

Characterizing Cases of Fatal Severe Malaria in the Child Health and Mortality Prevention Surveillance (CHAMPS) Sites of Manhiça and Quelimane, Mozambique.

Authors: Rosauro Varo¹, Elisio Xerinda², Sara Ajanovic², Natalia Rakislova¹, Carla Carrilho², Juan Carlos Hurtado¹, Milton Kincardett², Dercio Jordao², Dianna M. Blauz³, Khátia Munguambe², Inácio Mandomando², Quique Bassat^{1,2,4,5,6}

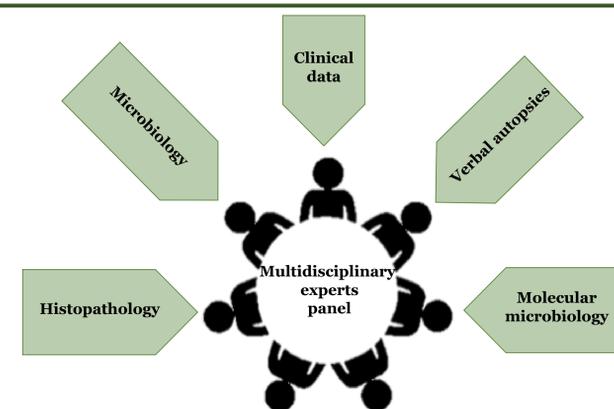
1. ISGlobal, Hospital Clínic - Universitat de Barcelona, Barcelona, Spain. 2. Centro de Investigação em Saúde de Manhiça (CISM), Manhiça, Mozambique. 3. Center for Global Health, Centers for Disease Control and Prevention, Atlanta, GA, United States. 4. ICREA, Pg. Lluís Companys 23, 08010 Barcelona, Spain. 5. Pediatrics Department, Hospital Sant Joan de Déu, Universitat de Barcelona, Esplugues, Barcelona, Spain. 6. Consorcio de Investigación Biomédica en Red de Epidemiología y Salud Pública (CIBERESP), Madrid, Spain

INTRODUCTION

- ✓ More than 5 million deaths occur annually in children <5 years of age globally, with **malaria accounting for approximately 8% of these deaths**. In 2020, there were 2-4M severe malaria cases and 627, 000 malaria deaths worldwide, **with 94% of these deaths occurring in Sub-Saharan Africa** and predominantly affecting children <5 years of age.
- ✓ **Mozambique** is one of the 4 countries with higher malaria burden (4,2% of the global burden). There are two differentiated seasons: rainy and warm (nov-april), dry and cold (the rest of the year). The infant mortality rate (per 1,000 live births) of the country is 67,4.
- ✓ **Manhiça**, is now a low malaria transmission area but **Quelimane** is still a high malaria transmission area. *Plasmodium. Falciparum* accounts for 90% of cases. Severe disease: 90% of children <5 years; Anemia: 75% of children have anemia and around 11% have severe anemia.

METHODS

- ✓ **When?** December 2016 -December 2021
- ✓ **Where?** Manhiça and Quelimane district area, Southern and Central **Mozambique**, Sub-Saharan Africa.
- ✓ **Why?** Child Health and Mortality Prevention surveillance (**CHAMPS**) network aims to collect robust, standardized, longitudinal mortality data in a network of sites to understand and track preventable causes of under-5 deaths and stillbirths in **high mortality areas**.
- ✓ **What?** minimally invasive tissue sampling (**MITS**), were conducted post-mortem in order to ascertain the cause of death under five years of age and stillbirths, after written informed consent was obtained. Clinical data was collected from health facilities, and verbal autopsies were conducted with family members. The final diagnosis have been classified according to **ICD-10** coding system.



RESULTS

- ✓ A total of **505 MITS** were conducted in children <5 years, including children less than 28 days of life and stillbirths. Of those deaths, 43 (8,5%) were in infants and 73 (14,4%) were in children aged 12-<60 months.
- ✓ Of **116 deaths in infants/children** with a cause of death determined, malaria was in the **causal chain leading to death in 20 (17%)**, and in **18 (15,5%) was considered the underlying cause** (2 infants; and 16 children between 12 and 60 months). In Manhiça, median age was 40 months (with all males except one females) and with deaths occurring between april and may. In Quelimane the median age of those children older than a year was 23 months; and there was two children under one year. The proportion of female and males were similar. The time from onset of symptoms to death were similar in both sites with 2,5 days. All deaths were caused by *Plasmodium falciparum*.
- ✓ Of these malaria deaths, 16 (88%) were specified as cerebral malaria (as **underlying condition**) and 8 children had more than one cause of death determined. Among those malaria deaths with multiple causes the **immediate cause of death** were the following: 5 had **pneumonia** [2 aspiration pneumonia, 1 pneumonia due to *H. influenzae*, 1 pneumonia due to gram-negative bacteria and 1 polymicrobial pneumonia (*S. pneumoniae*, *H. influenzae*, *M. catarrhalis*)]; 1 had polymicrobial sepsis (*S. pneumoniae*, *K. pneumoniae*, *Salmonella spp*), 1 had anemia and 1 had hypoglycemia.
- ✓ Considering **other significant conditions** contributing to death: anemia, acute gastroenteritis, aspiration pneumonia, acute malnutrition, hypoglycaemia, and HIV exposure.

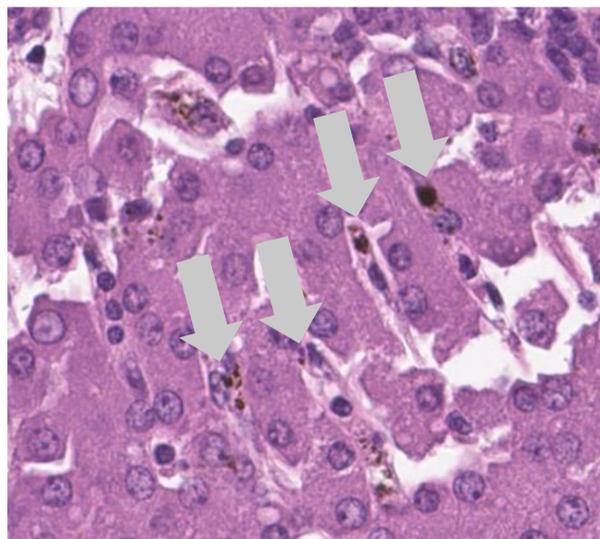


Figure 1: Liver showing abundant parasitized erythrocytes in the sinusoids

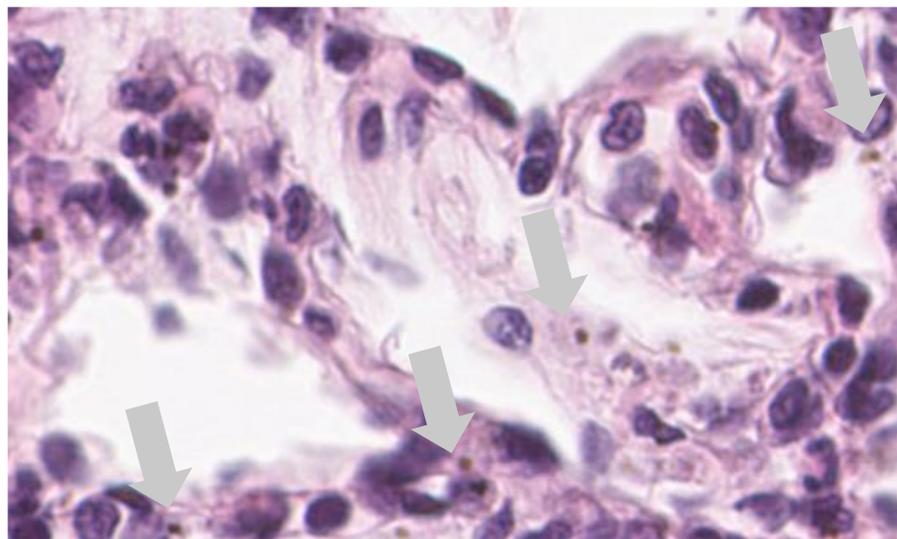


Figure 2: Lung, showing abundant parasitized erythrocytes in the septal capillaries

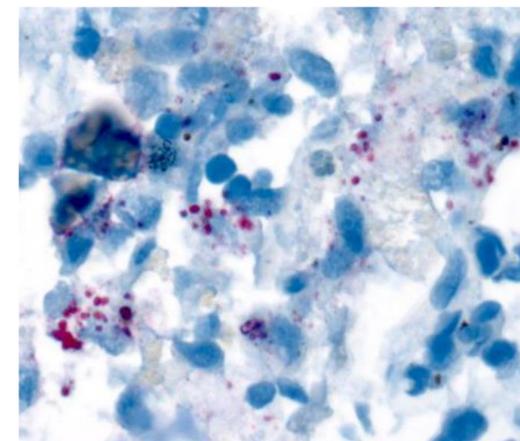


Figure 3: Immunohistochemistry in the lungs of a child who died with severe malaria showing *Streptococcus spp* (non-pyogenic).

CONCLUSIONS

- ✓ Malaria remains a leading cause of death in children in Mozambique. Understanding the **full chain of events** leading to death and associated conditions could help to guide better strategies for research and mortality prevention.
- ✓ It is important to consider co-infections and associated morbidities to treat **severe malaria cases**.
- ✓ All these deaths were considered as preventable deaths and the following recommendations were given to try to avoid them: improve **clinical management and quality of care**, improved **health-seeking behavior**.