Repeated Procalcitonin Levels for Monitoring of Sepsis Patients in the Critical Care Setting

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INTRODUCTION

- Accurate identification of ICU patients with sepsis at risk for poor outcome is challenging, but may help to improve patient management and decrease sepsis-related mortality and morbidity.
- In addition, identification of low risk patients may improve triage decisions and has thus important financial implications.
- Previous studies suggested that repeated procalcitonin measurements may help to guide duration of antibiotic therapy in ICU patients.
- Yet, the prognostic potential of repeated procalcitonin measurements to guide site-of-care decisions remains undefined.
- The aim of this analysis was thus to investigate the prognostic information derived from repeated PCT measurements in sepsis patients from a US critical care setting.

HYPOTHESIS

- We hypothesized that repeated procalcitonin measurements would predict fatal outcomes in a cohort of sepsis patients in a US critical care setting independent of severity of illness scores (APACHE IV).

METHODS

- This is a retrospective, observational cohort study
- We included adult patients with severe sepsis or septic shock and with least 2 procalcitonin measurements within the first 5 days of ICU admission between 01/2009 and 04/2010
- All patients were hospitalized in the ICU of Morton Plant Hospital (Clearwater, Fl).
- Procalcitonin was measured using the Kryptor® PCT (Brahms AG, Hennigsdorf, Germany)
- Data extraction was performed using ICUTracker® an electronic acquisition database drawing from electronic feeds of laboratory, vital signs, pharmacy, demographic and billing data.
- Cox regression models were calculated to assess the association of a PCT decrease from days 0-1 to either days 2,3,4 or 5 adjusted for severity using the APACHE IV score.

MAIN RESULTS

- The cohort included a total of 359 patients with a mean age of 67.3 years and 49% were female. Most patients had septic shock (80%) and APACHE IV scores were 79.8 (SD ±25.8).
- The in hospital mortality rate was 31.2% (95%CI 26.4%-36.0%).
- Mortality was 10.0% in patients with a high procalcitonin decrease of >90% and increased to 27.7% and 48.6% in patients with a decrease of 50-90% and <50%.
- This was also true across different APACHE IV categories and in cox regression analysis adjusted for the APACHE IV score (see Figure to the right).
- Compared to procalcitonin decrease of >90% (reference group*), a decrease of 50-90% and <50% had adjusted hazard ratios of 2.91 (95%CI 1.25, 6.8) and 5.58 (95%CI 2.38, 13.08) to predict fatal outcome.

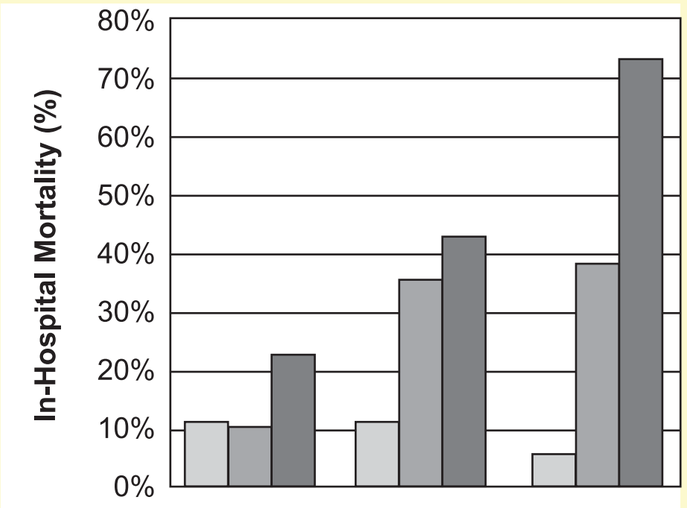
	Hazard Ratio (95%CI)	*p*
PCT decrease >90%	1.0	
PCT decrease 50-90%	2.91 (1.25, 6.8)	*0.0134*
PCT decrease <50%	5.58 (2.38, 13.06)	*<0.0001*
APACHE IV score (/10 points increase)	1.11 (1.04, 1.18	*0>0012*

- Sensitivity of a procalcitonin decrease of >90% was 94.6% and specificity of a decrease of <50% was 76.9%.

	Sensitivity	Specificity	NLR	PPV	NPV
PCT decrease >90%	94.6%	21.9%	0.25	10.0%	64.5%
PCT decrease <50%	48.2%	76.9%	0.67	52.3%	23.0%

- Adding procalcitonin decrease to the APACHE IV score increased the area under curve to predict mortality from 0.69 to 0.74 and improved classification of patients by 37% in reclassification tables (Net reclassification index 0.37, SE 0.07).

MORTALITY WITHIN APACHE IV



PCT decrease	APACHE <72points	APACHE 72-86points	APACHE >86points
>90%	10.7%	11.1%	7.1%
51-90%	10.5%	36.6%	38.0%
<50%	22.9%	42.7%	72.5%

CONCLUSIONS

- The decrease of procalcitonin in the first days of ICU provided prognostic information beyond the APACHE IV score in this US cohort of patients with severe sepsis and septic shock.
- Prospective trials are needed to confirm these results and demonstrate whether improved prognostic assessment translates into better triage and therapeutic decisions.

IMPLICATIONS & OUTLOOK

- Monitoring of procalcitonin may help to improve triage / discharge decisions in the ICU, and thereby may improve mortality and/or morbidity in patients with severe sepsis and septic shock.

FUNDING & CONFLICT

- Schuetz and Amin reported receiving support from BRAHMS Inc and Biomerieux to attend meetings and fulfilling speaking engagements.
- All other authors have no conflict of interest to disclose.

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