MORTALITY RATE PREDICTION IN THE CRITICALLY ILL PATIENTS BY USING APACHE-II SCORING TOOL

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ABSTRACT

OBJECTIVES

The study's objective was to implement a methodological approach, "Acute Physiological and Chronic Health Evaluation II (APACHE-II)," to classify critically ill patients based on severity.

METHODOLOGY

A retrospective study design was conducted at Shaukat Khanum Memorial Cancer Hospital Lahore, Pakistan, from May 2019 to May 2020. A pilot study of 6 months was conducted by reviewing the medical record of 30 adult patients following convenient sampling after the approval of the proposal by ASRB/IRB of Shaukat Khanum hospital. The record of both male and female patients was studied, while no record of paediatric or adult patients outside the ICU was studied. Each patient's severity score was obtained using the patient's parameters with the help of the APACHE-II table.

RESULTS

Among the patients, three out of 30 scored 25, 29 and 30 on APACHE-II. These patients later passed away in ICU. This indicates that the mortality rate increases with an increase in the APACHE-II score. Thus, the scoring system is very beneficial in predicting adult ICU patient's mortality rate.

CONCLUSION

It is concluded that APACHE II is one of the best severity scoring system in predicting the critical condition of patients.

KEYWORDS: *APACHE, Critically Ill Patients, Adult Patient, Mortality Rate, Intensive Care Unit*

INTRODUCTION

Critical care units are designed to deliver medical and nursing care to severely sick patients. In some hospitals, there is no critical care unit, while other tertiary care hospitals have multiple specialized ICUs like surgical ICU, medical ICU and cardiac ICU.[1] In the 1950s and early 1970s, physicians acknowledged that in life-threatening situations, patients should be placed in specialized areas of the hospital called Intensive Care Units.[1,2] The reason was to provide intensive management and lifesaving therapy for patients following critical illness, major injury or surgery.[3] In the intensive care unit, critically ill patients are admitted to manage life-threatening emergencies and to increase the chance of survival.[2] The patients admitted to ICU may be more or less critical; the severity of illness is calculated from various physiological variables on admission to the critical care unit.[4] The care provided to the patient is documented, and different diagnostic tests are performed ongoing bases. To predict the mortality rate and length of ICU stay, we can utilize the data from patient medical records.[5] The Acute Physiology and Chronic Health Evaluation II (APACHE-II) is one of the most effective scoring systems, first developed in George Washington University Medical Centre United States of America.[6] This system is commonly used in critical care units to assign scores based on different physiological variables.[4] There are four categories, namely APACHE-I, APACHE-II, APACHE-III and APACHE-IV, but the most widely used system is APACHE II which was developed in 1985.[7] The difference is based on incorporating many alterations according to the number of variables. The number of variables in APACHE - II is 12. There were more variables in APACHE I. According to APACHE II, a score of 25 mean a predicted mortality rate of 50% and more than 35 predicted 80% mortality.[8] This scoring system is based on the degree of deviation in the functioning of major organ systems.[7] The APACHE-II score is composed of three main parts: a) 12 critical physiological parameters, these are level conscio-usness, body temperature, mean arterial pressure, heart rate, respiratory rate, pH, Oxygenation, Na+, K+, Creatinine, leukocyte and haematocrit levels.[9] The second part is the patient's age, and the third consists of chronic illnesses like liver cirrhosis, heart failure, chronic obstructive pulmonary disease, chronic renal failure and immune deficiency.[9] Two extra points must

be added to the score of all those patients admitted with any of the above chronic health problems.[10,11,6] The purpose of this project was to predict the mortality rate and length of patient stay in the Intensive Care Unit (ICU).

METHODOLOGY

In this pilot study, a retrospective analysis of patients was carried out in ICU. These patients were admitted with different complications from Shaukat Khanum Memorial Cancer Hospital and Research Centre units to the hospital's intensive care unit. The population included in the study was only Intensive Care Patients. A sample of 30 patients, including males (56.66%) and females (43.33%), was randomly taken, and a computer record of the above physiological variables was analyzed. All paediatric patients were excluded because the physiological parameters of adult patients carry different values from that of paediatric patients. Adult patients outside ICU were also excluded. A score was given in the light of APACHE- II by measuring different parameters. These parameters include age, chronic diseases and 12 basic physiologic parameters given in table 1. The ages of all the patients were above 18 years. Both male and female patients were included in this study.

Table 1: APACHE II Score

	High Abnormal Range					Low Abnormal Range			
(Physiologic Variable)	+4	+3	+2	+1	0	+1	+2	+3	+4
(Temperature Rectal (^{O}c)	≥41	39-40.9	-	38.5-38.9	36.0-38.4	34-35.9	32-33.9	30-31.9	<=29.9
(Mean Arterial Pressure	≥160	130-159	110-129	-	70-109	-	50-69	-	<=49
(Heart Rate)	≥180	140-179	110-139	-	70-109	-	55-69	40-54	<=39
Respiratory Rate	≥50	35-49		25-34	12-24	10-11	6-9	-	<5
Oxygenation A-Ado$_2$ Or Pao$_2$(Mmhg) a)Fio$_2$>0.5:Record A-Ad	≥500	350-499	200-349	-	<200	-	-	-	-
B)Fio$_2$<0.5:Record Only Pao$_2$	-	-	-	-	>70	61-70	-	55-60	<55
Ph	≥7.7	7.6-7.69	-	7.5-7.59	7.33-7.49	-	7.25-7.32	7.15-7.24	<7.15
Serum Na	≥180	160-179	155-159	150-154	130-139		120-129	111-119	<=110
Serum K	≥7	6-6.9	-	5.6-5.9	3.5-5.4	3-3.4	2.5-2.9	-	<2.5
Serum Creatinine	≥3.5	2-3.4	1.5-1.9		0.6-1.4	-	<0.6	-	
Hematocrit	≥60	-	50-59.9	46-49.9	30-45.9	-	20-29.9	-	<20
White Blood Count	≥40	-	20-39.9	15-19.9	3-14.9	-	1-2.9	-	<1
Glasgow Coma Scale (GCS)	Score = 15 minus actual GCS								
Total Acute Physiology Score (Aps)	Sum of the 12 individual variable points								

RESULT

Out of 30 patients, 12 (40%) patients were admitted from the operation room, 03 (10%) from the emergency room, 01 (3.33%) from chemotherapy and 13 (43.3%) from the inpatient department were admitted. Out of 30 patients, 09 (30%) patients were admitted for monitoring after surgery, 03 (10%) were due to hemodynamic instability following surgery, 07 (23.3%) had postcode management, 05 (16.66%) with sepsis and 06 (20%) with other problems such as shortness of breath, electrolytes imbalance and decrease level of consciousness. Seven patients were admitted with chronic secondary health problems, while the remaining 23 had no secondary health issues. Four patients (13.33%) were readmitted once shifted from ICU, and three passed away. APACHE II scores were 25, 29 and 30. Two of them were females aged 53 years and 61 years and one male aged 68, respectively. The mortality rate was low in patients with low APACHE-II scores in the first 24 hours of ICU admission.

Table 2: Number of Patients with APACHE-II Score

APACHE II Score	Number of Patients
00-9.9	06 (20%)
10-19.9	15 (50%)
20-29.9	08 (26.6%)
30-39.9	01 (3.33%)

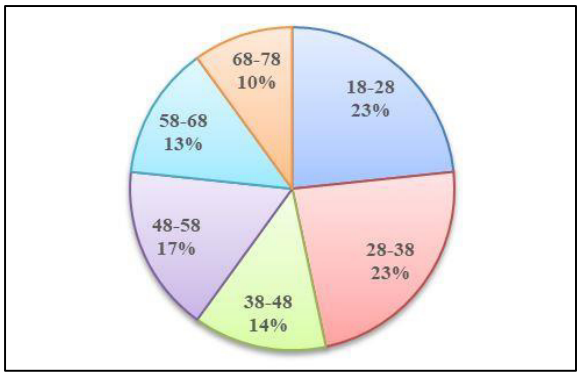

Figure 1: Age-Related Percentage of the Patient Admitted to ICU

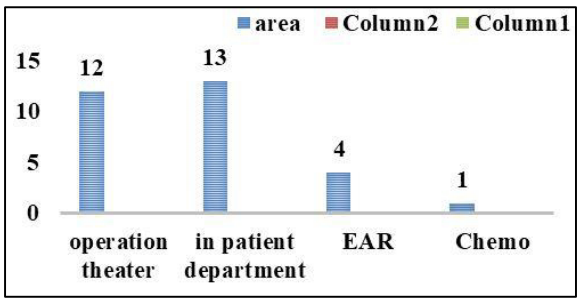

Figure 2: Number of Patients with the Area of Transfer

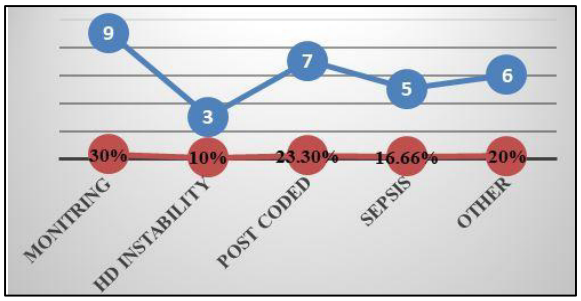

Figure 3: Percentage and Cause of Transfering to ICU

DISCUSSION

Different variables were assessed to know the severity of the patient in the intensive care unit. Patient age, chronic diseases and 12 basic physiologic parameters can be assessed to know patient severity.[12] Similar studies suggested that the increase in APACHE II is directly proportional to the increase in mortality rate. If the APACHE score is 25, the mortality rate will be 50%, while if the APACHE score is 35, the mortality score will be 80%.[8] In our study, the APACHE scores of the three patients were 29, 30 and 25, respectively, and all passed away during their ICU stay. The analysis of the spectrum of critical care admissions in this study indicates that a large proportion of admissions in ICU followed by surgical procedure and post-cod blue management from the inpatient department. Adult patients admitted for postcode management had higher mortalities, as demonstrated in the study at (SKMCH&RC). APACHE- II scoring results are more reliable to utilize resources and alert the health care professional on time. However, using a computer is very important to scan numerical data at high speed.[13] This study assessed patient computer records and different physiologic variables were analyzed. The score was given according to the value of each variable. The scoring was done in the initial 24 hours of addition. The previous studies recommend that to predict better results, the APACHE-II scoring should be done as early as possible.[14,15] In this study, the record of the only adult patient was reviewed, and their mortality rate was analyzed. The relevant study suggests that the APACHE-II tool is beneficial in predicting the death rate in critically ill adult patients only.[16,6] It was also found that this system was inappropriate for neonates and the paediatric population. It is because many physiologic variables considered abnormal for adults may be normal for neonates and paediatric patients depending on organ function according to age factor.[17] It is also observed that all the patients in this study were taken from cancer hospitals. In contrast, the study reveals that the physiologic variables of cancerous patients may differ from those of non-cancerous patients.[10] Glasgow Coma Scale (GCS) is another scoring system which is used in all critically ill patients.[4] It remains a critical measure of neurological assessment and assessment of the severity of traumatic injuries at admission or reassessing the patient. However, this measuring scale cannot be used to assess the patient who is sedated, intubated, intoxicated or if the patient has a maxillofacial injury. In addition, APACHE-II also covers the age factor, which is not included in the GCS scoring system.[18,10]

LIMITATIONS

A small number of participants participated in this six-month pilot research. To further increase the efficacy of this sort of study, it is suggested that it be carried out on a broad scale in all major hospitals of Pakistan. It has been observed that the tool's only flaw is its applicability to adult patient values. The tool does not apply to paediatric patients and those admitted to other wards in the ICU.

CONCLUSION

It is concluded that APACHE II is one of the best

severity scoring systems in predicting the critical condition of patients. In this study, different physiologic variables were used to score the severity of the critically ill patient intensive care unit. It is concluded that the mortality rate is directly proportional to APACHE-II. However, some of this scoring system tool's limitations are inapplicable to delayed admission and referral methods. In addition, the tool is inappropriate in predicting the mortality rate of neonates and paediatric patients due to organ functioning or organ development.

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