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THERAPEUTIC VALUE OF THE CRANIOTOMY EXPLORER IN THE EMERGENCY TREATMENT OF SEVERE TRAUMATIC BRAIN INJURY IN MADAGASCAR

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SUMMARY

Introduction: Craniotomy is a neurosurgical act which consists of cutting one or more bones of the skull in order to realize a cranial flap allowing to expose the brain to operate. It is called exploratory when the nature and extent of lesions will only be discovered during craniotomy. **Objective:** Report on the contribution of exploratory trepanning and craniotomy to the surgical management of severe cranio-encephalic trauma (TCE) in Madagascar. **Materials and Methods:** Descriptive study carried out in the neurosurgery department of CHUJRA-Antananarivo, Madagascar. It involved 260 cases of an exploratory craniotomy over an eight-year period running from January 2008 to December 2015. **Results:** The mean age of the patients was 32.46 years (ages 2 to 62 years) with a male predominance (93.08%). The sex ratio was 13.4 (242% ♂, 18% ♀). The traffic accident is the leading cause among our cases, 59.62%. 175 patients (67.31%) had a Glasgow score of 8/15. All our patients presented an anisocoria including 145 cases of left mydriasis, 115 cases of right mydriasis. Exploration was able to demonstrate: 112 cases of epidural hematoma (43.1%), 47 cases of acute subdural hematoma (18.1%), 3 cases of craniocerebral wounds (1.15%), 2 cases of chronic subdural hematoma (0.77%) and 96 cases of white exploratory craniotomy (36.92%). The mortality was 57.7%. **Conclusion:** There is no clinical presentation that is specific to epidural hematomas, but in front of an anisocoria with or without contralateral hemi corporeal deficit,

the neurosurgeon must act through the empirical method: explorative craniotomy because many patients with cranial trauma encounter Difficulties with scannographic equipment.

KEYWORDS: Exploratory craniotomy, cerebral engagement, cranio-encephalic trauma, cerebral scan, time to care.

INTRODUCTION

Head trauma is a global scourge and one of the leading causes of morbidity and mortality in young adults. The accessibility of the CT scan in each reference university hospital center has greatly improved the therapeutic management of cranioencephalic trauma (TCE). It allows an accurate diagnosis and an evaluation of the evolution of brain lesions.[1,2] The implementation and availability of the scanner in hospitals remains a major technical and financial obstacle in underdeveloped countries.

The standard radiographic examination of the skull representing well-known limits[3] is therefore often widely requested. Faced with the inaccessibility of CT scans in Madagascar, exploratory craniotomy remains the solution to be practiced in the face of the severity of head injuries. The purpose of this study was to report to show the important role played by the exploratory craniotomy in the surgical management of patients victims of a serious cranioencephalic trauma in Madagascar.

MATERIALS AND METHOD

This was a descriptive study carried out in the neurosurgery department of CHUJRA in Antananarivo, concerning the exploratory craniotomy in severe head injuries. Two hundred and sixty patients operated on for exploratory craniotomy over an eight-year period from January 2008 to December 2015 have been reported. It focuses on severe head trauma patients who have had disturbances of consciousness and signs of focusing, and who have not been able to benefit from a brain scan (operability criteria).

RESULTS

The average age of the patients was estimated at 32.46 years with extreme ages from 2 years to 62 years with a male predominance evaluated at 93.08% while the female gender constitutes only 7% with a sex ratio of 13, 4.

The traffic accident is the first cause among our patients, or 59.62%, second comes a fall from a high height of 25% and assaults (15.38%).

The clinical examination found 175 patients (67.31%) with a Glasgow score of 8/15, 35 patients with a score of 7/15 or 13.46%, and 25 patients or 9.62% with a score of 6/15. Ten patients had a score of 5/15 or 3.85% while five others were scored at 3/15 or 1.92%. All our patients presented with anisocoria including 145 cases of left mydriasis, 115 cases of right mydriasis. There were also 215 cases of motor deficit; 78 cases with bradycardia; 53 cases of otorrhage; 48 cases of vomiting; 8 cases presenting a phase of decerebration and 6 another in dehulling. A notion of initial loss of consciousness was found in 182 (70%) patients. This period of treatment between the trauma and the surgical procedure varies between 6h and 72h; on average we obtain the time of surgical management was 18h. In most cases, the time between the appearance of worsening signs and the intervention is imprecise and cannot therefore be analyzed.

Among the 312 severe brain injuries not documented by a brain scan, 260 have had an exploratory craniotomy. The average duration of the intervention was 128 minutes. The exploration was able to objectify: 112 cases of extradural hematoma (43.1%), 47 cases of acute subdural hematoma (18.1%), 3 cases of craniocerebral wounds (1.15%), 2 cases of chronic subdural hematoma (0.77%) and 96 cases of a white exploratory craniotomy (36.92%) (Table II). Among the 260 operated patients, 57.7% died and 42.3% survived.

Among the survivors, the following were diagnosed: 82 isolated HED cases who were evacuated; 15 acute HSDs; one PCC, two chronic HSDs and 10 white craniotomies.

DISCUSSION

Head trauma is a global scourge and one of the leading causes of morbidity and mortality in young adults. The lack of diagnostic means in certain hospitals as is the case at CHU-JRA requires the neurosurgeon to still practice the empirical method (exploratory craniotomy) in severe head injuries. Signs of clinical examinations and radiographic information may assist surgeons in deciding this, in the surgical management of these patients without a brain scan.[1,3]

Only the clinical signs that occur often enough in severe head injuries can be used to decide on immediate intervention. Three signs can fulfill this condition:

- The notion of mydriasis (initially present on the positive side in all cases)
- The presence of a unilateral skull fracture (visible on skull x-rays in 123 cases of epidural hematomas out of 161 fractures, or 76.4%)

- The existence of a conscious interval before the coma (97 epidural hematomas out of 260, or 37.31%).

If the decision to operate immediately was based solely on these three signs, the 260 patients could be divided into three groups:

- (a) Absolute criterion for immediate operative indication: presence of a fracture and (unilateral) mydriasis on the same side, associated with the concept of a lucid interval.[4]
- (b) Relative criterion: fracture and myolateral mydriasis without notion of lucid interval.
- (c) Questionable criterion: mydriasis with notion of lucid interval, without homolateral fracture.

The common point is the existence of mydriasis. Announcing compression of the brainstem, the presence of this sign requires a quick decision.

In our study, 25% craniotomy from the start was indicated. The choice was based on the discovery of fractures on the radiograph and their correlation with clinical signs leading to HED. A vault fracture and focal neurological signs were found in 61.92% of the cases. In 161 patients with a vault fracture, 78 (48.74%) had an extradural hematoma. The lesions objectified to the radiography, like fracture or embarrassment, can testify the violence and the mechanism of the shock, but cannot evaluate us the nature of intracerebral lesions[6,7] insisting on the interest of the indirect signs observed on the radiography standard of the skull in cases of TCE.

We were able to discover through this technique: 54 cases of HED; a case of HED associated with a PCC; 10 cases of acute HSD. Exploratory trepanation followed by a craniotomy constituted the majority of our technique with: two cases of chronic HSD; 5 cases of acute HSD; 1 HED associated with 1 acute HSD; 4 cases of HED with acute HSD; 24 HED cases, two of which had two different topographies.

The choice of an exploratory trepanation followed by a craniotomy seems to be the ideal choice because it meets the goal of craniotomy which is to find the real diagnosis. Besides, Koumtchev et al. recommends that in the presence of an intracranial hematoma, surgical treatment with a four-hole drill bit flap is preferable in the first three days of the trauma.[8]

During an exploratory craniotomy, the absence of an underlying cerebral expansion and the discovery of a tense dura connote the existence of an intracerebral lesion. This can only be

appreciated through a bony flap. Surgery is useless for a Glasgow score <or equal to 5 for some authors.[9] Zumkeller et al. demonstrate the absence of significant value on the fate of operated and unoperated patients with an intracerebral hematoma at this stage.[10]

In our case, an exploration was still made for two cases around 3/15 of the Glasgow score without it having produced favorable results. In fact at this stage, the nervous system is already in a purely vegetative function.

In our case, not knowing the nature and extent of the intracerebral lesions, the neurosurgeons refrained from an exploration for fear of an external cerebral hernia. We noted a mortality rate of 57.7%.

According to Di Rocco, 90% of mortality is noted when an aractive mydriasis is noted.[11] Acute HSD is always a poor prognosis and constitutes, according to the authors, 40% to 90% mortality.[12] According to Benedict P., 3 out of 5 acute HSDs have died despite immediate evacuation.[13] In our case, all patients with acute HSD succumbed to death. This proves that immediate evacuation is less rewarding during an HSD. In young subjects, there is an interest in the evacuation of an HSD acute compared to an elderly subject where brain atrophy helps to better tolerate HTIC. Isolated acute HSDs are rare; it is most often associated with bruises cerebral.[12] The existence of a cerebral contusion or an intracerebral lesion darkens the prognosis tripling mortality and the number of serious sequelae.[13] This has been proven in our research during which the majority of lesions intracerebral resulted in a death.

The skull X-ray in these cases appeared to be of no use and the operative indication was hazardous. This crucially posed the need to have the brain scanner in the closed TCE where the x-ray of the skull has no place.[2,14]

CONCLUSION

The interest of our study does not consist in going back to the old practice but in proving to what point the exploratory craniotomy is a crucial gesture which very often turns out to be beneficial. However, this examination, which is little or no longer practiced in developed countries, can in no way compensate for the therapeutic insufficiencies and uncertainties linked to the absence of a scanner.

For many patients, the exploratory craniotomy has offered them a chance to survive while avoiding being subjected to an autopsy. Unfortunately our results are only a reflection of the

reality in Madagascar and that the presence of a brain scanner in each hospital would greatly improve these results.

Conflicts of interest

The authors declare no conflict of interest.

Author contributions

All the authors contributed to the realization of this work. All have read and approved the final version of this manuscript.

Table I: Distribution of Clinical Signs.

CLINICAL SIGNS	Numbers	Percentage in%
Anisocoria		
Left	145	55,77
Right	115	44,23
Motor deficit	215	82,70
Free interval	126	48,46
Coma from the outset	134	51,54
Bradycardia	78	30
Otorrhagia	53	20,38
Vomiting	48	18,46
Pithing	8	3,08
Decortication	6	2,31

Table II: Peroperative Lesion Distribution.

Peroperative lesion	Numbers	Percentage in %
Extradural hematoma	112	43,08
Acute dural hematoma	47	18,08
Craniocerebral wounds	3	1,15
Chronic dural hematoma	2	0,77
White exploratory craniotomy	96	36,92

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