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Preliminary results of minimally invasive stereotaxic surgery of intraparenchymal hematomas at the Hospital of Mali (23 cases)

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Keywords
evacuation, haematoma, minimally, stereotactic, surgery

ABSTRACT

Introduction: Spontaneous intracerebral haemorrhage (ICH) is a rupture of blood vessels in the brain parenchyma, in the absence of any underlying structural vascular lesion. It's destructive and associated with a high mortality rate. There is a specific threshold of hematoma evacuation to impact mortality or functional outcome in ICH even the curative effect of minimally invasive hematoma removal for cerebral haemorrhage has not been fully recognized worldwide. We aim to evaluate surgical performance on hematoma volume and functional outcomes of patients.

Methods: This study is a retrospective and observational clinical study. A total of 30 ICH patients were treated in the Department of neurosurgery at the Hospital of Mali from December 2019 to November 2020. Minimal invasive puncture hematoma removal was performed in all the patients. The modified Rankin scale (mRS) was used to assess functional outcomes at 6 months and one year of surgery. Was considered poor functional outcome mRS >3. The percentages (%) of the count data were assessed by Fisher's exact test by SPSS 23.0 software was used.

Results: A total of 23 ICH patients met the inclusion criteria, the mean was 47,78 years. Among the risk factors, the HTA is present in 91,3% of patients. The evacuation was satisfactory in 91.30% of cases.

Conclusion: This first study of minimally invasive stereotaxic for ICH evacuation must be followed up and encouraged. Even if the results are satisfactory, a double-blind study is required in the largest sample.

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INTRODUCTION

Spontaneous intracerebral hemorrhage (ICH) or primary intracerebral hemorrhage (ICH) is a rupture of blood vessels in the brain parenchyma, in the absence of any underlying structural vascular

lesion, can lead to the accumulation of the blood within the brain substance (7). ICH is the second most severe type of stroke; it is destructive and associated with a high mortality rate. The current treatment methods are limited, and only a few surviving patients can recover their self-care ability, leading to a heavy economic burden on families and society (12). It is urgent that new therapeutic methods for cerebral hemorrhage are developed. A brain injury caused by cerebral hemorrhage can be considered either a primary brain injury or a secondary brain injury, and the treatment of cerebral hemorrhage focuses on the following two concepts: on the one hand, a mechanical injury, on the other hand, reducing the risk for deterioration of neurological function after cerebral hemorrhage (10). There is a specific thresholds of hematoma evacuation to impact mortality or functional outcome in ICH (5) even the curative effect of minimally invasive hematoma removal for cerebral hemorrhage has not been fully recognized worldwide (4,7). In Mali there is no study on the intracerebral hemorrhage evacuation, nor in west Africa and with the development of minimally invasive techniques we initiated the stereotactic evacuation of ICH. We aim to evaluate surgical performance on hematoma volume and functional outcome of patients.

Methods

Subject

This study is a retrospective and observational clinical study. A total of 30 ICH patients treated in the Department of neurosurgery at the Hospital of Mali from December 2019 to November 2020. Were included in this study 23 patients with complete clinical and radiological data. The inclusion criteria were: Age ≥18 with ICH whose surgical volume was location function.

Lobar≥ 30cc, Thalamic and basal ganglia≥ 15cc, brainstem≥5cc, cerebelum≥10cc with blood presure≤160/90 mmhg.

Glasgow score≥8pts and/or motor deficit≤3/5, presence of symptoms≤72h

Exclusion criteria were: secondary ICH, patient on anticoagulation or antiaggregating or plaletet≤100000.

The stereotaxic frame was attached to the patient's head under local anesthesia (Lidocaine 2%). All patients were operated on under general anesthesia,10cc plastic syringes were used for hematoma aspiration. Evacuation was considered satisfactory for a volume evacuated ≥ 80% of the volume of the hematoma.

The cavity was rinsed with isotonic serum, the temperature of which oscillated between 2 and 4 degrees.

All patients were awakened in intensive care unit, a brain CT scan at 24h-48h postoperatively was performed.

Minimally invasive puncture hematoma removal method: Surgical procedures

Brain CT scan was performed after frame fixation. The center of the largest plane of the scanned hematoma was selected as the target point and we used the axial plan for the planification and calculation of coordinates. In the operating room the patient position depended of hematoma location and all coordinates were calculated by manual way as ANKE formula (11).

We disinfected the surgical area with a conventional way and the patient is champed (figure1). A 3cm skin incision is made at the enter point and we drilled through the skull a 5mm hole. After opening the dura, we make a puncture with 4mm canula and the gently aspiration was made a 10cc sterile syringe (Figure 2). Finally, the hematoma cavity was cleaned with 2–4-degree Nacl 0,9%.

Figure 1. Patient Champed

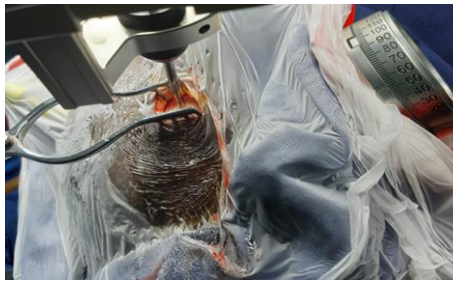

Figure 2. Puncture of hematoma

Clinical data collection

In this study the variables analyzed were demographic (sex, age), history (hypertension, diabetes mellites,), toxic habits (smoking, alcoholism) mode of transport to hospital (ambulance, personal vehicle, taxi), Glasgow scale at admission, the volume of the hematoma was measured by the ABC/2 method, presence or absence of intraventricular blood. The time points for minimal invasive surgery were divided into three groups: ≥6h ≤24 h group Ⅰ, >24h≤48h group Ⅱ and >48h≤72h group Ⅲ. Modified Rankin scale (mRS) was used to assess functional outcome at 6 months and one year of surgery. Was considered poor functional outcome mRS >3. The percentages (%) of the count data were assessed by Fisher's exact test. Univariate analysis with chi-square test and Mann-Whitney test by SPSS 23.0 software was used.

Results

A total of 23 ICH patients met the inclusion criteria, including 12 males and 11 females who were aged mean 47,78years. According to the time from onset to minimally invasive surgery, they were divided into three groups: group Ⅰ (34,8%), group Ⅱ (26,1%), and group Ⅲ (39,1%). Among the risk factors, the HTA is present in 91,3% cases with 100% in the group Ⅱ. All patients were transported by personal vehicle. The majority of patient operated were GSC between 9 and 13pts as showed in table 1. 65.14% of patients had deep localization versus 30.43% lobar localization. The less volume operated is 6cc in the brainstem and 70cc in lobar hematoma as maximum volume (Figure 3). The evacuation was satisfactory by 91.30% of patients. There was no intraventricular blood in 95.7% of cases. There was no difference between the 6 months and 12 months mortality.

Figure 3. Preoperatory CT scan after frame fixation.

Discussion

The evacuation of intraparenchymal hematomas is a holy grail in management, however, no previous study has correlated the success of the procedure with the residual volume of ICH (8,9). The conclusions in an explanatory trial, with rigorous monitoring of the process and results of the surgical intervention, demonstrated that there is a threshold (of ≤15ml EOT ICH or ≥70% hematoma evacuated) associated with the favorable functional result, after the control of the gravity variables of the disease (5). In this first study of hematoma evacuation in Mali, we didn't used the thrombolytic drogue and for hemostatic effect we used isotonic salt serum from 2-4 degree to clean the hematoma cavity, the relationship between temperature and adrenergic response seems to be one of the pivots of the cold-induced vasospasm process (3). We considered EOT if the was absolutely clear. Our satisfaction threshold was an evacuation ≥80% of hematoma and it was 91.30% of patient. The mean residual volume was 6,95cc.

Figure 4. Postoperative CT scan

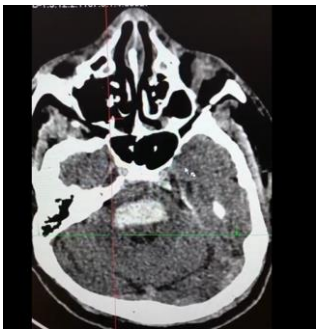

Figure 5. Preoperatory CT scan of brainstem hematoma

Figure 6. Control CT scan

There is no consensus on the appropriate timing of minimally invasive surgery. The time at which the surgery is performed may affect the curative effect,

Table 1. Data analysis of the three groups

Variables	Group Ⅰ (n=8)	Group Ⅱ (n= 6)	Group Ⅲ (n= 9)	P value
Sex(M/F)	(5/3)	(4/2)	(3/6)	
Mean Age	39,12	50,16	53,89	
HTA	87,5%	100%	88,89%	
DM	0%	16,67%	11,11%	
Smoke	12,5%	50%	0%	
Alcoholism	0%	33,33%	0%	
Mode of transport				
• Ambulance	0%	0%	0%	
• Personal vehicle	100%	100%	100%	
• Taxi	0%	0%	0%	
Hematoma Location				
• Lobar	25%	33,33%	33,33%	
• Thalamic and BG	62,5%	66,67%	66,67%	
• Brainstem	12,5%	0%	0%	
• Cerebellum	0%	0%	0%	
Glasgow scale				
• 8pts	12,5%	33,33%	0%	
• 9-13pts	75%	50%	100%	
• 14=15pts	12,5%	16,66%	0%	
Mean Vol of Hematoma	40,5cc	44,7cc	51,5cc	
Mean Residual vol	4,4cc	4,33cc	11cc	
mRS at 6 months				0.01
• ≤3	75%	83,33%	55,56%	
• >3	25%	16,67%	44,44%	
mRS at 1year				0.01
• ≤3	75%	83,33%	55,56%	
• >3	25%	16,67%	44,44%	

thus affecting the selection range of patients for this treatment (12). The choice to divided the time point was motived by:

The time for hematoma stabilization generally 6 hours after bleeding and 72 hours after ICH, delayed perihematomal oedema (PHE) is associated with the destruction of the blood–brain barrier (angioedema), massive lysis of red blood cells and neurotoxicity induced by hemoglobin decomposition products (6). About 39% of the patients were in group Ⅲ because of the blood pressure which was very high and which had to be checked first. None of our patients has benefited from a pre-hospital resuscitation because all of them came to the hospital in personal vehicle, which is perhaps a worsening factor.

The deep location was most frequent in all three groups with a total of 65,13% of patients. The threshold associated we favorable functional outcome maybe applicable to lobar, thalamic and basal ganglia hematoma but not to brainstem hematoma (figure 4 and figure 5) in which despite zero cc EOT the patient was mRS at 6 in the first month.

One month mortality rates associated with this devastating illness range from 35% to 52%, with half of those deaths occurring in the first 2 days (1,2) and in our sample it was 21,73%. Theoretically, removal of hematoma and reduction of cerebral oedema through surgical treatments can reduce intracranial pressure, relieve symptoms of cerebral tissue compression, and reduce inflammatory response and neurotoxic effects. However, the benefits of clinical surgical treatment for deep cerebral hemorrhage are unclear at present. The risks of surgery itself and the damage to brain tissue during the process of entering the hematoma limit the therapeutic effect (13).

There was no statistical difference at 6 mouths and one-year functional outcome and mortality between the three groups (p value 0.01).

Limitations: This is a single department study with limited means. The sample is small and the inclusion criteria are not accepted by many neurosurgeons.

Conclusion

This first study of minimally invasive stereotaxic for ICH evacuation must be followed up and encouraged. Even if the results are satisfactory, a double-blind study is required in largest sample. The result on the hematoma volume was good.

Abbreviations:
ICH: intracerebral hemorrhage
CT: computed tomography
mRS: modified Rankin Scale
CC: centimeter cubic
EOT: end of treatment
PHE: Perihematomal oedema
BG: Basal ganglia
M: Male.
F: Female.
HBP: High Blood Pressure
DM: Diabetes Mellitus
SPSS: statistical package for the social sciences.
ANKE: Name of company.
FMOS: Faculty of Medicine and Odontostomatology
USTTB: University of Sciences, Technics and Technologies of Bamako

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