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Histopathology and Immunohistochemistry Methods to Diagnose Fatal Malaria Infection in Minimally Invasive Tissue Sampling Samples

MR Bias[1,2], TM Wilson[1,2], JM Ritter[2], JN Seixas[2], BE Ndibile[3], S Sava[3], D Adera[3], T Massawa[3], IA Bassey[4], C Carrilho[5], MR Ismail[5], D Jordao[5], FC Fernandes[5], CB Traore[6], DM Blau[2], SR Zaki[2], RB Martines[2]

[1]ORISE, Oak Ridge, TN, USA, [2]Centers for Disease Control and Prevention (CDC), Atlanta, GA, USA, [3] Kisii Teaching and Referral Hospital, Kisii, Kenya, [4] ICAP-Columbia University, Makeni, Sierra Leone, [5]Department of Pathology, Faculty of Medicine, Eduardo Mondlane University and Maputo Central Hospital, Mozambique, [6]Department of Pathological Anatomy and Cytology, University Hospital of Point G, Bamako, Mali

Background

Malaria infection is a leading cause of mortality in low-income countries, including in children aged <5. There is a limited data about the use of specialized tissue-based diagnostic methods on minimally invasive tissue sampling (MITS) samples to investigate malaria as cause of death.

Materials & Methods

The Infectious Diseases Pathology Branch (IDPB) receives post-mortem formalin-fixed MITS samples from children <5 years in 7 countries in sub-Saharan Africa and South Asia as part of Child Health and Mortality Prevention Surveillance (CHAMPS). Specialized diagnostics at IDPB, including routine histopathological (HP) evaluation and immunohistochemical testing (IHC) for *Plasmodium falciparum* were performed on brain and liver tissues to identify malaria infection in MITS samples received between January 2017 to July 2021 from 4 countries where malaria is endemic. Pathologists from IDPB and CHAMPS sites performed collaborative pathology review using telepathology, and findings were discussed in online meetings to reach consensus diagnoses and to increase pathology capacity at sites through quality assessment and training for identification of HP patterns and interpretation of IHC.

Results

We identified 169 (12%) deaths among 1412 evaluated as having suspected malaria based on histomorphological features of malaria infection, including presence of hemozoin pigment and/or intraerythrocytic protozoan. Among these, 423 *P. falciparum* IHC tests were performed on liver and brain MITS samples from 169 cases deaths. Of these, malaria was detected in 113 (67%) cases in one or both tissues. IDPB demonstrated features of malaria and of IHC staining during virtual meetings with the CHAMPS sites to increase diagnostic capacity for malaria at the sites.

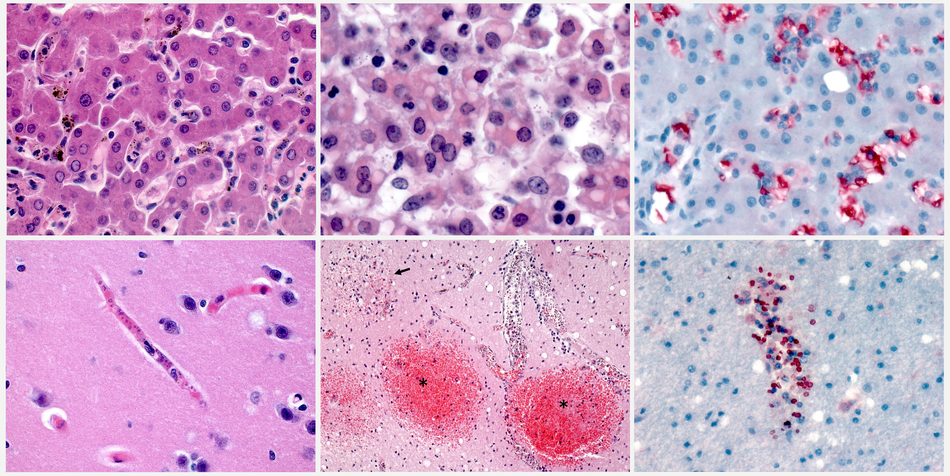
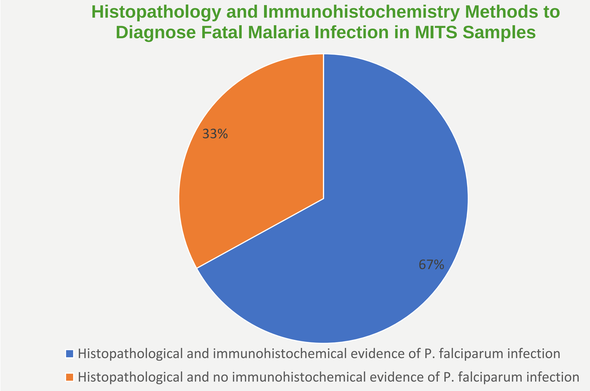


Figure 1: Histomorphological and immunohistochemical features of malaria infection in post-mortem formalin-fixed MITS samples of liver and brain from children <5 years from countries in sub-Saharan Africa as CHAMPS. A trough C: Liver. A: sinusoidal leukocytosis and hemozoin (black pigment) in red blood cells (RBC) and Kupffer cells, H&E. B: free and intraerythrocytic protozoan in sinusoids, H&E. C: immunohistochemical staining of *P. falciparum* (red) in RBC, IHC. D trough F: Brain. D: intraerythrocytic protozoan within vessel, H&E. E: Intraparenchymal ring hemorrhages (asterisks) and Dürck's granuloma (arrow), H&E. F: immunohistochemical staining of *P. falciparum* (red) in RBC, IHC.



Conclusion

Malaria is an important cause of child mortality in low-income countries. HP evaluation in combination with specialized IHC testing in MITS samples is useful for the diagnosis of malaria infection. The sequestration of parasitized erythrocytes in the microvasculature of vital organs is central to the pathogenesis of severe malaria, and recognition of HP and IHC features of malaria infection is crucial for the diagnosis.

The findings and conclusions in this presentation are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

CHAMPS

Contact information
Roosecelis Brasil Martines, MD, PhD
Infectious Diseases Pathology Branch, CDC
xgm7@cdc.gov

CDC