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Use of Specialized Tissue-Based Diagnostic Techniques for Minimally Invasive Tissue Sampling to Determine Bacterial Causes of Death in Children Under the Age of 5 in South Africa

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Background

Infectious diseases are an important, potentially preventable, leading cause of mortality in infants and children <5 years old in low-income countries. Postmortem pathological examination is useful to identify infectious etiologies of deaths in infants and children. Few data are available on how well tissue-based diagnostic assays on specimens from minimally invasive tissue sampling (MITS) are able to identify infections in this population.

Materials & Methods

Formalin-fixed MITS samples from child deaths in South Africa were sent to the Infectious Diseases Pathology Branch (IDPB) as part of the pilot phase of the Child Health and Mortality Prevention Surveillance (CHAMPS) project in 2016. Histopathological evaluation was performed, and findings were discussed among pathologists from IDPB and South Africa through telepathology sessions, as needed, to achieve consensus diagnoses. Routine diagnostic tests, including special stains (SS), immunohistochemistry (IHC) and molecular testing by PCR and sequencing, were performed on MITS specimens that showed histopathologic evidence suggesting of an infectious etiology.

Results

IDPB received MITS samples from 403 deaths with suspected infectious cause of mortality in children <5 years and stillbirths. Among these deaths, 55% (225) had histopathologic features suggesting of infection. Further testing at IDPB identified common infectious bacterial agents as *Klebsiella pneumoniae* (3 PCR and 41 IHC positive tests), *Pseudomonas aeruginosa* (2 PCR and 5 IHC positive tests), *Staphylococcus species*, including *Staphylococcus aureus* (12 IHC positive tests), *Streptococcus species*, including *Streptococcus pneumoniae* (10 PCR and 3 IHC positive tests) and *Acinetobacter species*, including *Acinetobacter baumannii* (13 PCR and 7 IHC positive tests).

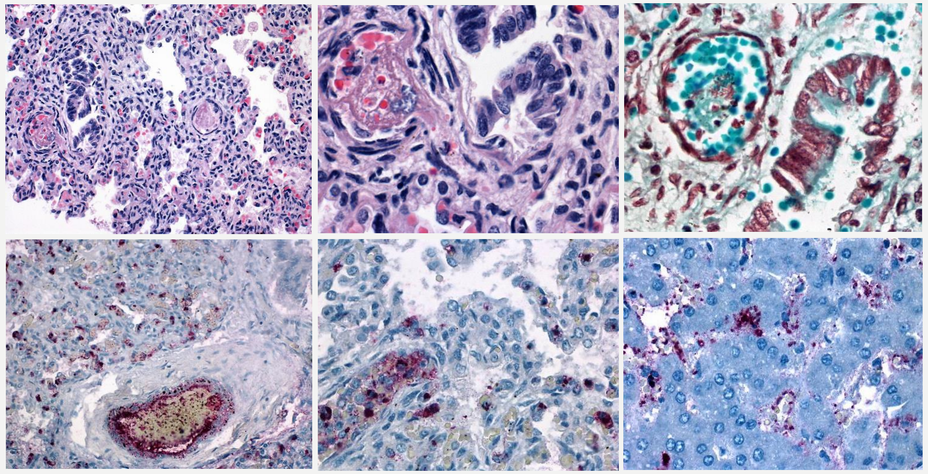
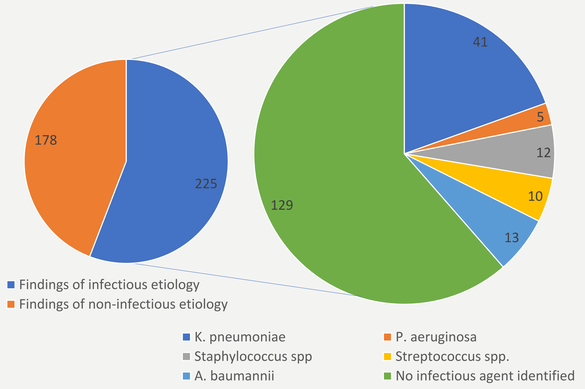


Figure 1: Microscopic findings of *Klebsiella pneumoniae* sepsis in a 10 day old male born at 28 weeks gestation with low birth weight (1kg) presenting cyanosis, lethargy, difficult breathing, and suspected sepsis. A: lung, increased alveolar macrophages and leukocytosis, H&E. B: lung, high magnification, intravascular rod bacteria and thrombi H&E. C: lung, gram-negative rod bacteria in vessel and bronchiole, L-T Gram stain. D and E: lung, *Klebsiella pneumoniae* antigen immunostaining (red) within vessels and alveoli, IHC F: liver, *Klebsiella pneumoniae* antigen immunostaining (red) within sinusoids, IHC.

Figure 2: Histomorphological findings of infectious etiology and common infectious bacterial agents identified



Conclusions

Tissue-based IHC and PCR assays performed on MITS samples are useful for identifying bacterial infections associated with childhood deaths in low-income countries. These infections include some that are preventable and treatable, emphasizing the potential for MITS to guide implementation of public health measures aimed at reducing childhood mortality.

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

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