Antimicrobial Resistance and Infection Control

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Vaginal colonization with antimicrobial-resistant bacteria among women in labor in central Uganda: prevalence and associated factors

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Abstract

Background: According to WHO (CISMAC. Centre for Intervention Science in Maternal and Child health), the antimicrobial resistant bacteria considered to be clinically most important for human health and earmarked for surveillance include extended-spectrum beta-lactamase (ESBL)-producing *Enterobacteriaceae,* carbapenem-resistant bacteria, methicillin-resistant (MRSA) and, macrolide-lincosamide-streptogramin B -resistant vancomycin-resistant (VRSA) *Staphylococcus aureus* and vancomycin-resistant *Enterococcus* (VRE). If these bacteria are carried in the female genital tract, they may be transmitted to the neonate causing local or systemic neonatal infections that can be difficult to treat with conventionally available antimicrobials. In order to develop effective treatment strategies, there is need for updated information about the prevalence of colonization with important antimicrobial-resistant pathogens.

Objective: We sought to estimate the prevalence of vaginal colonization with potentially pathogenic and clinically important AMR bacteria among women in labour in Uganda and to identify factors associated with colonization.

Methods: We conducted a cross-sectional study among HIV-1 and HIV-2 negative women in labour at three primary health care facilities in Uganda. Drug susceptibility testing was done using the disk diffusion method on bacterial isolates cultured from vaginal swabs. We calculated the prevalence of colonization with potentially pathogenic and clinically important AMR bacteria, in addition to multidrug-resistant (MDR) bacteria, defined as bacteria resistant to antibiotics from ≥ 3 antibiotic classes.

Results: We found that 57 of the 1472 enrolled women (3.9% prevalence; 95% Confidence interval [CI] 3.0%, 5.1%) were colonized with ESBL-producing *Enterobacteriaceace,* 27 (1.8%; 95% CI 1.2%, 2.6%) were colonized with carbapenem-resistant *Enterobacteriaceae*, and 85 (5.8%; 95% CI 4.6%, 7.1%) were colonized with MRSA. The prevalence of colonization with MDR bacteria was high (750/1472; 50.9%; 95% CI 48.4%, 53.5%). Women who were ≥ 30 years of age had higher odds of being colonized with MDR bacteria compared to women aged 20–24 years (OR 1.6; 95% CI 1.1, 2.2).

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Conclusion: Most of the women included in our study were vaginally colonized with potentially pathogenic MDR and other clinically important AMR bacteria. The high prevalence of colonization with these bacteria is likely to further increase the incidence of difficult-to-treat neonatal sepsis.

Keywords: Antimicrobial resistance, Multidrug resistance, MDR, ESBL, MRSA, MLSB, Carbapenem-resistant bacteria, Vaginal colonization

Background

The spread of infections with antimicrobial-resistant bacterial pathogens is a global public health challenge [1]. Pathogens that are responsible for most invasive neonatal infections are often resistant to commonly used antibiotics [2], and many are resistant to antibiotics from several different classes, including many last-resort drugs, which further complicates and limits the possibilities for treatment. Infections with these pathogens are associated with prolonged hospital stays, increased risk of complications and of death [3]. In the World Health Organization's recently published Global Priority Pathogens List, reducing the burden of infection with pathogenic antimicrobial resistant bacteria has been given priority, and combatting the spread of AMR is also listed as one of the main priorities in the United Nations general assembly's 2030 agenda for sustainable global health development [4].

The AMR bacteria considered to most importantly threaten neonatal health include extended-spectrum beta-lactamase (ESBL)-producing *Enterobacteriaceae,* carbapenem-resistant bacteria, methicillin-resistant *Staphylococcus aureus* (MRSA), macrolide-lincosamide-streptogramin B (MLSB)-resistant *S. aureus,* vancomycin-resistant *S. aureus* (VRSA), and vancomycin-resistant *Enterococcus* spp. (VRE) [5, 6]. The incidence of systemic infections with anaerobes is relatively low among neonates [2, 7, 8].

Many AMR bacteria are multidrug-resistant (MDR), which is commonly defined as being resistant to antibiotics from ≥ 3 different antibiotic classes [9]. Being infected with MDR bacteria tends to complicate or prolong treatment since the causative bacteria are resistant to commonly used antibiotics. Hospitalizations or visits to health clinics, direct contact with livestock and overuse of antibiotics are considered to be the most important risk factors for becoming infected with MDR bacteria and other clinically important AMR bacteria [4].

It is thought that pathogenic bacteria colonizes the birth canal mainly after faecal contamination [10] and are then sometimes transmitted to the baby during labour and delivery [11]. Such transmission is probably one of the main sources of neonatal bacterial infection within the first week of life, particularly if there was prolonged / obstructed labour or premature rupture of membranes (PROM) [12–14]. Having access to relevant antimicrobial resistance data for bacterial pathogens colonizing the birth canal can help clinicians make informed treatment decisions for neonatal bacterial infections, and, thus, improve chances of recovery while reducing the risk of complications and death. The availability of antimicrobial resistance surveillance data on a local level also helps to inform national health policies. There is a shortage of up-to-date data on AMR in sub-Saharan Africa. In addition, there is little knowledge about the extent of and risk factors associated with vaginal colonization with AMR bacteria. Here, we isolated potentially pathogenic bacteria from the birth canal of Ugandan woman in labour, determined the antimicrobial resistance patterns of the isolates, and estimated the prevalence of and identified risk factors associated with colonization with such bacteria.

Methods

Study design, setting and participants

We conducted a cross-sectional study between July 2016 and July 2018 at three primary health care facilities in and close to Kampala in central Uganda: Mukono General Hospital (formerly Mukono Health Centre IV), Kawaala Health Centre III, and Kitebi Health Centre III [15]. This study was nested within the Chlorhexidine Trial, which is a randomized controlled assessing whether a single application of 4% chlorhexidine solution on the umbilical cord stump immediately after birth reduces the risk of omphalitis and severe illness [16].

Of the 1658 women in labour who were screened for this study, we recruited 1472 who had already agreed to being enrolled in the above-mentioned Chlorhexidine Trial. The inclusion criteria for the trial were: mother was negative for HIV-1 and HIV-2 and gave birth on a weekday, the newborn weighed > 1.5 kgs, had no severe congenital anomalies, had no obvious signs of umbilical cord stump infection and had no severe illness on the day it was born. We enThe sample size was calculated for the trial but not for the present study. With this sample size we would obtain a very high (0.7% to 2.6%) absolute precision, i.e. the difference between the upper limit and the lower limit of the 95% confidence interval (CI) for prevalence estimates ranging from 2 to 50%.

and agreed to submit the final version of the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials
Datasets used during the current study can be obtained through a reasonable request from the principle investigator of the Chlorhexidine Trial (VN) nankabirwav@gmail.com and the corresponding author.

Ethical approval and consent to participate
Informed consent was obtained for both the interview and specimen collection and storage. Ethical approval was obtained from the Research and Ethics review Committee of School of Medicine, SOMREC, Makerere University (REC REF 2015-118) and from the Uganda National Council of Science and Technology (HS 1927).

Consent for publication
Not applicable.

Competing interests
Authors declare no competing interests.

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