

Complications of Ventriculo-peritoneal Shunting: 13 Years of Experience in a Sub-saharan Paediatric Neurosurgery Unit

Alain Jibia^{1,2,*}, Esperance Broalet^{1,3}, Carine Kacou Tetchi^{1,3}, Soress Dongo¹, Sa'Deu Fondjo^{1,2}, Aderehime Haidara^{1,3}

¹Neurosurgery Department, Yopougon Teaching Hospital, Abidjan, Côte d'Ivoire

²Neurosurgery Department, Essos Teaching Hospital, Yaoundé, Cameroun

³Neurosurgery Department, Bouaké Teaching Hospital, Bouaké, Côte d'Ivoire

Email address:

alainjibson@gmail.com (A. Jibia)

*Corresponding author

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Abstract: Complications of ventriculoperitoneal shunting in hydrocephalus cure are countless and well known nowadays; depending on several factors. They are all more so screened in children whom are vulnerable and growing; more again in sub-Saharan area, suggesting a close follow-up and a paid attention on family balance. We emphasised on this surgical and social challenge to analyse the experience of a paediatric neurosurgical unit. A retrospective study has been performed to determine statistical data over 13 years of our practice in sub-Saharan hospital area, referring to international recommendations. It was of above 90 complications collected in 62 patients over 302 children operated, 20.52%. Complications were mechanic (58) and infectious (32). The mean age of appearance was 2 years 8 months, with an average of 6 months of follow-up. Malformative aetiologies were of 4 over 5 children, 80.65% and more than half were non-obstructive, 58%. The complications were unique, multiple or associated. The treatment was mainly surgical 88.7% on several modes. Sixteen children deceased during the study period. Post-shunting complications are the source of a compromised functional or even vital prognosis, sometimes in a psychosocial stress or low feel. The challenge in sub-Saharan area remains the efficient management of complications with limited resources or a sociocultural family uncertainty. Perioperative prevention must be the master words.

Keywords: Child, Complications, Hydrocephalus, Ventriculo-Peritoneal Shunt

1. Introduction

Ventriculo-Peritoneal shunting is widely practised worldwide as a principal treatment of hydrocephalus. It is however prone to several complications. Many strategies of care of these are widely described in Literature [1-6]. In Sub-Saharan area, their management in children faces families with limited resources and/or despair again on the road [7]. Our aim was to highlight this surgical and social challenge, to assess the progress made and to analyse the experience of a paediatric neurosurgical unit in care of hydrocephalus-related complications, in order to link them to international

standards while adapting them to the working context.

2. Method

It was of a 13-year retrospective cross-sectional study (2003-2015), in our recently created paediatric neurosurgery unit, to provide statistical data in our context to compare to Literature. It involved 302 children aged 0 to 15 years admitted and operated for hydrocephalus.

3. Results

Three hundred and two children were operated on during

the 13 years. The cohort included 62 patients for 90 complications pooled, 20.52%. The average annual frequency was 4.7 cases per year (*Annual Incidence=1.58 cases per 100 children*). The average age was 2 years 8 months (*2 months – 14 years*); the infant was the most affected age group, 70.97%. The sex ratio was 1.69 (*39 boys – 23 girls*). Malformations were predominant in 4 out of 5 children, 80.65% and more than half were non-obstructive, 58%. The duration of initial surgery was between 1 and 2 hours for almost all patients, 93.5%; the majority were performed by junior surgeons, 75.81%. The complications were unique, multiple or associated. They were mostly mechanical (52) mostly shunt disconnections and obstructions (9/52 & 8/52) (*Figure 1*). They were also infectious (38) dominated by

meningitis (16/38) (*Figure 2*). Postoperative infections were primarily bacterial (26/38; 68.42%) (*Gram-Positive 57.9%, Gram-Negative 10.52%*). The average onset time for complications was 1 year 4 months (*20 days – 7 years*) for mechanical complications and 1 month 15 days (*4 days – 1 year*) for infectious ones. The treatment was mainly surgical 88.7% on several modes, including nearly 1/3 of cases with further surgeries (*2 revisions: 13/55, 3 revisions: 3/55*). The medical treatment (*Bi-antibiotherapy*) was of 11.3%. Progressive follow-up was between 3 and 6 months in 35% of cases and more than 6 months for 45% of patients. The evolution was favourable for more than half of the cases. We pooled 16 deaths, 25.8% and 9.67% aftereffects (*Figure 3*).

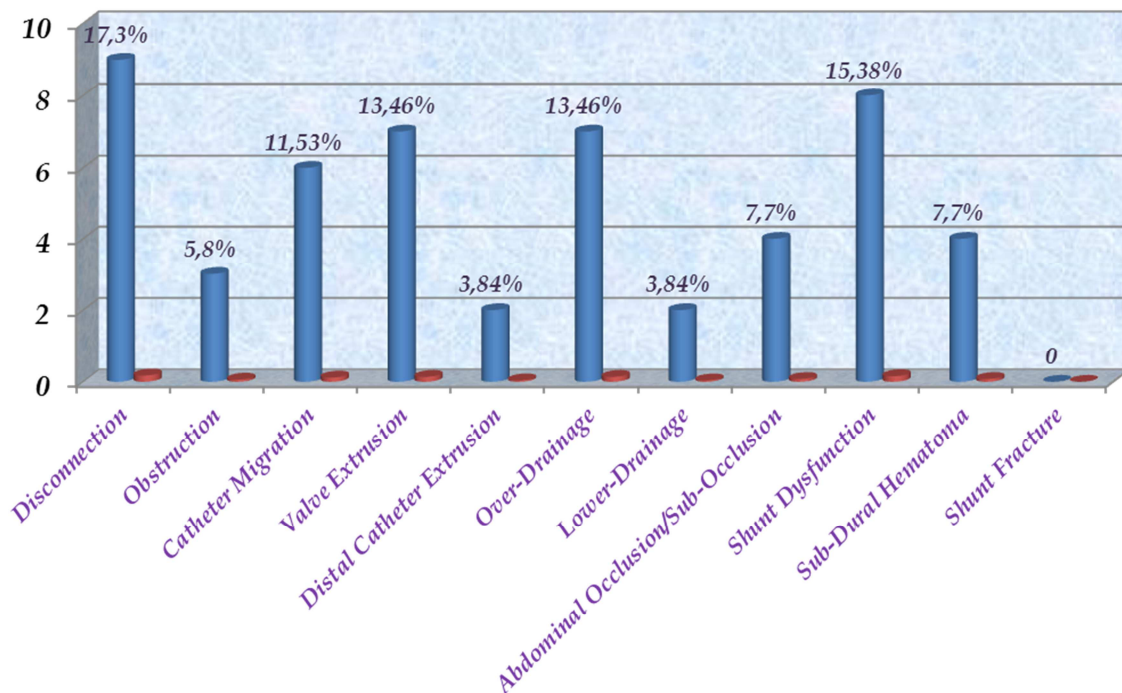


Figure 1. Mechanic Complications.

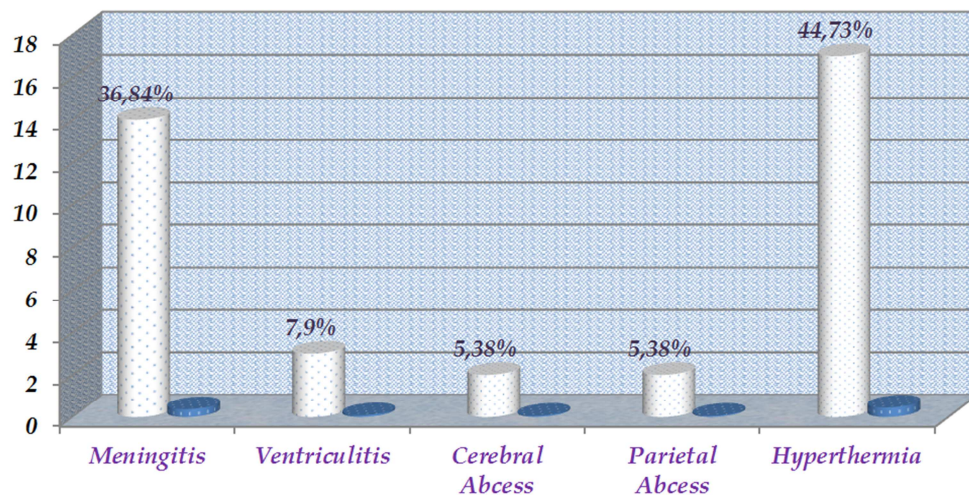


Figure 2. Infectious Complications.

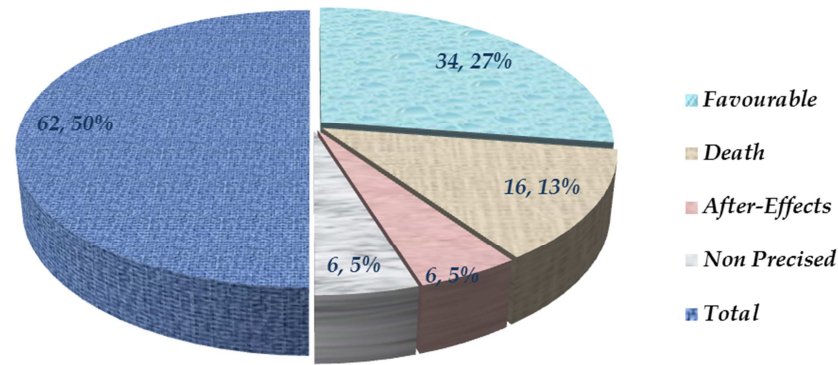


Figure 3. Evolution.

4. Discussion

Epidemiological parameters (*age, sex, provenance, aetiology*) did not generally have an impact on the occurrence of complications of ventriculoperitoneal shunting during the study period, but their preponderance according to the items seems more related to the initial causal hydrocephalus. According to *Drake JM, relayed by Neiter E et al (2015)*, will make complications: 50% of children shunted before their first 2 years and 30% for those shunted after 2 years [8]. *Paff M et al (USA, 2018)*, after meta-analysis of complication data in children suggested 3 most risk factors for hydrocephalus complications: an early post-shunting complication; congenital hydrocephalus, especially obstructive; male gender and low socio-economic status [9]. This analysis could be easily superimposable in sub-Saharan area. In our study, congenital malformative hydrocephalus mostly obstructive was predominant, 80%; as found by *Mbonihankuye A et al* [10]. In addition, there is a high risk of infection on shunt in premature new-borns, due to their incompletely developed immune system: *Gestational Age < 40 Weeks of Amenorrhea ==> Infectious Probability > 2.05* [9]. Furthermore to these factors, *Bober J et al* in a large literature review (250 articles) evoke ethnicity related to the occurrence of complications: It may exist a high risk of complications among Blacks, Hispanics and Native Americans than among Asians and Whites [3].

These complications depend on the technical and surgical experience, the duration and operating environment and the patient's initial clinical status. In our study, only 4.8% of children were operated on within an hour and 1/4 of patients operated on by seniors. According to *Minina A et al*, the highest rate of complications is noted among less experienced neurosurgeons [11]. The initial condition of the child, loco-regional or remote pathology: pneumopathy or ENT (*Ear-Nose-Throat*) infection, rash skin lesion around surgical sites, malnutrition, cranial perimeter +4SD (*standard deviations*) as sometimes observed during the study, are possible contributing factors to the occurrence of complications. We did not pooled any shunts fracture during the study as noticed by *Jibia and al (2021)* [12]. *Santos MM et al (Tanzania, 2017)* identified 3 risk factors for early

surgical complications: tumour aetiology related to hydrocephalus, a large cranial perimeter and long postoperative hospital stays [13].

These complications are generally of two kinds: mechanical and infectious [2, 4, 8-10]. The mechanic complications are: proximal/distal obstructions, disconnections, catheter migrations, low/over-drainage, subdural hematoma, valve/catheter extrusion, pseudocyst, intestinal perforation, CSF ascites (*Cerebro-Spinal Fluid*), shunts fractures. They represent the first cause of shunt malfunction in children, 60% [8]. Mechanical complications were the majority in our study 57.77%, corroborating the Literature. *Mbonihankuye A et al*, noted more shunt obstructions than disconnections [10]. Infectious complications are the second cause, 40% [8]; these are: meningitis, ventriculitis, cerebral abscess, peritonitis... No co-infection with HIV or associated Tuberculosis was found during our study.

Bober J et al suggest a more specific classification of complications into 3 categories: mechanical (*Obstruction – Fracture – Disconnection – Migration – Perforation*), infectious (*Bacterial – Parasitic – Fungal*) and functional (*Over-drainage – Ventricle Slit Syndrome – Pseudocyst – Ascites – Metastases*) [3].

Some shunt complications have obvious clinical presentations: extrusion, ascites, pseudocyst, meningitis. Others are alerts requiring further explorations: intracranial hypertension, hyperthermia, epileptic seizures, paralysis of the abdominal nerve, ataxia, papillary oedema, occlusive (sub-) syndrome. However, between 15–30% of postoperative complications are asymptomatic [8]. These clinical tools remain essential for the early diagnosis of complications, regardless of the area of surgical practice.

All children had been operated on by shunts – medium pressure during our study. Programmable valves would significantly reduce the rate of valve overhaul or drainage failure before 18 years [14]. Post-shunting complications are the source of a compromised functional or even vital prognosis, sometimes in the context of financial insecurity, psychosocial stress or low feel.

5. Conclusion

This paediatric neurosurgery unit in Sub-Saharan Africa is

more than a decade of existence. Despite limited resources, ventriculo-peritoneal shunting is possible with acceptable long-term outcomes and complication rates globally comparable on those of the Literature. A surgical-social challenge revolves almost constantly around the initial management of hydrocephalus in children and the early secondary management of the complications inherent in this surgery. Emphasis remains on the initial and secondary prevention of complications and on-going training of surgeons.

Conflict of Interest

No conflict of interest to declare.

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