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COMPARISON OF APACHE II & IV SCORING SYSTEM IN PREDICTING THE OUTCOME OF PATIENT ADMITTED IN CRITICAL CARE UNIT

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Abstract:

Introduction:

Critical III patients are those patients whose vital parameters are fluctuating above and below the normal values, and are under various life supports with almost lethal prognosis; it is a lethal condition which can result into mortality and morbidity of the patient.

Critically ill patients are kept in ICU (Intensive care Unit) on various life supportive devices and under round the clock observation and the diagnostic tests should be done on the frequent basis. Since ICU have the finite resources in terms of equipments and manpower.

Traditionally, ICU physicians were able to distinguish between the survivors and non-survivors based on their clinical experience, but now standarised scoring system approach can be used which is more effective and reliable. In addition to this these type of scoring system, also helps in allocating patients and comparing their performance in the ICU.¹

Although in this advanced scientific era; there are various diagnostic tools for identifying the diseases and various advanced medication in order to treat & prolong the life of patients; also there are tools developed to predict the severity of the disease conditions (such as SOFA) but there are no definitive tools for predicting the mortality or length of the stay in ICU.

Methods:

An observational study was conducted on MGM Hospital, Kamothe, Navi Mumbai to compare the outcome of critically ill patients using APACHE II & IV scoring system. All patients above 18 years and all intubated patients within 24 hours or more of admission were taken while pregnant ladies, patient below 18 years and discharged before 24 hours were excluded from the study. APACHE II & APACHE IV scores were calculated based on the worst physiological and laboratory parameters. All patients were followed up till the outcomes were recorded as survivors or non-survivors. ROC curve were used to compare two scoring systems.

Results:

Total score for APACHE II ranges from 1 to 32 & APACHE IV it is 25 to 146. Total 100 patients were included in study, out of which 37 (37%) were survivors while 63(63%) were non-survivors. There is a good correlation between APACHE II & IV scoring system with the spearman's rho value of 0.574. Discrimination for both scoring models was good with area under ROC curve for APACHE II (0.468) and APACHE IV (0.598). APACHE IV was more accurate as compared to APACHE II in this regard.

Conclusions:

Discrimination was better for APACHE IV than APACHE II. There was good correlation between the two 1JCH models observed in this present study.

Keywords: APACHE II; APACHE IV, ICU

INTRODUCTION

Critically ill patients are those patients whose vital parameters are fluctuating above or below the normal values, patient may be on various life saving supportive devices for body's functioning and in a risky prognosis which may be due to an outcome of various causes such as infections, environmental factors or inherited characters and can be through various signs and symptoms which can be confirmed through various diagnostic test.

Further, back in 1885, the modified version of APACHE scoring system came into practice known as APACHE –II, where there were reduced APS variables and various other variables such as GCS score; chronic health points and age points were added into it. Here the worst value of 24 hrs is taken and then A score of 25 denotes 50% mortality whereas more than 35 represent 80% mortality, in ICU setting.² In India there are minimal research conducted on the APACHE II & IV scoring system in ICU setting and if at all researchers have carries out the comparative research they have taken a specific setting or the tertiary setting for comparing this scoring system.³

scored accordingly; here maximum scoring is of 71 points, which is used to relate mortality in ICU setting.

In APACHE II a score of 25 represents predicted mortality of 50% & score over 35 represents a predicted mortality of 80%.⁴

Critically ill client should be kept in Intensive Care Unit (ICU) where a close and constant monitoring of the patient should be done round the clock to prevent further detoriation. Since ICU have finite resources in terms of equipment and man powers, and due to increase in worldwide population there is increase in various disease conditions too, so a proper evaluation of the patient and proper triaging should be done according to the disease severity so that more life can be saved or in other words the needed one can use the finite healthcare resources.

Apart from the various facilities in ICU; there are various scoring systems which are available to measure the outcome of patients. There of various scoring system to predict risk of mortality and evaluating the outcome in critically ill patients is important in predicting evidenced based outcome. There are various such resources available in ICU such as Glasgow coma (GCS) scale, Logistic Organ Dysfunction Score (LODS), Sequential Organ Dysfunction (SOFA), qSOFA (Quick Sequential Organ Dysfunction), etc...,

Although in this advanced scientific era; there are various diagnostic tools for identifying the diseases and various advanced medication in order to treat & prolong the life of patients; also there are tools developed to predict the severity of the disease conditions (such as SOFA) but there are no definitive tools for predicting the mortality or length of the stay in ICU.

METHODS:

After ethical committee's approval, the study was conducted. The duration of study was almost for 2 months of period into different ICU setting (EMS-ICU, SICU, CVTS, and MICU) in our hospital. Total 100 samples were taken for the study. All patients above age of 18 years were included in this study irrespective of any diagnosis were taken; admitted to critical care unit for 24 hours or more and intubated within 24 hours of more of admission were taken for the study; whereas age below 18 years, non-intubated, discharged within 24 hrs from ICU death and pregnant patients were excluded from this study.

Based on the worst physiological and laboratory values within 24 hours of admission APACHE II & APACHE IV scores were calculated, using online calculator.

All the patients were followed up till the outcome (death or shifted to ward) was recorded. The predicted mortality was correlated with the observed mortality rates in both the scoring system.

Statistical analysis was performed using SPSS version 27.0, data were reported as mean and standard deviation for continuous variables and percentages for categorical variables. Student's t-test and H-statistics were used.

P<0.05 was considered as a level of statistical significance.

RESULTS:

Out of 100 patients taken for this study, 62(62%) were males while 38(38%) were females. The mean age of current study was $47.16 \pm 18.74(18-94 \text{ years})$.maximum number of patient falls under the category of 21-40 years. In this study 17(17%) had underwent previous surgeries (C-section; Appendectomy; Hernioplasty; Mitral Valve Repair) while 83% do not have a history of previous surgery.

Among 100 patients 63(63%) were non-survivors while 37(37%) were among the survivors.

The mean length of stay was $8.04 \pm 3.96(1-19 \text{ days})$, where maximum patients stayed for 6 to 10 days and length of stay among survivors and non-survivors (calculated by APACHE IV scoring system was for survivors (7.48±1.57) and for non-survivors (7.53±1.65) with the p value of 0.86 & with APACHE II for survivors (8.75±3.30) and for non-survivors it was (7.61±4.27).



Figure 1: Length of stay score among Survivors Vs Non-survivors



Figure 2: Case Distribution as per APACHE II scoring System

APACHE II total severity score ranges from 0 to 71 points. In this present study, the mean score for APACHE II scoring system was $28.26 \pm 6.11(18-46)$, where in this study score ranges from 18 to 46.



Figure 3: Case Distribution as per APACHE IV scoring System

APACHE IV total scores ranges upto 286 where, in this study, the total mean score was of $105.43 \pm 17.55(67-160)$ and in this study the score ranges from 67 to 160.





In this study, area under the curve for APACHE II was 0.486 with the confidence interval of (lower bound of 0.367 and the upper bound of 0.604) and for APACHE IV it was 0.598 with the confidence interval of lower bound of 0.483 and upper bound of 0.714.

The H statistical value for APACHE II was 150.22 with the p value of 0.031 while for APACHE IV it was 179.59 with the p value of 0.001 which is significant for both scoring system.



Figure 5 shows declines of predicted risk mortality and observed mortality for APACHE II



Figure 6 shows declines of predicted risk mortality and observed mortality for APACHE IV

DISCUSSION:

ICU department consist of critically ill patients where patients are kept under constant observation and various life supports. There are various scales which can calculate various risks such as sepsis or neurological functioning of the patients but there are no definitive tools which can predict the accurate mortality and morbidity of the patient.

The result from our study shows that APACHE IV scoring system is much better as compared to APACHE II scoring system in our ICU setting, the most likely reason for this could be the necessary parameters upgraded in APACHE IV scoring systems.

Out of 100 patients selected for this study, the mean age of this current study was $47.16 \pm 18.74(18-94 \text{ years})$, majority of the patient were males and most common co-morbidities present was diabetes (16%) and hypertension (15%)

There were total 63(63%) non survivors and 37(37%) survivors and length of stay scoring system for survivors was higher in APACHE II scoring system (8.75 \pm 3.30) than in APACHE IV scoring system (7.48 \pm 1.57)

The discrimination of APACHE II as determined by area under curve (AUC) in current study was 0.486 whereas for APACHE IV it was 0.598.

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CONCLUSION:

In our hospital setting, APACHE IV scoring system was more reliable as compared to APACHE II scoring system.

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