RESEARCH BRIEF

Ventilator –associated *Acinetobacter baumannii* Pneumonia

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We report an outbreak of ventilator-associated pneumonia caused by carbapenem-resistant *Acinetobacter baumannii* in 6 infants with acute lower respiratory tract infection. Non-bronchoscopic bronchoalveolar lavage isolated *A. baumannii* in all these infants. Environmental microbiological survey of the Pediatric intensive care unit and pediatric wards identified oxygen humidifying chambers as the source of *Acinetobacter*. Practices of cleaning and changing of the humidifiers were reviewed and the outbreak was controlled with new recommendations.

Key words:*Acinetobacter, Nosocomial infection, Pneumonia, Ventilator-associated.*

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The incidence of ventilator-associated pneumonia (VAP) in pediatric patients varies from 5.1%-33.3% [1-3]. *Acinetobacter* has emerged as a common causative agent of nosocomial infections, particularly VAP [4-6]. Originally thought to be low-grade pathogen contaminating the hospital environment, with its inherent ability to survive in diverse reservoirs and develop resistance to disinfectants and antimicrobials, it has transformed into an emerging, multidrug-resistant nosocomial pathogen [7].

We report an outbreak, subsequent identification of source and control of VAP caused by carbapenem-resistant *Acinetobacter baumannii* in 6 infants admitted to the pediatric intensive care unit (PICU).

METHODS

The outbreak occurred between 18th September to 10th October 2008 at the PICU, which annually admits over 1200 children up to 15 years of age. Blood cultures are obtained before initiation of antibiotic therapy. Non-bronchoscope bronchoalveolar lavage (NB-BAL) is done if secondary lung infection is suspected, the indications being secondary fever with or without elevated white cell count and/or C-reactive protein (CRP), new or worsening findings on the chest *X*-ray, purulent endotracheal secretions and increasing oxygen or ventilatory requirement.

After isolating *A. baumanni* from clinical specimens, a microbiologic survey for possible sources was done. Water samples from oxygen humidifying chambers, ventilator humidifiers, thermometer solution and swabs from ventilator tubing, suction devices, and other surfaces were sent for culture.

Isolates were identified biochemically and antimicrobial susceptibility testing (AST) was done as per Clinical and Laboratory Standards Institute (CLSI) guidelines [8].Colony forming units per ml (cfu/mL) were calculated and reported.

RESULTS

During the study period there were 73 admissions to PICU with 43(59%) children receiving ventilatory support. Six isolates from NB-BAL grew *Acinetobacter baumannii*. Relevant clinical findings of the six infants (mean age 4.5 months) with ventilator- associated *A. baumannii* pneumonia are shown in ***Table* I**. All six received supplemental oxygen, nebulized terbutaline, intravenous fluids and antibiotics; five received parenteral steroids. Initial antibiotic therapy included penicillins and aminoglycosides followed by cefotaxime in four infants, vancomycin in two and meropenem in four.

Three infants were directly admitted to PICU. While one of them had arrived intubated the other was intubated at 36 hours in PICU for respiratory failure. The third infant improved and was transferred out on 5th hospital day. She however deteriorated on the 21st day with respiratory arrest, requiring cardiopulmonary resuscitation (CPR) and readmission to PICU.

Among those who were initially admitted to the ward, one was intubated there for apnea and cyanosis on the fourth day and subsequently transferred into PICU. The other two infants were transferred to PICU at 44 hours and seventh day for respiratory failure and intubated shortly thereafter.

Three infants remained on ventilatory support throughout their hospital stay. Even the three who were extubated following apparent successful weaning, were subsequently reintubated after a mean 49 hours (range 10-69 hours) for progressively increasing work of breathing and fatigue.

NB- BAL done after a mean 10.3 days (range 6-22) of hospitalization isolated multidrug-resistant *A. baumannii* (>10^4 cfu/mL) in all six infants. *X*-rays repeated simultaneously showed significant worsening of existing infiltrates in all and evidence of pneumonia in areas not previously affected in four. Of two infants treated with colistin one survived. While one infant died in the hospital, 4 were taken home terminally ill by the family.

Seven of the 12 water samples from the oxygen humidifying chambers from the ward and the ICU grew *A. baumannii*. Cultures taken from other sites did not isolate *Acinetobacter*. The *A. bauminii* isolates from patients and humidifiers were similar (sensitive to colistin, and resistant to gentamicin, amikacin, cefotaxime, ceftazidime, imipenem, meropenem, and aztreonam).

Review of existing cleaning and maintenance of respiratory equipments practices revealed them to be suboptimal. New recommendations were made as follows: (*i*) daily cleaning by rinsing first with soap solution and then plain water, (*ii*) air/sun drying daily; (*iii*) disinfection weekly, soaking the humidifying chamber in freshly prepared 1% sodium hypochlorite solution for 10 minutes, ensuring that the disinfectant completely covers and fills it, followed by rinsing with distilled water and air/sun drying; and (*iv*) usage of sterile water in the humidifier. The outbreak was controlled with these new practices.

TABLE I CLINICAL FINDINGS OF SIX INFANTS WITH VENTILATOR-ASSOCIATED A.*BAUMANNII* PNEUMONIA

Pt No	Diagnosis at admission	Place admitted	Day and place of first intubation	Extubation	Reintubation	Day NB-BALdone	No of hospital days	Outcome
1	Bronchiolitis ASD	ICU[#]	Ward, 21 d	No		Day 22	25	Discharged
2	Bronchiolitis	ICU	ICU, 36 h	No		Day 8	10	Discharged*
3	WALRI, PDA	ward	ICU, 7d	No		Day 8	10	Discharged*
4	Pneumonia	ward	ICU, 44h	6 d	8 d	Day 6	8	Died
5	WALRI, PFO	ward	Ward, 4 d	6 d	6 d	Day 8	21	Discharged
6	WALRI	ICU	arrived intubated	4 d	7 d	Day 10	12	Discharged*

*WALRI: wheeze associated lower respiratory tract infection; ASD: atrial septal defect; PDA: patent ductus arteriosus: PFO: patent foramen ovale; ICU: intensive care unit; *discharged at parental request; [#] transferred to ward day 5, readmitted to ICU; BAL: Bronchoaleolar lavage.*

DISCUSSION

Ventilator-associated, carbapenem-resistant *Acinetobacter baumannii* pneumonia was diagnosed in six infants based on clinical and radiological findings supported by quantitative NB-BAL cultures [9-11]. The infants had acute respiratory infections severe enough to require ICU admission, intubation and ventilatory support. These are exactly the known predisposing factors [7] for Acinetobacter, which has emerged as a significant multidrug resistant pathogen causing nosocomial infections, VAP in particular [6-12] as well as line- related infections in hospitalized oncology patients [14].

The outbreak of VAP with an organism unusual in our ICU till then led us to an extended microbial surveillance that revealed the same pathogen in oxygen humidifying chambers not just in the PICU but also the wards, where children were admitted before and after ICU stay.

Nosocomial infection can negate the benefits of even the best of medical care, underscoring the need for regular surveillance for environmental contamination with multi-drug resistant organisms in the hospital setting. Control of the outbreak of *Acinetobacter* pneumonia with humidifier disinfection shows that simple measures of infection control can help prevent hospital-acquired infections in the ICU setting.

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