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KEY WORDS: APACHE II, ICCU, mAPACHE II, Mortality, Oxidative stress.

A STUDY OF APACHE INDEX AND ITS RELATIOSHIP WITH OXIDATIVE STRESS IN CARDIAC PATIENTS

Dr Giles George* Consultant Anesthetist, Muthoot Healthcare, Kozhencherry. * Corresponding Auhor

ABSTRACT

This preliminary study aims (1) at validating the use of Acute Physiology and Chronic Health Evaluation II (APACHE II) scoring system in cardiac patients admitted to the intensive cardiac care unit (ICCU) for prediction of the risk for mortality, (2) to evaluate the use of a modified APACHE II (mAPACHE II) with addition of the scores related to urinary levels of oxidative stress parameters in prediction of the risk for mortality.

INTRODUCTION

Multiple severity systems have been developed over the years for assessing overall ICCU performance which includes quality care, resource allocation, cost effectiveness and improving decision making for therapeutic intervention. In this study, the widely used APACHE II score has been applied along with mAPACHE II to determine the outcome in the ICCU.

APACHE II scoring system is based on severity of disease, introduced by Knaus WA *et al.*, (1985).[2] The APACHE II score is in the range of 0-70. Higher scores indicate that the condition of the patient is critical and the prognosis is poor.

Oxidative stress can result from increased production of free radicals which can damage the cells by lipid peroxidation or by oxidizing DNA or proteins. MDA and Cp are used as indicators of oxidative stress. Studies have reported increased plasma levels of MDA and Cp in cardiac patients.[19,20]

The purpose of this preliminary study is to (i) validate APACHE II scoring system in cardiac patients admitted to the ICCU - as there is a paucity of literature on this subject in the Indian context and (2) to evaluate the use of a modified APACHE II (mAPACHE II) with addition of the scores related to urinary levels of oxidative stress parameters in prediction of mortality risk.

MATERIALS AND METHODS

This study was conducted on patients (n=100) admitted in the ICCU. The inclusion criteria were patients between the age of 18 -77 years of both genders and those admitted to the ICCU for the first time. The patients (n=100) were further sub-classified into groups of 10 years age intervals.

Parameters for calculating APACHE II were obtained within 24 hours of their admission to ICCU as in the study conducted in Brazil[10] and documented as per the guidelines mentioned by Knaus *et al.*, (1985).[2] Then APACHE II score was calculated as follows :

APACHE II = (acute physiology score) + (age points) + (chronic health points) as per the study conducted by Knaus *et al.*, (1985).[1,2]

Mortality rate:-

Predicted mortality was calculated by using the equation formulated by Knaus et al in 1981[2] and standardized mortality ratio (SMR) was calculated.

Urine analysis :

The urine samples were collected from all these cardiac patients and from 58 normal healthy, age, sex matched adult volunteers, who were non alcoholic, non-smokers for control data of the urinary oxidative stress parameters. MDA and Cp concentrations were determined.

Scoring of urinary MDA (M- score) and ceruloplasmin (C-score):

Scores were applied for different concentrations of urinary MDA and Cp ranging from +4 to -4 as applied for APACHE II in the original study by Knaus *et al*. The mAPACHE II score was calculated by adding the M score and C score to APACHE II score (APACHE II ± M score ± C score).

STATISTICAL ANALYSIS

Student's t test was used for comparing the mean of continuous variables. Chi square test was used for comparing the proportions of categorized measurements. Discrimination between survivor and non-survivor was assessed by plotting the ROC (Receiver Operating Characteristic) curve for the APACE II score and mAPACHE II score.

Data was analyzed using SPSS software version 17 (SPSS Inc, Chicago IL).

All statistical tests were 2 – tailed and $p<0.05$ was considered to be statistically significant.

RESULTS

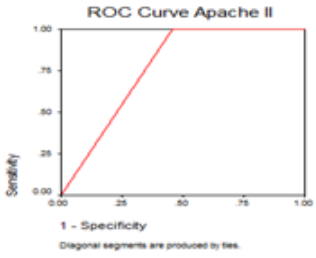

Figure a. ROC curve for APACHE II

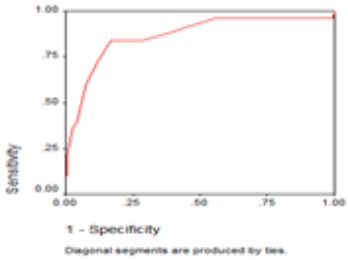

Figure b. ROC curve for mAPACHE II

The mortality prediction ability of APACHE II was determined by plotting sensitivity against 1-specificity and thus recording the area under the ROC curve.

DISCUSSION

This preliminary study is done to validate the relevance of APACHE II and mAPACHE II in predicting the mortality of patients admitted to the ICCU in the Indian context since there is a paucity of data in the Indian scenario.

As per Knaus *et al.,*[1,2] the data of the patients was collected within 24 hours of admission and mortality was considered within this period.

The mean APACHE II score of this study was 11 ± 4. This indicates that lower the APACHE II score, better is the outcome of the patients. Earlier, lower APACHE II scores have been reported from U.S.A[6] and Sweden.[7] The average APACHE II scores of several studies were higher than that reported in this study, such as, Australia,[8] four studies from India,[9,10] West Indies,[11] Iran,[12] Germany[13] andPakistan[14]

The lower APACHE II scores in this study maybe due to the fact that the APACHE II score was calculated based on the parameters collected for the initial 24 hours following the admission of the patient to the ICCU. The length of stay of patient beyond 24 hours in the hospital was not taken into account because the 24 hours follow up after admission of the patient reflected the greatest degree of derangement of some of the parameters considered to calculate acute physiologic score.[2]

Ushashree *et al*., (2005)[3] and Khalid Al-Fartosi *et al*., (2010),[4] have reported an increase in the levels of oxidative stress parameters, MDA and Cp, in plasma of cardiac patients. Considering this fact, this study was a preliminary attempt to evaluate whether addition of urinary levels of oxidative stress parameters would increase the discrimination power of the APACHE II score. Hence, mAPACHE II was determined by adding M score and C score to APACHE II.

CONCLUSION

There are valid cardiac markers in the 21st century for diagnosis of cardiac disorders. However, there is no particular national cardiac surgical database and particular risk stratification model in a developing country like India for predicting outcome in cardiac patients. Hence, an attempt has been made for this purpose by applying APACHE II and mAPACHE II in this study which shows that both can be used to predict mortality in ICCU patients. Further comprehensive studies are needed to confirm the findings in this study.

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