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Role of some Scoring Systems in Predicting Outcome in Respiratory ICU

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Abstract

Background: Scoring systems for use in intensive care unit (ICU) patients allow assessment of severity of the disease and provide an estimate of in hospital mortality. Also for quantify severity of illness for hospital and health care system administrative and to assess ICU performance and compare the quality of care of different ICUs and within the same ICU over time and used to assess the impact on patient outcomes of planned changes in the ICU, such as changes in bed number, staffing ratios, and medical coverage and to assess the prognosis of individual patients.

Aim of the work: This study to detect the ability of APACHE IV score, ASOFA score in predicting outcome of patients in respiratory ICU.

Patients and methods: A prospective observational cohort study was performed at the respiratory ICU of Bab El- Sharia and Al-Hussein Al- Azhar university Hospitals. The study includes all critically ill patients admitted to the respiratory ICU between November 2014 and April 2015.Data were collected from 100 patients (42 female and 58 male) consecutively admitted to the respiratory ICU (aged 18 years or older, ICU stay at least 24 hours). Patients were excluded from the study were younger than 18 years of age, had coronary artery bypass grafting surgery (CABG) and died or discharged within 24 hours of admission to the respiratory ICU**.**Means of APACHE IV score, length of stay and predicted mortality rate were calculated during the 1st 24 hours. Means of sofa score and length of stay were calculated during the admission. Data were analyzed with SPSS vs 15.

Results: In total of 100 patients the observed mortality rate was 49 %.The mean age in survived patients was 57.216 ± 12.588 and in non-survived patients was 62.694 ± 10.304.There were 26 female and 25 male survived patients and there were 16 female and 33 male non-survived patients. APACHE IV score >81 was kept as cutoff point with sensitivity81.6 % and specificity 80.4 % with AUROC 0.841 . SOFA score >7 was kept as cutoff point with sensitivity95.9% and specificity 100% with AUROC 0.997.

Conclusion: the mortality prediction by APACHE IV and ASOFA scoring systems performs acceptably in our patients and can be utilized as a performance assessment tool in our RICUs and both scores showed good discrimination between survived and non-survived patients with SOFA more accurate in predicting mortality than APACHE IV.

Key words: RICU, APACHE IV score, SOFA score

Introduction:

The severity scoring systems were first introduced for critically ill patients in ICUs in 1980. The basis for their development was the intention to provide information on the prognosis of patients, efficacy of therapeutic interventions, stratification for clinical studies, and benchmarking of ICUs **(1).** Acute Physiology and Chronic Health Evaluation **(APACHE) IV** scoring systems represent classification systems or point systems that have been designed for making quantitative statements regarding the severity of a disease, its course and its prognosis **(2).**These systems are based on physiologic abnormalities and have been successful in measuring severity of

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illness among critically ill patients. The Acute Physiology Score **(APS)** consists of weighted variables representing the major physiologic systems, including neurological, cardiovascular, respiratory, renal, gastrointestinal, metabolic, hematological variables, co-morbidies, admissions, admitting diagnosis. APACHE IV predictions of hospital mortality have good discrimination and calibration and should provide useful benchmarks for evaluating efficiency in ICUs **(3).**The Sequential Organ Failure Assessment **(SOFA)** Score **(4), (5**) has been developed by European Society of Critical Care Medicine (ESCCM), in 1994, as a system for measuring the status of the patient in the ICU. It basically evaluated the six different organ systems separately. Different variables and parameters are included in each of the organ system and a definite score is given to that state varying from 0 - 4, all of which is later added to calculate the SOFA score, (out of a maximum of 24).

Aim of the work: This study to detect the ability of APACHE IV score, ASOFA score in predicting outcome of patients in respiratory ICU.

Patients and methods : A prospective observational cohort study was performed at the respiratory ICU of Bab El- Sha'eria and Al-Hussein university Hospitals. The study included all critically ill patients admitted to the respiratory ICU between November 2014 and April 2015 and randomized selection. Critically ill patients are defined as those patients who are at high risk for actual or potential life-threatening health problems. Critical illness is the impairment of vital organ function or the presence of instability, or the risk of serious and potentially preventable complications. **(6)** The more critically ill the patient is the more likely he or she is to be highly vulnerable, unstable and complex, thereby requiring intense and vigilant nursing care.

Scoring systems have been used; the acute physiology and chronic health evaluation **(APACHE) (7)** and the sequential organ failure assessment **(SOFA)** scoring systems in critically ill patients The Sequential Organ Failure Assessment(SOFA) Score basically evaluate the six different organ systems separately. Different variables and parameters are included in each of the organ system and a definite score is given to that state varying from (0 – 4), all of which is later added to calculate the SOFA score, (out of a maximum of 24). The score increases as the organ system functioning worsens, thus assessment of individual organ dysfunction or failure can be done along with evaluation of patient as a whole. **(8) ,(4**).Data were collected on 100 patients (42 female and 58 male) consecutively admitted to the respiratory ICU (aged 18 years or older, ICU stay at least 24 hours).

All patients were subjected to the followings:

1- Complete history taking.
2- General examination including recording blood pressure, heart rate, body temperature and respiratory rate..
3- Local chest examination.
4- Laboratory investigation including CBC, ESR, serum glucose, renal and hepatic profile, serum sodium and potassium.
5- Arterial blood gases.
6- Recording urine output (ml/24hrs).
7- Length of stay in hospital from admission to discharge.
8- Outcome of patients (cured or died).

Exclusion criteria :Patients who were excluded from the present study include those who were younger than 18 years of age, had coronary artery bypass grafting surgery (CABG) and died or discharged within four hours of admission to the respiratory ICU**.**

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The predictive capability of the APACHE IV and SOFA scores at the best cutoffs was assessed using the receiver operating characteristic (ROC) curve. Discrimination was tested using the ROC curves and by evaluating areas under the curve (AUC).

Admission Criteria to ICU .

Admission to the RICU will be based upon the nature and severity of the patient's acutemedical illness, their need for ICU intervention(s) or monitoring, and the likelihood that suchinterventions and ICU management will improve outcome.

1- Acute respiratory failure requiring mechanical ventilation
2- Shock requiring vasopressors, aggressive fluid resuscitation, and/or invasive monitoring
3- Post cardiopulmonary arrest
4- Pulmonary emboli with hemodynamic instability
5- Patients in an intermediate care unit who are demonstrating respiratory deterioration
6- Respiratory distress or insufficiency requiring intensive therapy and observation
7- Massive hemoptysis
8- Cardiopulmonary conditions which require invasive hemodynamic monitoring
9- Chronic respiratory failure requiring mechanical ventilation**(9).**

Discharge Criteria from ICU

Patients are discharged to various sites with different levels of care provided. These include to another ICU, to the operating room, to a step-down or intermediate care unit, to a standard hospital ward, to a nursing home or extended care facility, . In general, patients being transferred to a lower level of care should have the following characteristics listed below. **(9).**

1-Stabilization of the patient's condition such that vasopressors and mechanical ventilation with an artificial airway are not needed.

2- Absence of a large bore single lumen ; central venous, pulmonary artery, or arterial catheter.

3-Absence of active, inadequately corrected conditions such as electrolyte disturbances , cardiac arrhythmias, or other serious medical illness.

4-Oxygen requirements not more than 60% **(9).**

Results: In the present study the mean age in survived patients was 57.21 ± 12.58 and in non-survived patients was 62.69 ± 10.30 so, there is significant difference between survived and non-survived patients regarding age distribution (P-value=0.019). Table (1)

Table (1): Age distribution among studied patients

Outcome / Age	Survival	Non-survival	T-test	
			t	P-value
Range	26 - 83	40 - 81	-2.376	0.019
Mean±SD	57.21 ± 12.58	62.69 ± 10.30		

In the present study there were 26 female and 25 male survived patients and there were 16 female and 33 male non-survived patients so there is insignificant difference among studied patients regarding sex distribution. (P – Value = 0. 062). Table (2)

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Table (2): Sex distribution among studied patients.

Outcome / Sex	Survival		Non-survival		Total		chi-square	
	N	%	N	%	N	%	X^2	P-value
Female	26	50.98	16	32.65	42	42.00	3.471	0.062
Male	25	49.02	33	67.35	58	58.00		
Total	51	100.00	49	100.00	100	100.00		

In this study the cause of admission was acute exacerbation (AE) of COPD , Obesity hypoventilation syndrome (HS) with infective exacerbation, severe CAP, Interstitial lung diseases (ILD) with infective bronchitis , AE of bronchiectasis, aspiration pneumonia , acute severe asthma and All patients were complicated by respiratory failure before admission to Respiratory Intensive Care Unite RICU . Table (3)

Table (3): The cause of respiratory failure before admission of patients to the RICU.

Outcome / Admission diagnosis	Survival		Non-survival		Total		chi-square	
	N	%	N	%	N	%	X^2	P-value
AE COPD	27	52.9	18	36.7	45	45	36.4	<0.001
Obesity HS	9	17.6	0	0.0	9	9		
severe CAP	7	13.7	23	46.9	30	30		
ILD	0	0.0	4	8.1	4	4		
AE of bronchiectasis	6	11.7	2	4.0	8	8		
aspiration pneumonia	0	0.0	2	4.0	2	2		
Acute severe asthma	2	3.9	0	0.0	2	2		
Total	51	100	49	100	100	100		

The study showed extremely significant difference between survived and non-survived patients regarding the presence of comorbidities. Table (4)

Table (4): The effect of comorbidities on survival status.

Outcome / Comorbidities	Survival		Non-survival		Total		chi-square	
	N	%	N	%	N	%	X^2	P-value
NO comorbidities	45	88.2	30	61.2	75	75	20.8	<0.001
Hepatic failure	2	3.9	13	26.5	15	15		
Non Hodgkin	0	0.0	3	6.1	3	3		

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Lymphoma								
Metastatic carcinoma	0	0.0	2	4.0	2	2		
CRF	4	7.8	1	2.0	5	5		
Total	51	100	49	100	100	100		

In the present study there is insignificant difference between survived and non-survived patients regarding receiving mechanical ventilation during the first 24 hours. Table (5)

Table (5): The effect of receiving mechanical ventilation during the first 24 hours of admission in RICU on mortality .

Outcome / **Mechanical ventilation**	**Survival**		**Non-survival**		**Total**		**chi-square**	
	N	**%**	**N**	**%**	**N**	**%**	**X^2**	**P-value**
Not ventilated	35	68.63	31	63.27	66	66.00	0.320	0.571
Ventilated	16	31.37	18	36.73	34	34.00		
Total	51	100	49	100	100	100		

In the present study the mean APACHE IV in survived patients was 72.0±13.08 and in non-survived patients was 105.2±29.9 so, there is a highly significant difference between survived and non-survived patients regarding values of APACHE IV score (P-value<0.001). Table (6)

Table (6): APACHE IV score among studied patients.

Outcome / **APACHE IV score**	**Survival**	**Non-survival**	**T-test**	
			t	**P-value**
Range	33 - 98	59 - 163	-7.2	<0.001
Mean±SD	72.0 ± 13.08	105.2 ± 29.9		

In the present study the mean SOFA in survived patients was 5.0 ± 1.48and in non-survived patients was 12.5 ± 2.45 so, there is a

highly significant difference between survived and non-survived patients regarding values of mean SOFA score (P-value <0.001). Table (7)

Table (7): SOFA score among studied patients

Outcome / **SOFA score**	**Survival**	**Non-survival**	**T-test**	
			t	**P-value**

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Range	2 - 7	7 - 17	-18.6	<0.001
Mean±SD	5.0 ± 1.48	12.5 ± 2.45		

In the present study the mean predicted mortality rate in survived patients was 27.16 ± 15.91 and in non-survived patients was 52.27 ± 22.83 so, there is highly significant difference between survived and non-survived patients regarding predicted mortality rate by APACHE IV score(P-value<0.001). Table (8)

Table (8): Predicted mortality rate (MR) by APACHE IV score.

Outcome / **Predicted MR by APACHE IV score**	**Survival**	**Non-survival**	**T-test**	
			t	**P-value**
Range (%)	0.76 - 64.9	15.16 - 93.07	-6.4	<0.001
Mean±SD (%)	27.1 ± 15.91	52.2 ± 22.8		

In the present study , there is highly significant difference between survived and non-survived patients regarding predicted mortality rate by SOFA score. Table (9)

Table (9): Predicted mortality rate by SOFA score

Outcome / **Predicted MR by SOFA**	**Survival**	**Non-survival**	**T-test**	
			t	**P-value**
Range (%)	7 - 22	22 - 95	-15.2	<0.001
Mean± SD (%)	18.6 ± 5.52	73.3 ± 24.96		

In this table, the predicted mortality rate for all patients was 39.46 %, and observed mortality was 49% Table (10)

Table (10): Predicted mortality rate for all patients by APACHE IV and observed mortality .

Predicted mortality rate for all patients	
Range (%)	0.76 - 93.070

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Mean±SD (%)	39.4±23.23
P-value	0.9
Observed mortality %	49%

In the present study the mean predicted (LOS) at ICU in survived patients was 5.6 ± 1.17and in non-survived patients was 5.4 ± 1.44(P-value=0.434). and the mean observed (LOS) at ICU in survived patients was 5.1±1.7 and in non-survived patients was 6.6±4.79(P-value=0.032).Table (11)

Table (11):Length of stay (LOS) at ICU.

Outcome **ICU Length Of Stay LOS**		**Survival**	**Non-survival**	**T-test**	
				t	**P-value**
Predicted by APACHE IV	**Mean±SD (days)**	5.6 ± 1.17	5.4 ± 1.44	0.78	0.434
Observed LOS	**Mean±SD (days)**	5.1 ± 1.71	6.6 ± 4.79	-2.1	0.032

Figure (1) Mean for predicted and observed length of stay by APACHE IV in survival and non survival patients.

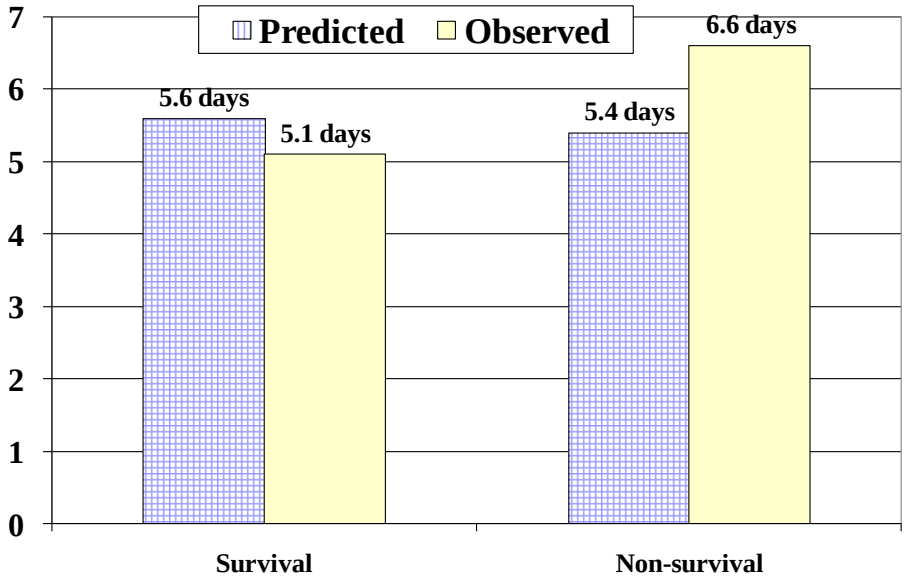

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Table (12): Correlations between Predicted LOS and Observed LOS.

Correlations between Predicted LOS and Observed LOS	
r	**P-value**
0.301	0.002

Significant positive correlation between Predicted LOS and Observed LOS where r=0.301 and P-value=0.002

In the present study, the cutoff point of APACHE IV score between survived and non-survived patients was> 81 with sensitivity 81.6 % and specificity 80.4% and AUROC was 0.81 showed good discrimination between survived and non-survived patients. Table(12)

Table (13): ROC curve between mortality and APACHE IV score

ROC curve between mortality and APACHE IV score					
Cutoff	**Sens.**	**Spec.**	**PPV**	**NPV**	**Accuracy**
> **81**	81.6	80.4	80.0	82.0	**84.1**

Figure (2A): ROC curve between mortality and APACHE IV score

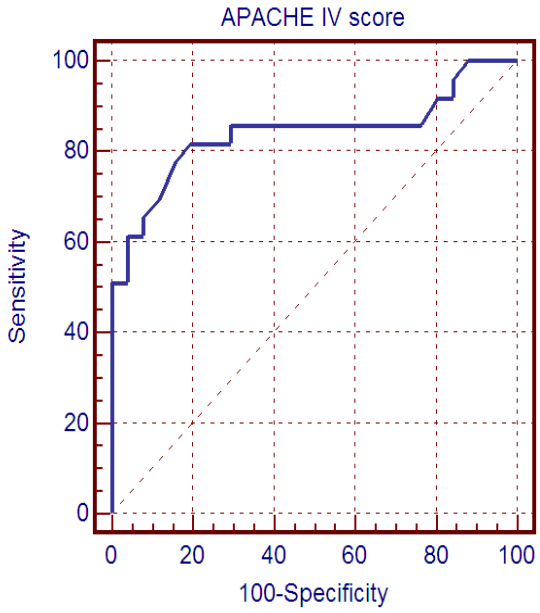

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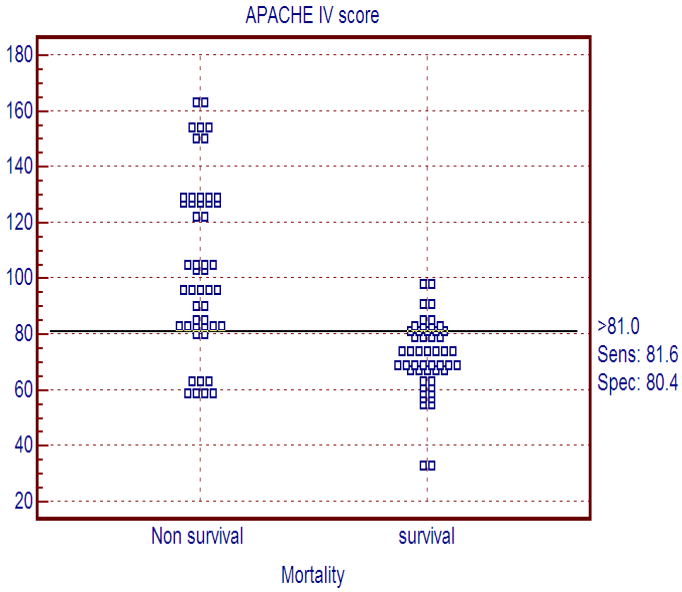
Figure (2B): ROC curve between mortality and APACHE IV score



In the present study, the cutoff point of SOFA score between survived and non-survived patients was> 7 with sensitivity 95.9 % and specificity 100% and AUROC was 0.997 showed good discrimination between survived and non-survived patients. Table(13)

Table (14): ROC curve between mortality and SOFA score

ROC curve between mortality and SOFA score					
Cutoff	**Sens.**	**Spec.**	**PPV**	**NPV**	**Accuracy**
> 7	95.9	100.0	100.0	96.2	**99.7**

Figure (3A): ROC curve between mortality and SOFA score

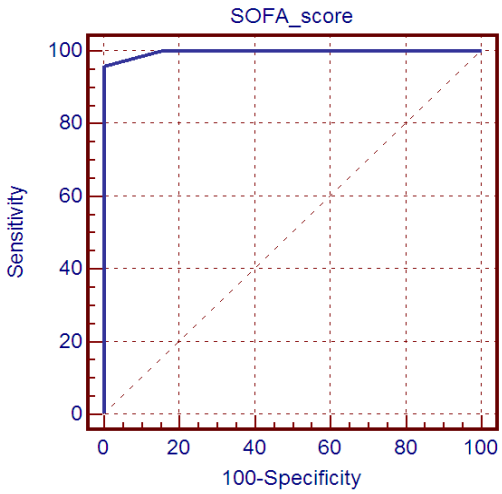


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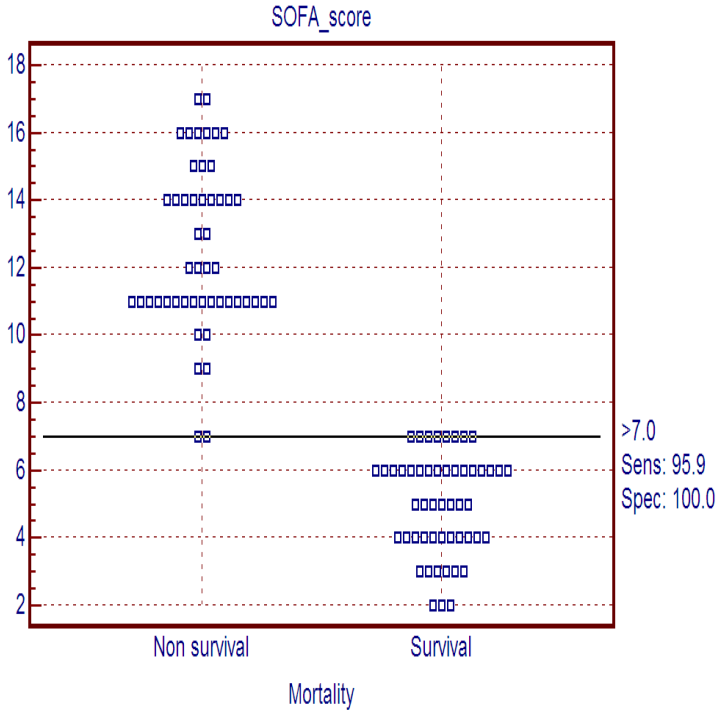
Figure (3B): ROC curve between mortality and SOFA score



In this study the accuracy in predicting mortality by SOFA score more than by APACH IV score Figure (4a,4b)

Figure (4a): comparison between APACHE IV and SOFA scores regarding the accuracy

Difference between areas = 0.156
Standard error = 0.039
95% Confidence interval = 0.079 to 0.233
P-value <0.001

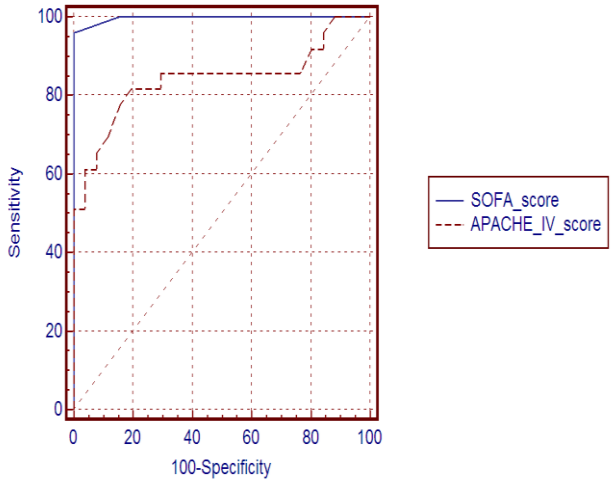


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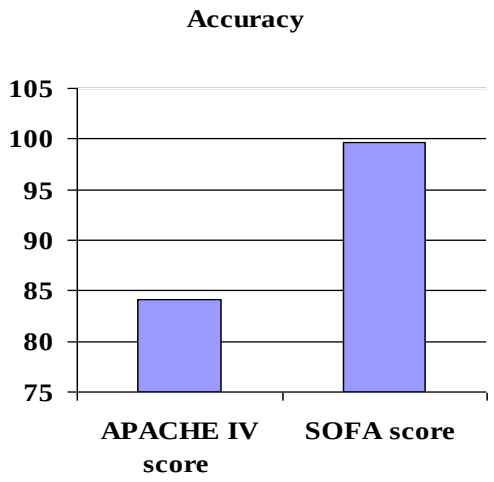
Figure (4b): comparison between APACHE IV and SOFA scores regarding the accuracy



Discussion

In this study, we determined the APACHE IV score and mean SOFA score during the first 24 hours and during the period of admission to the RICU. The outcome measure was ICU mortality. The observed mortality rate in this study was 49 %. This study has the advantage of evaluating these scores in the RICU, which was rarely tested in previous studies, general and surgical ICUs were mostly the environment under test. The area under the receiver operating characteristic curve (AU-ROC) was used to evaluate the ability of each model to predict discriminate between patients who survive from those who died (discrimination).

In the present study the mean age in survived patients was 57.2 ± 12.58 and in non-survived patients was 62.6 ± 10.30 so, there is a significant difference between survived and non-survived patients regarding age distribution (P-value=0.019) **(**Table 1), this agrees with **Kamal et al., 2013** who reported that mean age for survived was 28.8 and for non-survived was 47.9 P value= 0.000 **(5).** And **Moses et al., 2015** who reported that mean age for survived was 31.6±11.99 and for non-survived was 38.8±16.18**(10) .**

In the present study 26 female and 25 male patients were survived, while 16 female and 33 male patients were non-survived. There was insignificant difference among studied patients regarding sex distribution. (P – Value = 0. 062) (Table 2), this agrees with **Ayazoglu 2011** who found that 10 female and 26 male survived patients and 9 female and 10 male for non-survived P value= 0.146**(11), Kamal et.al., 2013** who found that 9 female and 23 male survived patients and 7 female and 8 male for non-survived P =value 0.127 **(5**) .

The admission diagnoses at ICU were AE COPD with respiratory failure 45 cases , severe community acquired pneumonia with respiratory failure 30 cases, obesity hypoventilation syndrome with respiratory failure 9 cases, AE of bronchiectasis with respiratory failure 8 cases, ILD with respiratory failure 4 cases, aspiration pneumonia with respiratory failure 2 cases and acute severe asthma with respiratory failure 2 cases. (Table 3)

In this study, it was obvious that the presence of comorbidities had a reflection on the survival status of patients **.** Comorbidities were present in 25 patients with the survival status distributed as following: Hepatic failure 15 cases : 2 survived and 13 non-survived, Non-Hodgkin lymphoma 3 cases: all were non-survived, Metastatic carcinoma 2 cases : all were non-survived, Chronic renal failure 5 cases : 4 survived and 1 non-survived.(Table 4).

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In this study, there was insignificant relation between early need for mechanical ventilation MV first 24 hours following Respiratory Intensive Care Unite RICU admission and the survival status of patients P value 0.571.Thirty four patients received early MV, among them 16 were survived and 18 were non-survived. (Table 5)

In the present study the mean value of APACHE IV in survived patients was 72.0 ±13.08 and in non-survived patients was 105.2 ±29.95 so, there is highly significant difference between survived and non-survived patients regarding values of APACHE IV score P-value <0.001 (Table 6) , this agrees with **Yamin et al., 2011** who found that mean APACHE IV in survived patients was 54.5 ±25.32 and in non-survived patients was 85.0 ±30.39 **(12),Moses et al., 2015** who foud that mean APACHE IV in survived patients was 32.7±11.11 and in non-survived was patients was 76.7±10.75 P value< 0.0001 **(10**) and **Kamal et.al., 2013** who reported that mean APACHE IV in survived patients was 78.9±12.6 and in non-survived was patients was 106.4±2.9 P value =0.000 **(5).**

In the present study the mean value of SOFA in survived patients was 5.0 ± 1.48 and in non-survived patients was 12.5 ± 2.45 so, there is highly significant difference between survived and non-survived patients P-value <0.001 (Table 7**)** , this agrees with **Acharya et.al., 2007** who found that ,the non-survived had high mean SOFA score as compared to survived P value < 0.001**(13), Yıldız et.al., 2010** who found that, mean SOFA in survived was 3.8±2.21 and in non-survived was 6.1 ±3.27 P value 0.004 **(14), Mansour et.al., 2013** who found that mean SOFA in survived was 4.9±2.49 and in non-survived was 6.1±2.76 P value 0.028 **(15)** and **Shrestha et.al., 2011** who found that mean SOFA in survived was 6.3±3.15 and in non-survived was 11.8±3.64 P value < 0.001 **(16)** .

In the present study the mean predicted mortality rate by APACHE IV score in survived patients was 27.1 % ± 15.91and in non-survived patients was 52.2%± 22.833. There is a highly significant difference between survived and non-survived patients P-value <0.001 (Table 8). These results agree with **Kamal et.al., 2013** who found that predicted mortality rate in survived was 0.38±0.11 and in non-survived was 0.66±0.12 P value= 0.000**(5**) and **Ayazoglu 2011** who found that predicted mortality rate in survived was 0.38±0.09 and in non-survived was 0.65±0.11 P value= 0.000 **(11).**

In the present study the predicted mortality rate in survived patients by SOFA score was 18.6 % ±5.52 and in non-survived patients was 73.3% ±24.96.There is highly significant difference between survived and non-survived patients P-value <0.001 (Table 9).These results agree with **Acharya et.al., 2007** who found that The mean SOFA score when > 7, predicted mortality of 73.9 % P value 0.00002 **(13).**

In the present study the predicted mortality rate by APACHE IV in all patients was 39.46 % (Table 10), this agrees with **Mansour etal., 2013** who found that predicted MR 59 **%(15),Yıldız etal., 2010** who found that predicted MR 49.7 % **(14),Ayazoglu 2011** found that predicted MR 36.3 % **(11)** and **Kamal et al., 2013** found that predicted MR 34.04 %**(5)** , but disagrees with **Zimmerman etal., 2006** who conducted a study on 131615 patients at 104 ICUs including medical, surgical, neurological , coronary, cardiothoracic and trauma ICU and the predicted mortality rate was 13.55 %**(17)** Also our results disagrees with **Moses etal., 2015** who conducted a study on 107 patients who were admitted in surgical ICU and the predicted mortality rate was 17.75 %**.(10)**

In the present study the observed mortality rate was 49 % Table 10 , in comparison with other studies the observed mortality rate in **Mansour et.al., 2013** was 55.2**%(15**) , **Acharya etal., 2007** was 40% **(13)** , **Yıldız et al., 2010** was 39.6% **(14)** , **Shrestha etal., 2011** was 37.6% **(16), Ayazoglu 2011** was 34.54 **% (11), Kamal etal., 2013** was 32 % **(5)** , **Yamin etal., 2011** was 28.4

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%(10) , **Moses etal., 2015** was 15.88% **(10**) , **Zimmerman et.al., 2006** was 13.51% **(17), Namendys-Silva etal., 2013** was 20.25**% (18)** and Vincent etal., 2006 was 22% **(19).**

The mortality rate was high in our study because .

1-There is other comorbidities in the patients as 15 cases had hepatic failure , 5 cases had chronic renal failure and 5 cases had malignancy

2-The cases were complicated by severe bronchitis or pneumonia beside the underling cause of admission and all of them were suffering from respiratory failure at the same time .

3-Most studies with low mortality rate were done in general ICUs including post operative surgical patients who were already fit and non complicated.

In the present study the predicted LOS at ICU in survived patients was 5.6 ± 1.17 and in non-survived patients was 5.4 ± 1.44 P-value=0.434 with no statistically significant difference (Table 11). Also, in the present study the observed LOS at ICU in survived patients was 5.1±1.71 and in non-survived patients was 6.6±4.79 P-value=0.032 with statistically significant difference (Table 11). So, there is Significant difference between Predicted LOS and Observed LOS between survived and non-survived patients (P-value=0.002). The observed LOS 5.1±1.71in survived less than the predicted LOS in survival 5.6 ± 1.17 because there is rapid removal of patient to the intermediate care when the patient fulfill the discharge criteria due to rapid turn over in our ICU

This is not in agreement with **Moses et.al., 2015** who found mean predicted LOS in ICU for survived patients was 3.06 ±1.42 and Mean Observed LOS in ICU was 3.81 ±2.01 P value <0.0001 **,** Mean predicted LOS for non-survived patients was 8.87±1.31 and Mean Observed LOS in ICU was 4.59 ±3.39. P value <0.0001**(10), Ayazoglu 2011** who found mean predicted LOS in survived was 6±0.8 and for non-survived was 5.5±0.8 P value 0.021 ,mean observed LOS in survived was 16±6 and in non-survived was 19±8 P value= 0.037 **[11]**and **Yıldız et.al., 2010** found that The median observed LOS was 11.5 days for survived and 5 days for non-survived P value < 0.01 **(14),**

In the present study, the cutoff point of APACHE IV score between survived and non-survived patients was> 81 with sensitivity 81.6 % and specificity 80.4% and AUROC was 0.81 showed good discrimination between survived and non-survived patients (Table 12) and Figure (1A): These results agree with **Kamal et.al., 2013** who conducted a study on comparison between APACHE II and APACHE IV scoring systems in predicting outcome in patients with acute lung injury ALI and the adult respiratory distress syndrome ARDS , they found that the cutoff point of APACHE IV score was > 90 and gives prediction of high possibility of death with sensitivity 94.73 % and specificity 93.74% and the area under ROC curve was 0.92**(5).**

Ayazoglu 2011 who conducted a study on comparison between APACHE II and APACHE IV scoring systems in predicting outcome in patients admitted with stroke to an ICU he found that the cutoff point of APACHE IV score was > 84 and gives prediction of high possibility of death with sensitivity 94.7 % and specificity 94. 4% and the area under ROC curve was 0.93**(11).**

Moses et.al., 2015 who conducted a study on APACHE IV score in abdominal trauma patients in 107 Critically Ill Patients in which they showed patients with an APACHE IV score > 60 were having very high chances of mortality. On this basis 19 patients were having chances of death. But on observation 17 died and 2 patients who were having high APACHE IV score did not died and were discharged **(10).**

Yamin et.al., 2011 who conducted a study for predictive efficacy of APACHE IV at different ICUs in which they showed that at APACHE IV scores more than 81 length of stay decreases and the mortality rate increases **(12).**

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Zimmerman et.al., 2006 who was assess APACHE IV on hospital mortality found that the area under receiver operating characteristic ROC curve was 0.88 **(17).**

In the present study, the cutoff point of SOFA score between survived and non.-survived patients was > 7 with sensitivity 95.9 % and specificity 100% and AUROC was 0.997 showed good discrimination between survived and non-survived patients (Table 14).

These results agree with:

Mansour et.al., 2013 who showed that the cutoff obtained by the ROC curve for SOFA score was 7.5 and area under ROC curve was 0.63, SOFA score was found to be an independent predictor of mortality among the RICU patients; with a unit increase in the SOFA score, there was a 1.2 times higher risk for mortality **[15].**

Shrestha et.al., 2011 who showed that the cutoff point for SOFA score between survived and non-survived patients was 8 with sensitivity 90.91 % and specificity 65.75% and the area under receiver operating characteristic ROC curve for SOFA score was 0.879 **(16).**

Acharya et.al., 2007 showed that the cutoff obtained by the ROC curve for SOFA score was 7 and area under ROC curve was 0.825 **(13).**

In comparison between APACHE IV and SOFA scores regarding the accuracy AUROC the SOFA score was more accurate than APACHE IV score P-value < 0.001 (Figure 4a,b).

Conclusion:

The present study demonstrates that the mortality prediction by APACHE IV and ASOFA scoring systems performs acceptably in our RICU patients and can be utilized as a performance assessment tool in our RICU and both score showed good discrimination between survived and non-survived patients ,with SOFA more accurate in predicting mortality than APACHE IV.

APACHE IV and SOFA scoring systems can help the ICU physicians in admitting patients, monitoring the clinical course, assessment of organ dysfunction, predicting mortality, and for transferring patients out from the ICU and thus in proper utilization of ICU resources also in developing countries like our, where the resources are limited.

Recommendations

The study recommendations are:

1-Use of a regularly recalibrated scoring system

2-Use of a scoring system that provides mortality and LOS performance data

3-Regular review of performance data with ICU staff and hospital leadership

4-Analysis of hospital discharge location data to monitor for “leakage” of adverse outcomes

5-APACHE IV can be used as it shows good prediction of mortality and LOS among all ICU patients

6-SOFA score can be used as it shows good assessment of organ dysfunction during ICU admission

7-More researches are needed to evaluate the predictive efficacy of APACHE IV and SOFA scores in different diseases and at other ICUs

8-Further studies with greater number of patients, more frequent measurement of variables and comparison between different scoring systems is required to improve the accuracy.

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