



Predictive accuracy of APACHE-II for mortality in poly trauma patients.

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ABSTRACT... Objectives: The objective of our study was to find diagnostic accuracy of APACHE-II score to predict mortality in poly trauma patients within first 24 hours of hospitalization. **Study Design:** Cross Sectional study. **Setting:** Department of Emergency Lahore General Hospital. **Period:** 25 March, 2016 to 25 September, 2016. **Material & Methods:** A total of 230 patients who fulfilled inclusion criteria were enrolled in the study from emergency department of Lahore General Hospital. To calculate APACHE-II score, vital signs, blood / serum profile, GCS, age and prolong health problems were measured on patients' arrival. Patients were classified as per their APACHE-II score. After calculating APACHE-II score patients were managed according to trauma severity and followed up till 24 hours to note the in-hospital mortality. **Results:** Out of 230 patients, 147 (63.91%) were male and 83(36.09%) were female; mean age was 38.53 ± 11.67 years. Out of 230 cases, in hospital mortality occurred in 84(36.5%) while other 146(63.5%) were alive within 24 hours of admission. According to APACHE-II score, 84(36.5%) cases had > 11.5 score and rests of 146(63.5%) had APACHE-II ≤ 11.5 . The sensitivity, specificity, PPV, NPV and diagnostic accuracy of APACHE-II was 89.16%, 93.2%, 88.1%, 93.84% and 91.74% respectively. **Conclusion:** According to the findings of this study, we found APACHE-II highly accurate for indicating in-hospital mortality. Using APACHE-II in future we can devise an efficient treatment plan for poly trauma patients to reduce the probability of hospital mortality.

Key words: APACHE-II, Injury, Mortality, Prediction, Scores, Survival, Trauma.

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INTRODUCTION

Trauma is originated from Greek language and means wound. Poly trauma is major trauma in which more than one region of body or organ systems are involved. In major trauma injury severity score is > 15 based on anatomical severity of injury. All over the world, about 10000 people die daily due to injury.¹

WHO data published in 2017 revealed that 27081 deaths occurred in Pakistan which is 2.22% of total deaths. However according to Pakistan Bureau of statistics, 5948 trauma victims were killed and 14489 patients were injured due to traffic accidents in one year 2017-18.²

Early evaluation and treatment of serious trauma

patients is a cumbersome duty and some advocate some factors can rapidly change depending on blood loss and quality of resuscitation and proposed prompt-individualized-safe management(PRISM) strategy.³

APACHE-II" Acute Physiology and Chronic Health Evaluation II" is a severity-of-disease classification system. It was designed to measure the severity of disease for adult patients admitted to intensive care units. APACHE-II score (the minimum score is 0 and maximum is 71) is calculated from measuring vital signs, laboratory values, Glasgow coma score, age, chronic health status of the patient and type of admission. These are measured within first day of admission. The most abnormal value is used to derive a score. It is

reported that the APACHE-II has sensitivity and specificity of 88% and 90% respectively with an accuracy of 90%.⁴ But some of the researchers do not agree and figures regarding sensitivity, Specificity and accuracy have been mentioned as low as 82.5%, 55.2% and 66% respectively.^{5,6}

The rationale of this study is to evaluate the clinical importance of APACHE-II score in poly trauma patients in terms of 24 hours in hospital outcome. Due to considerable statistics of accidents and trauma related deaths in Lahore General Hospital, we need certainty of APACHE-II scoring system to accurately predict the outcome of poly trauma patients for our own population as no local study is published and international data though gives consistent sensitivity but wide range of specificity.^{4,6} This study will help us for triage and to devise an efficient treatment plan for poly trauma patients to reduce the probability of hospital mortality. The objective of our research was to find diagnostic accuracy of APACHE-II score in forecasting mortality in poly Trauma patients within first 24 hours of hospitalization so that the more appropriate care is administered to more serious patients.

MATERIAL & METHODS

It was a Cross Sectional study which was conducted at emergency department of Lahore General Hospital in 6 months from March 25, 2016 to September 25, 2016. Non-probability consecutive sampling was used. We took 230 patients using sensitivity and specificity of APACHE-II 82.5%, 55.2% 13% margin of error for sensitivity, respectively at 8% margin of error for specificity and 95% confidence level using 10% prevalence of poly trauma.⁶

Patients presenting in emergency department with poly trauma (as per operational definitions) aged 18-60 years of either gender were included in the study. Patients with major burn, concomitant cardiac injury and those referred to other hospitals for continuation of treatment were excluded. A total of 230 patients who fulfill selection criteria were enrolled in the study from emergency department of Lahore General Hospital. Informed consent was taken for demographic profile

(name, age, gender and other necessary clinical data). To calculate APACHE-II score, vital signs, laboratory values, Glasgow coma score, age and chronic health points was measured on patients arrival. Patient was classified as per their APACHE-II score. After calculating APACHE-II score patient was managed according to trauma severity and followed up till 24 hours to note the in hospital mortality. All the data was recorded on a Performa by researcher himself. Data was entered and analyzed through SPSS version 20.

Frequency and percentages were calculated for all qualitative variables like gender and in-hospital outcome (alive/mortality) on both APACHE-II score and actual outcome. Mean \pm standard deviation was calculated for all quantitative variables like age and duration of injury and APACHE-II score. True positive was labeled if APACHE-II $>$ 11.5 and patient dies within 24 hours. False negative was labeled if APACHE-II \leq 11.5 and patient dies within 24 hours. False positive was labeled if APACHE-II $>$ 11.5 and patient survives within 24 hours. True negative was labeled if APACHE-II \leq 11.5 and patient survives within 24 hours. 2×2 tables were made and sensitivity, specificity, positive and negative predictive values and accuracy was calculated. Data was stratified by gender, age, duration of injury ($<$ 2 hours, 2-4 hours and more than 4 hours). Post stratification chi square test was applied to compare in hospital outcome and APACHE-II score. P- Value \leq 0.05 was considered as significant.

RESULTS

The mean age of patients was 38.53 ± 11.67 years with age range of 42 years (minimum and maximum age was 18 and 60 years). There were 131(56.96%) cases 18-40 years old and 99(43.04%) patients were 41-60 years of age. There were 147(63.91%) male and 83(36.09%) were female patients.

The mean duration of injury was 4.64 ± 3.76 hours with minimum and maximum duration of 1 and 16 hours. A total of 24(10.43%) cases had injury since $<$ 2 hours, 132(57.39%) cases had injury since 2-4 hours and 74(32.17%) cases had injury more than 4 hours. The mean APACHE

II score was 18.20 ± 17.01 with minimum and maximum score of 0 and 71. Out of 230 cases in hospital mortality occurred in 84(36.5%) while other 146(63.5%) were alive within 24 hours of admission. According to APACHE-II score, 84(36.5%) cases had > 11.5 score and rests of 146(63.5%) had $APACHE-II \leq 11.5$. The sensitivity, specificity, PPV, NPV and diagnostic accuracy of APACHE-II was 89.16%, 93.2%, 88.1%, 93.84% and 91.74%. When data was stratified over age, gender and injury duration we found significant association of APACHE-II score and in hospital mortality, p value < 0.001 . Table-I,II,III.

DISCUSSION

Trauma is a major killing factor in young patients in industrialized and developing world. It has become the modern epidemic in young people. Although traffic safety and occupational safety measures have been improved and implemented but still trauma remains the most common cause

of death despite advances in pre-hospital and in-hospital trauma care.

To decrease the preventable deaths, scoring systems are commonly used all over the world. Assessment of severity of a disease or illness offers a lot of advantages to health care providers. Some of these advantages include patient outcome prediction, treatment efficiency and improvement of therapeutic and preventive measures.⁷

Various tools and scoring systems have been used not only to predict mortality and morbidity in medical conditions but also in preoperative consent and prediction of mortality or survival after major trauma. Some of these include Acute Physiology And Chronic Health Evaluation (APACHE-II), APACHE-IV, Trauma Injury Severity Score(TRISS), Injury Severity Score(ISS) and Sequential Organ Function Score(SOFA).⁸⁻¹⁵

Age Groups (years)			Hospital Outcome		P-Value
			Mortality	Alive	
18-40	APACHE II score	> 11.5	42(87.5%)	2(2.4%)	< 0.001
		≤ 11.5	6(12.5%)	81(97.6%)	
41-60	APACHE II score	> 11.5	32(91.4%)	8(12.5%)	< 0.001
		≤ 11.5	3(8.6%)	56(87.5%)	

Table-I. Comparison of apachi-II score and in-hospital outcome when stratified for age (years).

Gender			Hospital Outcome		P-Value
			Mortality	Alive	
Male	APACHE II score	> 11.5	45(88.2%)	8(8.3%)	< 0.001
		≤ 11.5	6(11.8%)	88(91.7%)	
Female	APACHE II score	> 11.5	29(90.6%)	2(3.9%)	< 0.001
		≤ 11.5	3(9.4%)	49(96.1%)	

Table-II. Comparison of apachi-II score and in-hospital outcome when stratified for gender.

Duration of Injury (hours)			Hospital Outcome		P-Value
			Mortality	Alive	
< 2	APACHE II score	> 11.5	7(100.0%)	2(11.8%)	< 0.001
		≤ 11.5	0(0%)	15(88.2%)	
2-4	APACHE II score	> 11.5	34(81.0%)	5(5.6%)	< 0.001
		≤ 11.5	8(19.0%)	85(94.4%)	
< 4	APACHE II score	> 11.5	33(97.1%)	3(7.5%)	< 0.001
		≤ 11.5	1(2.9%)	37(92.5%)	

Table-III. Comparison of apachi-II score and in-hospital outcome when stratified for duration of injury.

All of these are in use in various setups especially in intensive care units depending upon the condition and simplicity of use in that particular unit. It is notable that some additional factors may contribute in final outcome.¹⁶⁻¹⁷ These scoring systems are very important tools for assessment of outcomes of traumatic illness and efficacy of trauma care units. In the past, main focus was on assessment of preventable mortality. With the passage of time the focus was shifted to tools which measure outcomes of patients after injury more accurately. These scoring systems have some strengths and weaknesses if used individually. The choice of scoring system varies according to setting, patients group, feasibility and applicability of scoring system in that particular setup.

APACHE system was introduced in 1981. It was used to classify severity of disease and prediction of future events in disease. In 1985, 12 physiologic measurements, age and previous health status were incorporated in APACHE I to develop APACHE II. It does not depend on prior therapeutic interventions or specific disease conditions. Despite newly developed scoring systems, APACHE II is still in common use for clinical research and audit owing to its easy use and consistency.

In 2016 a prospective study was conducted to observe the value of different prognostic scores used to predict mortality after admission. A total of 9549 patients were included. 1276 patients (13.3%) out of total patients died after admission in intensive care unit. Survivors and non survivors had different characteristics.¹⁸ In our study, we had highest mortality i.e. out of 230 cases in hospital mortality occurred in 83(36.1%) while other 146(63.5%) were alive within 24 hours of admission.

A study conducted in China on 98 geriatric trauma patients revealed that APACHE II may be more favorable in clinical decision making. In his study the overall mortality was 35.7%. In this study GCS, RTS and APACHE II were significantly different in survivors and non-survivors. The abilities of APACHE II and TRISS to predict group

mortality were examined by receiver operating characteristic curve analysis (ROC), two by two decision matrices, and calibration curve analysis. APACHE II had 0.898 ± 0.032 area under the curve whereas TRISS had 0.824 ± 0.043 . With decision criterion of .5 the sensitivity, specificity and correct classification of APACHE II was 57.1%, 95.2%, and 81.6% respectively concluding APACHE II a more specific score.¹⁹ These results are comparable in term of specificity to our study which had specificity of 93.2%. But our study had more sensitivity.

In 2015 a study by Agarwal et al was carried out in orthopedic poly trauma patients in ICU of hilly terrain. It was a retrospective study and included 95 patients. Sensitivity of APACHE II was 90.91% whereas specificity was 72.50%. The sensitivity in this study is comparable to our study however it had a lower specificity. He also compared with TRISS and concluded that APACHE II is far better than TRISS in prediction of survival especially if calculated at the time of admission.²⁰

CONCLUSION

According to the findings of this study, we found that APACHE II is highly accurate for prediction of hospital mortality with high sensitivity, specificity, PPV, NPV and diagnostic accuracy as 89.16%, 93.2%, 88.1%, 93.84% and 91.74%. Using APACHE II in future we can devise an efficient treatment plan for poly trauma patients to reduce the probability of hospital mortality.

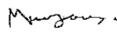
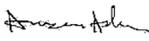
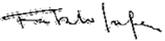
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AUTHORSHIP AND CONTRIBUTION DECLARATION

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2	Mudassar Murtaza	Concept design, supervision of study and manuscript writing.	
3	M. Ansar Aslam	Data collection.	
4	Fakhar Irfan	Author os resultts to and tables.	
5	Hira Liaqat	Data analysis and statistics.	
6	Ahmed Raza Naumani	Collection and writing of references.	