

Rapid Communication

Contamination of a Water Bottle Heater in Neonatal Intensive Care Unit and *Klebsiella Pneumoniae* ESBL+ Outbreak: Cases Series

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Methods

From September 2018 to September 2019, the incidence of *Klebsiella pneumoniae* with the ability to produce extended-spectrum beta-lactamases (KPE) was assessed in a Department of Neonatology and NICU composed by total 32 beds, with 15 physician and 41 nurse assistant personnel.

All newborns admitted to Neonatology unit and NICU were submitted, twice a week, to nasopharyngeal and rectal swabs to investigate for the presence of KPE+.

The newborns who had at least a positive nasopharyngeal or rectal swab, without any clinical signs and with negative C-reactive protein (CRP; normal values 0-5 mg/L) and negative blood culture, were defined as "colonized". The newborns who had at least a positive nasopharyngeal or rectal swab and the presence of clinical signs of infection associated with positive C-reactive protein (CRP) and/or positive blood culture were defined as "infected".

The patients admitted in Neonatology and NICU were 1028. The total number of surveillance swabs performed was 4122. One hundred and seventy-one of 1028 patients resulted positive to one or both swabs. Of these, 150 had only gastrointestinal tract colonization and 21 patients were infected. Three of these died for multiorgan failure. The 171 infants with positive swabs can be separated into 2 groups according to their birth weight: 25 were very low birthweight preterm infants, and 146 birth with weight >1500g. The median gestational age was 29.6wks (BW <1500g) and 36.6wks (BW >1500g). Of the 21 patients who presented septicemia, in 7 the infection developed from the respiratory tract, causing ventilatory status deterioration; the rest of them had elevated inflammatory indices and abdominal distension. The infected infants recovered after 10 days of treatment with two appropriate antibiotics given intravenously (meropenem and amikacin). No therapy was performed in the colonized patients

Abstract

In the context of a *Klebsiella pneumoniae* ESBL+ (KPE+) outbreak in a neonatal intensive care unit (NICU), hygiene practices and hospital environment were investigated. One hundred and seventy-one cases of colonized newborns, of whom 21 were confirmed as infected (clinical signs associated with positive C-reactive protein and/or positive blood culture), were recorded. The infection caused the death of 3 infants among the 21 infected ones.

The outbreak was stopped by improving the basic hygiene measures such as the hands washing, the use of disposable gloves and gowns and by removing a potential environmental contamination source: the water bottle warmer.

Keywords: *Klebsiella Pneumoniae* ESBL +; Colonization; Newborn; Water warmer bottle

who spontaneously came back negative.

Preventive Measures

In order to contrast the KPE+ outbreak, new preventive measures were implemented to limit transmission from patient to patient by the healthcare workers.

Infected or colonized patients were grouped in the same area of the ward, isolated from the other patients, and cared for by specific nurses not involved with the care of negative patients.

Healthcare workers were trained in prevention of nosocomial infections. It has been recommended them to improve the handwashing, to use frequently hydro-alcoholic handrubs and to wear disposable gloves and gowns during contact with patients.

Despite these measures, new cases occurred which prompted a search for an environmental cause of the outbreak.

Thus, swabs to the water taps in the ward and to the caregivers' hands (physician and nurse) were performed and resulted negative for the causative organism.

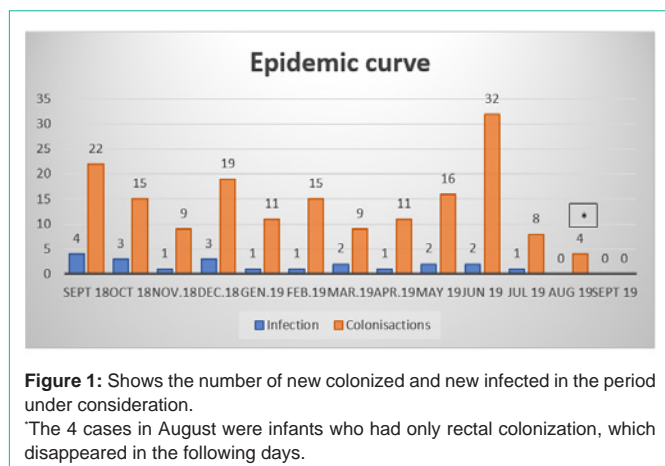
Finally, the hypothesis that the water bottles warmer was proposed and it was removed immediately (July 2019) (Figure 1) (culture examination of the heating water positive for *Klebsiella* EBLs).

The effectiveness of this last measure was confirmed in October 2019 by biweekly (Monday and Thursday) screening with surveillance swabs to all NICU patients, that resulted negative for KPE+.

The 4 cases in August (Figure 1) were infants who had only rectal colonization which disappeared in the following days.

Discussion

Many Enterobacteriaceae outbreaks in neonatal units have been



reported [1,2]. These organisms, presents in the environment, become potentially invasive and highly virulent in very low birthweight preterm infants (<28 postmenstrual weeks and birth weight <1500g). Patient-related factors (gestational age and birth weight) in our cases do not seem to play an important role in the prognosis of neonatal Klebsiella Pneumoniae infection. During a sudden large outbreak such as that reported here, the detection and the prevention of patient-to-patient transmission is necessary but not sufficient. The detection of environmental contamination by painstaking detective work is also essential. The source of contamination must be looked for extensively, not only in the products administered to the newborns but also on their containers [3,4]. The large number of

potential sources of contamination is a major difficulty [5,6]. Water bottle warmer contamination has not been never reported previously in literature. Neonatologists should consider this possible source of contamination when several cases of life-threatening infection caused by the same Enterobacter occur in a neonatal unit.

The infection committees of the hospitals can develop their protocols for the cleaning of water bottles, or they can create them.

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