Multi-Resistant Gram-Negative Bacteria

133. The Role of Active Surveillance in the Control of a Prolonged Hospital-Wide Outbreak of Carbapenem-resistant *Klebsiella pneumoniae*

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Background: Carbapenem-resistant *Klebsiella pneumoniae* (CR-KP) has emerged during recent years in several hospitals in Israel. During 2006 we faced a hospital-wide outbreak of CR-KP.

Objective: To describe the outbreak and the infection control strategies implemented to contain it

Methods: Control measures included isolation and contact precautions for colonized or infected patients with CR-KP. An e-mail report was sent to the medical and nurse director of the ward for each new isolate and a daily report was sent to hospital management. Patients with known colonization or infections were flagged and identified on re-admission. Rectal surveillance cultures were performed on admission and weekly in high-risk units. Strain typing was performed by pulsed field electrophoresis. This program was part of a national based program and a report was sent daily to the national coordinator.

Results: During 2006, a total of 72 patients, particularly patients in intensive care units and medical wards were colonized or infected with CR-KP. Infection developed in 35 patients, and primary bacteremia caused by CR-KP was the most frequent infection (32 of 72 patients [44.4%]). A single clone of CR-KP was identified by pulsed-field gel electrophoresis analysis throughout the whole period. Intensive control measures were implemented during May 2007. CR-KP was detected in 39 patients only by means of rectal swabs analysis (28.6% of total nosocomial CR-KP acquisition). Among the 85 patients with clinical specimens, 28 (28.5%) were identified with rectal colonization prior to clinical sample, with a median number of days between carriage of CR-KP in the digestive tract and a positive clinical sample of 8 days (range, 2 to 90 days). The incidence of CR-KP has decreased from 0.85/1000 to 0.38/1000 patient days after intervention (P=0.03).

Conclusions: A hospital-wide multi-factorial intervention achieved a decrease in the incidence of nosocomial CR-KP. Routine surveillance for CR-KP allowed earlier initiation of contact isolation precautions

134. Risk Factors for and Clinical Outcomes in Patients with *Acinetobacter baumannii*: Does Multi Drug Resistance Matter?

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Background: Our university based tertiary medical center experienced an outbreak of Multi Drug Resistant *A. baumannii* (R-ACB).

Objective: To study whether there were risk factors for the acquisition of R-ACB and to study the clinical outcomes of these patients.

Methods: This was a case control study. There were three groups of patients. Patients with 1) a culture positive for R-ACB defined as an isolate resistant to all but two classes of drugs 2) a culture positive for sensitive ACB (S-ACB) and 3) no ACB. The microbiology database was accessed to identify all patients with a culture positive for ACB during the period August 2006 through April 2007 (Groups 1 and 2). The hospital admissions/discharges database was accessed to develop a list of patients who were hospitalized for ≥2 weeks during the same period. This list was cross referenced against the microbiology list, patients from groups 1 & 2 were removed, and group 3 patients were randomly selected from the remaining patients. A tool was developed for data abstraction from the medical records which was approved by the Institution Review Board. Data abstracted included gender, age, reason for admission (trauma vs. other), whether patient had surgical procedures, site of culture of ACB(sputum/wound/other) presence of any co morbid conditions, wounds, other drug resistant organisms such as MRSA, VRE, or invasive devices (Central Line vascular catheters/ventilator), antibiotic therapy (ABx)prior to positive culture, and outcome measures (patient status at discharge, length of stay in the intensive care unit/ in the hospital, and the cost of hospitalization). Only those patients with non-missing data were included in the analysis. A bivariate analysis was used to compare R-ACB vs. S-ACB and ACB vs. no ACB. Chi square test and Student's t-test were performed for categorical and continuous risk factors; respectively.

Results: There were 55 patients with R-ACB, 31 with S-ACB, and 38 with no ACB for a total of 124 patients. The bivariate analyses on the risk factors for acquisition of R-ACB vs. S-ACB were not statistically significant for any of the variables analyzed. Grouping all cases of ACB vs. no ACB showed the following to be statistically significant (α=0.05): ABx prior to positive culture 27%vs.5%, presence of MDRO 79%vs.55%, ventilator/tracheotomy 79%vs.56%, wounds 85%vs.65%. Outcome measures evaluated for R-ACB vs. S-ACB were not statistically different. Comparison of ACB vs. no ACB showed the following: Mortality 17%.vs 3% (p=0.025), average total costs $147,479 vs. $ 87,634 (p=0.02), and average length of hospitalization 33 vs. 24 days (p=0.058).

Conclusion: The risk factors for acquisition of ACB and clinical outcomes were not different depending on resistant or sensitive ACB. Prior ABx pressure, loss of skin integrity and invasion of the airway increased the risk of acquisition of ACB and had a negative impact on survival and cost of care.

135. From Epidemic to Endemic: Descriptive Epidemiology of Nosocomial Carbapenem-Resistant *Acinetobacter baumannii* in a Surgical Intensive Care Unit

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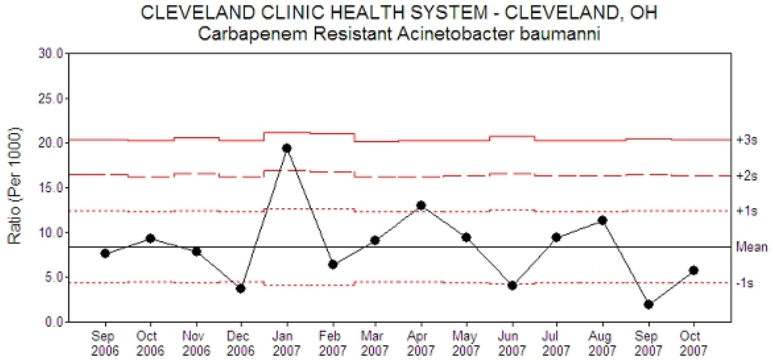
Background: We identified a cluster of patients with carbapenem-resistant *Acinetobacter baumannii* (crAb) isolates in the surgical intensive care unit (SICU) in September 2006. This prompted infection control interventions to limit incidence.
Objective: To report the epidemiology of (crAb) infections in an 18-bed SICU and the effect of control measures.

Methods: Case definition: Patient in the SICU with crAb isolated from any culture, imipenem minimum inhibitory concentration of ≥ 8, obtained ≥ 48 hours after admission from September 2006 - October 2007. Cultures were deemed to represent colonization or healthcare acquired infection (HAI) based on surveillance definitions of bloodstream infection (BSI) and ventilator associated pneumonia (VAP). A sample of isolates was referred for pulse field gel electrophoresis (PFGE).
Interventions: 1) Multidisciplinary educational sessions were conducted by infection control practitioners emphasizing hand hygiene and the significance of crAb. 2) Colonized or infected patients were placed in contact precautions and intra-unit transfer was discouraged. 3) Cohorting of patients and designated nursing staff was attempted. 4) Intensive cleaning of high touch surfaces, floors, walls and equipment was initiated upon discharge. 5) Use of bedside spirometers was suspended; surveillance cultures were obtained from 6 ventilators.

Results: 61 patients were identified with an incidence rate of 8.40 per 1000 patient days and an attack rate of 17 per 100 patient admissions. Mean age was 59 yrs; 68% were male. Median length of stay in the SICU was 17 days (range 1 to 94); median time from SICU admission to first crAb isolate was 13 days (range 3 to 53). 23% (14) were solid-organ transplant recipients; 25% (15) had a previous HAI. 20 BSI and 9 VAP were linked to crAb. Of the 61 patients in the cohort, crAb was isolated form multiple sites to include: respiratory tract 56% (34); blood stream 18% (11); and urine 6% (4). Associated hospital mortality was 48% (29). PFGE showed a predominate strain in 12 of 17 isolates. All 6 ventilators cultured were negative.
With the exception of January, 2007 the monthly incidence rate did not significantly change over time (see figure). Cohorting and designated nursing staff were operationally ineffective.

Conclusions: We describe 61 patients with nosocomial infection or colonization with crAb. Isolation of this pathogen was associated with significant hospital mortality. A variety of infection control measures were implemented to interrupt ongoing transmission with limited success. It is unclear as to next steps to eliminate nosocomial transmission of crAb in this setting.



136. Outbreak of Nosocomial Urinary Tract Infections caused by Multidrug-Resistant Serratia marcescens in Surgical Intensive Care Unit

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Background: 2005 March, Multidrug-Resistant Serratia marcescens was isolated from urine of 6 patients in SICU it compared in January and February it increased suddenly. This patient was all it had Foley catheter. This result with base, we found out an outbreak of nosocomial UTI caused by Multidrug-Resistant Serratia marcescens in SICU and we investigated the cause of UTI outbreak.

Methods: During the outbreak, we collected data from clinical records and observed the process of urine emptying, urine specimen collection from patients, methods of the catheter insertion and perineal care. Also we educated the staff on the correct methods of the catheter insertion and care. During the observation, surveillance culture was performed for the hands of healthcare workers in the SICU, urine collectors, N/S and 0.05% chlorhexidine sponge for perineal care, an urine collector's washer.
Results: Surveillance culture results Serratia marcescens was not isolated from urine collectors, N/S and 0.05% chlorhexidine sponge, an urine collector's washer all in the SICU. Also hand culture with 25 healthcare workers(doctors 5, nurses 18, assistants 2) results did not isolate. But the result which collected clinical records, it was all neurosurgery department patient, Multidrug-Resistant Serratia marcescens was isolated from urine of 6 patients in 5 patients were man and all patients had Foley catheter. According to the result of observing the process of interns' Foley catheter insertion and perineal care, hand washing didn't before and after handling. Also when the interns' perineal care and assistants empties urine from urine bag of each with an indwelling catheters, did not change their gloves each time.

Conclusion: In our hospital, perineal care and Foley catheter insertions of the man patients are intern's charge. Tried to synthesize all things, the infection route of outbreak of Multidrug-Resistant Serratia marcescens UTI in the SICU was assumed to be as follows : neurosurgery department interns and assistants did not change their gloves when perineal caring and emptying patients' urine and did not hand washing before and after Foley catheter relation managements.

Thus neurosurgery department interns were instructed to change gloves and enhance hand washing whenever they perineal caring and Foley catheter insertion. Assistants were instructed to change gloves whenever they empty patients' urine bag and cleanse the port of the bag with disinfectant after emptying urine. As such measures were taken for infection control, Multidrug-Resistant Serratia marcescens was not detected in urine specimens from patients in the SICU March 23rd 2005 and outbreak came to an end.

137. Extended-Spectrum β-lactamase-producing *Klebsiella pneumoniae* and *Escherichia coli* in a University Hospital, Thailand; Risk Factors and Consequences

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Background: Extended-spectrum β-lactamase (ESBL) producing gram negative bacteria are wide spread nosocomial infection problems, not limited to the developed countries.

Objective: To determine the risk factors for acquiring ESBL-producing *Klebsiella pneumoniae* and *Escherichia coli* and to assess the clinical outcomes.

Methods: A case-control study was conducted at Chiang Mai University Hospital, an 1800-bed teaching hospital in Northern Thailand, from May 1, 2005 to April 30, 2006. The study population consisted of 180 randomly selected cases of acquiring ESBL-producing organisms and 180 randomly selected controls of acquiring non-ESBL-producing organisms.

Results: The prevalence of ESBL-producing organisms was 29.76% of all *Klebsiella pneumoniae* and *Escherichia coli*. The average age was 55.58 ± 20.46 years among cases and 54.86 ± 20.31 years among controls. Cases and controls were comparable in terms of gender, age, underlying medical conditions, and site of infections. Cases were more anemic than controls (Hemoglobin of 8.97±2.82 g/dL versus 10.90 ± 2.35 g/dL, $p < 0.01$). ESBL-producing organisms were most initially isolated from urine (43.98%), followed by respiratory tract (20.94%). ESBL-producing organisms were 100% sensitive to ertapenem, 98.89% to imipenem and meropenem, 76.11% to cefoxitin, and 56.11% to piperacillin/tazobactam. (Figure 1). Uni-variable analysis revealed risk factors for acquiring ESBL-producing organisms as follows: mechanical ventilation, indwelling central venous catheter, indwelling urinary catheter, prolonged admission (> 1 week) prior to organisms growth, prior administration of antibiotics especially cephalosporins and carbapenems. Multivariable logistic regression analysis revealed three independent risk factors; mechanical ventilation (OR = 1.95, 95% CI=1.17, 3.25), prolonged admission (OR = 3.10, 95% CI = 1.90, 5.04), and prior administration of cephalosporins (OR = 3.92, 95%CI =2.72, 6.77). There were 87 patients died: 53 among cases and 34 among controls ($p<0.01$). Death attributable to ESBL-producing organisms for cases and to non-ESBL-producing organisms for controls was 41 and 23 patients, respectively ($p=0.02$). The length of hospital stay among cases was 52.57 ± 74.30 days and 27.46 ± 46.47 days among controls ($p<0.01$).

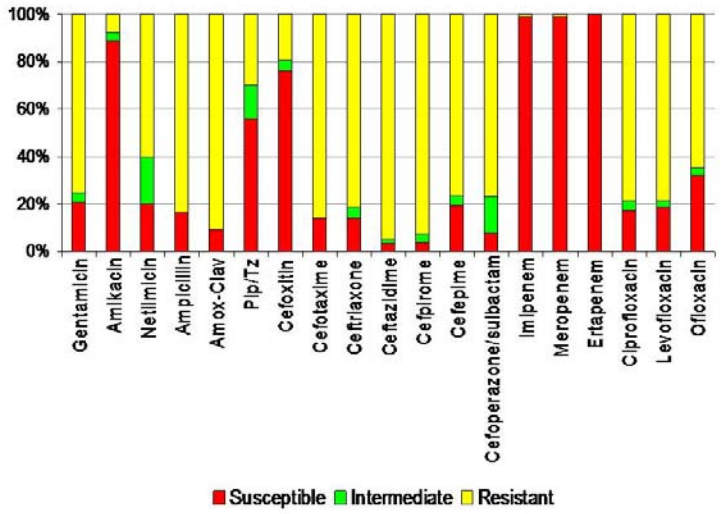

Figure 1: The susceptibility of ESBL-producing organisms to various antibiotics

Conclusions: ESBL-producing *Klebsiella pneumoniae* and *Escherichia coli* are now important nosocomial pathogens. Risk factors for acquiring these organisms associated with prolonged admission, uses of medical devices, and prior prescription of certain antibiotics. To reduce acquiring these organism, adherence to infection control practices and antimicrobial stewardship are needed.

138. *Pseudomonas aeruginosa* Bacteremia Over a 10-year Period: Trends and Risk Factors of Multidrug Resistance and Predictors of Mortality

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Background: Multidrug resistance is increasing among gram-negative bacilli, including *Pseudomonas aeruginosa*. This is especially concerning as Pseudomonas infections are a significant cause of morbidity and mortality.

Objectives: To characterize trends in multidrug-resistant *Pseudomonas aeruginosa* (MDR-PA) blood culture isolates, to quantify co-resistance patterns, to identify risk factors for MDR-PA bacteremia, and to identify predictors of mortality associated with Pseudomonas bacteremia.

Methods: A retrospective cohort study from 1996 to 2005 was performed, including 598 Pseudomonas blood isolates from 503 patients. MDR-PA was defined as an isolate resistant to three or more classes of antimicrobials: ciprofloxacin, imipenem, ceftazidime or cefepime, piperacillin or piperacillin-tazobactam, and amikacin, tobramycin or gentamicin. Temporal trends and co-resistance patterns were characterized over the 10-year study period. Multivariable models, using stepwise logistic regression, were used to identify independent risk factors for MDR-PA bacteremia and, among patients with nosocomial Pseudomonas bacteremia, predictors of mortality.

Results: Resistance to all antimicrobial classes increased over the ten year period ($p \leq 0.001$). The prevalence of MDR-PA increased from 11% in 1996 to 22% in 2005 ($p<0.001$). Among 161 MDR-PA isolates, 34.1%, 34.8%, and 31.1% were co-resistant to 5-, 4-, and 3-antimicrobial classes, respectively. Independent risk factors for MDR-PA bacteremia among the 503 patients were antibiotic exposure 30 days prior to bacteremia (OR 2.39 [95% CI 1.23-4.62], p=0.01), intensive care unit (ICU) admission in the previous year (OR 2.26 [95% CI 1.29-3.96], p=0.004), and previous organ transplantation (OR 2.34 [95% CI 1.48-3.69], $p<0.001$). The overall 28 day in-hospital mortality rate among patients with nosocomial Pseudomonas bacteremia was 35.4%. Independent risk factors for mortality in this group were a diagnosis of Pseudomonas bacteremia while in the ICU (OR 4.60 [95% CI 2.13-9.94], $p<0.001$) and neutropenia during the prior week (OR 2.18 [95% CI 1.09-4.38], p=0.028).

Conclusions: Multidrug resistance is increasing among Pseudomonas blood culture isolates. Patients with previous antibiotic and ICU exposure, or those who have received an organ transplant are at high risk of MDR-PA bacteremia. A poor outcome is more likely in neutropenic patients and those in the ICU at the time of bacteremia.

139. Emergence of Pan-resistant Strains of Non-fermentative Gram-negative Pathogens in a Trauma Hospital

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Background: *Pseudomonas aeruginosa* carrying SPM-1has emerged in Rio de Janeiro at 1999; since than, it has disseminated to almost all tertiary hospitals in the city. Pan resistant Acinetobacter sp. (Acn) has emerged at 2003, and it has become a public health problem as well. Macae Public Hospital (MPH) is localized 190km far from Rio de Janeiro city; it is a 127-bed trauma hospital. In July 2007, we observed in increasing incidence of pan resistant *Pseudomonas aeruginosa* (Pa) and Acn, simultaneously.

Objective: to describe the simultaneous emergence of pan resistant non-fermentative Gram-negative pathogens at a trauma facility

Methods: between August and November 2007, all patients (pts) colonized or infected by pan resistant Pa or Acn were analyzed. Pan resistant strains were defined as that only susceptible to amikacin or polymyxin and resistant to third and fourth cephalosporins, carbapenems, quinolones, gentamicin, piperacillin-tazobactam. Epidemiological data was reviewed from medical charts. Nosocomial infection was defined according to Centers for Diseases Control and Prevention. The cumulative incidence was calculated. Antimicrobial susceptibility testing were performed using Vitek-1. Genotyping of available strains was performed using RAPD-PCR.

Results: the cumulative incidence was 0.9 (1,000 pts-day; range: 0.24-1.63) and 0.96 (range: 0-1.77) of Pa and Acn, respectively. Thirty four pts had Pa or Acn colonization/infection, and six had both. The majority of pts were admitted at intensive care units (77%). The co-morbidities most frequent were pulmonary and neurological disorders. Ventilation-associated pneumonia was diagnosed in 12 pts,

blood stream infection in 9 pts and urinary tract infection in one pt. Mortality rate of pts colonized/infected by Pa or Acn was 47%. Nine (26%) pts had their isolates typed. Genotyping showed that the Acn strains had unique DNA pattern but, analysis of Pa strains showed a polyclonal pattern.

Conclusions: Among isolates of Acinetobacter species, there was one predominant pattern and the resistance appeared probably due to the spread of resistant strains from patient to patient. On the other hand, among the isolates of *P. aeruginosa* there was no predominant pattern. The possibility of transmission of resistant genes between species should be investigated. The emergence of pan resistant bugs has been a growing problem during the past decade; the emergence of pan resistant Pa and Acn simultaneously has not been described. Various measures involving antimicrobial use should receive great attention, but also it would seem that practices to prevent cross-transmission are also important in controlling resistance at this facility.

140. Struggles with Pan resistant *Acinetobacter baumannii* in a Tertiary Intensive Care Unit

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Background: In May 2007, a critically ill inpatient developed infection with multidrug resistant *Acinetobacter baumannii* (MDRAB). Subsequently, a cluster of ICU-associated MDRAB infections prompted concerted efforts by the Hospital Epidemiology Service and the Critical Care Medicine Department to determine mode(s) of transmission and potential reservoirs, and to implement control measures.

Objective: To curtail the nosocomial spread of MDRAB.

Methods: From August through December 2007, weekly meetings with key stakeholders addressed the outbreak and progress with control. All MDRAB isolates were typed by pulsed-field gel electrophoresis. Interventions included: 1) placing infected/colonized patients on intensified contact isolation and cohorting care; 2) segregating infected/colonized patients from other ICU patients; 3) maintaining isolation for all MDRAB patients until discharge and empirically on readmission; 4) extensive cleaning of the ICU; 5) encouraging prescribers to limit carbapenem use and monitoring carbapenem use; 6) conducting active microbial surveillance (groin and axillary cultures) at admission and twice weekly for all ICU patients; 7) performing environmental cultures (e.g. in ICU rooms, family room, pagers, etc.) on two occasions; and 8) stationing a healthcare worker outside ICU isolation rooms for 12 hours daily to monitor isolation guideline adherence.

Results: From May to December 2007 MDRAB was isolated from 29 inpatients. Active surveillance identified 11 colonized patients; 18, patients had infections. Patients with infections were almost uniformly immunosuppressed, with multiple risk factors for infection. Among 9 patients who died, MDRAB was judged to have contributed to the deaths of 7. All but 2 patients (93%) with infection/colonization received care in the ICU prior to positive culture. Three outbreak strains affected 28 patients (97%):

strain A (11; 38%) predominated early in the outbreak, strain B (17; 59%) in the latter three months, and strain C in a handful (4; 14%). One MDR isolate did not match any PFGE pattern. Environmental cultures were of limited utility. Increased carbapenem use coincided with outbreak onset. Hand hygiene gel use increased during the interventions.

Conclusions: Because several measures were implemented simultaneously, efficacy of individual interventions could not be assessed. The ICU was the apparent source of infection for nearly all patients, though no consistent environmental reservoir was identified. Inadequate hand hygiene and increased use of carbapenems were temporally associated with the outbreak onset. Aggressive infection control interventions, including isolation, cohorted care, cleaning, and use of an adherence monitor were associated with outbreak termination. Eradicating MDRAB is laborious and expensive. Single isolates should prompt immediate concern about the potential for, and consequences of, spread.

141. Multiple Drug Resistant *Acinetobacter baumannii* (MDR AB) Hospital-Acquired Infections (HAIs) Outbreak in a Cardiothoracic (CT) Intensive Care Unit (ICU)

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University of Pittsburgh Medical Center, Pittsburgh, PA

Background: Our CTICU provides post op care to patients including heart/lung transplants (Txs). Ten beds are located in an open ward (A) and 12 private rooms are in an adjacent ward (B). In 12/06 an index MDR AB case was identified. The patient was a NJ transfer post lung Tx. The donor cultures grew MDR AB however this information was not available to Infection Control (IC) thus delaying use of transmission (T) based precautions (BP). Over 3 months, 7 CTICU A and B patients developed MDR AB HAIs. All 7, including the index case, died of AB HAIs.

Objective: To develop effective protocols to identify and prevent MDR AB T and HAIs.
Methods: An initiative was begun to develop methods to facilitate earlier identification of colonized patients and recommend interventions to prevent T. A multi-disciplinary group was assembled with representation from IC, CT and Tx clinicians (MDs and nursing), risk management, respiratory therapy, housekeeping, microbiology, and administration.

Issues identified included:
1) Delay in recognition of MDROs/implementing TBPs: Center for Organ Recovery (CORE) was contacted to determine the process for review of donor cultures. Results were only sent to a select group of Tx clinicians leading to delays in intervention.
2) Concern for undetected reservoir: Data on colonization, risk of T, and active surveillance testing (AST) for MDR AB was not available. CTICU prevalence sweep was completed by obtaining 2 cultures: nasal and axillary/groin combined.
3) Need for cohorting: AB + patients located in both A and B wards.
4) Failure to clean common equipment (CE).
5) Need for molecular typing of patient isolates to assess for clonal outbreak.
Results: A MDR Organism (O) prevention bundle was developed and HCWs were educated on the protocol.

1) Early identification: CORE culture results were widely distributed and alerts were created to notify IC about incident MDROs triggering TBP.
2) Undetected reservoir:
a. Prevalence sweep via AST was done after implementing the MDR AB protocol that did not identify additional AB + patients.
b. Empiric gown and glove use was utilized for all patient care activity until cases were discharged.
3) Cohorting: Placement of AB + patients was restricted to a separate 4 bed area of ward B. This facilitated use of dedicated equipment and staff.
4) Cleaning of CE: Signage was placed to remind staff to clean CE after use.
5) Molecular typing (MT): All 7 patients' isolates had identical PFGE banding patterns. PFGE is now routinely used for ≥ 3 MDROs clustered by time/space.

Conclusions:
1.) Early identification of MDROs is difficult but critical, especially in imported cases.
2.) Implementation of a MDR AB protocol prevented further T and HAIs.
3.) MT and AST are useful tools for identifying clonal outbreaks and limiting reservoirs.
4.) AB HAIs are associated with high mortality in the critical care setting.

247. Risk Factors for Multi-Resistant *Pseudomonas aeruginosa* in a Hospital with AIDS Predominant Admissions

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Background: *Pseudomonas aeruginosa* is the third cause recovered from all sites of nosocomial infections in Brazilian hospitals. High rates of carbapenem-resistant *P. aeruginosa* (CR-PA) and outbreaks involving such pathogen have been reported worldwide. Recent Pub-Med search did not match any risk factor study for CR-PA in aids population.

Objective: Describe risk factors for CR-PA in a hospital with aids predominant admissions.

Methods: A surveillance program of clinical cultures for controlling multidrug-resistant pathogens has been conducted at IPEC/FIOCRUZ, Rio de Janeiro, Brazil, from April-2002 to February-2007. IPEC is a 27-bed total research, teaching and assistance institution for infectious diseases, which more than 50% of the admitted patients have aids or HTLV infection. After an outbreak of CR-PA detected in November-2004, routine surveillance cultures of rectal swabs or feces samples were performed from close inpatients whenever a positive case was detected. The same routine surveillance was performed after a second outbreak in November-2006. A case-control study (14 cases and 42 controls) was carried out from a prospective cohort of 1814 admissions of 1161 patients. The logistic regression by using the SPSS 15.0 and R 2.4.1 package logic software were performed for statistical analysis.

Results: Most of the studied patients were immunocompromised (76.78%), which 13 (92.85%) cases and 30 (66.4%) controls had aids and HTLV infection respectively. 13 of 14 cases were infected by CR-PA. Multivariate analysis of risk factors for acquiring CR-PA demonstrated that hemodialysis (OR=68.05), enteral (OR=43.82) and parenteral feeding (OR=23.48), urinary catheterization (OR=14.84) and prior use of ciprofloxacin (OR=21.40) were associated with a significant and independent risk. Analysis of odds ratio were not significantly affected by length of hospitalization, excepted parenteral feeding which did not show significance. Lower OR was noted particularly in hemodialysis (OR=50.50) and enteral feeding (OR=32.14). Patients submitted to hemodialysis (4 cases and 1 control) were 67.05 times more likely to acquire CR-PA.

Conclusions: As reported by some authors, prior exposure to ciprofloxacin represented an important risk for CR-PA infection. It was not surprising that urinary catheterization was associated to CR-PA infection, since its association has been demonstrated by numerous studies. Similarly to Defez *et al* (2004) who reported nasogastric feeding as a risk factor for multidrug-resistant *P. aeruginosa* (MDR-PA), we found a significant link between enteral feeding and CR-PA infection. Hemodialysis was an interesting finding, which was strongly associated to CR-PA infection, since few studies have linked dialysis or renal failure to MDR-PA. These risk factors are important to guide prevention measures, precise diagnosis and infection treatment in the studied population.