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KEY WORDS: APACHE II Score, Discrimination, Intensive Care Unit, Mortality Rate, Prognosis.

A STUDY OF ACUTE PHYSIOLOGICAL AND CHRONIC HEALTH EVALUATION (APACHE) INDEX IN CRITICALLY ILL PATIENTS.

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ABSTRACT

This study aims at (1) validating the use of Acute Physiology and Chronic Health Evaluation II (APACHE II) scoring system in the medical intensive care unit (MICU) for prediction of the risk for mortality, (2) to compare the predicted death rate with the observed death rate of the patients gender wise and age wise.

INTRODUCTION

A wide range of mortality models have been proposed over the last 30-38 years for determining their validity in critically ill patients. These models have been evaluated, compared and contrasted to emphasize on the aspects of forecasting the outcome in the intensive care unit. Acute Physiology and Chronic Health Evaluation (APACHE II) scoring system is one of them which has been widely used in different countries for this purpose.[1-5]

APACHE scoring system was developed by Knaus *et al*., (1981) [1] to measure the severity of disease. Later it was refined and simplified in 1985 and called as APACHE II [3] which helped in assessing the probability of death. The Apache II score is in the range of 0-71. Scores above 71 indicate poor prognosis. [3,5]

It is a general notion that critical care is economically very high and poses economic constrain. India is a developing country where the intensive care unit (ICU) resources are limited and ICU expenditure is one of the major economic constraint on the patient.

The present study was designed to evaluate performance of APACHE II score in prediction of mortality risk, as well as in determination of model validity in critically ill patients of Indian context. This is because there is a need, not only to provide quality care to the critically ill patients but also to optimally utilize ICU resources. Therefore an attempt is made to evaluate and validate the performance of APACHE II regarding patient outcome within 24 hours of admission to the ICU in the Indian scenario.

MATERIALS AND METHODOLOGY

After obtaining the approval of the ethical committee, informed consent was obtained from either the patient or their family/caregivers. This study was conducted on 350 patients admitted in the MICU. The sample size for this study was derived by statistical analysis. Parameters for calculating APACHE II were obtained from patients within 24 hours of their admission. The outcome (i.e., survivors/non-survivors) was considered within these 24 hours of admission as in the study conducted in Brazil.[6]The inclusion criteria consisted of patients between the age of 18-57 years of both genders. Patients who were discharged and re-admitted for the same purpose were excluded. As the study involved only collection of data, interventions on the patient based on data obtained were excluded in this study.

The clinical data for calculating acute physiology score (APS) included physiological and biochemical parameters for 12 variables. Scoring was also based on age and chronic health condition of the patients. Depending on these three criteria APACHE score was calculated, i.e., APACHE II score = (APS) + (age points) + (chronic health points). Lower APACHE II score means good prognosis of patients and higher score implies a more severe disease and poor prognosis.

Mortality rate:-

Predicted mortality was calculated by using the equation used by Knaus *et al*., (1985), [3] and the Standardized mortality ratio (SMR) was also calculated.

STATISTICAL ANALYSIS

Descriptive statistics was used to summarize the data of the study. Data for continuous variables were presented as mean ± SD (standard deviation) depending on the distribution of the variable. Categorical data were presented as frequencies with percentages. Discrimination of the model was assessed by using the ROC curve.

Data were analysed 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

The standard mortality rate was 0.8 for >28 yrs and 0.6 for 18 - 27 years age group (Table 3 and figure 1).

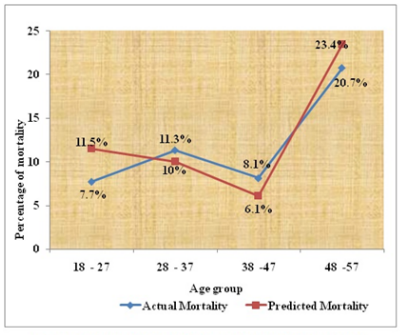

Figure 1. Comparison of actual mortality and predicted mortality in various age groups

The actual mortality was lower than predicted mortality for the age group 18-27 and 48-57 whereas predicted mortality was lower than actual mortality for the age group 28-47 (Figure 1)

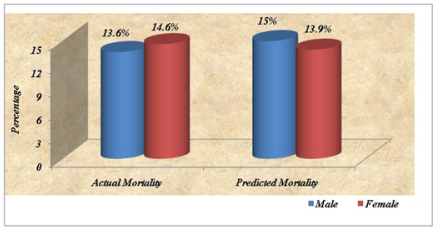

Figure 2. Comparison of actual mortality and predicted mortality in male and female

There was no significant difference ($p>0.05$) between observed and predicted mortality rates of male and female (figure 2).

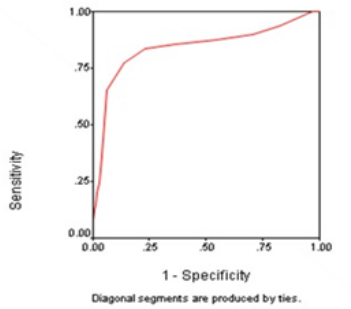

Figure 3 : ROC curve for APACHE II

DISCUSSION

The present study showed a significantly lower mean APACHE II score for the 350 ICU patients. This value is somewhat similar when compared with the study conducted in USA[7] and Korea,[8] but considerably low when compared to the studies in Sweden,[9] Australia,[10] India,[11-13] West Indies,[14] Taiwan,[15] Brazil,[6] Iran,[16] Pakistan[17] and Canada.[18] The lower APACHE II reported in this study may be because variables relevant to the disorders were considered and other parameters were assumed to be normal as done by Knaus *et al.*, (1985).[5]

A significantly higher APACHE II score was observed in non-survivors compared to survivors as reported by studies in India,[11] West Indies,[14] Pakistan [17] Germany,[19] and Iran.[20] A higher APACHE II score suggests greater mortality risk.

The observed mortality rate was similar to the predicted mortality rate in this study which is also reported by studies conducted in Iran,[16,20] Pakistan[17] and Hong Kong.[21] In contrast to this, the study conducted in Brazil reported a lesser predicted mortality than observed mortality.[6]

The calculated overall SMR, 0.9, in the present study is similar to the SMR reported by the studies in Iran,[16] Pakistan,[17] and Hong Kong.[21] However, it was slightly lower when compared with an earlier study from India.[11] This is because SMR is a ratio of observed and predicted mortality, a higher value could result from higher observed mortality and decreased predicted mortality as in the study reported in India.[11] This study shows, the calculated SMR for genders to be 0.9 for male and 1.1 for female, which is similar with the result obtained, i.e., the observed mortality is somewhat similar to the predicted mortality between the male and female patients (figure 1). The calculated SMR is <1 for different age groups as predicted mortality is greater than observed mortality (figure 2), which indicates that less mortality has occurred than expected.

The higher predictive ability of Apache II score was evidenced by a greater area under the ROC curve in this study (figure 3). The area under the ROC curve obtained in this study was slightly lower than recorded by Knaus *et al.*,[3-5] and studies from India, [13] Iran,[20] and Hong Kong.[21] The area under the ROC curve obtained in this study was similar to the recordings in Brazil,[6] Pakistan[17] and Germany.[19] This indicates that APACHE II score is a good prognostic tool that can be used for patients admitted to the ICU within 24 hours after admission

CONCLUSION

The study indicates that APACHE II score can be applied to predict mortality rate in the MICU for the Indian patients within 24 hours of their admission as the study shows good discrimination, making it suitable to be compared gender wise, age wise and also with the ICU performance in other countries.

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