Spontaneous intracerebral hemorrhage treated by neuroendoscopy – Technical note

Flávio Ramalho Romero[1], Marco Antôno Zanini[2], Luiz Gustavo Ducatti[1], Roberto Colichio Gabarra[3]

Division of Neurosurgery, Botucatu Medical School, São Paulo State University (Unesp), Botucatu, SP, Brazil.

ABSTRACT

Spontaneous intracerebral hemorrhage (SICH) is responsible for 10%-15% of the acute stroke. Hematoma or the occlusion of cerebrospinal fluid (CSF) flow by ventricular clotting can result in obstructive hydrocephalus, increasing intracranial pressure, which needs urgent decompression. We report our results of management of spontaneous deep cerebral hematoma by endoscopic approach.

KEYWORDS

Intracranial hemorrhages, neuroendoscopy, stroke.

RESUMO

Hematoma intracerebral espontâneo tratado por neuroendoscopia – Nota técnica

Hemorragia intracerebral espontânea é responsável por 10%-15% dos acidentes vasculares encefálicos agudos. Hematoma ou a oclusão da drenagem de liquor por coágulo sanguíneo pode resultar em hidrocefalia, aumentando a pressão intracraniana, com necessidade de tratamento de emergência. Relatamos nossa técnica na abordagem do hematoma cerebral profundo por neuroendoscopia.

PALAVRAS-CHAVE

Hemorragias intracranianas, neuroendoscopia, acidente vascular cerebral.

1 Neurosurgeon at Hospital das Clínicas, São Paulo State University (Unesp), Botucatu, SP, Brazil.
2 Assistent professor at Unesp, Botucatu, SP, Brazil.
3 Head of neurosurgery division at Unesp, Botucatu, SP, Brazil.

Introduction

Spontaneous intracerebral hemorrhage (SICH) causes 10% to 15% of first-ever strokes, with a 30-day mortality rate of 35% to 52% and half of the deaths occurring in the first 2 days.[1,2] The common causes of SICH are hypertension, aneurysm, arteriovenous malformation (AVM), coagulopathies and vasculopathies.[3-6] Death at 1 year for ICH varies by location of ICH: 51% for deep hemorrhage, 57% for lobar, 42% for cerebellar, and 65% for brain stem.[7-11] Initial investigation methods include computed tomography (CT), magnetic resonance images (MRI) and digital substraction angiography (DSA).[12,13]

Hematoma can result in obstructive hydrocephalus and intracranial hypertension, which needs urgent treatment. Surgical and clinical measures have been used to control increased intracranial pressure (ICP). Clinical treatment includes infusion of manitol[7,14] and initiators of hemostasis like recombinant factor VIIa.[8,14] Surgical techniques include external ventricular drain (EVD)[2,15] and other minimally invasive techniques, such as endoscopic evacuation of a hematoma[12,16] and stereotactic CT guided aspiration and thrombolysis.[10,17]

Supporting evidence from controlled trials is lacking, and according to the AHA/ASA Guidelines for the Management of Spontaneous Intracerebral Hemorrhage, the effectiveness of minimally invasive ICH evacuation utilizing the endoscopic method is still uncertain and the technique considered investigational.[18] We described the technique of management of spontaneous deep cerebral hematoma by endoscopic approach.

Methods

Procedures were performed between may 2010 and march 2011 (n = 13; five men and eight women; age range 60-77 years; average age 66.5 years). Inclusion criteria were putaminal hematoma with volume greater than 30 ml, thalamic hematoma with volume greater than 20 ml, intraventricular bleeding with acute hydrocephalus, or subcortical hemorrhage greater than 30 ml with significant mass effect (midline shift greater than 5 mm and effacement of perimesencephalic cistern) and neurological deterioration, and surgery within 12 hours after ictus.

All patients had hypertensive hemorrhages, investigated with CT scan, MRI and angio-MRI (to rule out vascular malformations or other vasculopathies). Pre and postoperative CT scan were performed in all patients (Figure 1). The surgical procedure was explained to the families of all the patients and informed consent was obtained.

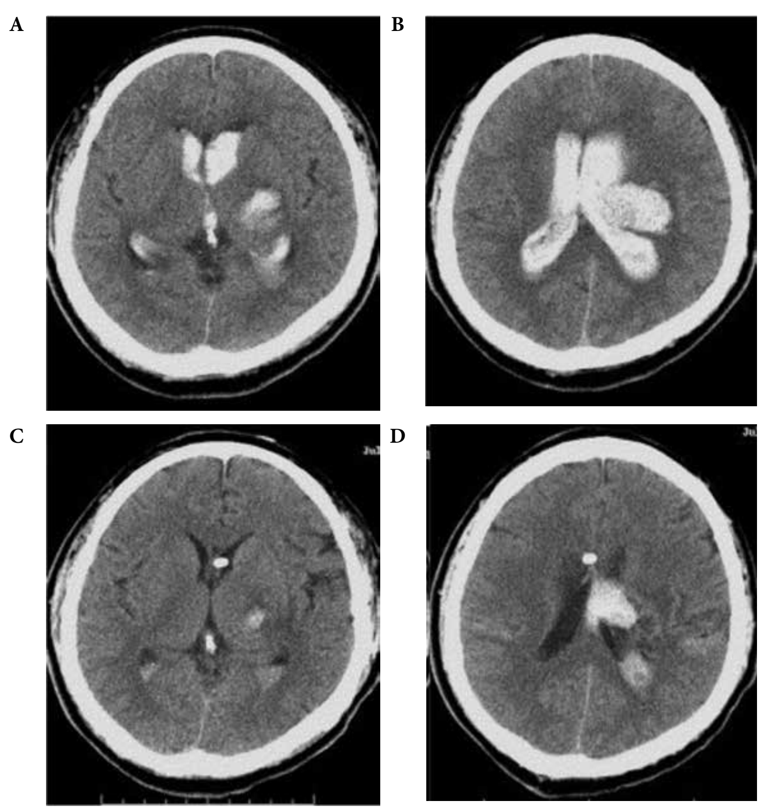

***Figure 1** – Images of patient treated by neuroendoscopic approach of intracerebral hemorrhage. Before surgery (A and B) and after surgery (C and D) brain CT scan of thalamic hemorrhage treated by neuroendoscopy.*

Technical note

Approach was determined by the pre operative CT scan. For most putaminal ICHs the transtemporal approach was used. The frontal approach was used only when the frontal route provides the shortest distance between the cortical surface and the hematoma on the preoperative CT scan. Hemorrhages in the left side were approached through the inferior or medium temporal gyrus. Patients with right ICH were operated through the shortest distance to the hematoma, avoiding the central lobe.

After a general anesthesia, a linear skin incision (3-4 cm in length) was performed. In this point a 1.5 cm bur hole was made and dura mater was opened in cruciate fashion. Small corticotomy was made and a transparent plastic sheath was inserted pointed to the hematoma. Through this sheath a rigid endoscope (18 cm 4-mm 0°) with irrigation system was introduced to provide visualization during hematoma removal.

The hematoma was evacuated by direct endoscopic vision manipulating the suction through the working space within the sheath. The surgeon pointed the endoscope on the tip of the hematoma, and an assistant evacuated the hematoma by using a suction system. To avoid injury in the ventricular wall, the surgeon withdrew the endoscope by a few millimeters during evacuation. All procedure was performed with continuous irrigation of Ringer Solution (RS) to clarify the vision, clear the endoscopy tip and avoid ventricular collapse and ventricular wall injury during the surgery. Evacuation was stopped when the ventricle was clear and the aqueduct was visible. We did not insert the endoscope into the fourth ventricle or perform third ventriculostomy (Figure 2).

External ventricular drain (EVD) was performed at the end of the surgery, and intracranial pressure (ICP) was maintained at 200 mm H_2O by continuous CSF drainage. The EVD was discontinued using a cramp ring when the amount of CSF drained was less than 120 ml/day and no obstruction of CSF in the whole ventricles was observed on a CT scan.

A

B

C

D

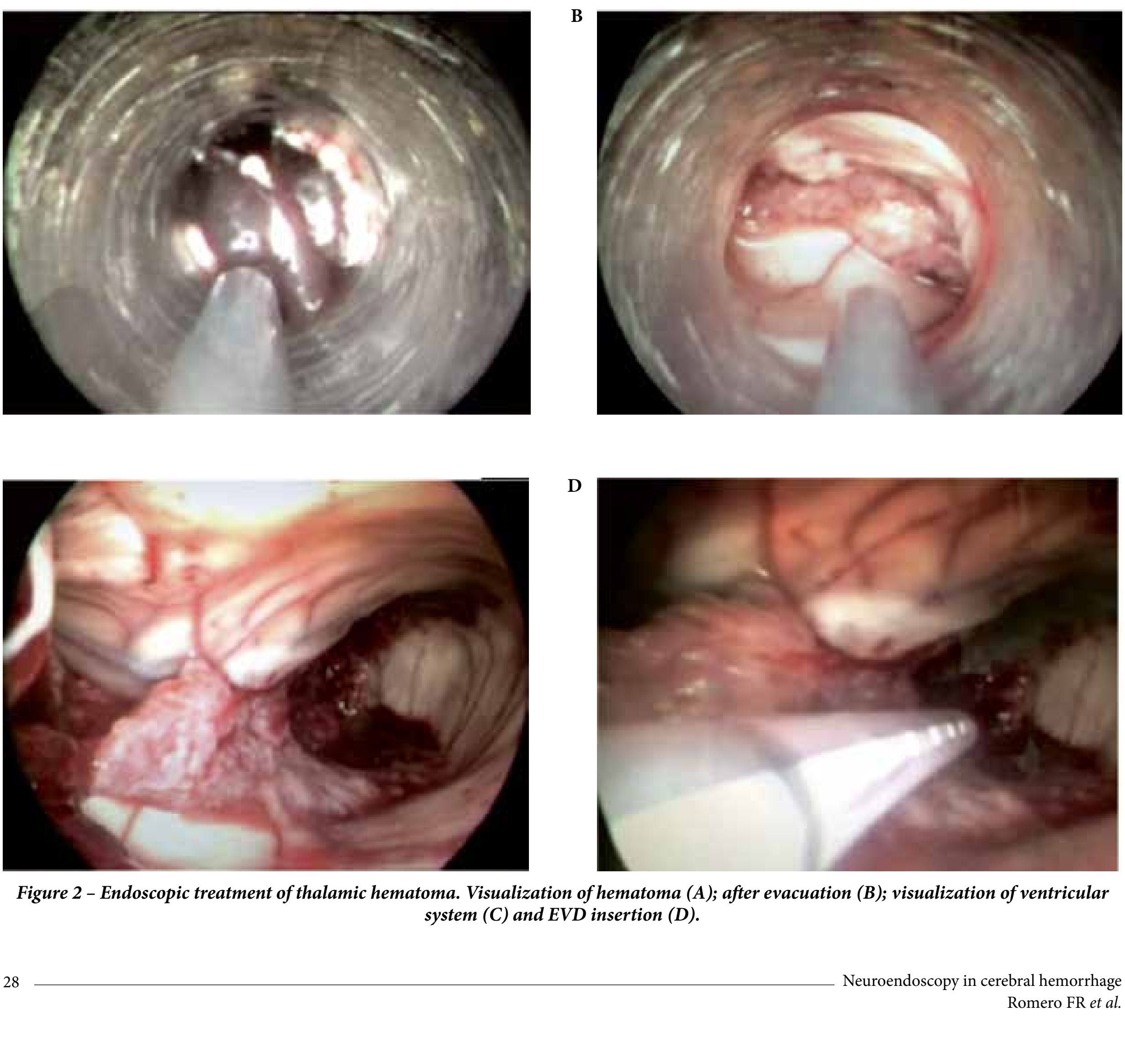

Figure 2 – Endoscopic treatment of thalamic hematoma. Visualization of hematoma (A); after evacuation (B); visualization of ventricular system (C) and EVD insertion (D).

Discussion

AHA/ASA Guidelines for the Management of Spontaneous Intracerebral Hemorrhage don't state that ultra-early removal of supratentorial ICH improves functional outcomes or mortality rates. In addition, very early craniotomy would increase the risk of recurrent bleeding. That conclusion was based on a trial of 11 patients randomized within 4 hours of hemorrhage onset, where rebleeding rate was 40% in patients treated within 4 hours, compared with 12% of the patients treated within 12 hours using the craniotomy method.[7,14,19] Recent series suggested that early and complete evacuation of ICH via a minimally invasive method could improve neurological outcome in these patients.[3,6,18,20]

Some studies suggested that the hematoma contributes to local mass effect and elevated ICP, increasing the pathological cascades resulting in a great neuroinflamatory and biochemical response.[2,3,21-23] This finding could support that early and complete removal of ICH via a minimally invasive method could reduce the secondary injury associated with ICH. Theoretically, this should lead to improved functional outcomes and decreased mortality rates.

Authors believe that endoscope-assisted ICH evacuation performed in the early stage was associated with a minimal rebleeding rate (0%-3.3%) compared with the traditional craniotomy method (5%-10%).[1,2] Other advantages of the endoscope-assisted method include low complication rate, less operative time, less blood loss, improved evacuation rate, and early recovery of the patients.[2,5,15,20,24]

Neuroendoscopic technique may provide a better hematoma evacuation rate with minimal damage to normal brain tissue. Due to the improvement of neuroendoscopic systems and instruments, recent series have shown high rates of hematoma evacuation that ranged from 83.4% to 99%.[1,3,10,12,16]

Studies suggested that surgery should be performed within 24 hours after onset, because intracerebral hematoma usually starts to harden about 24 hours after onset and 48 hours later it can't be evacuated with a suction tube.[10,14,25]

An important decision is choose the better approach (the frontal or temporal approach). The frontal approach was recommended by the authors in these cases due to its involving noneloquent regions and providing better visualization that may result in maximal hematoma evacuation.[7,15,26] The frontal approach may pass through the lenticulostriate arteries, causing intraoperative bleeding and worse outcomes.[17] This may explain the high incidence of intraoperative bleeding [9 (82%) of 11 cases] in one series in which the frontal approach was used.[10]

When temporal approach was choice for putaminal ICH, evacuation could be accomplished in approximately 70% of the cases without obvious intraoperative bleeding. Other advantage was the shorter working distance, which increases the comfort of the procedure and facilitates deftness. When a frontal approach was used, we usually performed the bur hole in a more lateral position.

Cases of acute bleeding were controlled using the bipolar coagulator, and we did not place a drainage tube within the hematoma cavity after securing hemostasis. Our study also demonstrated that the use of a hemostatic agent for noncoagulation hemostasis seems to be safe because the rebleeding rate was very low.

Conclusions

This study showed that early and complete evacuation of ICH could lead to improved outcomes in selected patients. Also, early endoscope-assisted ICH evacuation is safe and effective in the management of supratentorial ICH.

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Endereço para correspondência
Flávio Ramalho Romero
Rua Distrito de Rubião Júnior, s/n, Rubião Jr.
18618-970 – Botucatu, SP, Brazil
Telefones: (14) 3811-6260/(14) 3811-6000
E-mails: frromero@ig.com.br/romeroncr@gmail.com