

# Practice of Pediatric Neurosurgery at the “Hôpital Spécialisé Mère-Enfant Blanche Gomes” in the Republic of the Congo

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## Abstract

**Introduction:** Pediatric Neurosurgery is a growing specialty in its own right worldwide. Its practice in sub-Saharan Africa remains confronted with many challenges, notably the absence of a pediatric neurosurgeon, the lack of a dedicated service and the absence of multidisciplinary pediatric collaboration (neuroanesthesiologist, neurologist, oncologist and psychotherapist). The objective of this preliminary study is to describe the practice of pediatric neurosurgery at the HSMEBG and to present perspectives for its improvement. **Methods:** This is a retrospective, monocentric, descriptive study covering the period from March 2021 to March 2022 at the Pediatric Surgery Department of the HSMEBG. **Results:** During the study period, 50 children were hospitalized for a neurosurgical condition. The sex ratio was 1.77. The average age was 6 years with extremes of 2 weeks and 16 years. Most children were from the emergency department (46%). Computed tomography (CT) was performed in 35 patients (70%), magnetic resonance imaging (MRI) in 4% and plain radiography in two patients (8%). Malformative, traumatic (cranial and spinal) and tumor pathology were the most frequent with 42%, 36% and 12% respectively. Twenty-six patients were operated (52%). We recorded one postoperative infection (2.5%). The overall mortality was 8% (N = 4). **Conclusion:** This preliminary study allowed us to identify the epidemiological and clinical profile of the patients treated in our context as well as the therapeutic approach. Malformative pathology remains the most frequent, followed by traumatic and tumor pathology. The development of the practice of this discipline re-

mains a challenge in our working conditions and requires the training of pediatric neurosurgeons and dedicated paramedical staff.

## Keywords

Neurosurgery, Pediatric, Practice, Brazzaville

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## 1. Introduction

Pediatric neurosurgery (PN) is a sub-specialty of neurosurgery dedicated to the care of children with central and peripheral nervous system (CNS) pathologies from the fetal period to adolescence (0 to 18 years). The neurosurgical pathologies in children are numerous, diverse and specific (craniosynostosis, malformations of the cervico-occipital hinge, spinal dysraphism, hydrocephalus, ...) [1] [2]. These pathologies are serious because of their consequences on the psychomotor development of the affected children. The management of these pathologies requires specific material resources and a complete multidisciplinary team, including a neurosurgeon, a neuroanaesthetist, a pediatrician, an endocrinologist and a neuro-oncologist dedicated to the child. The Pediatric neurosurgery (PN) in Africa is faced with a lack of a pediatric neurosurgeon and appropriate technology [3] [4]. The difficulties of practicing in Congo are linked to the lack of human and material resources, in a hospital environment that does not have a pediatric neurosurgery department [2] [5]. The management of neurosurgical pediatric pathologies is done in hospitals where the staff is generally trained for the management of adults. Currently, the Congo has a pediatric hospital where pediatric neurosurgery has been booming for a year. This is linked to the increase in the number of neurosurgeons in the country. Thus, the availability of specialized pediatric neurosurgery care and services in general hospitals has not been assessed in Congo. The objective of this study was to describe the practice of pediatric neurosurgery at the HSMEBG in Brazzaville.

## 2. Methods

This is a retrospective, monocentric study with a descriptive aim, covering the period from March 2021 to March 2022 (12 months).

All children aged 0 to 16 years hospitalized at least 24 hours in the service for a neurosurgical pathology operated or not were included. The diagnosis was made based on neurological and/or imaging clinical arguments, was excluded, patients with an unusable file for scientific work. Patients were recruited via the pediatric emergency department, the various hospital pediatric departments of HSMEBG, including pediatrics and neonatology, and the neurosurgery polyclinic. The parameters evaluated were socio-demographic (age, sex), diagnostic (CT, cerebrospinal MRI), therapeutic (operated or not) and evolutionary (length of hospitalisation, clinical status). The pathologies were classified as traumatic,

malformative, infectious and tumorous. The average follow-up time was three months. The follow-up was multidisciplinary, including pediatricians and ophthalmologists.

Collection of data was performed from a hospital register and medical data from the various hospitals. The data were recorded and processed in a Microsoft Excel file for Mac 2011. The quantitative variables were expressed as an average and the qualitative variables as a percentage.

The study took place in the pediatric surgery department of the HSMEBG in Brazzaville. The department has a capacity of 16 beds divided into 5 rooms. It has a permanent pediatric surgeon who has completed a pediatric neurosurgery course of more than a year, a non-permanent neurosurgeon, two general practitioners and a secretary. It has an operating theatre always located on the 2nd floor with 2 operating theatres, one of which is for neurosurgical activity and a recovery room. The operating room dedicated to neurosurgery is equipped with an image intensifier and an endoscopy column of the Karl Storz type without an operating microscope, an operating table allowing surgery in dorsal or ventral decubitus with or without flexion of the pelvic limbs and in pectoral knee, and a Mayfield tip headrest with tips for pediatric use. We work closely with the 6-bed intensive care unit and the neonatal intensive care unit. In addition, the HSMEBG has a radiology department with, among other things, a 16-slice CT scan available 24 hours a day and a standard x-ray. The hospital does not have an MRI or an electroencephalogram. However, during our study period, the capital Brazzaville had an MRI in a private facility. The permanent neurosurgeon provides consultations on Tuesdays and Thursdays from 8 a.m. to 2 p.m. The patients were operated according to a defined scheme or urgently according to the clinical picture on admission. The relatives of the patients, outside the hospital, paid for the care services (imaging, prescription of drugs and blocks) before the care was administered. None of our patients received social benefits.

To carry out this work, ethical clearance was obtained from the Ethics Committee of the “Hopital Spécialisé Mère-Enfant Blanche Gomes” in Brazzaville.

### 3. Results

#### 3.1. The Socio-Demographic Characteristics

During the study period, 50 children (28.89%) were hospitalised for a neurosurgical condition out of 173 admissions to pediatric surgery. The average age was 6 years with extremes from 2 weeks and 16 years. The sex ratio was 1.77. The infant age group (29 days to 30 months) was the most represented with 25 patients (50%) followed by children (31 months to 16 years) and newborns (0 to 28 days) with 20 children (40%) and 5 children (10%) respectively. The children were from the emergency department (46%), from other departments (40%). **Table 1** illustrates the distribution of the study population according to socio-demographic characteristics.

**Table 1.** Distribution of the study population according to socio-demographic characteristics.

	N = 50	%
<b>Age</b>		
0 to 28 days	5	10
29 days to 30 months	25	50
31 months to 16 years	20	40
<b>Sex</b>		
Male	32	64
Female	18	36
<b>Origin</b>		
Emergency	23	46
Pédiatric	15	30
Néonatology	5	10
Scheduled consultation	5	10
Other hospital	2	4
<b>Total</b>	50	

### 3.2. Diagnostic Aspects

Computed tomography (CT) was performed in 35 patients (70%), magnetic resonance imaging (MRI) in 4% and plain radiography in two patients (8%). Brain angiography was performed in one patient (2%) and transfontanellar ultrasound in six infants (12%).

### 3.3. Type of Pathology

Malformative (**Figure 1**) and traumatic cranial and spinal (**Figure 2**) pathology were the most frequent with 42%, and 36% respectively. **Table 1** shows the distribution of patients according to the type of pathology.

### 3.4. Therapeutic Aspects

26 children (52%) underwent Surgery. The surgery was performed in emergency on seven children (26.92%) and scheduled as elective surgery in 19 patients (73.08%). The parents of five patients refused the surgical procedure (12.5%) despite the indication. General anesthesia was used in all patients. Of the 26 surgical procedures, nine ventriculoperitoneal shunt (VPS) were performed and three external ventricular derivation (EVD). The VPS was made by the same type of drain “Chhabra®”. Two patients had undergone endoscopic third ventriculostomy (ETV). Two spina bifida cures and one occipital encephalocele cure had been performed. On the traumatological side, three hematoma evacuations were performed, including two epidural dural hematoma evacuations and one chronic subdural hematoma evacuation, and finally three embarrure lifts. On the



**Figure 1.** Ruptured lumbar swelling in a 2-day-old newborn.

**Table 2.** Distribution of patients according to the type of pathology.

	N	%
<b>Traumatic</b>	<b>18</b>	
TCE	9	
Undisplaced Fracture	2	
Epidural Hématoma	2	<b>36</b>
Cervical trauma	1	
Chronic Subdural Hematoma	1	
Fracture-Embarure	3	
<b>Malformative</b>	<b>21</b>	
Hydrocéphalus	13	
Spina bifida	4	<b>42</b>
Encéphalocele	2	
Craniosynostosis	2	
<b>Tumor</b>	<b>6</b>	
Intracranial:	4	<b>12</b>
Scalp cyst:	2	
<b>Vascular</b>	<b>1</b>	<b>2</b>
Aneurism	1	
<b>Others pathologies</b>	<b>4</b>	
Idiopathic intracranial hypertension "	1	<b>8</b>
Seizures being explored	2	
Cervical Spondylitis	1	

Tumors\*\*\*: diagnosis evocated on radiological aspect not confirmed by histology. Idiopathic intracranial hypertension\*: diagnosis evocated on clinical, radiological and child's history.



**Figure 2.** Left parietal embelishment after a fall from a tree in an 8-year-old child.



**Figure 3.** Cerebral scanner without injection objectifying a subarachnoid hemorrhage of the left sylvian territory and frontal interhemispheric.

oncological side, we performed two resection of lesion. These were a cyst of the scalp and an extra axial right parietal tumor. Histological results are not available.

### 3.5. Evolution

Post-operative imaging was performed in three children. This included a brain scan and two valve assembly X-rays. Two children with a brain tumor were evacuated abroad (**Figure 3**). There were four deaths (8%). One of which was after an EVG. Non-operative mortality concerned one case of myelomeningocele and one case of encephalocele, both ruptured while awaiting surgery.

## 4. Discussion

Due to the development of the practice of neurosurgery in Congo, the need for diversification of the sub specializations of this discipline seems to emerge. To improve the efficiency and quality of care in Neurosurgery, his permanent practice in a pediatric environment began 1 year ago. Pediatric neurosurgery (PN) is undergoing remarkable development throughout the world. The specificity of neurosurgical pathologies in children justifies specific care [6]. The neurosurgic-

al management of pediatric patients in the Congo is undergoing major changes. There are quite a few children suffering from these pathologies in the Congo. Unfortunately, very few are treated. Some parents prefer to consult traditional practitioners, given the lack of popularization of this field. The main difficulty facing the practice of PN remains the absence of universal health coverage. This makes care complex. Also the distribution of neurosurgeons in the country is not homogeneous. In December 2019, the Congo had only five neurosurgeons for 3 million inhabitants. These neurosurgeons were all concentrated in the two major cities and spread over two general hospitals [5]. In March 2022, we have three additional neurosurgeons, one of whom has completed a pediatric neurosurgery fellowship of more than one year and is practicing in a pediatric hospital (HSMEBG). The increase in the number of neurosurgeons in Congo indicates the need to train pediatric neurosurgeons.

#### 4.1. The Socio-Demographic and Clinical Characteristics

The annual hospital incidence varies from country to country and from center to center [3] [5] [7]. In Kiffa, Mauritania, an incidence of 28 children over 11 months hospitalised for neurosurgical pathology was reported [3] and Kaoudi *et al.* [5] in Pointe-Noire reported 15 children over 18 months. The difference between these figures can be explained by the fact that in most sub-Saharan African countries, pediatric neurosurgery is performed in dedicated adult departments, with staff (medical and paramedical) working on both children and adults. The HSMEBG is a hospital designed specifically for the care of children. Most children were from the emergency department (46%). This is explained by the regular awareness of the management of neurosurgical pathology within the hospital. Good coordination of care between different services and collaboration between professionals are essential elements for the development of the practice of this discipline.

#### 4.2. Diagnosis

The management of children requires diagnostic investigations and hospital follow-up, which takes place mainly in large cities. The availability of CT scanners in the hospital has improved the conditions for diagnosis in our working context. The scanner remains the first-line examination because of its 24-hour availability and its cost. Indeed, the cost of the scanner without injection in the hospital is 91.86 euros (95, 53\$). Although cerebrospinal MRI remains fundamental for the management of pediatric patients, its unavailability in the hospital and its cost in the capital limit its indication. The absence of angioscanner and angi-MRI in the hospital is still a hindrance in the management of vascular and tumor pathologies in particular.

#### 4.3. Pathology

The predominance of malformative and traumatic pathology is similar to that



found in the literature [3] [8]. The availability of CT scans has made it easy to diagnose these pathologies. Malformative hydrocephalus is a frequent condition in children [9] [10] [11]. It is the first reason for hospitalization in our context, followed by cranioencephalic trauma. The cranioencephalic trauma is a global public health problem in terms of mortality, morbidity and economic and social impact [2]. The low number of cases of craniosynostosis is simply due to the lack of awareness of this condition in our community, even among health professionals. This disease is still easy to deal with socially and does not lead to specialized consultation by parents. In addition, surgery for craniosynostosis should be developed in our hospital. The low number of cases of vascular pathology can be explained primarily by a diagnostic problem. The lack of good quality angioscan and MRI scans is a major reason for this. Secondly, this number is justified by an absence of specific signs, which sometimes requires late consultation with the parents. When they are diagnosed at an early stage, they are managed in the intensive care unit. The absence of pediatric vascular neurosurgeons also contributes to this. Thus, pediatric vascular neurosurgery remains a challenge in our context. The diagnosis of these pathologies can be improved through a popularization of their management and a close collaboration between specialists.

#### **4.4. Treatment**

The emergency indications are more related to traumatic and then acute malformative pathology. The management of hydrocephalus remains the main pediatric neurosurgical activity in our context. Hydrocephalus constitutes fifty percent of the pediatric neurosurgical activity in Ait Idir Alger [12]. In Benin, surgical treatment of hydrocephalus constitutes about 50% of the demand for pediatric neurosurgical care [9]. VPS remains the main treatment regardless of the etiology. This surgical choice is related to the availability of equipment and the surgeon's experience. However, the idea of having a lifelong device in children's bodies is often not accepted by parents. Hence the refusal of surgery is in five cases. Also, the problem of the cost of treatment remains a thorny issue in Congo. In Cotonou, the financing of hospital care for hydrocephalus at the CNHU results in disproportionate expenses compared to the purchasing power of families [9]. ETV remains a safe alternative [4] [10] and less restrictive for families. The low number of SCVs is linked to the fact that this endoscopic practice only began in 2021 and to the fact that patients are selected according to international recommendations. The management of spinal dysraphia is a challenge in our context.

#### **4.5. Evolution**

Control imaging in our context remains difficult because of the cost. It is required in case of postoperative complication. It was performed four weeks after evacuation of a chronic subdural hematoma in an infant. Post VPS mounting radiographs are systematically requested within 48 hours after a VPs is performed in the department. The fact that they are rarely performed is simply a



sign of the parents' financial difficulties. A child operated on for a chronic subdural hematoma presented 6 hours after surgery with a respiratory infection manifested by respiratory distress and then an infectious syndrome from day 2. It was controlled by a bi-antibiotic therapy. Medical evacuation was the prerogative of tumor pathology. This choice seems to be justified by the parents' request in the first instance. Only one child was evacuated to Europe due to the lack of technical facilities. The second patient was evacuated to the parents country of origin due to the parents' lack of emergency financial resources. Post-operative death occurred in only one case. It occurred in a child undergoing emergency surgery for acute hydrocephalus of infectious origin in a pre-surgical coma. CSF analysis confirmed decapitated meningitis. This was a natural course of the disease in a late diagnostic setting. The other deaths concerned three children who did not undergo surgery, including a ruptured encephalocele with discharge against medical advice and a ruptured myelomeningocele. The prognosis can be improved by reducing the delay in management. The last death concerned a child with a meningeal hemorrhage (**Figure 3**). Follow-up must be multidisciplinary. Coordinated management with the various pediatric specialties allows for quality specialised care and improved therapeutic protocols.

#### 4.6. Limitation of the Study

This study has the same limitations as any retrospective study. Aspects such as the socio-economic level of the parents were not assessed due to a lack of information in the files. In addition, some diagnoses remained at the stage of suspicion because examinations such as craniospinal MRI, a fundamental examination for exploring the child's PNS, could not be carried out in the majority of our patients for lack of financial resources. Good quality CT angiography or angi-MRI could not be performed due to the unavailability of the technical platform. This reflects the need to establish universal health coverage as required by the Sustainable Development Goals (SDGs).

Another limitation is the small sample size, although exhaustive over the study period. This can be explained by the fact that permanent neurosurgical activity in a specialized pediatric hospital is nascent in Congo. New studies are needed in the years to come to allow for larger databases.

#### 5. Conclusion

This preliminary study allowed us to identify the epidemiological and clinical profile of the patients treated in our context, as well as the therapeutic approaches. Traumatic pathology remains the most frequent, followed by malformative and tumoral pathologies. The development of pediatric neurosurgical practice remains a challenge in our working conditions and requires the training of pediatric neurosurgeons as well as the training of paramedical staff dedicated to the care of children. The establishment of health coverage remains essential. The authors underline the interest in a collaboration between the pediatric neu-

rosurgery centers of the North and the South.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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