ORIGINAL ARTICLE

Prediction of Outcome in Critically ill Patients with Perforation Peritonitis Using APACHE-II Scoring System

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ABSTRACT

Background: Perforation peritonitis is a common condition encountered in surgicalemergency in third world countries and most of these patients are managed in critical care units. APACHE-II scoring system was outlined in 1985 by Knaus et al and is still in use for the prediction of outcome in critical care patients.
Aim: To find out the level of accuracy of APACHE-II scoring system in the prediction of outcome in critically ill patients with perforation peritonitis.
Methodology: Study was carried out in 10 bedded ICU in Lahore General Hospital, Lahore, Pakistan from 2012 to 2016. Five hundred and seventeen patients with perforation peritonitis were included in the study after their informed consent. Prediction of outcome for each patient was done through APACHE-II equation by using the obtained variables. Actual/Observed outcome of each patient was documented in the form of discharge from ICU or death in the ICU. Predicted mortality rates were compared to the actual/observed mortality rates and Standardized Mortality Ratios (SMR), sensitivity and specificity were calculated. Statistical analysis was done using Software Package for windows, IBM SPSS version 20. Area under the ROC curve was measured to test the discrimination. Standardized Mortality Ratios were calculated with ninety five percent confidence intervals and difference between predicted and observed mortality rates were analyzed.
Results: Mean APACHE-II score of 517 patients included in our study was (17.39 ± 5.36) with minimum score of 9 and maximum score of 38. Sensitivity, specificity and diagnostic value of APACHE-II scoring system turned out to be 97.7%, 90.7% and 91.87% respectively with an SMR of 0.696. Area under the Receiver Operating Characteristics Curve was found to be 0.907.
Conclusion: APACHE-II scoring system is a reliable predictor of outcome in criticalcare patients with perforation peritonitis.
Key words: peritonitis, critical care, APACHE, scoring system, outcome, mortality, sensitivity, specificity, SMR,

INTRODUCTION

Perforation peritonitis is a common condition encountered in surgical emergency in third world countries. It is the inflammation of peritoneum secondary to the perforation in the wall of hollow viscus. It may be there in the form of enteric perforation, tuberculous perforation, traumatic perforation, peptic ulcer perforation or perforated diverticulum etc.

These patients are usually critically ill when they present in surgical emergency and evaluation for prognosis is desired early after the admission. Prediction of prognosis for these patients is always helpful in management plans for the patients and management of allocated resources for health, which are always scarce in third world countries.

Several systems have been devised for evaluation of prognosis of the critically ill patients and one of them is Acute Physiology Age and Chronic Health Evaluation (APACHE) Scoring System, used worldwide to predict the outcomes and to monitor the performance of intensive care units (ICUs). APACHE-II scoring system was outlined in 1985 by Knaus et al and is still in use. APACHE-II scoring system takes into account different variables related to acute physiology of the patient in first twenty four hours of admission, age of the patient and few chronic conditions related to health of the patient. Worst readings of these variables in first twenty four hours of admission are used by

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the scoring system to predict the outcome of the patient in the form of expected mortality rate.

The purpose of this study was to find out the level of accuracy of APACHE-II scoring system in the prediction of outcome in critically ill patients with perforation peritonitis.

METHODOLOGY

Study was carried out in 10 bedded ICU in Lahore General Hospital, Lahore, Pakistan from 2012 to 2016. Five hundred and seventeen patients with perforation peritonitis were included in the study after their informed consent. All the patients were admitted in ICU through surgical emergency. Worst values on all the variables required by APACHE-II scoring system were documented in the way recommended by APACHE user manual. These values were obtained through clinical history, examination, investigations, per-operative findings and the monitoring of the patients included in the study. Prediction of outcome for each patient was done through APACHE-II equation by using the obtained variables. All the patients were managed in the ICU through multidisciplinary approach. Actual/Observed outcome of each patient was documented in the form of discharge from ICU or death in the ICU. Data was compiled, tested for normality and managed accordingly. Predicted mortality rates were compared to the actual/observed mortality rates and Standardized Mortality Ratios (SMR), sensitivity and specificity were calculated. Statistical analysis was done using Software Package for windows, IBM SPSS version 20.

Receiver Operating Characteristics (ROC) curve which is the graphical presentation of true positive rate versus false positive rate, was drawn for APACHE-II scoring system. Area under the ROC curve was measured to test the discrimination. Standardized Mortality Ratios were calculated with ninety five percent confidence intervals and differences between predicted and observed mortality rates were analyzed.

RESULTS

Five hundred and seventeen (517) patients were included in our study. Average age of patients in our study was 39.98±14.19 years with minimum of 18 years and maximum of 77 years. Out of 517 patients 312 (60.3%) were males and 205 (39.7%) were females with male to female ratio of (1.5 : 1.0).

APACHE-II predicted that 125/517 patients will show outcome as death in ICU which is 24.2% and 392/517 patients will show the outcome as Discharge from ICU which was 75.8%. While the actual/observed outcome showed that 87/517 (16.8%) patients underwent mortality and 430/517 (83.2%) were discharged from the ICU as shown in table 1.

Mean APACHE-II score of 517 patients included in our study was (17.39±5.36) with minimum score of 9 and maximum score of 38. Sensitivity, specificity and diagnostic value of APACHE-II scoring system turned out to be 97.7%, 90.7% and 91.87% respectively with an SMR of 0.696.

Sensitivity: 85/87 x 100 = 97.7%, Specificity: 390/430 x 100 = 90.7%, SMR: 87/125 = 0.696, Diagnostic value: (85+390)/517 x 100 = 91.87% Mean APACHE-II score of the non-survivors group was (26.02±4.88) with range and variance of 19 and 23.83 respectively. The mean APACHE-II score of survivors group was (15.64±3.41) with range of 16 and variance of 11.65 as shown in table 2.

Area under the Receiver Operating Characteristics Curve was found to be 0.907 with lower bound of 0.870 and upper bound of 0.945 with 95% confidence interval as shown in Table 3.

Table 1: APACHE-II Predicted Ratios versus Observed Ratios

	Situation		Total
	Non survivor	Survivors	
Predicted			
Deaths	85	40	125
Discharges	2	390	392
Observed	87	430	517

Table 2: Comparison of Survivors and Non-Survivors Scores:

Group	N	Mean	SD	Range	V
Non survivors	87	26.02	4.88	19	23.83
Survivor	430	15.64	3.41	16	11.65
P	.0001	.0001	.0001	.0001	.0001

Table 3: Area under ROC Curve

Area	Std Error	Asumptotic Sig	95% confidence interval	
			Lower bound	Upper bound
0.907	0.019	0.000	0.870	0.945

Fig. 1: Comparison of observed and predicted mortality rates
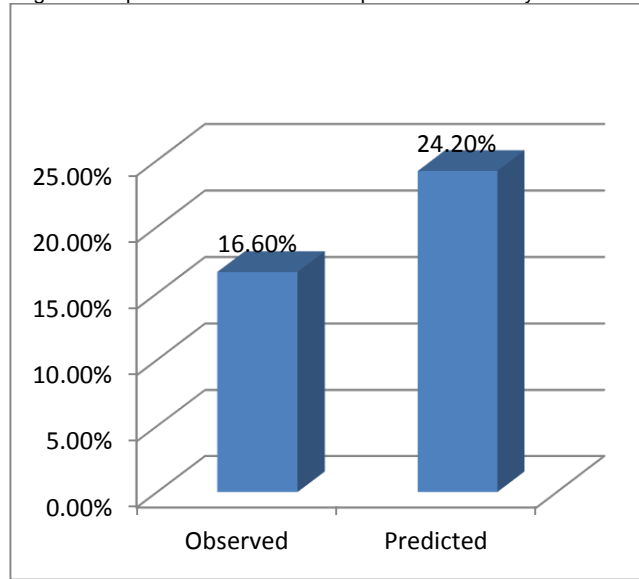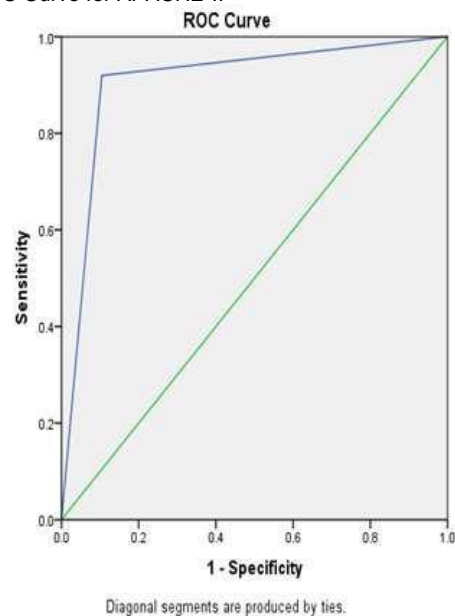

Fig. 2: ROC Curve for APACHE-II

Diagonal segments are produced by ties.

DISCUSSION

Prediction of mortality in critical care patients is highly desired regarding the decision making for management of patients and the management of health resources. For this purpose different scoring systems are being used in the world with different equations. Acute Physiology Age and Chronic Health Evaluation (APACHE) scoring system is one of the most commonly used predictors of mortality in critical care patients. APACHE-II equation was devised in 1985 by Knaus et al and is still in use to predict the outcomes in critical care patients worldwide. It is still considered a reliable tool. Evolution of the system continued and later on APACHE-III scoring system was developed, which couldn't become so popular. The latest

equation was developed in the form of APACHE-IV equation and is also being used worldwide.

As the APACHE-II equation is based upon the old data from 1979 to 1982 and is still being used where the standards of management of patients have been changed with time. So it was desired to evaluate the efficacy of APACHE-II scoring system under current protocols of the management of patients in critical care units.

In our study APACHE-II predicted the mortality rate of 24.2% in patients with perforation peritonitis in critical care unit while the actual/observed mortality rate came out to be 16.8% as shown in figure 1. This showed that the prediction of mortality rate by APACHE-II was a little higher than the actual mortality rate. Observed mortality rate in our study was comparable to other studies conducted previously.

Sensitivity and specificity of APACHE-II scoring system for the prediction of mortality rate was 100% and 86.1% respectively according to Ayazoglu TA. Kulkarni et al found that sensitivity and specificity of APACHE-II was 87.5% and 100% respectively in patients with perforation peritonitis. Our study showed almost comparable level of sensitivity of APACHE-II which was 97.7% and specificity which was 90.7%.

According to Samir et al in their study area under the ROC curve for APACHE-II score was 0.86 in critical care patients with perforative peritonitis. In our study the area under the ROC curve for APACHE-II score came out to be 0.90 as shown in figure 2. Thus it is comparable to the results of above said study and the other reported values in different studies.

Overall results of our study came out to be comparable to the previous studies regarding the accuracy of APACHE-II scoring system in prediction of outcome in critical care patients, with slight differences.

CONCLUSION

APACHE-II scoring system is a reliable predictor of outcome in critical care patients with perforation peritonitis.

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