Cranietomy Surgery in Brain Trauma Injury in Child: (Therapeutic Decisions and Evolution)

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Abstract: The decompressive cranietomy is described as temporary removal of a portion of the skull for the relief of high intracranial pressure. The new interest of this technique is its good outcome in management of some brain pathologies in adult such as traumatic brain injury (TBI).

Objective: Assess our outcome of the decompressive cranietomy in brain trauma injury in the child.

Material and Method: Overall seventeen children with brain trauma injury were prospectively underwent for cranial flap during 36 months. This study concerned children between 0 and 15 years old.

Result: Seventeen files were kept. The mean age was 7.9 years. The male gender was predominant in 11 cases. We recorded 7 patients in coma. An anisocoria was observed in 6 patients, and a hemiplegia in 5 cases. The brain CT-Scan showed the presence of the cerebral bruise lesions associated with an intracranial hematoma in 7 cases. The mean delay therapeutic was 45 hours. Death rate was recorded in 5 cases. The clinical evolution was good in 8 patients. A vestigial neurological deficit was recovered in 4 cases.

Conclusion: The cranietomy provides mostly good outcome in brain injury and permits intracranial pressure monitoring, and reduces mortality or morbidity. It deserves to be integrated into management of severe trauma brain injury in child.

Key Words: Brain trauma, Cranietomy surgery, Child, Intracranial hematomas

Introduction

The decompressive cranietomy is described as temporary removal of a portion of the skull for the relief of high intracranial pressure.

Traumatic brain injury (TBI) is a serious public health problem associated with high morbidity and mortality. Severe TBI is most common in young and middle-aged persons, thus causing serious socioeconomic problems [1; 2]. A day, few studies were focused on cranietomy in children. The aims of this study is to evaluate the impact of cranietomy on intracranial pressure after traumatic brain injury in children, assess the future of children with trauma brain injury after cranietomy, and evaluate the effectiveness of this technique in children.

Patients and Methods

Prospective and descriptive studies about 17 children spread over 36 months (December 2013 - December 2016), at the department of Neurosurgery of the Hospital University Gabriel TOURE of Bamako in Mali. It involved all children underwent cranietomy on emergency for skull-brain injuries responsible to high intracranial pressure. Children
underwent craniectomy for other brain injuries were not included from this study. Elements of postoperative monitoring were in a study based on repeated assessment of the state of consciousness, examination of the pupils and blood pressure.

**Results**

The average age was 7.9 years [range 10 months to 15 years]. Eleven patients were male and six female. The sex-ratio was 1.8. Twelve children were schoolarized. We recorded 9 cases in road traffic injuries followed by 6 cases in falls in height and 2 cases in blows and wounds. Seven patients were admitted with Glasgow Coma Scale ≤ 8. Examination found an anisocoria in 6 cases and hemiplegia in 5 cases (Figure 1).

CT-Scan was performed for all patients (Figure 2) and showed lesions of hemispherical intracranial hematoma associated with cerebral contusion in 7 patients, followed by hemispherical focal cerebral contusion in 6 cases, skull-brain wound associated with edema on 3 cases and diffuse cerebral edema on 1 case. Emergency surgery was performed in 10 patients with intracranial hematoma associated with involvement sign in 7 cases and brain injuries wounds in 3 cases. The 7 remaining patients had received prior medical treatment (sedation, hyperventilation, osmotherapy) before surgery. No cases of external ventricular shunt (EVS) had been reported.

The average therapeutic time was 45 hours [range 7 hours to 83 hours]. Surgery average was 2 hours and 48 minutes [range 2 hours 10 min to 3 hours 62 min]. Craniotomy flap associated with escape of intracranial hematoma was performed in 7 cases. These intracranial lesions were extradural hematoma in 5 cases and acute subdural hematoma 2 cases. A decompressive craniectomy associated with duroplasty was performed in 7 cases. The craniectomy associated with trimming and dural matter breach repair was performed in 3 cases. During immediate postoperative period, 1 patient was admitted for shocking, 1 patient at the short hospitalization unit, and 5 patients had been admitted to multi-purpose intensive care. Mean follow-up was 19.6 months [range 9 to 26 months]. We recorded binocular blindness in 1 case, hemiparesis in 3 cases, death in 5 cases and favorable outcome in 8 patients.

**Discussion**

Traumatic brain injury has been deemed a serious public health concern by the Center for Disease Control and Prevention [3]. Early childhood is characterized by growth and physical, psychological and social development, during which they are exposed to accidents. Severe traumatic brain injury is the most common cause of disability in children. Refractory raised intracranial pressure can be a therapeutic challenge. Decompressive craniectomy can be performed when medical management is insufficient.

In 36-month, 17 children underwent craniectomy for skull brain trauma. The choice of children aged between 0 to 15 years was to see the real impact of decompressive craniectomy in this population with severe cranial trauma. We recorded favorable outcome in 8 cases (47%) that corroborate the rate of previous studies [4; 5]. The clinical picture was assessed by Glasgow Coma Scale for the elder children and Blantyre in infant, state of the pupils, the neurological deficit, the search of skull-brain wound and other associated lesions. The GOS (Glasgow Outcome Scale) and the Modified Rankin Scale (MRS) seem to be reliable tools for measuring neurological disorders. It is used in few studies to compare outcomes with control group. Josan reported satisfactory neurological outcomes (1-year GOS ≥4) in 100% of
craniectomized children, compared to 50% in his control group [6].

The surgical decision will take into account the clinical and brain imaging data in order to get an idea of the patient's vital parameters and functional prognosis. In addition to these parameters, monitoring of intracranial pressure by intracranial pressure sensors (ICP: Intracranial Pressure, IVP: Intra Ventricular Pressure) would be a valuable help in making a therapeutic decision. They evaluate the intracranial pressure in real time, which makes it possible to evaluate the effectiveness of the treatment in progress and to perform another management.

Decompressive craniectomy in cranial trauma reduces intracranial pressure to maintain cerebral perfusion pressure sufficient to maintain cerebral blood flow, and thereby maintain brain oxygenation. Some studies had shown the reduction of the median line deviation after decompressive craniectomy and thus preventing the occurrence of a cerebral engagement [7; 8]. In developed countries, monitoring of intracranial pressure (ICP) or intraventricular pressure (IVP) is performed in severe brain trauma. It is of great therapeutic value and allows the follow-up of these patients in intensive care. The absence of these tools in our work context makes us most often surprised by a neurological degradation of our patients. The majority authors agree that it would be unnecessary to perform decompression craniectomy in patients with bilateral mydriasis or in those with signs of brain stem involvement. Surgery should be performed before signs of neurological severity occur. The earlier it is done, better are the outcome and prognosis.

Although there is no threshold value for the intracranial pressure at which surgery will become imperative, an intracranial hypertension at 20 or 25 mmHg should prompt a review of the therapeutic option adopted. Because of adaptive capacity and cerebral self-regulation, hypertension within the brain cavity occurs and can vary according to the patient. Vigilance should therefore be a prerequisite for every case of head trauma. Children, due to cerebral neuroplasticity, may have a better response to treatment than adults. Decompressive craniectomy has a real advantage over survival by reducing the rate of death in pediatric head trauma [9]. Postoperative resuscitation with respiratory assistance for bedridden patients could improve their clinical course. In our study, we recorded 5 of mortality that may be explained by delayed care, poverty, ignorance and dramatization of neosurgery. We recorded favorable evolution in 8 cases. Three patients with neurological deficit had physiotherapy with a quite slow regression. The prognosis depends on the precocity of multidisciplinary management, involving emergency physicians, neurosurgeons, anesthetists, resuscitators and physiotherapists.

**Conclusion**

The craniectomy is a surgical procedure that reduces mortality and morbidity through its reducing effect of intracranial pressure, improving cerebral blood flow, and limiting the spread of cerebral edema. This reduction in intracranial pressure improves the survival rate by preventing brainstem engagement. It is therefore an interesting therapeutic option that must integrate our arsenals of management of the severe cranial traumatism on children.

**Conflict of interest**

We declare to have no conflict of interest for this article.

**References**

