Postinfectious hydrocephalus in African infants: common, under-recognised, devastating, and potentially preventable

See Articles page e1793

With an almost 200 000 estimated new cases of infant hydrocephalus annually, this disease constitutes a heavy burden of disease in sub-Saharan Africa.[1] A 2011 analysis estimated that untreated infant hydrocephalus in these countries could result in annual economic losses of more than US$50 billion.[2] Currently, the only available treatments for infant hydrocephalus require neurosurgical intervention, to which there is very poor access across Africa. This means that many, and perhaps most, of these infants are never treated, resulting in unnecessary suffering, disability, and death. The causes of hydrocephalus are diverse, and the neurocognitive outcome of successfully treated hydrocephalus is often predetermined by its aetiology.[3] The aetiologies of infant hydrocephalus in high-income countries are well-documented, with post-haemorrhagic hydrocephalus of prematurity being the most common.[3] However, in lower-middle income countries, particularly those in sub-Saharan Africa, the primary causes of infant hydrocephalus are not clear from the existing literature. Importantly, the incidence of specific aetiologies of hydrocephalus, such as infection and neural tube defects, could be greatly reduced through public health measures such as the reduction of neonatal sepsis and its sequelae, and folate fortification of the grain supply. Identifying areas of greatest need would facilitate the optimum investment of scarce resources.

In 2005, I reported that neonatal infection was the single most common cause of infant hydrocephalus in eastern Uganda and the surrounding region, accounting for 179 (60%) of 300 of all cases.[4] These infants typically have evidence of severe ventriculitis and cerebritis that is often accompanied by substantial destruction of brain parenchyma. Although this postinfectious hydrocephalus can be successfully treated, often by an endoscopic procedure that avoids shunt-dependence, neurocognitive disability from the primary brain injury is inevitable.[5] Brain growth has been shown to stagnate in these infants, despite successful hydrocephalus treatment,[6] and a 5-year postinfectious hydrocephalus outcome study showed that one-third of treated infants had died and one-third of the survivors were profoundly disabled.[7] Prevention or early treatment of these infections is obviously paramount; however, that requires identification of causative pathogens, which have so far been elusive. Only recently has the primary pathogen, a uniquely virulent form of *Paenibacillus thiaminolyticus*, been discovered, thus paving the way for possible medical interventions to reduce the incidence and improve the outcome of postinfectious hydrocephalus in Ugandan infants.[8] Understanding whether postinfectious hydrocephalus is common in other lower-middle income countries, and identifying the responsible pathogens, is essential to crafting public health strategies for its prevention.

In *The Lancet Global Health*, with their important analysis of the existing literature, Camilla G Aukrust and colleagues[9] have helped make sense of diverse reports regarding the predominant aetiologies of hydrocephalus among African infants. The authors have taken a rigorous approach that acknowledges the heterogeneity of current methods of determining and reporting the prevalence of various aetiologies of hydrocephalus, classifying those cases in which no determination can be made from the original report as unclear. The authors have also acknowledged the problematic absence of criteria for identifying postinfectious hydrocephalus in many of the studies reviewed. Furthermore, those studies that were rated as having an intermediate or high methodological quality were found to have reported higher incidences of postinfectious hydrocephalus than studies of low quality. Thus, if studies judged to be of low quality had been excluded from the analysis, the proportion of postinfectious hydrocephalus would have been even higher. The 20% of pooled patients the authors classified as being of unclear aetiology probably included cases of unrecognised postinfectious hydrocephalus. It is worth emphasising that, unlike postinfectious hydrocephalus, non-postinfectious hydrocephalus is not itself an aetiology, but rather a general category containing all the other disparate aetiologies of hydrocephalus besides postinfectious hydrocephalus and spinal dysraphism. Thus, this meta-analysis strongly suggests that postinfectious hydrocephalus is the single most common aetiology of infant hydrocephalus in Africa,

which is not surprising given the substantial estimated burden of neonatal sepsis on the continent.[10]

The authors' finding that postinfectious hydrocephalus prevalence increased with decreasing country-level economic status and increasing proximity to the equator supports the notion that postinfectious hydrocephalus is a condition of poverty, and post-haemorrhagic hydrocephalus of prematurity is a condition of prosperity. This important observation will help to strategically focus resources on future efforts to reduce infant morbidity and mortality from postinfectious hydrocephalus across the continent, and perhaps in other parts of the world as well. Such efforts must include identification of regions with the highest postinfectious hydrocephalus prevalence, followed by the expensive and labour-intensive process of discovering the responsible pathogens, which are likely to vary among those regions. Postinfectious hydrocephalus is a common and devastating, yet previously under-recognised, condition. However, the disease is potentially preventable. Aukrust and colleagues have helped bring us one step closer to that goal.

BCW reports participation on the data safety monitoring board of the Hydrocephalus Clinical Research Network ESTHI trial and being chairman of Neurokids.

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