Quality Assessment

236
Use of a Computer-Based Information Alert System for Patients Re-admitted with Resistant Organisms

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Background:
Drug resistant gram negative organisms, *VRE* and *MRSA* infections increase the mortality and morbidity of hospitalized patients. A system was established to identify these patients and place them on contact isolation and determine the frequency of the same organisms being found on screening.

Objective:
A computer based alert for patients previously hospitalized with known resistant organisms now re-admitted, could be a useful tool to identify high-risk patients that are colonized.

Methods:
Hospitalized patients are placed on contact isolation using our computer information system when a resistant organism (RO) is identified. These organisms are resistant gram negatives, *VRE* and *MRSA*. Once a patient is identified, weekly cultures are performed from 5 different sites (axilla, rectum, sputum, urine and wound). Patients that remain colonized are flagged in the computer upon discharge. An automatic alert is activated on re-admission and an order for cultures from the 5 sites is generated from the computer. Patients that screened positive were compared to patients that screened negative.

Results:
Over a 4 month period 116 patients were admitted with history of prior RO. 51/116 (44%) screened positive on readmission for one or more resistant organisms. Resistant *Klebsiella* species and *MRSA* were the most common organisms isolated. There was no difference in age, sex, presence of comorbidity or dialysis between the two groups. Patients that screened positive were more likely to be admitted to an ICU, require mechanical ventilation and expire on the current admission (p=.002, p=.035, p=.001 respectively). Nursing home patients were more likely to screen positive (p=.001), as were patients requiring mechanical ventilation on their last admission (p=.013). Previous antibiotic use was associated with screening positive (p=.05). Patients with multiple resistant organisms on previous admission were more likely to screen positive on this admission (p=.019).
There was no difference between length of stay on the previous admission, but patients with longer ICU stays on that admission were more likely to screen positive (p=.05). Multivariate logistic regression found that being a nursing home resident and admission to the ICU on the current admission were associated with screening positive for a resistant organism.

Conclusion:
Automatic alerts for newly admitted patients previously placed on contact isolation by infection control can identify patients harboring resistant organisms that are readmitted.

Being a nursing home patient and a current ICU admission were strongly associated with screening positive for a resistant organism in nursing home patients. Isolating these patients early in their hospital stay may prevent nosocomial spread.

237

Compliance with Evidence-Based Recommendations for Management of *Staphylococcus aureus* Bacteremia at a Tertiary Care Hospital

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Background
Staphylococcus aureus bacteremia (SAB) is often associated w/ complications such as endocarditis and metastatic infection. Evidence-based management should focus on detection and prevention of complications of SAB, including use of echocardiography, removal of infected foci, and longer courses of intravenous antibiotics where indicated.

Objective
To evaluate compliance with evidence-based recommendations for the evaluation and treatment of SAB.

Methods
Patients with >=1 blood cultures positive for *S. aureus* were prospectively identified between 7/05-11/06. Demographic data, details of management, and outcomes were collected. Management was defined as adherent to evidence-based recommendations if all of the following criteria were met: 1) appropriateness of antibiotics (a parenteral ß-lactam for sensitive isolates in non-allergic patients), 2) removal of any foci of infection, and 3) adequate duration of therapy [i.e., 2 weeks if transesophageal echocardiogram (TEE) negative for vegetation and no complications, >=4-6 wks for complicated infections]. Patients were excluded if they died as inpatients before completing treatment.

Results
142 patients were evaluated. Mean age was 55.8 years, and 84/142 (59%) were male. Common co-morbid conditions included diabetes mellitus (26%), chronic renal failure (25%), and malignancy (27%). Mean duration of SAB was 1.4 days (range 1-4). Eight (5.6%) patients met modified Duke criteria for definite endocarditis.
92 of 142 (65%) eligible patients were not managed according to evidence-based recommendations. The reasons for deviation from evidence-based recommendations included: treatment with a short course of antibiotics without ruling out endocarditis by TEE (77/92, 84%), use of inappropriate antibiotic agents (25/92, 27%), and failure to remove an infected focus (6/92, 7%). Management of 20/92 (22%) patients did not meet >1 criteria. 83/142 patients (59%) had any echocardiography performed, and 23/142 (16%) patients underwent TEE.
Patients receiving non-adherent care were more likely to have cancer [31/92 (34%) vs. 7/50 (14%), p=0.020], cirrhosis [12/92 (13%) vs. 1/50 (2%), p=0.033], or to have used tobacco [62/92 (67%) vs. 22/50 (44%), p=0.011]. Patients whose care was judged non-adherent were less likely to have a metastatic focus of infection [4/92 (4%) vs. 13/50 (26%), p<0.001] or an infectious diseases consult [11/92 (12%) vs. 34/50 (68%), p<0.001].

Independent risk factors associated with non-adherent care were infectious diseases consultation (OR 0.034; 95% CI:0.012-0.102) and chronic renal failure (OR 0.29; 95% CI:0.10-0.90), which were protective.

Conclusions
Management of SAB frequently did not follow evidence-based recommendations. Infectious diseases consultation was strongly associated with appropriate treatment and should be encouraged for patients with SAB.

238
Clinical Prediction Rule for Smear-Negative Pulmonary Tuberculosis (TB)

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Background:
For patients evaluated for suspected TB who are smear-negative, there is uncertainty about whom to treat empirically while cultures incubate for several weeks.

Objective:
To develop a clinical prediction rule to more accurately identify patients with smear-negative active pulmonary TB.

Methods:
We conducted a case-control study at a large public hospital in Chicago, including all 66 patients diagnosed with smear-negative pulmonary TB and 67 patients randomly sampled from all smear-negative, culture-negative patients during the 26-month period from 1/2003 through 2/2006. Trained physician chart abstractors, blinded to final diagnosis, collected clinical, demographic, and laboratory data from the medical records of the index hospitalization. Chest radiographs and chest CT scans were independently reviewed by two physicians; disagreements were resolved by a pulmonary specialist who was also blinded to final diagnosis. Multivariable logistic regression, ROC curve analysis, and recursive partitioning using CART software were used to develop the prediction rule. The results of the prediction rule were then compared with the actual clinical decisions regarding empiric therapy.

Results: In multivariable logistic modeling, the independent predictors of smear-negative, culture-positive TB included: cough $\geq$ 14 days (OR 2.5; CI 1.4-4.5), history of residence in a TB endemic country (OR 8.5; CI 3.0-24.1), history of TB or positive PPD (OR 11.2; CI 3.8-32.9), hypoalbuminemia (OR 3.6; CI 1.05-12.3), heavy alcohol use (OR 5.7; CI 1.7-19.6), and upper lobe abnormalities on chest radiograph (OR 3.8; CI 1.4-10.1). The predictive model had an area under the ROC curve of 0.89 (see figure 1) and the sensitivity of the model for correctly identifying patients with smear-negative pulmonary TB was 92%. In contrast, the sensitivity of physicians' empiric treatment decisions (correctly starting TB therapy for patients with smear-negative pulmonary TB) was only 76%.

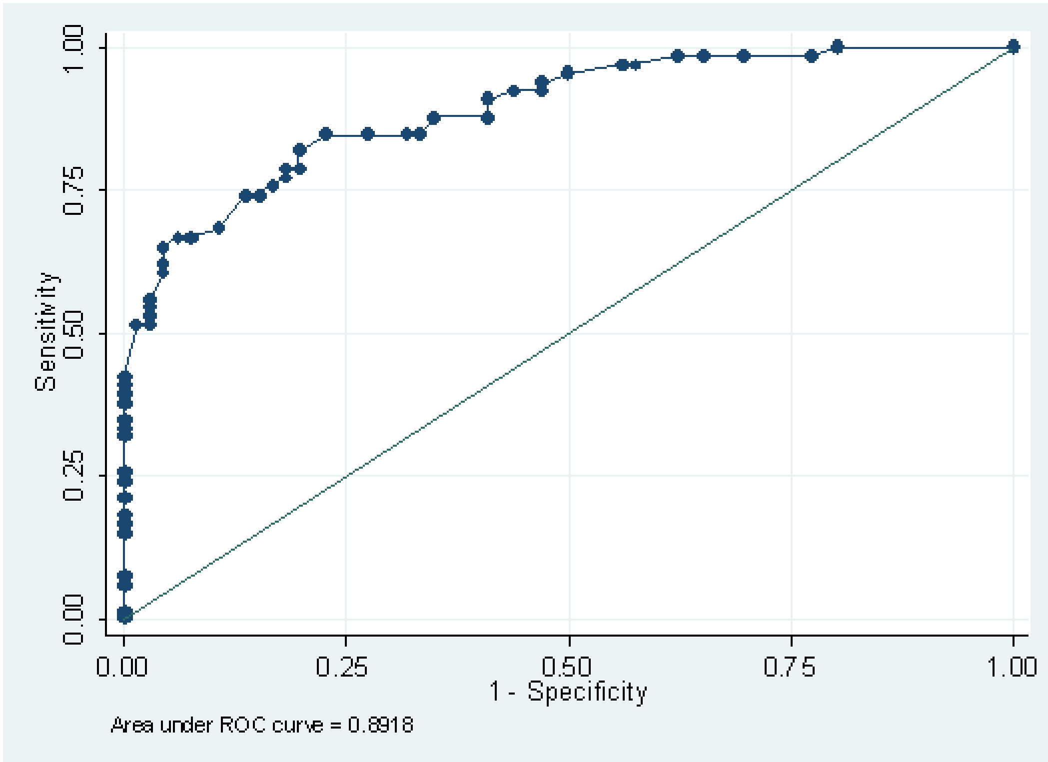

Figure 1

Conclusions:
A simple clinical prediction rule that included six easily collected and clinically sensible variables accurately discriminated between smear-negative patients who were culture positive and culture negative. A follow-up study is planned to validate the rule in another patient population and determine whether use of the rule improves clinical decision-making for smear-negative patients.

239

Monitoring the quality of infection control management on ICUs by transmission rates

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Background:
Nosocomial infections (NIs) contribute significantly to morbidity and mortality in intensive care units (ICUs). An important instrument of infection control is the surveillance of nosocomial infections. Though surveillance data of device associated infection rates are not able to distinguish between the endogenous or exogenous origin of infections, they are increasingly used for the public reporting of healthcare-associated infections.

Objective:
To survey the rates of device associated and other NIs in 11 ICUs of two university

hospitals, determine the extend of patient-to-patient transmissions of common bacterial organisms in these ICUs and to analyse if there is a correlation between these parameters.

Methods:
Over a 2 years period, primary isolates of 6 bacterial indicator organisms (*A. baumanii, E. faecium, E. faecalis, K. pneumoniae, P. aeruginosa, S. aureus*) cultured from clinical samples of ICU-patients underwent typing by PFGE. Genetically indistinguishable isolates from different patients were considered as cross-transmissions if the patients were hospitalized on the same ICU in a temporal proximity of at least 9 days. Surveillance of NIs was performed following the protocol of the German Nosocomial Infection Surveillance System KISS (which is based on NNIS System methodology).

Results:
During 100,781 patient days, 1,216 NIs were recorded, which corresponds to an incidence density of 12.07 per 1,000 patient days (CI95: 11.4-12.76). Depending on the ICU, the incidence density of NIs ranged between 6.18 and 18.5 per 1,000 patient days. In total, 90,832 microbiological specimens were sampled (average investigation density of 0.9 samples per patient * day) and 3,419 indicator organisms were cultured. Altogether, 463 patient-to-patient transmissions were discerned (total incidence density of 4.59 transmissions per 1,000 patient days, ranging between 1.42 and 14.66 per 1,000 patient days depending on the respective ICU). Correlation analysis was unable to reveal an association between the incidence of patient-to-patient transmissions and NIs, duration of hospitalisation or device utilisation (Spearman rank correlation coefficient < 0.5).

Conclusions:
Nosocomial infection rates are influenced by different factors, like the severity of the patients underlying diseases, the patients endogenous flora and the extend and duration of invasive procedures. Therefore, NI rates have to be analysed considering these different risk factors and cannot only be explained by differences in infection control practices. If NI-rates are high, the rate of nosocomial transmissions may be used to assess the proportion of exogenous origin. If NI-rates are high and transmission rates are low, NI-rates may be due to other factors (e.g., the patients disease severity) than the quality of infection control management.

240

Advanced Clinic Access Methodology Influences No Shows Rates at VA Specialty Clinics

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Background:
Advanced Clinic Access (ACA) is a methodology adopted by the VA over the past several years to improve clinical and business efficiency in a healthcare setting. As applied to patient flow in outpatient clinics, ACA utilizes 10 Key Elements that focus on such variables as supply, demand, appointment types and patient needs. Patient missing appointments-termed no shows-risk losing healthcare opportunities, increase costs, impact medication adherence, and reduce appointment slots for other patients.

System wide, the average VA NSR was 17.4% in 2004 so improvement to a 10% NSR would eliminate over 40,000 no shows. There are multiple strategies suggested to improve no show rates (NSR) but few studies reporting their effect on specialty clinics..

Objective:
To determine if teaching ACA concepts throughout our medical center would reduce NSR in specialty clinics.

Methods:
ACA concepts were presented throughout the medical center starting in FY2005 emphasizing the 10 Key Elements of ACA. Of 24 specialty clinics studied, 4 surgical and 2 medical clinics were part of 10 Performance Measure clinics, ones that were monitored closely and that utilized ACA "learning collaboratives" to intensify ACA education in 2005. Non-Performance Measure clinics were exposed to ACA in less intense ways. Outcomes of NSR were monitored monthly within our VA integrated service network (VISN7) and were posted on a common internet site (http://klfmenu.med.va.gov). NSR targets were established for each VA clinic, including all specialty clinics. At the end of FY2006, we used the Wilcoxon signed-rank test to compare corresponding monthly rates to determine if the clinic NSR for 2006 was significantly different from 2005.

Results:
For 64,907 specialty patients scheduled in 2005, and 65,394 scheduled in 2006, 11 of 24 (45.8%) specialty clinics studied had a significant decrease in NSR ($p<.05$). The range of NSR for individual clinics was 7.3-32% in 2005 and 2-20% for 2006, respectively. One Performance Measure Clinics (Cardiology) showed a significant lower NSR. 9.0% in 2006 versus 15% in 2005. The NSR for Infectious Diseases clinic (80% HIV patients) averaged 20% in 2005 versus17% in 2006, a non-significant difference.

Conclusions:
Teaching ACA concepts in 2005 throughout our VA medical center was associated with decrements in NSR in medical and surgical specialty clinics the following year. Future individualization of ACA Key Elements for each specialty clinic including focused learning collaboratives may result in further improvement of NSR.