

Complications of Hydrocephalus Surgery in Children: Study of 18 Cases at the University Hospital Center of Conakry

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Abstract: Context and Objective: Hydrocephalus is the active abnormal dilation of the cerebral ventricular cavities and leads to a disorder of cerebrospinal fluid dynamics. Ventriculoperitoneal shunt and ventriculocisternostomy shunt are the most frequently used techniques in our context. However, a number of complications can occur. Our goal is to contribute to the improvement of the prevention of complications in the surgical management of hydrocephalus. Patients and Method: This is an observational study, over a period of five years and six months, of children aged 0-15 years who have undergone hydrocephalus surgery. All these data and their correlations were analyzed on Excel and EPI Info tables in version 7.2.3.1. The study was previously submitted to the ethics committee for approval. Anonymity and compliance with ethical rules were the norm. Results: We collected 18 cases of complications, i.e. 11.92%. Infants were the most affected with 16.70%. Most of the patients had a risk factor of neighborhood skin lesions. These were mainly infectious complications 50% and mechanical complications 33.30%. For the management of complications, equipment removal and revision/replacement were the procedures most frequently adopted, with frequencies of 50% and 22.20%. 66.70% were improved. Conclusion: The management of hydrocephalus is essentially neurosurgical and involves ventriculoperitoneal shunt and ventriculocisternostomy shunt, which, despite their effectiveness, are sometimes accompanied by various complications, including infectious ones, which were found to be at the forefront of this study. Even if the evolution has been favorable for 2/3 of the children studied, we believe that the constant search for risk factors for complications and the education of the parents of the children will limit the occurrence of the complications found.

Keywords: Complications, Hydrocephalus, Children, Post-surgery

1. Introduction

Hydrocephalus is the abnormal, often active dilatation of the cerebral ventricular cavities. It is at the origin of the cerebrospinal fluid (CSF) dynamic disorder leading to progressive, often irreversible cerebral pain [1]. Its etiologies are multiple, differ according to age and are dominated by

malformative, tumoral and infectious causes [2]. Treatment is currently surgical. There are different surgical techniques that can be used depending on the type of hydrocephalus. The most commonly used today are still ventriculoperitoneal shunt (VPS) and ventriculocisternostomy (VCS) [3]. However, no method is free of risk and complications [4]. One of the factors contributing to the severity of this pathology is the high frequency of postoperative

complications. The VPS has essentially two types of complications, infectious complications of the order of 10% and mechanical complications of up to 40% [4]. Complications related to CSF are not negligible, dominated by leakage of CSF and depending on the surgeon's experience [5]. Taking into account the frequent occurrence of post-surgical complications of hydrocephalus, we considered it appropriate to evaluate this phenomenon in a context of resource-limited work. The aim of this study is to contribute to improving the prevention of complications in the surgical management of hydrocephalus.

2. Materials and Methods

The study was previously submitted to the ethics committee for approval and confidentiality was maintained throughout the study period. Informed consent of patients and/or responsible persons was obtained for all patients. Thumbprints were used instead of signatures for parents with low or no literacy skills.

A mixed descriptive study was conducted for a duration of 5 years 6 months. The retrospective portion covered five (05) years from January 1, 2014 to December 31, 2018 and the prospective portion covered six (06) months from January 1 to June 30, 2019. It covered all cases of children aged between 0 and 15 years old admitted and operated on for hydrocephalus in whom postoperative complications arose during the operation. We proceeded to an exhaustive recruitment of data from the medical records and the database of children operated for hydrocephalus in service. The variables of our study were quantitative and qualitative (sociodemographic, clinical, paraclinical and evolutionary). Of the 151 cases of hydrocephalus operated on we obtained 18 cases of complications, which were categorized as

follows: mechanical, infectious, cutaneous complications and failure of VCS. The time of onset of complications was divided into early (10 days after surgery), late (11 days to 3 months after surgery) and late (more than 3 months after surgery) complications. All of these data and their correlations were analyzed on Excel spreadsheets and EPI Info in version 7.2.3.1.

3. Resultants

Out of a total of 151 cases of hydrocephalus operated on in the department, we obtained a rate of 11.92% of postoperative complications. In the course of the study, we found a female predominance of 61.10. The most represented age group was infants with a frequency of 72.20%, followed by newborns and infants with percentages of 16.70 and 11.10 respectively. 61.10% had a malformative etiology, 22.2% infectious, 11.1% idiopathic and 5.6% tumoral. The VPS and the VCS were the most used surgical techniques with percentages of 66.70 and 22.20. The average duration of the procedure was 50.20 minutes. Neighbourhood skin lesions (44.50%) and resumption of surgery (22.20) were the most common risk factors. Complications of surgical management of hydrocephalus were mechanical, infectious, cutaneous, and leakage of CSF in the following proportions: 6 (33.30%), 9 (50%), 2 (11.10%), and 1 (5.60), respectively (Table 1). Complications occurred within the first 10 days prior to the first surgery in 6 patients and 9 patients experienced complications between 10 days and 90 days after the first shunt. However, three (3) of the patients had complications beyond 3 months. Complications were revealed by clinical signs related to intracranial hypertension (77.80%), fever (61.10%), consciousness disorders (16.70%) and abdominal signs (5.60%) (Table 2).

Table 1. Distribution of complications according to type of complications.

Complications (%)	Types	Staff	%
Mechanical 6 (33,30%)	Valve dysfunction	4	66,70
	Anal migration of the catheter	1	16,70
	Hyper drainage	1	16,70
Infectious 9 (50%)	CSF infected	7	77,80
	Surinfection of the wound	2	22,20
Cutaneous 2 (11,10%)	Scar disunion	1	50,00
	Cutaneous necrosis	1	50,00
Leakage of CSF 1 (5,60)	Leakage of CSF	1	100

Table 2. Distribution of patients according to signs of complications.

Clinical signs	Staff	Proportion (%)
Evidence of Intracranial Hypertension	14	77,80
Fever	11	61,10
Altered consciousness	3	16,70
Abdominal signs	1	5,60

According to age, three newborns had complications, two of which were of infectious origin and the other unknown. Thirteen infants had complications, six of which were of infectious origin, three were due to resumption of surgery and four of unknown origin. Only two grandchildren had complications, split between unknown origin and revision

surgery.

For the management of these complications, all patients had received medical treatment. Four (4) children or 22.20% benefited from a revision of the shunt system or replacement of the shunt system by another. Nine patients (50%) benefited from equipment removal, 2 (11.10) received a dressing and 3

(16.70) received VPS. It should be noted that complications related to VCS were managed by the implementation of a VPS system. At the end of the management of complications, we found an overall improvement in 12 (66.70%), progressive recovery in 2 (11.10%) and death was recorded in 4 (22.20%).

4. Discussion

Out of a total of 151 cases of hydrocephalus operated on in the department, we had obtained a prevalence of 11.92% of postoperative complications. This result is similar to that found by Souaré. IS *et al* [3] in Conakry in 2018 who reported 12% of postoperative complications of hydrocephalus at any age over a 5-year period. Even if this observation was not limited to children, it still indicates the persistence of these complications in our environment. In Morocco, Mbonihankuye A *et al* [2] in 2011 found a frequency of 18.22% of VPS and Elkadadra complications. M *et Coll* [6] reported 16.9% complications in 2013 in their study of complications and failure of endoscopic ventriculocisternostomy. Our result would be justified by an under-reporting of complications due to the failure to keep appointments by some parents who refrain from returning patients when they notice the reappearance of certain signs of complication. It appears from this study that infants were the most concerned. These results are similar to those found by ADJENOU Komlanvi V *et Coll* [7] in Lomé (Togo) in 2012 who reported that the age group between 01 months and 02 years (infants) was the most represented with a frequency of 53%. These results corroborate the data in the literature that hydrocephalus occurs at an early age. The vast majority of patients were from the city of Conakry, with a frequency of 83.30%. This result can be justified on the one hand by the fact that the referral service for the management of hydrocephalus is in Conakry, and on the other hand, patients from rural areas provided the address of their host family.

The etiologies of hydrocephalus were dominated by congenital malformations and infections. Vaessen S *et Coll* [8] in Liege in 2006 reported in their study of hydrocephalus in children that malformations were the most frequent cause followed by idiopathic malformations with proportions of 35% and 15% respectively. In our context, the high frequency of malformative aetiologies could be explained by consanguineous marriages in our communities.

The most common surgical technique used was the ventriculoperitoneal shunt in 66.70% of cases. Our result is close to Broalet's. M. Y. E. *et al* [9] in Côte d'Ivoire in 2011 who found in their study that the most commonly used technique was VPS in 92% of cases. The complications encountered in the surgical management of hydrocephalus were infectious, mechanical, cutaneous and leakage of CSF. These results are contrary to those found by Sissoko DM [10] who reported more mechanical than infectious complications in his PhD thesis on complications of VPS. The majority of the complications manifested as clinical signs related to intracranial hypertension and fever. Failure to drain the CSF by

any kind of malfunction of the installed bypass system had a direct impact on the persistence of intracranial hypertension. Given the operative wound and the ventricular shunt system which is a foreign body to the encephalic structures, microbial aggression and reaction of the organism can still be expected. This indicates the need for prophylactic antibiotic therapy in such a context. Mechanical complications were dominated by valve dysfunction, anal catheter migration and hyperdrainage. Of the six (6) cases of mechanical complications, five (5) were of early onset. This early onset of complications is explained by the fact that most mothers are not sufficiently equipped to actuate the valve as needed. This can then lead to valve disconnection. Infectious complications consisted of CSF infections and wound superinfections. They occurred late in 2/3 of cases and most of the time in newborns and infants. We believe that the low immunity at this age would be a favourable ground for aggression and microbial outbreaks. In the same way the lack of hygiene could favour the occurrence of this condition.

No germ was found on cytobacteriological examination of the CSF, which paradoxically had a cloudy appearance at the time of ventricular puncture. Is this due to antibiotic therapy prior to CSF puncture or a misinterpretation of the results by the laboratory? This finding does not, however, detract from the introduction of antibiotic coverage. A repeat puncture, if possible, for a cytobacteriological analysis of CSF is necessary to clarify the question.

The evolution was favorable in the majority of cases. We note that this study has some limitations, in particular, the insufficient number of cases due to the low referral rate of patients to the department and the lack of establishment of links between complications and possible risk factors. The public's lack of knowledge of the subject and especially the mystification of brain pathologies seems to create a loss of cases to the benefit of traditional healers who know no more than the parents of these children. Nevertheless, this work retains all its interest after having answered the fundamental questions of the research. We believe that a future study on the early prevention of post-operative complications, hydrocephalus in newborns and infants will allow a good appreciation of the subject and will facilitate the implementation of appropriate measures and education of the parents of these children.

5. Conclusion

The treatment of hydrocephalus is essentially neurosurgical and uses VPS and VCS which, despite their effectiveness, are sometimes accompanied by various complications. Complications in the management of hydrocephalus are not uncommon in the neurosurgical department. They are often favored by neighborhood skin lesions and resumption of surgery. The management of these complications varies from case to case. In our context it has consisted either in the removal of the VPS system in a first step followed by its replacement, or in the revision of the VPS system. More than two-thirds of the patients had a

favorable outcome after their treatment. Ongoing research and more in-depth analysis of the various risk factors will undoubtedly facilitate the implementation of an effective strategy for the prevention of these complications.

Abbreviations

CSF: cerebrospinal fluid; CT: Cerebral computed tomography; VPS: ventriculoperitoneal shunt; VCS: Ventriculocisternostomy shunt

Authors' Contributions

All authors contributed to this work.

Availability of Data and Materials

All data sets used and/or analyzed in this study are available from the corresponding author upon reasonable request.

Declaration of Interest

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

Consent for Publication

This work was done after receiving informed consent and signatures from patients and/or parents.

Ethical Approval and Consent to Participate

The collection of samples and the analysis of data were approved by the ethics committee of the CHU of Conakry: The National Ethics Committee for Health Research (CNERS). Contact Miss Aissatou Sanoussy BAH at the phone number +224 669 930 951.

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