are summarized in Table 1. This preliminary report included four male patients with age ranged from 52 to 57 years (mean, 54 years). Three patients had left-sided, and one patient had right-sided HPHs. Preoperative GCS score ranged from 7 to 12, and extent of midline shift ranged from 5.7 to 10.3 mm (mean, 8.1 mm).

The mean hematoma volume on preoperative CT scans was 63.85 ml. The average volume of residual hematoma on postoperative CT scans was 3.68 ml with 93.53% evacuation rate. Pre- and post-operative CT images for each individual patient are shown in Figure 2. The 8.71 ml residual hematoma in one patient was located on higher parietal region. No patient had delayed hemorrhage or newly developed hypodense lesion on the postoperative CT image.

Three patients got clear consciousness with improved muscle strength of involved limbs on discharge from our institute. The modified Rankin Scale grades were 3 at 3 months postoperatively. One patient remained in a condition of lethargy with functional dependence at 3 months postoperatively.

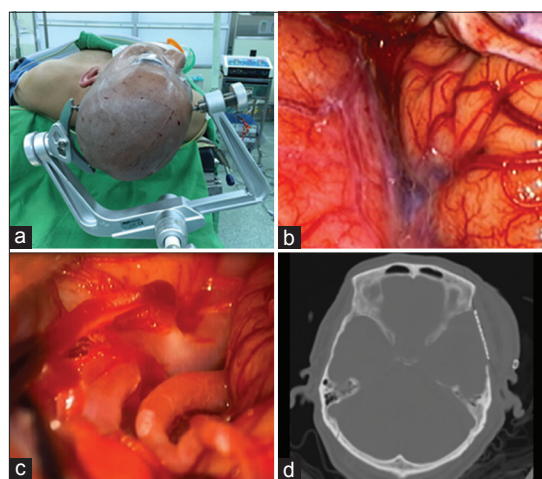


Figure 1: Illustration of one patient with left-sided hypertensive putaminal hemorrhage. (a) Head position of minipterional craniotomy. (b) Intraoperative finding before Sylvian fissure dissection. (c) Exposure of M1 and M2 segments of middle cerebral artery after Sylvian fissure splitting. (d) Small bony flap of minipterional craniotomy

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Table 1: Demographic data of four patients with hypertensive putaminal hemorrhages

Age	Gender	Lesion side	ICH score	Preoperative GCS	Preoperative BV (ml)	Midline shift (mm)	Preoperative MS	Postoperative GCS	Postoperative BV (ml)	Postoperative MS	Evacuation rate (%)	MRS grade
57	Male	Left	3	E3M6V2	54.11	5.7	0	E4M6V1	8.71	2	83.90	3
54	Male	Right	2	E4M5V3	76.79	10.3	1	E4M6V4	1.34	2	98.25	3
52	Male	Left	3	E1M5Vt	70.45	9.6	1	E4M5V2	1.35	2	98.08	4
53	Male	Left	3	E2M4Vt	54.06	6.8	1	E4M6V2	3.31	2	93.87	3

BV = Blood volume; MS = Muscle strength of involved limbs; MRS = Modified Rankin Scale; ICH = Intracerebral hemorrhage; GCS = Glasgow Coma Scale

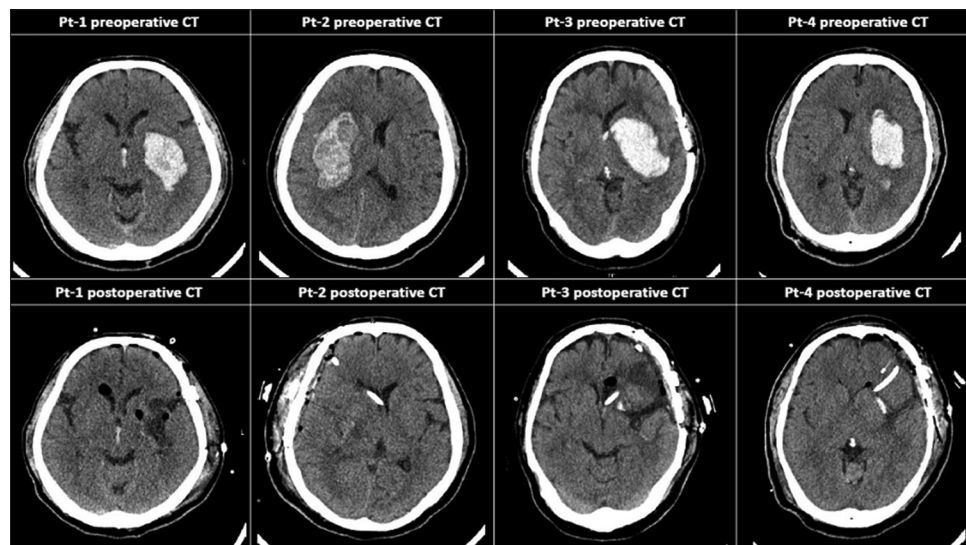


Figure 2: Pre- and post-operative computed tomography images of each individual patient

DISCUSSION

The role of surgical intervention for patients with spontaneous ICH is questionable until now.^{6,7} Although subgroup analysis of the STICH trial reported that some selected patients may be beneficial to surgery, there was no consensus regarding optimal management.² Early removal of hematoma is helpful in reducing intracranial pressure and preventing secondary insults of blood clot.⁸⁻¹⁰

Surgical managements of basal ganglia hematomas, the most common sites of hypertensive ICH, are classified into transsylvian and transcortical approaches. TS-TI approach for basal ganglion hematoma evacuation was reported first by Suzuki and Sato.¹¹ In the recent years, several studies recommended TS-TI approach as effective surgical procedure to treat basal ganglion hematoma.^{3-5,12-16} As compared with conservatively treated patients, those accepting TS-TI approaches had favorable prognosis.^{14,16} Usage of TS-TI approach was announced to be superior to conventional transcortical approach with better functional outcome.³⁻⁵ On

the other hand, one study reported the same surgical results between transsylvian and transcortical approaches.¹⁷

Transinsular approach can provide shorter intracerebral distance to target the hematoma, and the Sylvian fissure is the nature pathway to reach the insular cortex.

With adequate Sylvian fissure dissection, it is effective to widely expose the insular cortex without damage to the frontal or temporal cortex. TS-TI approach can avoid language or visual complication and postoperative cerebral edema, commonly associated with transcortical approach. Otherwise, TS-TI approach can easily detect and control lenticulostriate arteries, most common offending vessels, while comparing with the transcortical approach. Minipterional craniotomy is evidenced as an effective alternative of classic pterional craniotomy in some anterior circulation aneurysms surgeries.^{18,19} The advantages of minipterional craniotomy include shorter skin incision, less soft tissue trauma, smaller bone flap, and good cosmetic outcome. However, the role of minipterional craniotomy in the management of basal ganglion hemorrhage is not discussed by any previous study.

In this preliminary report, the surgical technique what we use is minipterional approach with TS-TI approach. This modification is considered as proximal TS-TI approach rather than distal TS-TI approach, usually used in previous studies. As compared with distal TS-TI approach, proximal TS-TI approach exposes more anterior and larger insular surface. Otherwise, it provides route to drain cerebrospinal fluid (CSF) from basal cisterns before Sylvian fissure splitting. Releasing CSF first is important to relax the brain, especially while facing tense brain parenchyma secondary to mass effect of hematoma. The compressed CSF space within the Sylvian fissure makes the dissection more difficult and increases the opportunity of unnecessary brain retraction. Larger exposure of insular surface and wider working space makes hematoma evacuation more quickly and safely.

The major advantage of proximal TS-TI approach over distal TS-TI approach is effective decrease of ICP by releasing CSF from basal cisterns with wider exposure of insular cortex and surgical field. On the other hand, the disadvantages of proximal TS-TI approach include more complex vascular structure over anterior insular surface and limited angle to more posterior and higher components of hematoma. Overall, this proximal TS-TI approach is a feasible and safe procedure for HPH. This preliminary report is a retrospective study with small patient population. In future, large patient populations and prospective studies are needed to confirm the clinical efficacy of minipterional craniotomy and TS-TI approach in HPH.

CONCLUSIONS

Minipterional craniotomy and TS-TI approach is the modification of distal TS-TI approach. In this preliminary report, we assess its clinical use in treating HPH with high evacuation rate of blood volume and good functional prognosis.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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