Bacterial colonization of the lower genital tract and neonatal infections: Etiology, antibiotic resistance and associated factors

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Introduction

• Globally, infections account for 3.3 million deaths among children under 5 years annually of which 45% are in neonatal period

• They include pneumonia, meningitis, tetanus and septicemia

• Septicemia may follow omphalitis

• Omphalitis is associated with unhygienic (sometimes traditional) cord care practices

• Newborns are very susceptible to infections
  • Immature immunity
  • Incomplete skin barrier
Introduction cont’d

• Microorganisms often colonize the cord stump or surrounding skin

• Localized infection may subsequently spread to the bloodstream leading to sepsis

• Some of the causative microorganisms are multidrug resistant

• Infections caused by multidrug resistant organisms are difficult to treat and often have poor outcomes
  • Long hospitalization
  • Disease severity (sepsis and death)
Introduction cont’d

• It is unclear whether colonization of the maternal genital tract could increase the risk of serious newborn infections

• Potentially pathogenic bacteria that may cause illness in neonates born to colonized mothers include:
  
  *Staphylococcus aureus, Klebsiella pneumoniae, Escherichia coli, Enterococcus spp, Enterobacter spp, Acinetobacter spp, Citrobacter spp and Pseudomonas aeruginosa*
Aim

To describe bacteria colonizing the lower genital tract of women in labour and those causing infections among their newborns; the antimicrobial resistance patterns and associated factors at three primary health care facilities in Uganda
Objectives

Study I
• To describe the prevalence of bacterial colonization of the lower genital tract in HIV-1 negative women in labour, the antimicrobial resistance profiles and associated factors in three birth clinics in Kampala

Study II
• To determine the bacterial etiology of umbilical cord stump infections among HIV-1-unexposed neonates born in the birth clinics and describe the antimicrobial resistance profile of isolated putative pathogens
Objectives cont’d

Study III
• To determine the genetic relationship between potentially pathogenic bacteria isolated from women and those isolated from their newborns at three primary health care facilities

Study IV
• To determine the bacterial etiology, risk factors and clinical outcomes of newborns with suspected sepsis at Mulago national referral hospital
Chlorhexidine (CHX) trial

• My studies are nested into the ongoing CHX trial in Uganda

• The trial aims to estimate the efficacy of umbilical cord cleansing with a single application of 4% CHX to prevent infections in HIV-1 unexposed newborns
Study I: Antibacterial resistance profiles of pathogenic bacteria isolated from the lower genital tract of women in labour and associated factors

- Study design: A cross sectional study

- Study population: HIV-1 negative pregnant women in the CHX study giving birth in
  - Kawaala Health Center III
  - Kitebi Health Center III
  - Mukono Health Center IV

- 1,056 vaginal swabs were collected in Amies transport medium & kept in cold boxes (between 10°C & 25°C)

- Study procedure: trained study staff interviewed mothers using open data kit (ODK) based validated mobile based electronic questionnaires
Midwife and study nurse interacting with a mother in labour at Kitebi health center III
Methods cont’d

Lab methods

Swabs were cultured on

- Blood agar (5% sheep blood)
- MacConkey agar
Methods cont’d

• Identification
  • Standard panel of biochemicals for ID of gram negatives
  • Gram/hemolysis/catalase/coagulase/DNAse/bile esculin and serotyping for ID of gram positives

• Drug susceptibility testing
  • Muller Hinton agar
  • Zone diameters interpreted according to CLSI guidelines
Methods: Methicillin resistant *S. aureus* identification

*mecA* PCR

- Subcultured stored *S. aureus* isolates on nutrient agar
- Conducted *mecA* PCR
- Gel electrophoresis
Study II: Etiology of umbilical cord stump infections among neonates born at three primary health centres in Kampala, Uganda

- Definition of umbilical cord stump infection (omphalitis)

- Diagnosis based on clinical signs
  - Redness
  - Swelling
  - Pus
Methods: Study II

• Study design- Cross sectional study
• Study setting : as paper I
• Study population
  • Neonates delivered to HIV-1 negative women at these health facilities and recruited in the CHX trial
• Eligibility criteria
  • Included neonates whose mothers/caretakers consented to participate in the CHX trial
  • Excluded neonates born with severe congenital anomalies, obvious cord infection or in need of hospitalization at birth
Study III: Maternal colonization, a potential risk factor for neonatal infection

Objective

To determine the genetic relationship between bacterial species isolated from the lower genital tract of women in labour and those isolated from infected newborn umbilical stumps
Methods: Paper III

• On-going cohort and laboratory study

• A paired analysis will be done when the same species is isolated from mother and child
  • To assess the genetic relatedness of the bacteria isolates in mother and baby

• Lab methods
  • Genotyping will be performed on *S. aureus* isolates based on the
    • Staphylococcal protein A (spa typing by PCR)
    • Staphylococcal chromosomal cassette (SCCmec)
  • Multi locus sequence typing (MLST) will be performed on *E. coli* and *K. pneumoniae* isolates
Progress with Study III

• All samples have been collected

• Further lab analysis waiting for delivery of some reagents
  • PCR reagents (Taq polymerase and master mix)

• Optimizing protocols
  • This depends on the new set of PCR reagents
  • Anticipate by end of July (Spa typing)
  • MLST optimization after spa typing
Paper IV: Clinical sepsis in Ugandan neonates: Etiology and antibiotic resistance of causative bacterial pathogens

Objective

• To describe the risk factors, clinical outcomes and bacterial etiology of clinical sepsis among Ugandan neonates

• An on-going cross sectional study in the acute care unit (ACU) at Mulago national referral hospital

• Started January 2018 will finish December 2018

• Recruited so far: 160 neonates with suspected sepsis-Total projected sample size: 360 needed