

Session: P098 Severe sepsis: sepsis definitions, biomarkers and bacteraemia

Category: 2b. Severe sepsis, bacteraemia & endocarditis

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Risk-based stratification of sepsis patients in the emergency ward

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Background: Prediction of bacteraemia allows for cost-effective decisions on rapid diagnostic tests.

Material/methods:

Prediction/Classification model: SepsisFinderLite is a partial model of the inflammatory response to sepsis. It uses a causal probabilistic network (CPN) to predict bacteraemia based on “infection variables” – laboratory variables including C-reactive protein, neutrophil fraction, platelet count and bilirubin. The model is a “lightweight” version of the SepsisFinder CPN which also included vital parameters (Ward 2016, PhD thesis). Both CPNs were constructed manually and tuned via machine learning. The training dataset consisted of the infection variables, presence of bacteraemia, age and 30-day mortality recorded for 4707 patients with a community acquired infection at Beilinson Hospital, Petah Tikva, Israel. Patient data were acquired during studies/use of the TREAT decision support system in the period from 2002-2016.

Setting and patients: Data were collected retrospectively for patients from whom blood cultures were drawn in the emergency ward at 7 hospitals in Emilia-Romagna, Italy from January 1 to June 30 2016, who also had other laboratory test data available. Episodes were excluded if they contained two or fewer infection variables, if infection variables were recorded more than fifteen minutes after blood

samples were taken for culture, if the same patient had a previous infectious episode within the two weeks prior or if blood culture results were missing.

Analysis: The model was used to provide a probability of bacteraemia for each patient. Predictive power was assessed from the receiver-operating characteristic (ROC) curve.

Results: 1064 patients (1106 episodes) were included. Following exclusion, the final dataset consisted of 1067 episodes for 1035 patients. 345 patients (32.3%) had positive blood cultures. After removal of potential contaminants, 248 patients (23.2%) had bacteraemia. The area under the ROC curve for bacteraemia prediction (Figure) was 0.74 (95% confidence interval 0.70 – 0.78), indicating that the prediction was fair. The predictions enabled the stratification of the patient group according to probability of bacteraemia. For the 320 patients (30%) with the lowest predicted probability of bacteraemia there were 26 (8%) cases of bacteraemia. For the 214 patients (20%) with the highest predicted probability of bacteraemia there were 106 (50%) cases of bacteraemia. Of the remaining 533 patients (50%), 116 (22%) had bacteraemia.

Conclusions: The model provided a valuable prediction of bacteraemia. The ability to make a continuous stratification of patients by risk allows for economic decisions to be made regarding the diagnostic workflow of the patient. This is particularly relevant in laboratories with several alternative technologies, with defined capacities/costs/benefits.

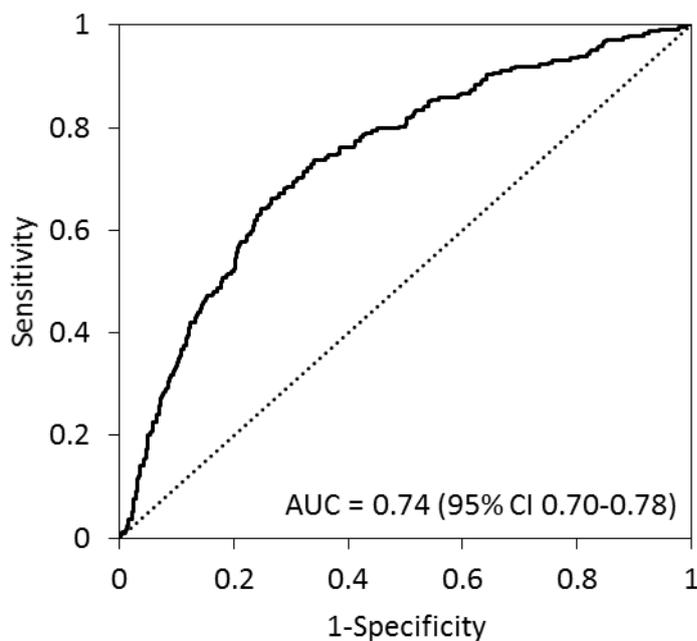


Figure: ROC curve for bacteraemia prediction. Cut-offs are varied for the model's predicted probability of bacteraemia.