# Fully Endoscopic Freehand Evacuation of Spontaneous Supratentorial Intraparenchymal Hemorrhage

*Filippo Flavio Angileri, Felice Esposito, Stefano Maria Priola, Giovanni Raffa, Daniele Marino, Rosaria Viola Abbritti, Maria Giusa, Antonino Germanò, Francesco Tomasello*

■ OBJECTIVE: **A modification of other reported endoscopic techniques for intracerebral clot evacuation is described and illustrated.**

■ METHODS: **From January 2014 to December 2014, we operated on 6 patients harboring a spontaneous supratentorial intracerebral hemorrhage using a fully endoscopic freehand technique. Clinical chart and surgical videos were analyzed. Volumetric evaluation of the clot preoperatively and the residual hematoma postoperatively was performed. Clinical outcome was measured using the modified Rankin Scale and Glasgow Outcome Scale.**

■ RESULTS: **The mean operative time was 96 minutes (range, 72–125 minutes). Clot evacuation was >90% in all patients. No patient experienced rebleeding after surgery. Two patients died. The Glasgow Outcome Scale score at 6 months was 4 in 2 patients, 3 in 2 patients, and 1 (death) in 2 patients. The modified Rankin Scale score at 6 months was 6 (death) in 2 patients, 4 in 2 patients, 3 in 1 patient and 2 in 1 patient.**

■ CONCLUSIONS: **The proposed minimally invasive technique allows a good rate of hematoma evacuation and intraoperative bleeding control. Further studies in large series are needed to confirm the role of this freehand endoscopic technique.**

## INTRODUCTION

Spontaneous intracerebral hemorrhage (ICH) is the second most frequent form of stroke and carries the worst prognosis.[1] Surgical evacuation of supratentorial ICH is currently performed in most neurosurgical departments; it is the second most common nontraumatic cerebral emergency in neurosurgical practice.[1,2] Nevertheless, its efficacy is not proven for both deep and lobar hematomas.[3,4] The most recent American Heart Association guidelines state that for most patients with supratentorial ICH, the usefulness of surgery is not well established (class IIb; level of evidence A), and the effectiveness of minimally invasive clot evacuation with stereotactic or endoscopic aspiration with or without thrombolytic usage is uncertain (class IIb; level of evidence B).[5]

An effective and reliable method for minimally invasive clot evacuation in supratentorial ICH is still missing. We report a modification of other already proposed endoscopic techniques of clot evacuation based on a fully endoscopic freehand procedure.

## MATERIALS AND METHODS

Over a 12-month period, we operated on 6 patients harboring a spontaneous supratentorial ICH using a full endoscopic technique. Clinical charts and surgical videos were analyzed. There were 4 male patients and 2 female patients with a mean age of 64 years (range, 58–72 years). Preoperative Glasgow Coma Scale score was ≤8 in 4 patients and >9 in 2 patients. One patient was admitted with a Glasgow Coma Scale score of 14 but rapidly deteriorated to a score of 11. All patients underwent emergency computed tomography (CT) scan and were operated on following a neurosurgical consultation (**Figures 1** and **2**). CT angiography was performed in selected cases. The mean preoperative ICH volume was 74.8 mL (range, 60–105 mL). All patients underwent clot evacuation by a fully endoscopic freehand technique. Postoperative CT was performed 4 hours after surgery (**Figures 1** and **2**) and then as needed according to the patient's clinical condition. The amount of residual clot was evaluated on the first postoperative CT scan. Patients were

**Key words**
- Endoscopic management
- Intraparenchymal hemorrhage
- Stroke
- Surgical treatment

**Abbreviations and Acronyms**
CT: Computed tomography
ICH: Intracerebral hemorrhage

*Division of Neurosurgery, Department of Biomedical and Dental Sciences and Morphofunctional Imaging, University of Messina, Messina, Italy*

*To whom correspondence should be addressed: Filippo Flavio Angileri, M.D., Ph.D. [E-mail: fangileri@unime.it]*

*Citation: World Neurosurg. (2016) 94:268-272.*
*http://dx.doi.org/10.1016/j.wneu.2016.07.015*

*Supplementary digital content available online.*

*Journal homepage: **www.WORLDNEUROSURGERY.org***

*Available online: **www.sciencedirect.com***

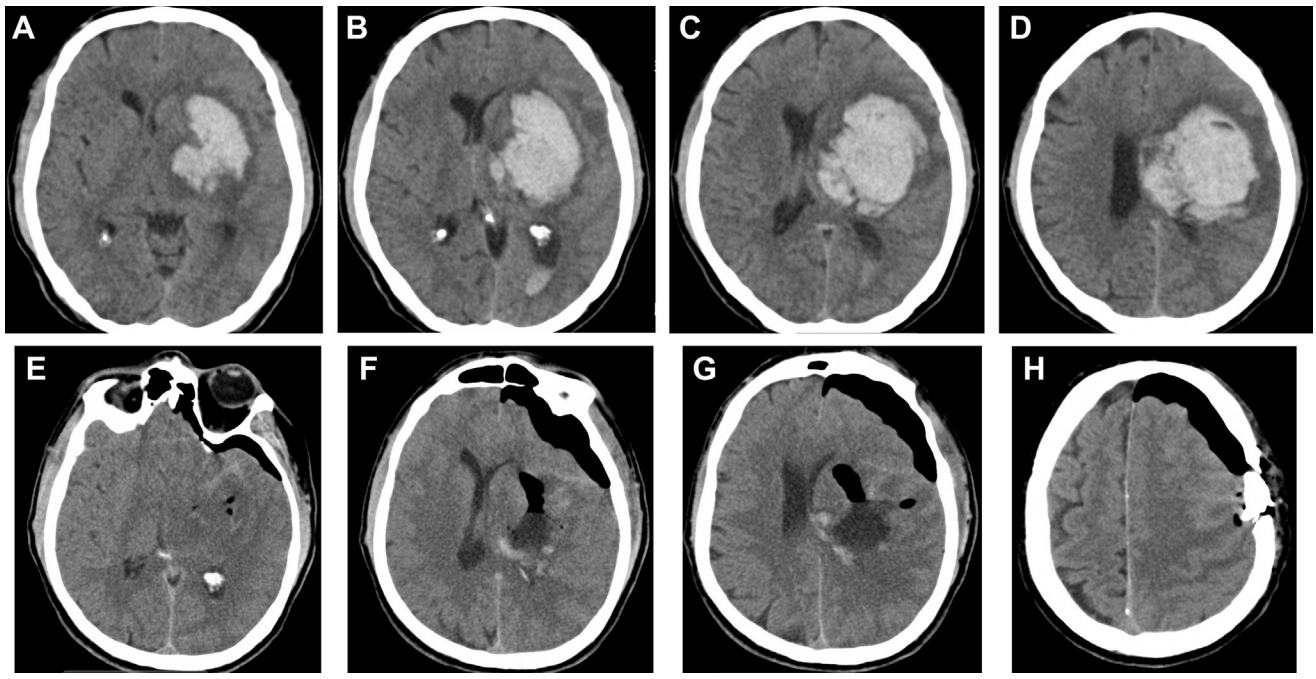


**Figure 1.** (**A**–**D**) Preoperative computed tomography scan showing a large deep supratentorial intracerebral hemorrhage (72 mL) with significant midline shift. (**E**–**H**) Postoperative computed tomography scan showing near-total clot evacuation (residual clot volume 4 mL) and midline shift reduction.

discharged to a rehabilitation ward and evaluated at 1, 3, and 6 months postoperatively. Volumetric evaluation of the clot preoperatively and the residual hematoma postoperatively was performed by standard commercial OsiriX Imaging Software version 6.5 (Pixmeo SARL, Bernex, Switzerland). Outcome was evaluated using the Glasgow Outcome Scale and the modified Rankin Scale.

### Surgical Technique

The surgical procedure was performed with the patient under general anesthesia in the supine position with a pillow under the ipsilateral shoulder and the head turned approximately 60° to the contralateral side. A linear incision was planned according to neuronavigation indication to access the most superficial portion of the hematoma and remove the clot following the longest axis. A small craniotomy (approximately 2.5 cm in diameter) was drilled (**Figure 3**). Dura mater was incised and opened, and a pial incision on the cortex was performed to allow insertion of the tubular retractor. A ViewSite Brain Access System tubular retractor 17 mm in width, 11 mm in height, and 7 cm in length (Vycor Medical Inc., Boca Raton, Florida, USA) was kept in place by 1 surgeon. The other surgeon used the rigid endoscope without working channel (18 cm length, 4 mm, 0° and 30°; KARL STORZ GmbH & Co. KG, Tuttlingen, Germany) in his left hand as sole visualization source and other surgical instruments in his dominant right hand. In this way, the tubular retractor was advanced and moved with a freehand technique by 1 surgeon according to the request of the other surgeon to allow exposition and evacuation of the clot.

The endoscope and all other surgical tools are moved with a freehand technique enabling a true 3-hand technique (**Figure 4**). As soon as the clot is suctioned and evacuated, the tubular retractor is advanced and moved according to the clot cavity. Care is taken to perform an intraclot removal without harming brain parenchyma. If the ICH reached and opened in the lateral ventricle, clot evacuation allowed exploration of the ventricular cavity. At this stage, intraventricular hemorrhage can be cleared (**Figure 2**). Hemostasis is achieved by means of bipolar coagulation, hemostatic agents, and compression with cottonoids as usually performed with standard microsurgical technique. At this point, the tubular retractor is removed, and the decompressed brain surface is endoscopically inspected. Finally, the dura mater is closed. **Videos I** and **II** demonstrate the surgical procedure.

Video

*Video available at WORLDNEUROSURGERY.org*

## RESULTS

The mean operative time was 96 minutes (range, 72–125 minutes). Clot evacuation was >90% in all patients. No patient