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Decompresive Craniectomy in Infants at Fann University Hospital in Dakar

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Abstract: Introduction: Decompressive craniectomy is a neurosurgical technique indicated as a last resort in the management of intracranial hypertension refractory to medical treatment. Carried out in infants, it represents an additional challenge due to the morbidity and mortality with which it is associated. The objective of our study was to report the experience of the neurosurgery department of Fann University Hospital in Dakar. Patients and Methods: It's a retrospective study on 4 infants who have undergone a decompressive craniectomy at Fann University Hospital in Dakar over a period of 10 years, from January 1, 2010 to December 31, 2020. Results: Four patients under 2 years of age underwent decompressive craniectomy out of a total of 26 patients over the study period. The mean age at diagnosis was 10 months with extreme (60 days to 24 month). The average consultation time was 3 days with extremes (1 to 8 days). Two infants had had severe head trauma. Only one infant showed significant clinical improvement postoperatively; the other three died within 1 to 6 days of surgery. These deaths were linked to acute bleeding in 75% of cases. The mean survival time was 2 days with extremes ranging from 1 to 4 days. Conclusion: Decompresive craniectomy remains the challenge in infants due to the risk of bleeding and hemodynamic instability. Given the low number of publications, we encourage other authors to share their. In our study, three patients died at the end of the operation from bleeding complications. Among these deaths a patient had a coagulopathy which also poses another challenge to the management of these patients.

Keywords: Decompresive Craniectomy, Infant, Subdural Hematoma, Intracranial Hypertension

1. Introduction

Decompressive craniectomy for infants is a neurosurgical technique indicated as a last resort in the management of intracranial hypertension (ICH) refractory to medical treatment [1]. This intervention can be performed in infants. It has proven its effectiveness in the management of ICH

refractory to medical treatment [2, 3]. However, it is a challenge at this age for the neurosurgeon, with a risk of decompensation by blood loss [4]. Unfortunately the literature is quite poor in this age group [5]. The aim of this work is to report the experience of the neurosurgery service of Fann university hospital of Dakar in this particular age group.

2. Patients and Methods

This was a retrospective study spanning a 10-year period (January 1, 2010 to December 31, 2020), focusing on four infants who have received craniectomy decompression for ICH refractory to medical treatment. Were excluded from our study all children over 2 years old. The parameters studied were: age, sex, Blantyre score, condition of pupils, initial neurological signs, results of computed tomography, etiology, technique, postoperative complications as well as mortality. The data collected was analyzed with SPSS software version 21.0.

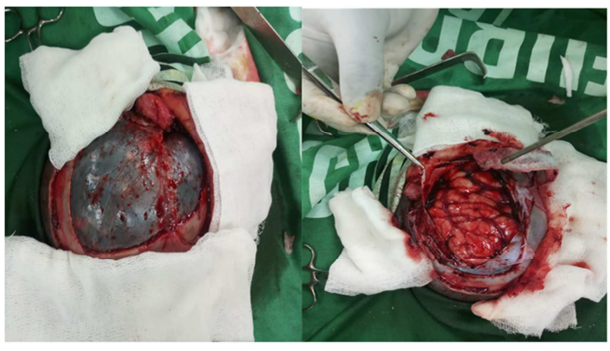
3. Results

During our study period, 04 decompressive craniectomy cases were performed in infants out of a total of 26 decompressive craniectomies, 15.38% of cases, the subject of this work. The mean age at diagnosis was 10 months with extreme ages ranging from 60 days to 24 month. Both sexes were equally represented with 2 female and 2 males. The average consultation time was 3 days with extremes ranging from 1 to 8 days. Two (02) infants had had severe head trauma, the other two had an acute subdural hematoma. One on coagulopathy, the second after intraventricular punction for an etiological assessment of probable meningitis. The clinical data of the patients are summarized in Table 1.

Upon entry, all of our patients presented with impaired consciousness. They were treated in an intensive care unit upon admission, intubated with respiratory ventilation. The indication for a decompressive craniectomy was urgently asked in all our patients. In patient 3, the indication for decompressive craniectomy was due to diffuse cerebral edema complicating evacuation of an acute subdural hematoma. All of our patients underwent a decompressive craniectomy which consisted of a question mark incision allowing a fairly large craniectomy. A durotomy was performed without duroplasty with the apposition of surgicel. All four infants were transfused intraoperatively. The duration of the interventions ranged from 2 to 3 hours.

Table 1. *Clinical data of patients.*

N0	Age	Sex	Blantyre score	Exam Pupils	Neurological signs initials	Etiology	Gesture	Complications	Mortality
1 (Figure 1)	4 months	F	1/5	Isocores and not very reactive	Lack of mobilization of the 4 members	HSD Left hemispherical	Evacuation and decompressive craniectomy	Acute bleeding	Yes
2 (Figure 2)	9 months	F	1/5	Anisocores left areactive mydriasis	Lack of mobilization of the 4 members	Bilateral fronto-parietal contusion Curvilinear parietal fracture	decompressive craniectomy	Acute bleeding	Yes
3 (Figure 3)	1 month 10d	M	1/5	Isocores not very reactive	Lack of mobilization of the 4 members	HSD Right hemispherical	Evacuation and decompressive craniectomy	Meningitis	No
4 (Figure 4)	24 months	M	3/5	Right-responsive mydriasis isocores	Moves the 4 limbs to pain	Diffuse right hemispherical ischemia	Decompressive craniectomy	Acute bleeding	Yes



(a) (b)

Figure 1. *Intraoperative images, 4 month old child, before durotomy (a) bluish appearance of dura mater witness of subdural blood collection. After durotomy and evacuation of the HSD (b).*

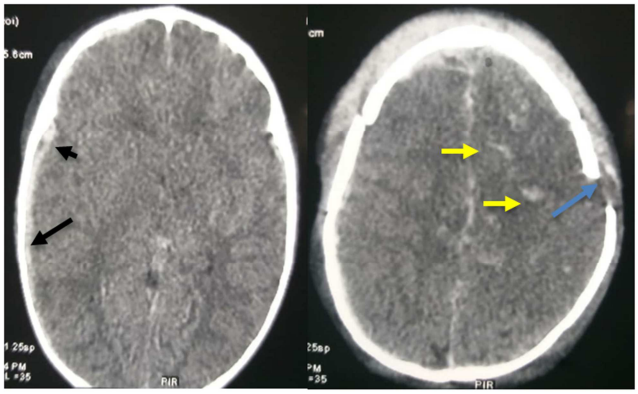
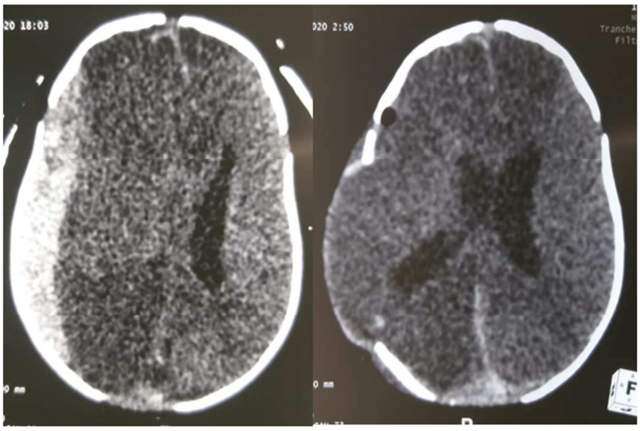


Figure 2. *Preoperative brain CT, 9 month old child showing bilateral fronto-parietal contusions (Yellow arrow) with a left parietal fracture (Blue arrow) and an acute subdural hematoma (Black arrow).*



(a) (b)

Figure 3. *Preoperative cerebral CT (a), child aged 1 month 10 days, showing an acute right hemispherical HSD. Post-operative cerebral CT (b) showing the bony flap with expansion of the cerebral parenchyma.*

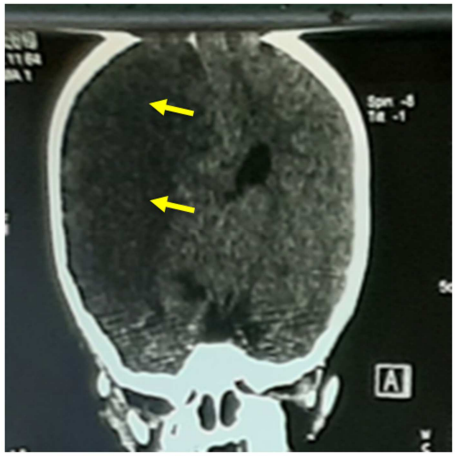


Figure 4. *Preoperative tdm of patient 4, a 24 month old child, presenting with right hemispherical diffuse ischemia 5 (yellow arrow).*

Patient 3 had clinically presented a significant improvement in the state of consciousness with a Blantyre score of 5/5 on discharge. Regarding postoperative complications, patients 1, 2 and 4 presented with acute anemia postoperatively, patient 1 also presented with pneumonia and patient 3 presented with postoperative meningitis. The mean survival time was 2 days with extremes ranging from 1 to 4 days. One patient survived and descharged after 23 days of hospitalization, the other 3 patients died. Patients 1, 2 and 4 died of bleeding complications from the surgery.

4. Discussion

Traumatic brain injury is a common cause of permanent disability for which clinical management remains suboptimal [6]. Severe traumatic brain injuries are a principal cause of neurologic dysfunction and death in the pediatric population [7]. The management of ICH in infants is a real challenge. However, guidelines have been established to manage this pathology [5]. Among which, sedative hypnotics, osmotic agents, ventriculostomies, etc. [2]. Decompresive craniectomy is the last resort in the management of ICH refractory to medical treatment. The use of decompresive craniectomy to treat high ICH in paediatric and adult traumatic brain injury patients has long been a subject of debate [8]. This technique, carried out in this age group, is associated with a high number of complications such as necrosis of the skin flap, CSF leakage, collected suppurations [2, 9]. Our study focused on 4 cases of decompressive craniectomy in infants; out of 26 in total carried out during the study period. The number of patients is quite small, which is not surprising for this age group. Adamo et al in 2009 had published a series of 7 patients, 2 of whom were less than one year old [2]. Muhammad Riyaz et al in 2005 publish the largest series with 5 patients under one year old [5]. Prasad et al in 2015 had published a series of 71 patients of which 7 patients were infants (aged less than 1 year) [10]. One of our patients had presented a significant clinical improvement postoperativel and discharged after 23 days of hospitalization. In the series by Muhammad Riyaz et al in 2015, 03 patients survived [5]. In our study, one patient survived and three others died. The three deaths are attributable to bleeding complications (acute anemia), the little girl (patient 1) who had a coagulopathy died on the operating table at the end of the operation, the patient 2 and 4 are died in intensive care. Patient 3 who had improved clinicall postoperatively, he presented with meningitis as a complication. Ranger et al noted a rare case of bilateral decompressive craniectomy performed in a 13-month old infant who later died of non-neurological complications [11]. Muhammad Riyaz et al noted a mortality of 2 in 5 children and one lost to follow-up [5]. Prasad et al noted an infant mortality of 58% (4 out of 7 children) [10]. Infectious complications such as meningitis or empyemas subgaleal or subdural have been described in a few cases [5]. Meningitis was found in a child who had a long stay in intensive care. Adamo et al had 3 patients who developed subdural empyemas requiring surgical drainage [2]. In our series, a question mark incision was made in all the patients. Previously the authors recommended a T-incision to reduce the incidence of flap necrosis and CSF leaks [2]. Rutigliano et al published in 2006 a series of decompressive craniectomy, where the bone flaps were preserved in the subcutaneous tissues [12]. All the patients were transfused intraoperatively. Red blood cells and fresh frozen plasma were administered. Patient 1 presented with bleeding disorders. It is very important to transfuse infants who undergo decompressive craniectomy as shown in the study by Yang et al [13]. Peiniger et al report that up to 44% of children with severe traumatic brain injury have bleeding disorders [14]. Mortality is also high in patients with bleeding disorders according to Bent Whittaker [15]. Controversies exist regarding the timing of decompressive craniectomy and its favorable results when performed early [9, 14]. With regard to the present study, it was decided and performed urgently in all patients. Our study is an important contribution to the literature given the low number of publications on the subject. The small size of the sample studied does not allow us to formulate recommendations regarding the management of decompressive craniectomy in children under 2 years of age.

A study bringing together the existing series would be of great help.

5. Conclusion

The risk of bleeding and hemodynamic instability make a decompressive craniectomy difficult in infants. In our study, three patients died at the end of the operation from bleeding complications. Among these deaths a patient had a coagulopathy which also poses another challenge to the management of these patients. Given the low number of publications, we encourage other authors to share their experience on the subject.

List of Abbreviations

ICH: Intracranial hypertension
CSF: Cerebro-spinal fluid

Ethics Approval and Consent to Participate

This work has been accepted by the ethics committee of the Department of Neurosurgery, Fann University Hospital Center.

Consent to participate has been approved also by the same committee.

Consent for Publication

Informed consent was obtained from patients involved in this study that they will be involved in research.

Competing Interests

All the authors do not have any possible conflicts of interest.

Authors' Contributions

All the authors contributed to this work.

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