ORIGINAL ARTICLE

APACHE II Score as a Predictor of the Type or Virulence of Sepsis

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Summary

A variety of systems for assessing severity of illness in critically ill patients have been described. The APACHE II (acute physiology and chronic health evaluation) is used widely for predicting probability of hospital mortality. We have looked, in our retrospective review, at the correlation between APACHE II scores of patients admitted to our Intensive care unit (ICU) within twenty four hours and the development and type of infection as well as evidence of hemodynamic involvement (i.e. presence of sepsis) as outlined by the criteria described for systemic inflammatory response syndrome (SIRS). As evidenced by following these patients with increased APACHE II scores and their cultures, we found that many of them had moderate to severe signs and symptoms of sepsis including hemodynamic complications, increased respiratory rate, temperature changes and mental status changes. They were also eventually found to be culture positive for organisms like *Candida*, Methicillin-resistant *Staphylococcus aureus* (MRSA), *Pseudomonas sp., E. coli, and Klebsiella sp.* in the blood, tracheal cultures and urine –organisms possibly virulent in compromised patients even though these patients were intubated and catheterized.

Keywords
APACHE II, septicemia, virulent infections.

Introduction

Mortality from sepsis remains unacceptably high throughout the world. The cost of treating virulent infections is also high[1]. A variety of systems for assessing severity of illness in critically ill patients have been described. Many studies have examined hemodynamic parameters in an attempt to identify those that are prognostic indicators in patients with septic shock [2]. However, these scoring systems do not address the type of infection that these critically ill patients can succumb to. The APACHE II (acute physiology and chronic health evaluation) is used widely for predicting probability of hospital mortality[3]. We have looked, in our retrospective review, at the correlation between APACHE II sores of patients admitted to our Intensive care unit (ICU) within twenty four hours and the development and type of infection as well as evidence of hemodynamic involvement (i.e. presence of sepsis) as outlined by the criteria described for SIRS (systemic inflammatory response syndrome)[4]. These include Blood pressure changes, increased respiratory rate, mental status changes and temperature fluctuation. We hope to prove, by doing this review, that the APACHE II score can point out those patients who are at increased risk for certain types of virulent infections. We do realize, however, that other aspects, for example, immuno-suppression and other co-morbidities will also contribute to the development of septicemia. The APACHE II score combines variables according to which a numeric score is allotted [4,5].

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They are:

1. A variety of physiologic variables (e.g. mean arterial pressure, temperature, arterial partial pressure of oxygen)
2. Certain laboratory values (such as hemoglobin, creatinine, White blood cell count)
3. Age
4. Chronic health variables

Methods

All consecutive patients admitted to the ICU were included over four months in this review, with N=36. A chart review was conducted recording the following:

1. mean arterial pressure range (average) over their entire ICU admission,
2. respiratory rate trends
3. maximum temperature trend
4. Glasgow coma scale (GCS) trends reflecting mental status changes.

Also recorded were the microbiology results including blood, urine and tracheal culture results. These were correlated to the presence or absence of the signs and symptoms of sepsis [5,6] as well as the APACHE II score. Cultures were taken on admission and also on appearance of clinical signs of sepsis such as fever, neutrophilia, hemodynamic compromise. The number of specimens varied from patient to patient, generally varying from between 1-3.

APACHE II score was calculated by a standard technique which included age points, chronic health points and physiology variables including heart rate, mean arterial blood pressures, arterial pH, etc. [6]. This is routinely carried out in the ICU within 24 hours of admission of the patient.

Results

Thirty six charts were reviewed. Positive cultures were N= 18 and are summarized in Table 1. Tracheal cultures positive N=5, urine cultures N= 5 , blood cultures N= 8 and no positive culture N = 5.

Table 1. APACHE II Score versus Organisms isolated

APACHE II score	No. of patients	Sepsis signs & symptoms	Tracheal cultures	Blood cultures	Urine cultures
0 - 8	4	M	S. aureus	NA	NA
9-12	6	Mo	Acinetobacter, S.epidermidis, MRSA	Klebsiella	NA
13-16	15	Mo-S	Candida, Pseudomonas	Klebsiella, S.aureus	Candida
17-20	7	Mo-S	Acinetobacter	E. coli	Candida
21-25	4	S	MRSA, AFB	MRSA, NA Pseudomonas, Candida	

Key: M = mild (1 out of 4 symptoms of sepsis present : BP, RR, Temp, GCS); Mo = moderate (2 out of 4); S = severe (3-4 out of 4);acid fast bacilli (AFB)

Analysis

Median APACHE II score was 13-16 (N=15). Patients with this score had moderate – severe signs and symptoms of sepsis (i.e. 2-3 out of 4). Infections in this category of patients were *Candida* in urine culture (3 patients); *Acinetobacter and Klebsiella* in blood and *Pseudomonas* in tracheal cultures. These organisms are considered fairly virulent and have significant mortality [7]. Patients with low APACHE II scores (i.e. 0-8 and 9-12) had mild and moderate signs and symptoms of sepsis – one or two out of four). They also had other organisms for example *S. aureus, S. epidermidis* in tracheal cultures and urine especially without clinical correlation. Patients with higher scores (17-20 and 21-25) with N = 7 and 4 respectively, had mostly severe signs and symptoms and organisms were MRSA in blood and tracheal culture and *Pseudomonas and E. coli* in blood cultures.

Discussion

Nosocomial infections in the lungs, blood and urine continue to be the leading cause of death in the ICU [7,8]. Mortality rates from sepsis may be as high as 40% even if appropriate antibiotics are administered [9]. The rates of multi resistant organisms are also growing. Empirical antibiotics have a place in preventing sepsis, however, have not proven dramatic results and may infact lead to the development of multiple drug resistance [10,11]. By using the APACHE II score (which is done in the first twenty four hours of ICU admission) as a predictor of the type or virulence of the infecting organisms, we may be able to target that population of ICU patients – correlating to clinical scenario – who may be susceptible to the more dangerous pathogens. At the same time we may be able to start earlier empiric treatment on them. As evidenced by following theses patients with increased APACHE II scores and their cultures, we found that many of these not only had moderate to severe signs and symptoms of sepsis including hemodynamic complications, increased respiratory rate, temperature changes and mental status changes. They were also eventually found to be culture positive for organisms like *Candida*, MRSA, *Pseudomonas, E. coli* and *Klebsiella* in the blood, tracheal cultures and urine – all considered very virulent [12,13].

Although much more work is required in this direction, this may be a unique and so far not investigated aspect of the APACHE II scoring system, which may help us curtail the high risk of infections and septicemia in our ICUs.

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