

Treatment of Pediatric Brain Tumors in Brazzaville (Congo) about a Case Series

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Abstract

Introduction: Tumors of the central nervous system are the most common group of solid neoplasm in children and account for 20% to 25%. They are common in Sub-Saharan countries, despite the insufficiency of histological diagnosis. No study has been performed concerning the pediatric brain tumors in the Republic of Congo. The aim of this study was to describe the conditions of neurosurgical management of pediatric tumors in Brazzaville. **Materials and Methods:** We performed a retrospective and descriptive study, from January 2014 to December 2017 (48 months), into the neurological unit of the surgical department of Brazzaville. We included all patients aged from 17 years old and below, hospitalized for a brain tumor. **Results:** We have identified 11 cases of brain tumors. The average age was 8.1 ± 4.3 years old, a sex ratio of 0.57. Ten out of the eleven patients of our series have intracranial hypertension. We found six cases of infratentorial tumors and five of supratentorial location. Only three cases had histology. Ten patients were operated, limited by ventriculoperitoneal shunt in 6 cases, surgical resection in three cases, biopsy in one case. There were no possibilities of radiotherapy and chemotherapy during this period of study. **Conclusion:** A multidisciplinary team must be organized to improve the management of pediatric brain tumors in our context. Histological diagnosis and possibilities of radiotherapy are imperatively needed.

Keywords

Pediatric Brain Tumor, Posterior Fossa Tumors, Surgical Resection, Brazzaville

1. Introduction

Tumors of the central nervous system are the most common group of solid tumors in children and account for 20% to 25% of childhood neoplasms [1] [2] [3]. In the United States, mortality rates among children with brain tumors exceed those in children with acute lymphoblastic leukemia [1]. Magnetic Resonance Imaging (MRI) is the required non-invasive investigation for the diagnosis of brain tumors. Accurate diagnosis is important in selecting the optimal therapy for a child with a brain tumor. Surgery is the initial treatment in the majority of cases, with extensive resection for the best long-term survival. Important factors that have contributed to improving the long-term survival of children with brain tumors include advances in neuroimaging, histopathology, neurosurgery, and radiotherapy, associated with chemotherapy [3]. There are different types with variable survival rates depending on the histology, biology, age, and degree of spread. Some types of brain tumors may be completely resected, many cannot be removed without a considerable degree of morbidity [1].

Pediatric brain tumors are common in Sub-Saharan countries, despite the insufficiency of histological diagnosis, because brain computed-tomography scan (CT-Scan) helps to evoke this diagnosis and to carry out a treatment [4]. Furthermore, conditions for identifying childhood brain tumors are difficult because of economic conditions; no insurance health system is associated with a difficulty to have access to an equipped center with a multidisciplinary team including neurosurgeons [5]. So far, no study has been performed concerning pediatric brain tumors in the Republic of Congo.

This work stands as one of a kind and will aim to describe the conditions of neurosurgical management of pediatric tumors in Brazzaville (Republic of Congo).

2. Material and Methods

We performed a retrospective and descriptive study, from January 2014 to December 2017 (48 months) into the neurological unit of the surgical department of the University Hospital of Brazzaville. This unit is the national reference center for the management of neurosurgical diseases, including pediatric brain tumors, with four neurosurgeons.

The University Hospital is equipped with CT-scan and MRI, an operative room dedicated to neurosurgery, with an operative microscope, a Mayfield head clamp, and bipolar coagulation among others.

We selected all patients aged from 17 years old and below, hospitalized in the neurological unit of the surgical department for a brain tumor.

Patients were admitted after orientation from emergencies, pediatric department or scheduled consultation. CT-Scan and or MRI were performed when the intracranial lesion was pronounced. A brain tumor was suspected from CT-Scan and MRI with histological presumption. The preoperative management included multidisciplinary discussion in the function of histological presumption but not systematically. After surgery, patients were admitted into the pediatric intensive

care unit or multipurpose intensive care unit if ventilatory assistance was needed. When the patient was stable, with good clinical presentation, postoperative care could be performed directly in the neurological unit of the surgical department. Postoperative control was performed by CT-scan 24 hours after surgery, and or in case of clinical aggravation. Depending on the histology, a patient could be oriented to oncology for further management. Concerning the histology, pathological material was sent to an anatomopathological laboratory of our hospital or to Kinshasa (Democratic Republic of Congo).

Funding for treatment was directly assured by the child's parents including the radio-imaging as well as all the operative prescriptions, hospital stay, anatomopathological examination, and medical treatment.

The parameters evaluated were the diagnosis, therapeutic and evolutionary.

Collection of data was performed from a hospital register and parent of patient's phone information. Statistical values were obtained using the software Numbers for Macintosh 5.3 2008-2018 Apple Inc.

3. Results

3.1. Studied Population and Anthropometric Characteristics

We have identified 11 cases of brain tumors. The average age was 8.1 ± 4.3 years old, a sex ratio of 0.57.

3.2. Diagnostic, Therapeutic Aspects and Evolution

Median delay for admission in the hospital was 5.9 ± 3.7 months, with extremes ranging from 1 to 12 months. Intracranial hypertension was the most common clinical presentation in our case series. We found six cases of infratentorial tumors and five of supratentorial location. About cases of brainstem tumors, biopsy was not discussed. All cases of hydrocephalus needed a ventriculoperitoneal shunt. The parents of the patient n°2 refused the surgery for lack of financial means. It was about decompressive surgery with at least one diagnostic biopsy, or even an excision of the cerebellar lesion. All clinical parameters, the topography of the lesion at neuroimaging, modalities of treatment, histology when it was possible and evolutionary are summarized in **Table 1** below.

Figure 1 and **Figure 2** below indicate the radiological aspects of brain tumors for 2 cases: in the first one, there is a left intraventricular lesion with moderate hydrocephalus; the lesion is tissue and heterogeneous in Flair sequence of MRI. In the second, there is a lesion located in fourth ventricle, and another in medulla oblongata, with hyposignal in T1 sequence.

4. Discussion

Epidemiology

Childhood central nervous system tumors incidence varies by country from 1.12 - 5.14 cases per 100,000 persons with the highest incidence in the United States of America. They are more common in males, though this varies by histo-

logic type [6]. The epidemiological profile of pediatric brain tumors has been poorly described in Africa. In the region of Marrakesh (South Morocco), on one hundred and thirty-six patients, the average age of patients was 8.28 years, with

Table 1. Characteristics of the series.

	Age*	Sex**	Clinical data	Topography	Treatment	Histology	Evolution
01	12	F	ICH, DVA	Lateral ventricle (left)	Parieto-occipital approach Resection: 20%	Glioma	Dead 5 days after surgery
02	11	F	ICH, Cerebellar syndrome	Brainstem and cerebellum	VP-shunt		Refusal of surgical resection
03	15	F	ICH, cerebellar syndrome Tétraparesia	Fourth ventricle Brainstem Cervical spinal cord	VP-shunt Suboccipital transcerebellar approach Resection: 90%	Ependymoma	Dead 2 months after surgery
04	5	F	ICH, ataxia Blindness	Cerebellum	VP-shunt Suboccipital transcerebellar approach Resection: 90%	Medulloblastoma	Tumor recurrence after 9 months. Surgical resection again. Dead 17 months after first surgery.
05	4	F	ICH	Lateral ventricle Occipital lobe (right)	Biopsy		Dead 7 days after surgery
06	8	F	ICH, seizure	Suprasellar	VP-shunt		Dead 7 months after VP-shunt
07	12	F	ICH, blindness, seizure	Suprasellar	VP-shunt		Postoperative meningitis treated by antibiotics. Seizure
08	4	M	ICH, facial nerve palsy Loss of consciousness	Brainstem	Not operated	Brainstem glioma?***	Dead 2 months after surgery
09	5	M	ICH	Lateral ventricle (left)	VP-shunt		Lost sight
10	2	M	Hypotonia	Cerebellum	VP-shunt		Refusal of surgical resection
11	11	M	ICH, palsy of abducens	Brainstem	VP-shunt	Brainstem glioma?***	Stationary at 12 months

*Age (years). **Sex: M = male. F = female. Brainstem glioma***: diagnosis evocated on radiological aspect, not confirmed by histology. ICH: Intracranial hypertension. DVA: decreased visual acuity. VP-Shunt: Ventriculoperitoneal shunt.

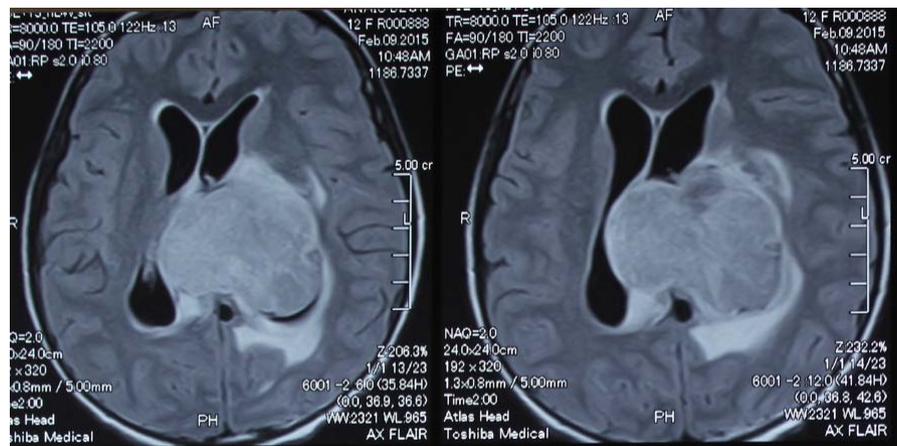


Figure 1. MRI (axial view, Flair) of case n°1. Tumor located in left lateral ventricle.

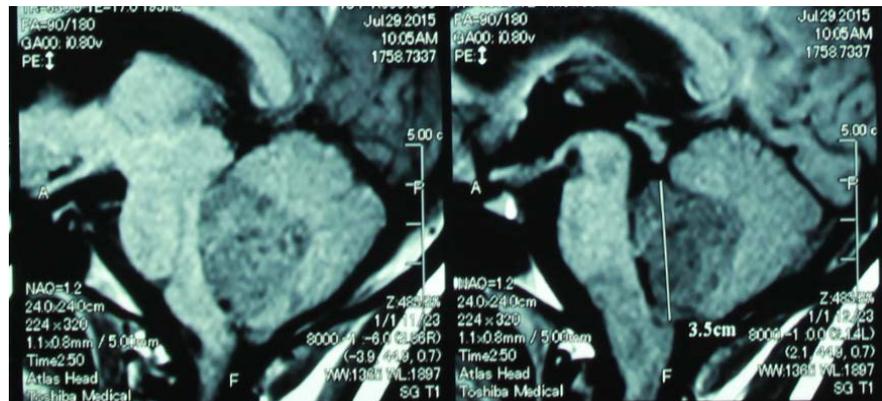


Figure 2. MRI (sagittal view, T1) of case n°3. Tumor located in fourth ventricle and medulla oblongata.

a sex ratio of 1.6 [7]. But in another Moroccan study about two cities, Rabat and Casablanca, the authors found on 542 patients that 51.8% were males and 48.2% were females [8]. In Cameroon (Center of Africa) cerebral tumors in children represented 35.29% of all cerebral tumors. The average age was 9 years, and they found 47.62% of males against 52.38% of females [4]. Broalet *et al.* (Ivory Coast) found a frequency of 15.74% with a sex ratio of 0.5 [5]. In our case series, we found 7 females against 4 males.

Clinical aspects

Ten on eleven patients of our series have intracranial hypertension (Table 1). Mbonda, E. *et al.* [4] in Cameroon found intracranial hypertension in 88% of cases. Ndubuisi *et al.* [9] in Nigeria found in a series of 54 cases from 2006 to 2007 (one year) that a significant proportion of cases presented an advanced disease. They found that 48% of patients had an alteration of the level of consciousness and more than 70% with a definite focal deficit.

Topography

About location of the lesion, Barnholtz-Sloan *et al.* [2] in a study about pediatric brain tumors in Non-Hispanics, Hispanics, African Americans and Asians; the majority of the tumors were infratentorial in each racial group (57% of Non-Hispanics, 47% of Hispanics, 55% of African Americans and 53% of Asians). Hazmiri *et al.* [7] in Morocco found the same results (infratentorial tumors in 61.53% of cases). Some authors like Broalet *et al.* (Ivory Coast) found a majority of supratentorial tumors, 54.38% [5]. In our case series, we found six cases of infratentorial tumors and five of supratentorial location. Globally, there is no difference between these locations in the literature, but the difference is found depending on the age of patients: before three years old, supratentorial tumors are predominant and between three and eleven years old, tumors of posterior fossa are predominant; after this step, there is no difference about location [10] [11].

Histology

In the United States of America, the previous study showed that African Americans had the highest proportion of medulloblastoma. Actually, Barn-

holtz-Sloan *et al.* found that the Hispanics and Asians had the highest proportions of these tumors. Hispanics, African Americans, and Asians had higher proportions of astrocytoma, high-grade tumors compared to Non-Hispanics [2].

In Morocco (North of African continent), astrocytoma and medulloblastoma accounted for 46.32% (29.41% and 16.91%, respectively) in the study of Hazmiri *et al.* [7]. In another study, also in Morocco, Karkouri *et al.* [8] found 34.5% for medulloblastoma, followed by pilocytic astrocytoma (17.3%) and diffuse astrocytoma grade 2 (12.5%). The difference between these two studies can be explained by methodology about the selection of patients (cases ranged until 19 years old in the first group and until 15 years old in the second). Near the Republic of Congo, in Cameroon; astrocytoma was the most frequent type in histology, in 45.23% of cases [4]. The same result was found in the Ivory Coast (astrocytoma) for 19% of cases [5]. In our study, only three cases had histology.

Treatment

Surgery represents the initial treatment for the majority of pediatric brain tumors. The surgical resection that is as extensive as possible is important for long-term survival with most tumors [3].

Pilocytic astrocytoma is generally circumscribed and slow-growing tumors. They are commonly located within the cerebellar hemispheres. When complete tumor excision is achieved, there is no need for another therapy, and complete surgical resection is curative. When total resection is not possible without damage to eloquent structures of the brain, chemotherapy or radiotherapy can be used for the residual and recurrent tumors [3] [12] [13]. With the introduction of neuro-navigation systems, functional brain mapping and cortical mapping, the lesions located in eloquent brain areas become more accessible for surgical resection with minimal morbidity [3] [13].

Medulloblastomas are undifferentiated embryonal neuroepithelial tumors of the cerebellum. Complete resection should be performed at 74.6%. Brainstem infiltration could be one of the major reasons for the high incidence of subtotal excision. Standard therapy consists of total surgical resection followed by radiation to the entire craniospinal axis and or chemotherapy [3] [13] [14]. Some patients might require a ventricular shunt or third ventriculostomy prior to the resection of the tumor, and the majority of them will have a resolution of the hydrocephalus after tumor resection. Cerebellar mutism syndrome is one post-surgical complication characteristically developing after surgery of posterior fossa [13].

The understanding of tumorigenesis, molecular growth pathways, and immune mechanisms in the pathogenesis of these tumors has ushered in a new era in cancer therapeutics. Some biologic agents tested in pediatric clinical settings have demonstrated promise, with a consequent antitumor activity in preclinical studies. Regarding some barriers to long-term success, most of these novel biologic agents exhibit cytostatic activity and therefore may need to be combined with conventional chemotherapy and radiotherapy [15] [16].

In our context of work, total resection of the tumor can be performed for cerebellar pilocytic astrocytoma. But the difficulty of to manage the surgical treatment of pediatric brain tumors is characterized by poor working conditions regarding possibilities of brain mapping because the neuro-navigation system is not available. Also, there was no possibility of radiotherapy in Congo, during the period of study. This situation contributes to explain a case of recurrence of medulloblastoma after a surgical resection estimated at 90%.

Evolutionary

About some sub-Saharan series, postoperative with complementary treatment follow up is characterized by satisfying evolution in 15% of cases, global mortality around 22% and, postoperative mortality estimated at 7%, survival at 1 and 5 years were 56% and 47% respectively [5] [17]. Also, pediatric brain tumors survivors at 5 years have an increased endocrine disease, psychiatric disorders, cognitive and developmental disorders [18] [19]. Most of this morbidity can be attributed to direct neurological damage to the developing brain caused by the tumor, surgery, toxicity of chemotherapy and effects of irradiation. Generally, children treated at a young age and those who receive the most intensive therapy are more likely to develop late effects [20].

Limitation of the study

This was a retrospective study, limited in the collection of data from perioperative aspects and evolutionary during hospitalization (blood loss, duration of intervention, anesthetics parameters). The size of this case series was limited at patients admitted in the neurological unit of the surgical department. It was important to verify if all cases of brain tumors admitted in the pediatric department were addressed for neurosurgical management.

5. Conclusion

The epidemiological profile of pediatric brain tumors has been poorly described in Sub-Saharan countries. Their diagnosis can be improved by more access to CT-scan and MRI. Intracranial hypertension is the most common clinical presentation. The majority of these tumors are infratentorial. Histological data are dominated by low-grade astrocytoma and medulloblastoma. Surgical resection that is as extensive as possible is important for long-term survival, but the quality of life after surgery depends on postoperative morbidity, chemotherapy and radiotherapy toxicities. In our context, to organize a multidisciplinary team to manage these cases, including pediatrician, radiologist, neurosurgeon, and oncologist is needed to improve the management of pediatric brain tumors. Histological data and the possibilities of chemotherapy and radiotherapy are imperatively needed.

Conflicts of Interest

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

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