Artículo Original

Endoscopic evacuation of spontaneous supratentorial intracerebral hemorrhage

Lacerda A.[1], Mazorra M[1], Mederos F[1], Abreu D[2], Rojas C.[3], Edes P.[4]

ABSTRACT:

Spontaneous intracerebral hemorrhage (SICH) constitutes a major public health problem worldwide, despite active research it is still a leading cause of morbidity, disability, and death. In Cuba cerebrovascular disease represents the 3rd cause of death and in the last decade, the number of deaths for this cause has increased and the mortality rate is about 41/100000/year. We have carried out a descriptive study of 14 patients admitted in the intensive care unit of Moron General Hospital in Ciego de Avila, Cuba, with diagnosis of Spontaneous Supratentorial Intracerebral Hemorrhage (SSICH), who were treated with endoscopic surgical evacuation in the period from January of 2013 to December of 2014. All patients underwent surgery within 12 hours of ictus and 10 (71.43%) underwent surgery within 6 hours. The mean time from SSICH onset to surgery was 7.6 hours. The mean operative time was 90 minutes. Endoscopy was successfully completed in all cases and the hematoma evacuation rate was 97%- 100% in all patients. The mortality rate was 5 patients (35.71%). Six months after clot endoscopic evacuation, six cases (42.86%) had poor results (Grade IV-VI) and 8 (57.14%) had good recovery (Grade 0-III). early endoscope-assisted SSICH evacuation is safe, effective and feasible method in hematoma evacuation.

KEY WORDS: Spontaneous supratentorial intracerebral hemorrhage. Endoscopic evacuation. Surgical treatment.

1. Department of Neurosurgery and Intensive Care Unit. Moron General Hospital. Ciego de Avila. Cuba.

2. Pediatric Intensive Care Unit. Moron General Hospital. Ciego de Avila. Cuba.

3. Department of Intensive Care Unit. Moron General Hospital. Ciego de Avila. Cuba.

4. Medical Student. Moron General Hospital. Ciego de Avila. Cuba.

INTRODUCTION:

Spontaneous intracerebral hemorrhage (SICH) constitutes a major public health problem worldwide, despite active research it is still a leading cause of morbidity, disability, and death[1]. It accounts approximately for 2 million (10%–15%) of about 15 million strokes worldwide each year[2]. In the US, on average, someone has a stroke every 40 seconds[3].

In Cuba, cerebrovascular disease represent the 3rd cause of death and in the last decade the number of deaths for this cause has increased from 8 143 cases in the year 2000 to 9 011 in 2013. The Cuban mortality rate is about 41/100 000/year and in Ciego de Avila the mortality rate by this cause is about 34.6/100 000/year[4].

In the last five years we have operated 56 cases with diagnosis of spontaneous supratentorial intracerebral hemorrhage (SSICH), endoscopic evacuation was used only in 14 cases (25%), however decompressive craniotomy was the surgical choice in 22 patients (39,29%) and other techniques were used in 20 (35,71%) for hematoma evacuation.

There is not definitive evidence to guide the best treatment in SSICH and the role of surgery is controversial, however surgical evacuation appeared promising due to frequent association of the intracerebral clot with cerebral edema, intracranial hypertension and the harmful effect of chemical characteristics of the blood poured into the brain but the benefit has been not consistent in all the studies, which has suggested that surgical option may not be very reliable[5].

In 2005, the International Surgical Trial in Intracerebral Hemorrhage (STICH) compared outcomes of surgery versus medical management in 1,033 patients in 83 centers, and found no difference in outcome. A small number of patients received minimally invasive techniques in that study and delays in getting the patients to the operating room was observed[6]. The STICH II trial which randomized 601 patients with superficial SSICH to early surgery or initial conservative treatment failed to reach significance, but the authors suggested that early surgery might have a small survival advantage for patients especially in cases of impaired consciousness[7].

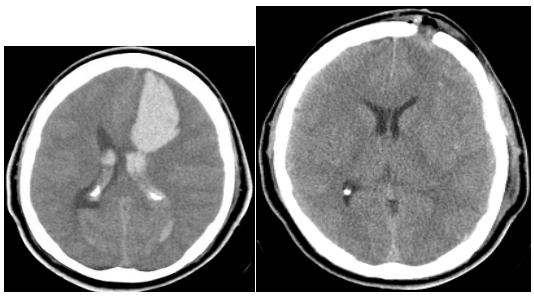
The information regarding the effect of endoscopic hematoma evacuation on the long-term outcome of SSICH patients is limited and reported data samples have been too small, however minimally invasive techniques have shown a trend toward improved outcomes[8-13].

In Cuba all the national available information on the surgical treatment in the SSICH comes from "Roberto Rodriguez" general hospital in Moron, Ciego de Avila[14,15]. The aim of this study is to show the results obtained in a short series of cases with SSICH using endoscopic evacuation in our hospital.

METHOD:

We have carried out a descriptive study of all patients admitted in the intensive care unit of Moron General Hospital in Ciego de Avila, Cuba, with diagnosis of SSICH, who were treated with endoscopic surgical evacuation in the period from January 2013 to December 2014.

A CT scan was indicated to all the patients with clinical suspicion of cerebrovascular disease when they arrive to the emergency room (Figure 1). In patients younger than 45 years without history of hypertension, the pathogenesis of the SSICH was investigated immediately with contrast CT, magnetic resonance imaging and CT angiography to exclude the presence of tumor or vascular lesion.



A B

Figure 1. CT scan left frontal SSICH.

A: Preoperative. B: Postoperative.

The hematoma volume was calculated by Kothari system (AXBXC/2), and it´s evacuation rate was calculated by comparing the pre- and postoperative CT scans. The age, the interval from SSICH to surgery, clinical examination, rebleeding or hematoma expansion, morbidity and mortality were recorded as primary end points. Side and location of the clot, number of affected lobules, distance to the cortical surface, pre- and postoperative midline shift were recorded. The clinical status on admission was evaluated by the Glasgow Coma Scale score.

The inclusion criteria were: 1. Patients older than 18 years and younger than 60. 2. A subcortical hemorrhage greater than 20 ml and less than 60 ml. 3.Significant mass effect with midline shift greater than 5 mm and effacement of perimesencephalic cistern. 4. Progressive neurological deterioration. 5. Initial Glasgow Coma Scale (GCS) scores greater than 4 and less than 12. 6. Surgical treatment within 12 hours after ictus. The inclusion criteria were used for patients operated on with other surgical techniques too.

The study exclusion criteria were: SSICH caused by tumor, trauma, coagulopathy (prothrombin time > 12.2 seconds, platelet count < 100 × 103/μl), aneurysm, or arteriovenous malformation. Patients taking anticoagulation medications or antiplatelets or with liver cirrhosis were also excluded. Patients with preoperative GCS scores less than 4 or greater than 12 were excluded. Patients who did not have a follow-up after surgery for 6 months were also excluded.

Mortality and functional outcome were defined by modified Rankin Scale (mRS). The mRS was dichotomized into favorable (0-III) and unfavorable outcome (IV-VI) at the six month post-operative follow up.

SURGICAL PROCEDURE:

The procedure was carried out with the patient under general anesthesia. A linear skin incision of 3–4 cm length was created. A bur hole was done on the site over the clot location looking for nearest noneloquent regions and the dura matter opened in cruciate fashion. A small corticotomy was created and a Cushing´s trocar was inserted into the clot looking for the distance between the cortical surface and the most proximal part of the clot, this measurement was estimated from the preoperative CT scan. This step can be done under real-time ultrasound guidance[16].

After Cushing´s trocar removal the rigid 4-mm 0° endoscope was introduced deep in the core of the clot to provide visualization during hematoma removal using local irrigation, suction and bipolar coagulation. We do not place a drainage tube within the hematoma cavity after securing hemostasis.

RESULTS:

The sample was constituted by 14 patients who underwent endoscopic

assisted SSICH evacuation. This group included 13 men and one woman, all of them with subcortical SSICH. All patients underwent surgery within 12 hours of ictus and 10 (71.43%) underwent surgery within 6 hours. The mean time from SSICH onset to surgery was 7.6 hours, with a minimum of one hour and maximum of 12 hours. The mean operative time was 90 minutes. Endoscopy was successfully completed in all cases and the hematoma evacuation rate was 97%-100% in all patients.

Data regarding patient characteristics are summarized in Table 1. The predominant preoperative GCS score was 8-6 (57.14%), 10 patients (71.43%) showed clot volume by CT scan between 31 cm3 - 50 cm3. Predominant midline shift was 5-10 mm in 8 cases (57.14%). The brain lobe affected more was temporal in 6 (42.86%).

Table 1. Patient characteristics.

Characteristic		No	%
GCS at admission	12-9	2	14,29
	8-6	8	57,14
	5-4	4	28,57
Clot volume by CT Scan	20-30 cm^3	2	14,29
	31-40 cm^3	5	35,71
	41-50 cm^3	5	35,71
	51-60 cm^3	2	14,29
Midline shift	5-10 mm	8	57,14
	>10 mm	6	42,86
Predominant Location	Frontal lobe	4	28,56
	Temporal lobe	6	42,86
	Parietal lobe	2	14,29
	Occipital lobe	2	14,29

Complications were categorized as: Neurological and extra neurological (Graph 1.) Intracranial hypertension was the predominant neurological complication, 7 (50%), and three patients had rebleeding (21.43%), who underwent repeated surgery using the endoscope-assisted method without surgical complications. Pneumonia was the more frequent extra neurological complication, 10 (71.43%).

There was no incidental injury of the venous or arterial structure in any of our cases. Modified Ranking Scale for results at six month is summarized in Graph 2. The mortality rate was 5 patients (35.71%). At sixth month after clot endoscopic evacuation, six cases (42.86%)

had poor results (Grade IV-VI) and 8 (57.14%) had good recovery (Grade 0-III).

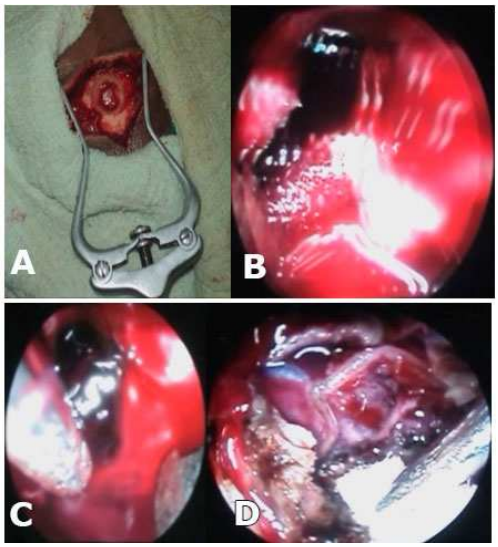


Figure 2.Endoscopical evacuation SSICH patient of figure 1. A. Left frontal bur hole. B and C: Endoscopic view of ICH. D: Endoscopic visualization of vascular structures in hematoma cavity.

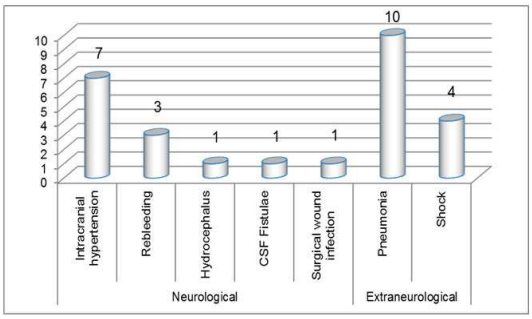


Figure 3. Complications.

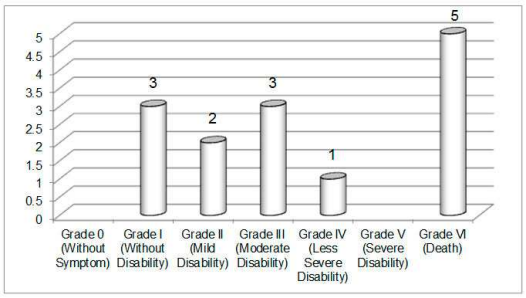


Figure 4. Modified Ranking Scale for results at six month.

DISCUSSION:

The role of surgical treatment for SSICH is much less established than in cerebellar hemorrhage and the decision whether to evacuate these hematomas remains controversial. However recently the STICH II trial has suggested that early surgery might have a small survival advantage for patients especially in cases of impaired consciousness[7] and a systematic review to prove beneficial effects of surgical hematoma evacuation in patients with SSICH has demonstrated that surgery in primary SSICH is effective in reducing the odds of an unfavorable outcome. This conclusion is contrary to the original review which stated that, there was not enough evidence to evaluate the effect of craniotomy or stereotactic surgery, or endoscopic evacuation in patients with SSICH[5].

Today there is limited data regarding the effects of endoscopic hematoma evacuation in SSICH because the evidence from last two decades is based on case series with limited numbers of included patients[8,9,10,11,13,17].

A randomized study compared three techniques for basal ganglia hemorrhage.

Ninety patients were randomly assessed in 3 groups: 30 patients underwent stereotactic aspiration, 30 underwent endoscopic surgery, and 30 underwent craniotomy. Stereotactic aspiration needed a significant greater time delay before surgery than the other techniques ($p<0.001$). The craniotomy group had the longest operation time ($p<0.001$) and more blood loss ($p<0.001$). Endoscopic surgery had the highest hematoma evacuation rate ($p< 0.01$). The mortality rate at 3 months after treatment among the techniques was not significantly different; it was 0% in the endoscopic surgery group, 6.7% in the stereotactic aspiration group, and 13.3% in the craniotomy group. However, the functional independence mean and the Barthel Index scores were significantly better in the endoscopic surgery group than in the craniotomy group[18].

Although in our institution we have obtained good results with conventional surgical hematoma evacuation through decompressive craniectomy[15], the introduction of endoscopic technique has shown quality advantages. We do think key advantage has been a reduced manipulation of viable brain tissue and better visualization during hematoma removal (Figure 2). Endoscopic technique has allowed us longer trajectories without increased retraction of viable brain tissue, moreover endoscopic surgery has allowed us the highest hematoma evacuation rate too, like other authors found[9,12]. However the surgical results in our study were not enough to show a significant quantitative benefit of the procedure related with reduction of mortality ($p\leq0.285$) or quality of these results (good recovery vs poor results) ($p\leq0.593$). We do think the results could be independent of surgical technique used in hematoma evacuation. Patient selection, age, GCS on admission, clinical status at surgical indication, timing of surgery, perioperative care and complications could do the difference.

CONCLUSION:

The results in our study indicate that early endoscope-assisted SSICH evacuation is safe and effective and that endoscopic surgery is a feasible method in hematoma evacuation but prospective controlled clinical trials comparing this treatment modality with conventional hematoma evacuation through craniotomy, decompressive craniectomy and with conservative treatment are needed

REFERENCE:

1. Rincon F, Mayer SA: Intracerebral hemorrhage: getting ready for effective treatments. Curr Opin Neurol 2010; 23:59–64.

2. Kelly ML, Sulmasy DP, Weil RJ. Spontaneous intracerebral hemorrhage and the challenge of surgical decision making: a review. Neurosurg Focus 2013; 34 (5):E1.

3. Lloyd-Jones D, Adams RJ, Brown TM, Carnethon M, Dai S, De Simone G, et al.: Heart disease and stroke statistics—2010 update: a report from the American Heart Association. Circulation 2010; 121:e46–e215.

4. Cuba. Ministerio de Salud Pública. Dirección Nacional de Registros Médicos y Estadísticas de Salud. Anuario estadístico de salud 2013. La Habana: MINSAP; 2014. Available in: http://www.sld.cu/sitios/dne/

5. Prasad Kameshwar, Mendelow A David, Gregson Barbara. Surgery for primary supratentorial intracerebral haemorrhage. Cochrane Database of Systematic Reviews. In: The Cochrane Library, Issue 2, 2013. Art. No. CD000200. DOI: 10.1002/14651858.CD000200.pub1.

6. Mendelow AD, Gregson BA, Fernandes HM, Murray GD, Teasdale GM, Hope DT, et al. Early surgery versus initial conservative treatment in patients with spontaneous supratentorial intracerebral haematomas in the International Surgical Trial in Intracerebral Haemorrhage (STICH): A randomised trial. Lancet. 2005; 365:387–97.

7. Mendelow AD, Gregson BA, Rowan EN, Murray GD, Gholkar A, Mitchell PM, Investigators STICHII. Early surgery versus initial conservative treatment in patientswith spontaneous supratentorial lobar intracerebral haematomas (STICH II): a randomised trial. Lancet 2013; 382(9890):397–408.

8. Dye JA, Dusick JR, Lee DJ, Gonzalez NR, Martin NA. Frontal bur hole through an eyebrow incision for image-guided endoscopic evacuation of spontaneous intracerebral hemorrhage. J Neurosurg. 2012 Oct;117(4):767-73.

9. Kuo LT, Chen CM, Li CH, Tsai JC, Chiu HC, Liu LC, Tu YK, Huang AP. Early endoscope-assisted hematoma evacuation in patients with supratentorial intracerebral hemorrhage: Case selection, surgical technique, and long-term results. Neurosurg Focus. 2011; 30(4):E9.

10. Orakcioglu B, Beynon C, Bösel J, Stock C, Unterberg AW. Minimally invasive endoscopic surgery for treatment of spontaneous intracerebral hematomas: a single-center analysis. Neurocrit Care. 2014;21(3):407-16.

11. Nagasaka T, Tsugeno M, Ikeda H, Okamoto T, Inao S, Wakabayashi T. Early recovery and better evacuation rate in neuroendoscopic surgery for spontaneous intracerebral hemorrhage using a multifunctional cannula: preliminary study in comparison with craniotomy. J Stroke Cerebrovasc Dis. 2011; 20(3):208–213.

12. Beynon C, Schiebel P, Bösel J, Unterberg AW, Orakcioglu B. Minimally invasive endoscopic surgery for treatment of spontaneous intracerebral haematomas. Neurosurg Rev 2015. DOI 10.1007/s10143-015-0606-6.

13. Ochalski P, Chivukula S, Shin S, Prevedello D, Engh J. Outcomes after endoscopic port surgery for spontaneous intracerebral hematomas. J Neurol Surg A Cent Eur Neurosurg. 2014; 75(3):195-205.

14. Lacerda Gallardo AJ. Tratamiento quirúrgico en las hemorragias intracerebrales espontáneas. Estudio de 7 pacientes. Rev. Cubana. Cir. 2001;40(4):251-5.Available in: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0034-74932001000400001&lng=es&nrm=iso&tlng=es

15. Lacerda Gallardo AJ, Díaz Agramonte JA, Martín Pardo JC, Pérez Leal S, Martín Chaviano D, Abreu Pérez D. Results of 11 years of surgical treatment of spontaneous supratentorial lobar intracerebral hemorrhage. Rev Cubana Neurol Neurocir. [Internet] 2012 [citado 8 de marzo del 2015]; 2 (2):114–20. Available in: http://www.revneuro.sld.cu

16. Lacerda Gallardo AJ, Díaz Agramonte JA, Martín Pardo JC, Martín Chaviano D, Nieves Torrez JC, Vélez Gómez I, et al. Surgical evacuation ultrasound guided of spontaneous lobar intracerebral hemorrhage. Rev Cubana Neurol Neurocir. [Internet] 2012 [cited 8 de marzo del 2015];2(2):132–5. Available in: http://www.revneuro.sld.cu

17. Zhu H,Wang Z, Shi W. Keyhole endoscopic hematoma evacuation in patients. Turk Neurosurg. 2012; 22(3):294–299.

18. Cho DY, Chen CC, Chang CS, Lee WY, Tso M. Endoscopic surgery for spontaneous basal ganglia hemorrhage: comparing endoscopic surgery, stereotactic aspiration, and craniotomy in noncomatose patients. Surg Neurol 2006; 65:547–556.

Correspondencia:

Angel Jesús Lacerda Gallardo

E-mail: ajlacerda@hgm.cav.sld.cu

Recibido: 22/12/2015

Aprobado: 24/12/2015

Conflicto de intereses: El autor declara no presentar conflictos de intereses