Healthcare-Associated Severe Acute Respiratory Syndrome Coronavirus 2 Transmission in a Neonatal Unit: The Importance of Universal Masking, Hand Hygiene, and Symptom Screening in Containment

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Following exposure to a healthcare worker with an influenza-like illness, 2 preterm neonates and 6 staff members developed symptoms and tested positive for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). This neonatal unit coronavirus disease 2019 outbreak occurred prior to the implementation of universal masking and symptom screening policies. Both neonates and all staff recovered, with no further healthcare-associated SARS-CoV-2 transmission following the implementation of effective outbreak containment measures.

Key words. healthcare-associated SARS-CoV-2; neonatal viral infection; outbreak.

Since the emergence of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in Wuhan, China, the global spread of the coronavirus disease 2019 (COVID-19) pandemic has been rapid with more than 47 million laboratory-confirmed infections to date [1]. Approximately 10% of all COVID-19 cases worldwide occur among healthcare workers (HCWs), with an estimated 11-fold increased risk of a positive test in HCWs compared with the general community [2]. In contrast, neonates and children have been relatively spared, representing only 1%–5% of cases globally [3] with a case fatality rate of <0.1% [4].

Only 25 COVID-19-infected neonates were described in a recent systematic review that reported on 7480 children with SARS-CoV-2 [4]. Most of the neonatal SARS-CoV-2 infections were acquired postnatally from COVID-19-infected mothers [4], although transplacental transmission has been documented [5]. Limited data are available on the clinical presentation, management, and outcome of COVID-19-infected neonates. To our knowledge, there are no published cases of healthcare-associated (HA) SARS-CoV-2 transmission to hospitalized neonates, although transmission is possible from contaminated surfaces, equipment and hands and exposure to the respiratory droplets of COVID-19-infected caregivers and HCWs [6].

In Africa where neonatal unit outbreaks are frequent but underreported [7], the risk of staff-to-staff and staff-to-patient COVID-19 transmission is high, especially in hospitals with limited isolation facilities and overcrowding. In this brief report, we describe an outbreak of SARS-CoV-2 infection at a tertiary care neonatal unit in Cape Town in late April 2020, 7 weeks after the first laboratory-confirmed COVID-19 cases in South Africa.

Neonatal HA SARS-CoV-2 Cases

Two preterm neonates admitted in the same 8-bed cubicle of a neonatal 30-bed high care ward had new onset of respiratory distress (1 day apart) with subcostal retractions, tachypnea, increased nasal secretions, and hypoxia (Figure 1). Baby A (28-week gestation, 720 g birth weight) was a twin who was given up for adoption at birth. His mother was clinically well at delivery and had no contact with the baby thereafter. Baby A had recovered from prematurity-related respiratory distress syndrome and was nursed in a closed incubator in room air. On day 42 of life (May 5), he deteriorated and was placed on high-flow nasal cannula oxygen. A work-up for infection was performed, including blood culture (negative), full blood count (hemoglobin 9.6 g/dL, white cell count normal), C-reactive protein (55 mg/L), and a chest radiograph (CXR) (nonspecific streaky infiltrates bilaterally). He was commenced empirically on meropenem, but developed apnea requiring intubation and admission to the neonatal intensive care unit (NICU). A tracheal aspirate, taken 2 days after his deterioration, was sent for multiplex respiratory virus and SARS-CoV-2 real-time-polymerase chain reaction (RT-PCR) testing. Four days later (May 11), COVID-19 infection was confirmed, with no other respiratory viruses identified. He was extubated 5 days later, had a negative repeat SARS-CoV-2 RT-PCR test 14 days after the illness onset, and was discharged 5 weeks later weighing 2 kg.
Baby B (28-week gestation, 850 g birth weight) was also initially treated for respiratory distress syndrome, had been oxygen flow-dependent from birth, and was admitted in the same cubicle as baby A. On day 48 of life (May 6), he had a respiratory deterioration requiring escalation to high-flow nasal cannula oxygen. A work-up for infection was performed, including blood culture (negative), full blood count (hemoglobin 7.0 g/dL, white cell count normal), C-reactive protein (19 mg/L), and a CXR (diffuse bilateral infiltrates). He was commenced empirically on piperacillin-tazobactam plus amikacin but was switched to azithromycin 2 days later as his septic markers did not suggest bacterial infection and his CXR suggested viral or atypical pneumonia. On May 7, one day following his deterioration, a multiplex respiratory virus panel and SARS-CoV-2 RT-PCR test was performed; on May 11, the PCR confirmed COVID-19 infection and was negative for other respiratory viruses. Baby B's mother had no symptoms/signs compatible with COVID-19 infection and tested SARS-CoV-2 negative. Baby B's condition stabilized over the following days and he was weaned back to nasal prong oxygen. His repeat SARS-CoV-2 RT-PCR test 2 weeks after the illness onset was negative. He was subsequently diagnosed with chronic lung disease, received dexamethasone, and was successfully weaned off oxygen. He was discharged home 5 weeks following the COVID-19 infection weighing 2.3 kg.

Neonatal Ward HCW COVID-19 Infections

At the time of the neonatal outbreak, COVID-19 infections among hospital staff were rapidly increasing with 50–100 new infections per week (1%–2% of the staff complement). Three nurses in this neonatal ward who had worked together on the same shift in the week prior to the neonates’ deterioration were subsequently evaluated for COVID-19 after reporting compatible symptoms. Nurse 1 had developed cough, myalgia, and dizziness on April 26, the last day of her shift, but was not tested for COVID-19 at the time. She remained symptomatic and was placed on sick leave from the 29th of April when she was due to return to work, eventually undergoing SARS-CoV-2 testing 17 days after the symptom onset (test negative). Antibody testing to confirm recent COVID-19 infection was not available at this time. The other 2 nurses, who had worked 4 shifts with nurse 1, developed myalgia, fatigue and fever on May 6 and May 15, respectively; both were tested and had COVID-19 infection confirmed on the 19th of May. A doctor who was 29 weeks pregnant developed compatible symptoms on the day of the neonates’ COVID-19 diagnosis and required prolonged hospitalization following COVID-19 respiratory complications. A week later in the same ward (May 22 and 23), a further 2 nurses and the ward cleaner developed symptoms, and all tested SARS-CoV-2 positive.

COVID-19 Outbreak Containment Measures

Following the identification of the index neonatal cases of HA COVID-19, all babies in the same cubicle were tested but found to be SARS-CoV-2 negative. As single negative pressure rooms are not available in our unit, the infected infants were nursed in closed incubators under droplet precautions in an attempt to limit further spread of the virus. Before COVID-19,
personal protective equipment for HCWs performing aerosol-generating procedures included face masks, gloves, and aprons, but this was changed to N95 respirators at the beginning of the pandemic. Hand hygiene and the use of surgical gloves when handling bodily fluids form part of standard infection prevention precautions in our hospital. Various additional containment measures were put in place at the time of the outbreak, including ward closure to new admissions for a 2-week period and a restricted visitor policy. Mothers could visit their babies at any time, but fathers were only allowed to visit if their baby was critically ill. Previously, 2 close relatives were allowed to visit. Universal masking for hospital staff and caregivers had been recommended in the week prior to this outbreak but was not fully implemented until a week later. Extensive training regarding COVID-19 transmission risk was provided to staff and mothers, emphasizing the need for physical distancing and mask use, especially in tearooms and neonatal cubicles. Neonatal mothers were identified as a high-risk group for incident COVID-19 infections, as many traveled home daily and others stayed in the on-site mothers’ rooms and hostel. There was insufficient laboratory capacity to routinely test all neonatal mothers for COVID-19, so ongoing counseling was provided reinforcing twice daily symptom screening, hand hygiene, and environmental cleaning. Following the emergence of COVID-19 in Cape Town, our hospital’s environmental cleaning program was adapted to twice daily cleaning with the use of detergent and surface disinfection. Processes for triage and SARS-CoV-2 testing of symptomatic staff and mothers were streamlined, and test turnaround times were reduced to less than 24 hours for priority samples. Following the implementation of these measures, no further HA COVID-19 transmission occurred.

DISCUSSION

HA infections (HAIs) are major contributors to neonatal morbidity and mortality in low-and-middle-income countries, exacerbated by overcrowding, understaffing, lack of isolation facilities and poor infection prevention practices [8, 9]. Gram-negative bacteria are the leading cause of neonatal HAIs and outbreaks in these settings although outbreaks of viral pathogens do occur [7]. Typically, neonates with in-hospital deterioration are investigated for bacterial HAIs, but viral pathogens should always be considered. Viral pathogens have been transmitted to hospitalized neonates seasonally (influenza, respiratory syncytial virus, and rotavirus) or during pandemics (H1N1 influenza). The high transmission rate and large proportion of asymptomatically infected individuals are likely to facilitate HA COVID-19 transmission. In this neonatal ward, alert clinicians promptly identified the index neonatal COVID-19 cases, as the incidence of community-transmitted SARS-CoV-2 in Cape Town was escalating.

These 2 neonates with HA COVID-19 presented with clinical, radiographic and laboratory findings in keeping with that described in a recent systematic review [4]. Treatment for COVID-19-infected neonates to date has been supportive care only with excellent outcomes described [4]. Although both neonates required several days of respiratory support, both recovered without any specific treatment. The cluster of 7 symptomatic (6 confirmed SARS-CoV-2 infected) staff temporally linked to the neonatal cases fulfilled local criteria for initiating an outbreak investigation [10]. An outbreak investigation team was assembled, including neonatology, infectious diseases, infection prevention, and public health specialists. For each affected patient and staff member, the outbreak team documented potential COVID-19 exposures and infectious periods to facilitate contact tracing. Although many hospital-wide COVID-19 infection prevention policies were in place, there were initial delays in staff screening, testing, and access to COVID-19 test results. As universal masking was not fully implemented at the time of the outbreak, many high-risk staff-to-staff exposures occurred resulting in severe nursing shortages while staff completed the required quarantine period. This created ongoing challenges in patient care and environmental cleaning of rooms and equipment. The 2-week ward closure to new admissions allowed staff to maintain high-quality neonatal care despite the staff shortages.

Although the source case in this outbreak was not confirmed, the timeline, symptoms and subsequent transmission chains strongly suggested COVID-19 infection in nurse 1. Further factors that facilitated rapid spread from the putative source case were the shared rooms with 8 babies each, crowded physical space, poor ventilation, difficulty in physically distancing, and delayed presentation for SARS-CoV-2 staff testing and presenteeism (4 staff worked additional shifts after the onset of possible COVID-19 symptoms and prior to laboratory testing).

This first report of HA COVID-19 infections in a neonatal ward highlights the propensity of SARS-CoV-2 to be transmitted in overcrowded settings, with vulnerable patients who have prolonged hospital stays. These cases also emphasize the need for rapid access to SARS-CoV-2 testing for hospital staff and caregivers of hospitalized neonates to ensure the prompt detection of COVID-19. Adherence to quarantine until COVID-19 PCR results are available is critical to avoid additional staff exposures and negative impacts on patient care. Implementation of universal masking and bi-daily COVID-19 symptom screening for staff and mothers in the neonatal unit terminated the outbreak, with no further HA COVID-19 transmission events.

Notes
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