Collaborative Translational Research and Control of Meningitis in Sudan

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Sudan lies within the meningitis belt and meningococcal disease has been one of its major problems throughout the twentieth century. Over 12,000 and 55,000 cases were recorded in the years 1935 and 1950 respectively; and during the period 1968-1980, over forty thousands (40,513) were inflicted with the disease of whom 1,220 have died. A collaborative translational research between the University of Khartoum and Uppsala University in Sweden managed to document the epidemiology, clinical features and complications of childhood acute bacterial meningitis (ABM) in Sudan during both an inter-epidemic (endemic) period (1985-1986), and the 1988 serogroup A epidemic; and to examine the phenotypic and genetic similarities and differences of Neisseria meningitidis strains isolated in Sudan and Sweden. A novel enzyme immunoassay test (Pharmacia Meningitis EIA-Test) was evaluated as a potential rapid diagnostic method for the detection of Haemophilus influenzae (HI) type b, Neisseria meningitidis (MC) and Streptococcus pneumoniae (PNC). The test was found to have good sensitivity (0.86) and specificity (0.95) in the inter-epidemic period; and to be adaptable to the field work in Sudan during the 1988 MC epidemic. During inter-epidemic (endemic) situations in Sudan, >90 % of childhood ABM was caused by one of the three organisms, HI type b, MC and PNC. HI accounted for 57% of the cases. The peak incidence (76%) of HI cases was in infants (<12 months) similar to the situation in other African countries. The overall case fatality ratio was 18.6%.

Prospective follow-up of survivors for 3-4 years revealed that an additional 43% either died or had permanent neurological complications, the most prevalent and persistent of which was sensorineural hearing loss recorded in 22% of long term survivors. Post-meningitic children were found to have significantly lower intelligence quotients (92.3 ± 13.9) than their sibling controls (100.7 ± 10.2, P=0.029). Features of the large serogroup A sulphonamide resistant MC epidemic (February-August 1988) in Khartoum were documented. An estimated annual incidence of 1,679/100,000 was recorded at the peak of the epidemic. The highest attack rate was in young children <5 years, as in many other African countries; nevertheless, a high morbidity was observed in adults (31% of the cases > or = 20 years). The clinical features, mortality (6.3%) and short term

sequelae in Sudanese children were generally within the framework described for MC disease elsewhere.

Detailed analysis of MC isolates from Sudan and Sweden by characterizing their electrophoretic enzyme types, DNA restriction endonuclease pattern and outer membrane proteins, revealed that serogroup A MC clone III-1 was responsible of The Sudan epidemic in 1988 and has been the dominant serogroup A organism in Sweden since 1973. The Sudanese strains isolated prior to the epidemic (1985) were clone IV-1. Clone III-1 has caused two global pandemic waves within three decades and clone IV-1 has been resident in the meningitis belt for 25 years. This collaborative translational research paved the way for the successful control of acute bacterial meningitis following the introduction of conjugate vaccines.