Bacterial Contamination of Medical Personnel Hands as a Risk Factor in the Neonatal Intensive Care

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Abstract – Health care–associated infections persist as a major problem in most neonatal intensive care units (NICU). Hand hygiene has been sing out as the most important measure in preventing hospital-acquired infection. However, hand hygiene compliance among health care workers (HCWs) remains low. At this study fifteen clinical isolates were pecked from hands of nine staff nurses at the NICU of Misurata central hospital. They were identified by using API 20E system as following: *Staphylococcus aureus*, 8; *Enterobacter cloacae*, 2; *Enterobacter sakazakii,* 2; *Enterobacter amnigenus*, 2; *Acinetobacter bummanii*, 1. *Staphylococcus aureus* was the most predominant bacteria carried by nurse's hands (53.34). Tetracycline was found the most effective antibiotic for these isolates except *Enterobacter cloacae* which was sensitive to gentamycin in this study.

Keywords: Neonates, NICU, Outbreak, healthcare workers' hands, Hand hygiene.

Introduction

Nosocomial infections contribute a growing, yet underappreciated, share of neonatal mortality in the developing world (Goldmann and Huskins, 1997). The majority of the hospital- acquired infections (HAIs) is believed to be transmitted directly from patient to patient, but increasing evidence demonstrates that also the medical personnel as well as the clinical environment (i.e., surfaces and equipment) often are a source of infection (Tringe and Hugenholtz, 2008; Caporaso *et al.*, 2012; Passaretti *et al.*, 2013; Salgado *et al.*, 2013). One major vector for cross-contamination are hands of medical personnel, contributing to approximately 20–40% of nosocomial infections (Agodi *et al.*, 2007; Weber *et al.*, 2010). Poor hand-hygiene practices (Parry, *et al*; 1998), Pawa, *et al.*, 1997), reuse of single-use medication vials and devices (Archibald, *et al*; 1996), and inadequate sterilization of medical equipment (Zaidi, *et al.*, 1995) are key proximate events that facilitate transmission of nosocomial pathogens. Institutional factors, especially inadequate resources to fund infection-control programs, also contribute to such transmission. Overuse of empirical antibiotic therapy is simultaneously a consequence of and a contributing factor to transmission (Isturiz, 2000). Health care-associated infections

occurring in Neonatal Intensive Care Unit (NICU) is likely to have disastrous consequences for affected patients and raise enormous concerns in staff (KaranIndra, *et al*; 2014). Some studies have confirmed the progressive contamination of hands or gloves (Pessoa-Silvam, *et al.*, 2004), and identified key opportunities for hand hygiene during routine cares, even if wearing gloves, because of possible hand contamination during removal (Polin, *et al*, 2010). Handwashing with a chlorhexidine solution followed by application of an alcohol rub must carried out before every infant contact. Gloves are worn during nursing procedures and napkin changes. Routine hand washing is one of the most important strategies to reduce nosocomial infections (Pittet, *et al*; 1999). The importance of good hand hygiene practices in a NICU cannot be overemphasized, yet many published studies conducted in intensive care units have reported that health care workers (HCWs) failed to wash their hands more than half of the recommended times, and in many cases, the hand-washing procedure was inadequate (Quraishi, *et al*; 1984, Albert, Condie, 1981).

Materials and Methods

Eighteen swab samples were collected from hands of nine staff nurses at the NICU of Misurata central hospital. The samples were transported to the laboratory for analysis within one hour. The study was done between October 2014 to January 2015.

Isolates were identified according to Greenwood *et al.* (2002) by classical microbiological methods and API 20-E system. The *in vitro* activities of antimicrobial agents were tested against the clinical isolates by a disk diffusion method according to the Clinical and Laboratory Standards Institute (CLSI) standards (2005). Mueller-Hinton agar plates were inoculated with a bacterial suspension equivalent to a 0.5 McFarland standard and then antibiotic susceptibility disks (Oxoid) were applied. Zones of growth inhibition were recorded in millimeters after overnight incubation at 37°C.The antimicrobials used were: Oxacillin (OX), Rifampicin (RD),
Sulphamethoxazole/Trimethoprim (SXT), Amoxicillin-Clavulanic acid (AMC), Gentamicin (GN), Ampicillin (AMP), Ceftriaxone (CRO), Tetracycline (TE).

Results and Discussion

A total of 15 isolates were obtained from the screening of the Staff nurses hands at this study (Table 1). A commercially available bacterial identification test (API 20-E bioMe´rieux) was used, as conventional biochemical reactions for definitive identification of these isolates. Eight of these isolates were methicillin-resistant *Staphylococcus aureus* (MRSA), two *Enterobacter cloacae*, two *Enterobacter sakazakii,* two *Enterobacter amnigenus*, and one isolate *Acinetobacter bummanii* (Table 1).

Table 1: Bacteria strains isolated from NICU nurse's hands.

Bacterial spp.	Number of Isolates	%
MRSA	8	53.34
Enterobacter cloacae	2	13.33
Enterobacter sakazakii	2	13.33
Enterobacter amnigenus	2	13.33
Acinetobacter baumanii	1	6.67
Total	15	100

This study showed high presence to 53.34% (8 /15) of MRSA occurred on the nurse's hands at the NICU. Gili *et al.*, (2005) Methicillin-susceptible *S. aureus* was carried by 28.1% of healthcare workers at Sheba medical center. The organism representative 42.75% among the bacterial isolates screened at Manipal teaching hospital (Gili *et al.*, 2005). *Enterobacter cloacae*, *Enterobacter sakazakii,* and *Enterobacter amnigenus* represented 13.33 % each. Only one isolate of *Acinetobacter bummanii* was pecked from the nurse's hands (9.67%). KaranIndra, *et al.*, (2014) reported the screening of hand care workers (HCWs) showed pure growth of *Enterobacter cloacae*

in two staff nurses with hand print method. *Enterobacter sakazakii* considered an ubiquitous microorganism: it has been in fact isolated from a great variety of sites: foods, water and several areas, including houses and hospitals (Iversen and Forsythe, 2003).

The sensitivity pattern of various organisms was also studied (Table 2). *Staphylococcus aureus* was resistant to oxacillin, Sulphamethoxazole/Trimethoprim, ampicillin and ceftriaxone, whereas was sensitive to rifampicin, amoxicillin - clavulanic acid, gentamicin and Tetracycline. Maria*, et al,* (2013) reported that MRSA isolates showed resistance to

Sulphamethoxazole/Trimethoprim (18.8%) which was agreed with our finding. MRSA resistance to erythromycin (43.8%), clindamycin (37.5%), ciprofloxacin (25.0%) and all MRSA strains were susceptible to vancomycin (Maria*, et al,* 2013). In this *Staphylococcus aureus* isolates showing inhibition zones around oxacillin (Oxoid, Cambridge, UK) disks were characterized as methicillin-resistant *S. aureus* (MRSA). Methicillin-resistant *Staphylococcus aureus* (MRSA) is composed of 80% of isolated *Staphylococcus aureus* in intensive care units and has become a threat to critically ill population including neonates (Ellen and Kim, 2013). Increase in the number of methicillin resistant *Staphylococcus aureus* strains lead to difficulties in treatment and

increase morbidity and mortality rates (Tekerekoglu, *et al.*, 2007).

Table 2: Antibiotic sensitivity of bacteria isolated from staff nurses hands by disc diffusion method

Bacterial isolate	No.of Isolates	OX	RD	SXT	AMC	GN	AMP	CRO	TE
MRSA	8	R	S	R	S	S	R	R	S
Enterobacter cloacae	2	R	R	R	R	S	R	R	R
Enterobacter sakazakii	2	S	S	S	R	R	R	S	S
Enterobacter amnigenus	2	R	R	R	S	R	R	S	S
Acinetobacter baumanii	1	S	R	R	S	S	S	S	S

Enterobacter cloacae sensitive to only gentamicin among of all antibiotic used in this study. In contrast *Enterobacter cloacae* isolated from NICU of Maternity Hospital was resistant to

gentamicin (Modi *et al.*, 1997). The majority of *E. cloacae* showed no important differences in the antimicrobial susceptibility patterns, being homogeneously resistant to ampicillin, cephalothin, cephalexin, and gentamicin (Celia, *et al*; 2000). Study finding showed sensitivity of *Enterobacter sakazakii* to oxacillin, rifampicin, Sulphamethoxazole/Trimethoprim, Ceftriaxone and Tetracycline while it was resistance to the others used in this study. However, resistance to ampicillin has emerged owing to the acquisition of transposable elements and the production of b-lactamases (Pitout, *et al.*, 2002, Girlich*, et al.*, 2001) this was agreed with our finding. *E. sakazakii* infections have been traditionally treated with ampicillin-gentamicin or ampicillin-chloramphenicol (Lai, 2001), these finding were disagreed with our results for ampicillin and gentamicin. *Enterobacter sakazakii* susceptible to some antibiotics, including tetracyclines, aminoglycosides, numerous b-lactams, chloramphenicol, antifolates, and quinolones (Stock and Wiedemann, 2002). *Enterobacter amnigenus* sensitive to only amoxicillin-clavulanic acid, ceftriaxone and tetracycline. *E. amnigenus* showed susceptibility patterns to some cephalosporins and was less susceptible to loracarbef, cefotiam, cefixim, cefpodoxime, cefdinir and ceftibutene (Stock and Wiedemann 2002). *Acinetobacter baumanii* was resistance to rifampicin, and Sulphamethoxazole/Trimethoprim and was sensitive to the other

antibiotics used in this study. High resistance percentage of *A. baumanii* strains to AMP (29%) was reported by Joshi, *et al.,* (2003), this result disagreed with our finding. Bayuga *et al.*, (2002) reported 45% multiresistant *A. baumanii* strains and Joshi *et al.* (2003) showed that 75% of the isolates were multidrug resistant and more than 70% were lactamasesproducers (Bayuga *et al.*,2002; Afzal-Shah and Livermore, 1998).

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