WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 9, Issue 3, 872-881. Research Article ISSN 2277– 7105

THERAPEUTIC APPROACHES TO CRANIOCEREBRAL WOUNDS IN MAHAJANGA (MADAGASCAR)

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Article Received on
25 Dec. 2019,
Revised on 15 Jan. 2020,
Accepted on 05 Feb. 2020
DOI: 10.20959/wjpr20203-16842

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ABSTRACT

Introduction: The cranioencephalic wound is a solution of continuity of all the planes of cover separating the cerebral parenchyma from the external environment. The interest of our study lies in the fact that craniocerebral wounds are more frequent in civil practice with a very high morbidity. **Objectives:** The aim of this study was to show the epidemiological and clinical aspects of cranioencephalic wounds and to assess their management in an underdeveloped country such as Madagascar. **Patients and methods:** We carried out a retrospective study of 54 files collected from May 2017 to October 2018 (18 months). All patients who were admitted to the emergency department were assessed clinically by the Glasgow score and a complete neurological examination. They benefited from a brain scan before medical and surgical treatment. **Results:** The average age of our patients was 29.87 years, with a male prevalence of 50 cases (92.59%). The main cause was assaults, 81.48%. The average time before hospitalization was 30 hours and the average time for surgical management was 12 hours; the majority of the patients had a good state of consciousness according to the Glasgow scale 40 cases (15 - 13), 12 cases (12 - 9) and 2 cases (8-3). The average length of hospital stay was 8 days. The immediate post-operative course was excellent was in 42 cases (77.78%). One patient died, five had aphasia and six others had hemiparesis. **Conclusion:** Cranioencephalic

wounds are a fairly common neuro-traumatic entity, the main complication of which is meningeal infection. Early treatment with trimming and antibiotic prophylaxis would make it possible to obtain satisfactory results, especially in Madagascar.

KEYWORDS: Meningeal infection, Madagascar, Cranioencephalic wounds, Surgical treatment.

INTRODUCTION

Cranioencephalic wounds result from the communication of encephalic structures with the surrounding environment by the presence of a solution of continuity going from the scalp to the dura at least. Insecurity, fueled by political and economic crises and the illicit possession of firearms, are the main causes of the head trauma. They therefore pose two types of immediate major complications: hemorrhage and infection. These make it a diagnostic and therapeutic emergency. The objective of this study was to identify the clinico-epidemiological aspects of cranioencephalic wounds at Professor Zafisaona Gabriel University Hospital and to evaluate their therapeutic management in the light of results from foreign series.

PATIENTS AND METHODS

This was a retrospective study from May 2017 to October 2018 (18 months) on 54 files of patients who presented with a cranio-cerebral wound and treated at the PZAGA university hospital Androva Mahajanga. The patients were examined at admission and underwent an X-ray scan of the skull and a cranioencephalic computed tomography. Patient selection is clinical, based on the outcome of brain matter or LCS through the scalp wounds, and / or the intraoperative discovery of a dura mater wound next to the point of impact.

RESULTS

During the same 18-month period, we received 487 cases of head trauma that required hospitalization for at least 24 hours, 54 of which (10.08%) had a brain injury. The incidence was 3 cases per month (Table I). The average age was 29.87 with a peak age range between 31 to 45 and extremes ranging from 1 year to 51 years and a sex ratio of 12.5 in favor of men. The average evacuation time was 27 hours. All patients were evacuated by land: firefighters (2 patients), individual vehicles (38 patients), Bajaj (14 patients). The results of the physical examination are presented in Table II. These lesions occurred in the context of multiple trauma in two patients. They were associated with a tibia fracture in one case and a stable vertebra C2 fracture in another.

Radiological exploration, especially on CT scan, showed various lesions, including 30 cases of cerebral contusions located in various places of the cranial vault (Table IV). First aid consisted of local detersion, tetanus prophylaxis (vaccination status generally not specified). The operating time was between 36 and 72 hours. The surgical treatment consisted of two stages:

- A careful washing of the operating field with isotonic saline with removal of foreign bodies and contusive tissue followed by careful hemostasis. The inventory of bone and encephalic lesions was thus made.
- We then proceeded to an osteo-dural and cutaneous repair (sutures and plasty). This time may require an enlargement craniotomy or the size of a flap to properly expose the meningoencephalic lesions (45 cases).

The dural closure was performed with an autologous graft taken from the epicranium or the fascia of the temporal muscle. The dural closure was waterproof in 46 patients and incomplete in eight patients. The bone flap was replaced and fixed in one piece or reconstituted from the fragments (puzzle) in all patients. Immediate postoperative follow-up was simple in 42 patients (77.78%). Two patients had an LCS leak. Two patients later developed meningitis, the germs of which could not be determined. One died on D3 despite triple antibiotic therapy (ceftriaxone, ciprofloxacin and metronidazole). He had a GCS score of 8/15 on admission with a large temporal wound and large contusion in front.

The average length of hospital stay for our patients was 8 days. Table V summarizes the evolution according to the "Glasgow outcome scale: GOS" over a period of two to 6 months. Ten patients were lost to follow-up, four had aphasia, one patient had memory impairment associated with aphasia and seizures, and six others had hemiparesis.

DISCUSSION

Epidemiology

Cranioencephalic wounds account for between three and eight percent of cranioencephalic trauma[1-2], confirming the 10.08% of our series. The clear male predominance (sex ratio of 12.5) could be explained by a more marked exposure of men to the circumstances of occurrence dominated in our poor countries, to juvenile delinquency, defective roads and the dilapidated car fleet, by accidents of circulation.[3]

Assaults represented the second cause in the literature, which is the first in our case.[1-3] They occurred for 44 of our patients or 81.48% especially in rural areas for 42 patients or 77.77% (including 36 cases of ax blow during an attack by banditry / Dahalo and 8 cases of conflicts between farmers) and in urban areas for two patients, ie 3.7%.

The frontal region ranks first in the lesional topography, it is around 53.70%. Followed by the parietal region which represents 29.63% of the cases. The occipital zone represents only 2 cases, ie 3.70%. These results are comparable to that of the literature. The majority of lesions were in the parietal and frontal region. In Madagascar, this result may be explained by the resurgence of assault accidents (62.5%) where the forehead is often the most exposed during an attack, particularly face to face; and the absence of a helmet (2-wheeled vehicle) or seat belt when driving (dashboard accident) or the fairly high incidence of drinking and driving. The postero-inferior position in the skull gives the cerebellum a certain protection and would justify the rarity of the wounds of this organ. Thus only one case by a small saber embedded in the left cerebellar lobe, was reported in our series with an asymptomatic picture. However, lesions of this posterior fossa touching the brainstem are thought to generate mortality between 80 and 100%[4,5] justifying the rarity of cases seen in hospital.

Clinical study

The initial clinical assessment of patients with head trauma already defines prognostic predictors and a therapeutic strategy. The Glasgow admission score is correlated with the mortality rate.[6,7] Thus 98% of patients with a Glasgow score ≤ 8 would die (only one of our patients with a GCS to 8 will die later) while 96.29% of those who had a Glasgow score> 8 would survive (52 cases of our series is 96%).[6,7]

In our study, the frequency of issue of brain matter and of the LCS was correlated with the use in 42.59% of the cases of knives during an assault. The loss of substance, especially the loss of cerebral matter, is characteristic of craniocerebral wounds. LCS fistulas are revealed by rhinorrhea or otorrhea which testify to the communication of the endocranium with the air cavities of the base (frontal sinus, sphenoid rock).[2,8]

Neurological deficits were observed in 35.17% of the injured. They are distributed as follows: 6 cases of hemiplegia or 11.11%, 7 cases of aphasia or 12.95%, 6 cases of hemiparesis or 11.11%. The low rate of focal neurological deficit in our series could be explained by the

predominance of frontal lesions, especially the precentral part. These lesions were isolated in our series and unlike the Moroccan series.[2]

Paraclinical examinations

Brain CT has significantly changed the diagnostic approach for these patients and has enabled practitioners to more safely adopt a therapeutic strategy. It significantly changed the diagnostic approach to lesions and allowed neurosurgeons to refine their therapeutic strategy. Cerebral contusion ranks first, 55.56% in our series, followed by pneumatocele, 31.48%. We also observed 11 cases of embarrassment (20.37%), 6 cases of extradural hematomas (11.11%), 3 cases of subdural hematomas (56%), 2 cases of intracerebral hematomas (3, 70%) and one case of brain abscess as a complication of the craniocerebral wound. The survival rate would be significantly better in patients with unilobar disease[5] compared to multilobar disease. Multiple unilateral trauma would have a poorer prognosis than trauma involving a single lobe.[7,9] Mortality is also linked to the bi-hemispherical characteristics of the lesions with the exception of bipolar trauma (bi-frontal and bi-occipital in particular).[6,10] Ventricular involvement would also have a poor prognosis.[4,6] MRI, despite its great sensitivity, does not add anything to the information provided by CT in the acute phase, but it does better explore deep and axonal lesions in the late phase.

Therapeutic care

The medical treatment, always preceding surgery, is centered on resuscitation and prevention of infection: tetanus and anti-pneumococcal serovaccination as well as anti-Hib and probabilistic antibiotic prophylaxis targeting firstly staphylococcus (3rd generation cephalosporin combination, fluoroquinolones and imidazole). Recall that before the era of antibiotics, the infection rate of cranio-cerebral wounds was 58.8% with a mortality rate from infection of 83% during the First World War.[11] During the Second World War, the local application of sulphate powder and injection of sulphonamide had made it possible to have a reduction in mortality around 21% to 31%. When penicillin was introduced into the treatment, this rate dropped from 5.7% to 13%. Nowadays, several molecules are used in prophylaxis allowing to have an infection rate between 4% and 11% and reducing the risk of brain abscess from 8.5% during the Second World War to 1.6% to 3, 1% in recent series.[12-14] The use of broad spectrum molecules is therefore recommended. All of our patients had received antibiotic therapy based on amoxicillin + clavulanic acid.

Anti-tetanus serotherapy must be systematic in case of doubt about the patient's vaccination status (frequent situation in Madagascar). The lack of consensus on the systematization of anticonvulsant therapy from the start meant that we had only implemented it in eight of our patients who had seizures. However, faced with a high risk of comitiality, in the event of an intracranial foreign body, this anti-comitial treatment should be started here very early (twenty-eight of our patients).

The importance of the response time has been emphasized by several authors; they emphasized the importance of early intervention to prevent sepsis.[11,15] The intervention includes several stages:

- The cutaneous time consists in making an economic but complete excision of the edges of the wound and the evacuation of foreign bodies and contaminated tissues, followed by a good hemostasis.
- Bone time consists of performing an esquectomy or the size of a flap in order to see all the banks of the dural tear.
- Meningeal time will excise the jagged edges and hemostasis of cortico-meningeal vessels.
- The cerebral time consists in the ablation of the foci contus, dilacéré and nécrosés. It is done from the periphery to the depth, gradually with a hemostasis of the vessels. Debridement must be careful to minimize brain damage. For this encephalic time, irrigation with warm physiological saline will suffice to remove the mortified tissue.
- Duroplasty constitutes the essential time for the treatment of cranio-cerebral wounds. It is a tight closure of the dural opening.

The use of autologous substitutes (fascia lata, galea) offers excellent results in our conditions of practice. Sufficient area must be removed to avoid tensioning the plasty. Post-operative clinical monitoring should look for signs of meningitis, the local wound condition. Control CT may be required if neurological worsening occurs.

Operating suites

Serious complications and serious sequelae can follow PCC, which is why there is a need for close clinical monitoring of patients. Infection is the major complication to these open trauma[17]: meningitis, often pneumococcal; brain abscess; wall infection, osteitis factor. Bone fragment retention intra parenchymally is an unusual complication, since it is the prerogative of the CCP with firearms.

The LCS fistula is the cause of 20% of post-traumatic meningitis, which for the most part dries up spontaneously within 24 to 48 hours of the accident. Otherwise, surgery and sufficient antibiotic therapy are really necessary. In our series two cases of LCS fistula were noted and treated with antibiotic therapy. A postoperative hematoma may follow an imperfect hemostasis after a craniectomy or craniotomy.

PCC mortality is linked to several factors: time to care, age, initial state of consciousness, type of brain damage, association with multiple trauma.

Evolution

The outcome was considered favorable in patients with a score of one to two on the Glasgow outcome scale (Glasgow outcome scale GOS) and unfavorable in patients with a score of 3 to 5.

Forty of our 54 patients developed favorably with minor neurological sequelae: epilepsy (one patient) and memory impairment (two patients) and minor motor deficits (two patients) were noted during a follow-up of two to six months. The studies carried out in Dakar in 1986[7,16] and in Morocco in 1994[15] had obtained 67% and 80% respectively of good results.

LIST OF TABLES

Table I: Monthly distribution of craniocerebral wounds.

Months	Number of patients	Percentage in %
Mei 2017	1	1,85
June 2017	3	5,55
Jully 2017	2	3,7
August 2017	4	7,4
September 2017	2	3,7
October 2017	4	7,4
November 2017	1	1,85
December 2017	3	5,55
January 2018	2	3,7
February 2018	3	5,55
March 2018	4	7,4
April 2018	6	11,11
Mei 2018	2	3,7
June 2018	3	5,55
Jully 2018	5	9,25
August 2018	4	7,4
September 2018	3	5,55
October 2018	2	3,7
TOTAL	54	100

Table II: Distribution of patients according to neurological signs.

Neurological signs	Number of patients	Percentage in %
Glasgow > 8	52	96,3
Glasgow < 8	2	3,7
Hemiplegia	5	9,25
Monoplegia	2	3,7
Aphasia	5	9,25
Convulsion	28	51,85

Table III: Distribution of patients according to the types of brain damage.

Types of lesions	Number of patients	Percentage in %
Localized arch wounds	29	53,7
Craniocerebral decay	10	18,5
Communication with the sinuses of the face	7	13
Penetrating wounds	8	14,8
TOTAL	54	100

Table IV: Distribution of patients according to the site of the lesion.

Seat of the lesion	Number of patients	Percentage in %
Frontal	29	53,7
Pariétal	16	29,6
Temporal	7	13
Occipital	2	3,7
TOTAL	54	100

Table V: Distribution of patients according to their postoperative outcome (GOS).

GOS	Number of patients	Percentage in %
1	36	66,67
2	14	25,93
3	2	3,7
4	0	0
5	2	3,7
TOTAL	54	100

CONCLUSION

Bladed cranioencephalic wounds are a fairly common neuro-traumatic disorder in developing countries, the main complication of which is meningeal infection. The insufficient number of Neurosurgery departments in the country and the inaccessibility of the brain scanner negatively affect the quality of care. Their prognosis depends on many factors, essentially, the speed and quality of medico-surgical management. The best remedy remains a good prevention of reduction of the rate of aggressions.

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.

REFERENCES

1. Solumsmoen S, Buch KF, Lilja-Cyron A, Kelsen J. Traumatic penetrating brain injury. Ugeskr. Laeg, Dec 17, 2018; 108(51).
2. Sami A., Choukri M., Achouri M., Ait Benali S. Les plaies crânio-cérébrales à propos de 150 cas. Magreb Médical, 1994; 278: 38-9.
3. Balogun JA, Awana E, Akwada O, Balogun FM. Acces to the intensive care unit by severe head injury patients. J Neurosci Rural Pract, 2019; 10(4): 666-71.
4. Bizhan A, Aarabi JA, Mossop C. Surgical management of civilian gunshotwounds to the head. Handb Clin Neurol, 2015; 127: 181-93.
5. Turco L, Phillips B, Cornell DL. Penetrating bihemispheric traumatic brain injury: a collective review of gunshot wounds to the head. World Neurosurg, 2017; 104: 653-9.
6. Clark W.C., Muhlbauer M.S., Watridge C.B., Ray M.W. Analysis of 76 civilian craniocerebral gunshot wounds. J. Neurosurg, 1986; 65: 9-14.
7. Maragkos GA, Papavassiliou E, Flippidis AS, Stppler M. Civilian gunshot wounds to the head: Prognostic factors affecting mortality: meta-analysis of 1774 patients. J. Neurotrauma, 2018; 35(22): 2605-14.
8. Nohra G., Maarrawi W.I., Samaha, Ritzk T., Okais N. Infection et plaies crânio-cérébrales par arme à feu : Expérience durant la guerre civile libanaise. Neurochirurgie, 2002; 48(4): 339-44.
9. Vakil MT, Singh AK. A review of penetrating brain trauma: epidemiology, pathophysiology, imaging assessment, complications, and treatment. Emerg Radiol, 2017; 24(3): 301-9.
10. Glapa M, Snyckers FD, Yilmaz TH, Degiannis E, Zorio M, Bowley DM, Doll D. Gunshot wounds to the head in civilian practice. Am Surg, 2009; 75(3): 223-6.
11. Cushing H. Notes on penetrating wounds of the brain. Br Med J., 1918; 1: 221-6.

12. Aarabi B, Haghnegahdar A, Mobley L, Taghipour M, Farokhi M. Prognostic factors in the occurrence of posttraumatic epilepsy after penetrating head injury suffered during military service. Neurosurg Focus, 2000; 8(1): e1.
13. Besenski N, Jelavic-Koic F, MMikulic D, Maskovic J, Jadro-Santel D, Pavic D, Glavina K. CT analysis of missile head injury. Neuroradiology, 1995; 37(3): 207-11.
14. Chen L, Liang Y, Jiang J, Bao Y, Wang Y. Surgical management and outcomes of non-missile open head injury: report of 44 cases from a single trauma centre. Brain Inj, 2016; 30(3): 318-23.
15. Karger B, Brinkmann B. Multiple gunshot suicides: potential for physical activity and medico-legalaspects. Int J Legal Med., 1997; 110(4): 188-92.
16. Beach H.H.A. Gold foil in cerebral surgery. Boston Med Surg J., 1897; 136: 281-282.
17. Houdart R, Plaies crâniocérébrales. Pathologie Chirurgicale, Masson, 3ème édition, Paris, 1978; 294-297.