State of the Globe: The Resurgence of Vivax

Malaria occurs throughout most of the tropical regions of the world. *Plasmodium falciparum* (PF) predominates in Africa, New Guinea, and Hispaniola (i.e., the Dominican Republic and Haiti); *Plasmodium vivax* (PV) is more common in Central America. In South America, the Indian subcontinent, Eastern Asia, and Oceania the prevalence of these two species is approximately equal. About 3.2 billion people are at risk of the disease in 97 countries, territories, and areas. In 2013, the disease killed about 584,000 people, mostly children aged under 5 years in sub-Saharan Africa.[1]

In India, 95% population resides in malaria endemic zone, and 80% of malaria comes from 20% of population living in tribal, hilly, difficult, and inaccessible areas.[2,3] PV is no longer the most common form of malaria in India PF% among the total malaria cases is 65.5%.[3] Most deaths due to malaria occur in patients who develop cerebral malaria (CM). CM is a dreaded form of malaria known to be caused only by PF among all species of malaria till now.

CM in cases of PV has recently been reported in numerous case reports and case series from India and Pakistan.[4-8] Polymerase chain reaction (PCR)-based studies from Rajasthan have reported 11 (adults) and 13 (children) of PV mono-infection causing CM.[5,6] The clinical profile of PV-associated CM was found to have both sequestration-related and nonsequestration-related complications of severe malaria, including CM, renal failure, circulatory collapse, severe anemia, hemoglobinurea, abnormal bleeding, adult respiratory distress syndrome, and jaundice.[5,6] At present, WHO and National Vector Disease Control Program (NVBDCP) of India are silent about PV-induced CM.

In light of above findings, Chaudhary *et al*., have presented a glaring evidence for PV-associated CM in 25 patients of a total of 112 clinically diagnosed cases of CM from tribal areas of Assam with mortality almost equal to that of PF, i.e., 32%.[4] Neurological sequelae, however, were less severe in PV compared to PF, i.e., 16% and 51%, respectively.[4] Twelve patients were confirmed mono-infections using PCR and rest were diagnosed by microscopy.[4] Keeping in mind the gross underreporting of cases in tribal areas and the study being an institution-based study, the actual figures of CM and mortality may be higher. Meghalaya, another North-Eastern State of India with 86% tribal population, alone reported 27% of all deaths due to malaria in 2015 in the whole country.[3]

Chaudhary *et al*. add to the already existing hospital-based evidence, however, further studies looking into the pathogenesis (sequestration versus nonsequestration mechanisms) and epidemiology of PV-associated CM are needed. Although most evidence has come from PF intensive areas where mixed infections can occur, mono-infection due to PV has now been established beyond doubt by PCR-based studies.[4-6]

Use of rapid diagnostic kits has been recommended by the NVBDCP, but Chaudhary *et al*., have not reported their use in Assam. Mortality among females was 50% which the authors have somehow overlooked. Some take home messages from this important study on malaria from North-Eastern tribal areas of India are: PV associated CM is on the rise in the Indian Subcontinent with a mortality equivalent to PF but less severe neurological sequelae. WHO and NVBDCP need to consider revising definitions of CM and include PV as its cause in the light of recent evidence.

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