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Comparitive Study of Predicting Prognosis of Obstetric Patient Admitted in Icu By Sofa And Apache Scores

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Abstract
Aim & objective:- *comparative study of predicting prognosis of obstetric patient admitted in icu by sofa and apache scores*
Methods:- *It was a prospective study done on 50 patients in the department of obstetrics and gynecology in Gandhi hospital,Secunderabad, from January 2014 to November 2015.*
Comparison and analysis between APACHE 1V SCORE and SOFA SCORE for maternal outcome of patients admitted in ICU was done.
Results*:- In our study , for prediction of outcome in ICU, SOFA score had a sensitivity of 24.3% and specificity of 88.8% whereas for APACHE IV score the sensitivity was 66.6% and specificity was 78.1%.*
Hence in our study it was evident that APACHE IV score was better for predicting outcome in patients admitted in ICU.
Conclusion*:- A better scoring system especially applicable to the critically ill obstetric patients in Indian scenario could lead to accurate monitoring of the quality care and risk stratification for the clinical and therapeutic trials. Accurate predictive scores in the ICU,apart from providing aggressive management in those predicted for a poor outcome could lead to better productive utilization of limited resources.*

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I. Introduction

Critical care and measuring the severity of the disease and the prognosis of the patients is important as it effects the outcome of patients admitted in ICU . Various scoring systems such as Glasgow scale, APACHE (acute physiology and chronic health evaluation score) III and IV and Sequential Organ Failure Assessment (SOFA) scoring have been validated and are being used in predicting prognosis of non-pregnant patients admitted in intensive care unit (ICU),but It is very difficult to conduct well structured trials in parturient due to lack of standard guidelines which are available in other critically ill patients . Aim & Objective:- This study was done to compare APACHE IV score Vs SOFA score. SOFA[1,2] score 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 sofa score, (out of 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.

RESPIRATORY SYSTEM	
pao2 / fio2 [mm Hg]	**SOFA score**
>400	0
<400	1
<300	2
<200 & mechanically ventilated	3
<100 & mechanically ventilated	4

Fio2-fraction of inspired oxygen

NERVOUS SYSTEM	
Glasgow coma scale	**SOFA score**
15	0
13-14	1
10-12	2
6-9	3

<6	4

CARDIOVASCULAR SYSTEM	
Hypotension	**SOFA score**
No hypotension	0
MAP <70 mmHg	1
Dop≤5 or dob (any dose) §	2
Dop>5, epi ≤ 0.1, or norepi ≤ 0.1§	3
Dop>15, epi>0.1, or norepi >0.1§	4

MAP - mean arteriolar pressure
Dop - dopamine
Epi - epinephrine
Nor epi - nor epinephrine
§-adrenergic agents administered for at least 1 hour (dose given are in μg/kg per minute)

LIVER	
Bilirubin, mg/dl	**SOFA Score**
<1.2	0
1.2-1.9	1
2.0-5.9	2
6.0-11.9	3
>12.0	4

COAGULATION	
Platelets×103/ □l	**SOFA Score**
>150	0
≤150	1
≤100	2
≤50	3
≤20	4
RENAL SYSTEM	
creatinine mg/dl or urine output (ml/day)	**SOFA score**
<1.2	0
1.2-1.9	1
2-3.4	2
3.5-4.9 <500/day	3
>5 <200/day	4

Apache 4 Score

The original APACHE score was developed in 1981 to classify groups of patients according to severity of illness and was divided into two sections: a physiology score to assess the degree of acute illness; and a preadmission evaluation to determine the chronic health status of the patient[3]. In 1985, the original model was revised and simplified to create APACHE II[4], now the world's most widely used severity of illness score. In APACHE II, there are just 1 physiological variables, compared to 34 in the original score. The effects of age and chronic health status are incorporated directly into the model, weighted according to their relative impact, to give a single score with a maximum of 71. The reason for ICU admission is, therefore, an important variable in predicting mortality, even when previous health status and the degree of acute physiological dysfunction are similar. APACHE III was developed in 1991[5] and was validated and further updated in which equations for predicting risk-adjusted ICU length of stay were also developed using the APACHE III model[6]. APACHE IV was developed 2002/2003 in USA, remodelling APACHE III with the same physiological variables and weights but different predictor variables and refined statistical methods[8]. APACHE IV scoring system better predicts mortality rate than APACHE I, II, III Scoring systems as it has disease-specific sub groups and includes a specific reason for ICU admission in its risk prediction. Thus this may be a better alternative and an effective predictor of short term outcome in ICU patients.

Apache 4 criteria;

Acute physiology and chronic health evaluation score most widely used in ICU to quantify severity of illness of patients admitted to ICU.

It includes

- Age
- Temperature,
- Mean arteriolar pressure [mm hg]
- Heart rate/ min
- Respiratory rate/min
- Mechanically ventilated [yes/no],
- Fio2 [%]
- Po2 [mm hg]
- Pco2[mm hg]
- Arterial PH
- Sodium [meq/ltr]
- Urine output [ml/day]
- Creatinine [mg/dl]
- Urea [meq/ ltr]
- Blood sugars [mg/ dl]
- Albumin [gms/ ltr]
- Bilirubin [mg/ dl]
- Hematocrit [%]
- WBC [X1000/mm3]
- Glas gow coma scale
- Chronic health condition – CRF/HD, cirrhosis, hepatic failure, metastatic carcinoma, lyphoma, leukemia/myeloma, immune suppression, AIDS
- Admission information-pre ICU LOS (length of stay) [days], origin, Readmission, emergency surgery
- Admission diagnosis- non operative, post-operative, system, diagnosis, thrombolysis [yes/no].

By using APACHE 4 calculator the score can be estimated which indicates the severity of illness.

II. Material And Methods

Prospective analysis of maternal outcome of patients admitted to ICU in the department of obstetrics and gynecology, Gandhi Hospital, secunderabad.

Study period:

The period of study was from January 2014-November 2015.

Inclusion criteria:

Using WHO NEAR MISS criteria as admission criteria for 50 patients who were admitted to ICU during the study period.

III. Observation And Results

Indication For Icu Admission

- **Obstetric Cause For Admission**

In present study, 24 cases (48%) hypertensive disorder was the common indication for ICU admission, 19 cases (38%) were admitted with haemorrhagic complications, and 2 cases (4%) with sepsis/unsafe abortion.

Table No. 1: Showing direct obstetric causes for ICU admission

Cause	No. Of Cases	Percentage %
Haemorrhage	19	38
Hypertensive Disorder	24	48
Sepsis / Unsafe Abortion	2	4

Non obstetric causes for icu admission:

In our study 10 cases (20%) were presented with cardiac disease, of these 3 cases (30%) presented with CRHD, 7 cases (70%) presented with PPCM. 2 cases (4%) with viral hepatitis, 1 case (2%) with GBS, and 2 cases (4%) with AKI.

Table No. 2 : Showing non-obstetric causes for ICU admission

Causes	Total No	Percentage %
A Cardiac causes	10	20
CRHD	3	30

PPCM	7	70
C viral hepatitis	2	4
D others		
GBS	1	2
AKI with PET	2	4

Intervention in icu:

In present study 33 cases (66%) required blood transfusion, 17 cases (34%) inotropic support needed, for 2 cases (4%) required renal replacement therapy, and 23 cases (46%) required ventilator support.

Table No.3 : Showing intervention in ICU

A Medical	**Total no**	**Percentage %**
Blood transfusion	33	66
Inotropic support	19	38
Renal replacement therapy	2	4
Mechanical ventilation	24	48

B surgical	**Total no**	**Percentage %**
Emergency laparotomy	7	14
Caesarean hysterectomy	2	4
Evacuation of placental bits	2	4

For the 50 patients admitted in ICU both SOFA and APACHE scoring was given on daily basis.

Sofa score:

sofa score was calculated on daily basis and we represented the outcome of patients by initial sofa, mean sofa and highest sofa.

Initial Sofa Score: An initial SOFA score of >11 and <11 had the following results

Table No 4 : Showing results of initial SOFA score.

Sofa score		**Total no N (%)**	**Survival no N (%)**	**Expired no N (%)**	**X2 (p- value)**
INITIAL SOFA	>11	11 (22)	1 (9)	10 (91)	**15.52 (0.0001)**
	<11	39 (78)	31 (79)	8 (21)	

Among 50 cases, 11 cases (22%) had Initial SOFA score of >11, in these only one case (9%)survived, 10 (91%) of them expired. 39 cases (78%) had Initial SOFA score of <11, among these 31 cases (79%) survived, 8 cases(21%) died.

Mean sofa score:

An average of SOFA score (mean SOFA) was taken covering the entire duration of ICU, cut off score of 7 had the following results.

Table No. 5: Showing mean SOFA score

SOFA SCORE		**TOTAL NO N (%)**	**SURVIVAL NO (%)**	**EXPIRED NO. N (%)**	**P VALUE**
MEAN SOFA	>7	18 (36)	2 (11)	16 (89)	**30.65 (<0.0001)**
	<7	32 (64)	30 (94)	2 (6)	

18 cases (36%) had a Mean SOFA score of >7, of these 2 cases (11%) survived, 16 cases (89%) of them died. 32 cases (64%) had Mean SOFA score of <7, of these 30 cases (94%) survived, 2 cases (6%) died.

Highest sofa score:

On any day of ICU if the SOFA score >11 the results were as follows.

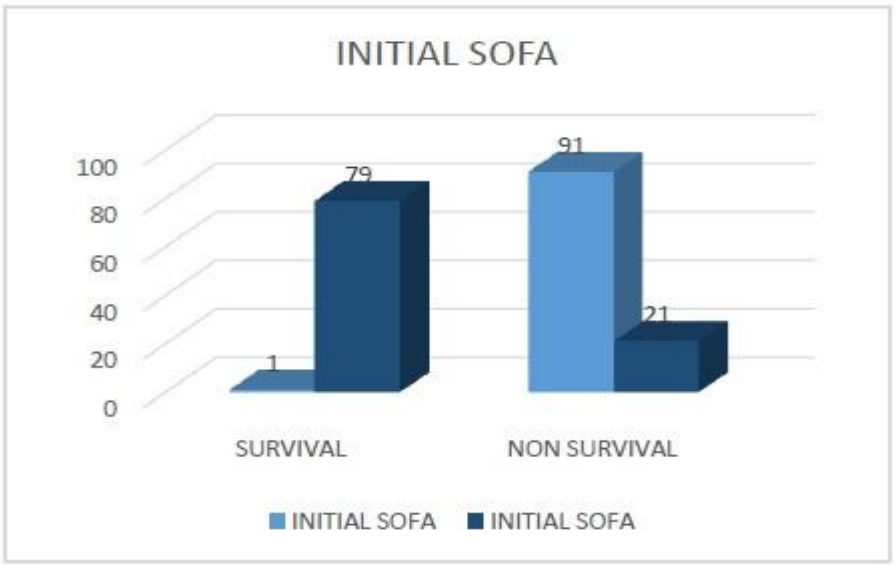
17 cases (34%) had a Highest SOFA score of>11, of these only 2 cases (12%) survived, 15 cases (88%) died. 33 cases (66%) had highest SOFA score of <11, of these 30 cases (91%) survived , 3 cases (9%)expired.

Table No. 6 : Showing highest SOFA score

		TOTAL NO. N (%)	**SURVIVAL NO. N (%)**	**EXPIRED NO. N (%)**	**P VALUE**
HIGHEST SOFA	>11	17 (34)	2 (12)	15 (88)	**27.16 (0.0001)**
	<11	33 (66)	30 (91)	3 (9)	

Conclusion

The Initial SOFA >11, Mean SOFA >7, and Highest SOFA >11 was associated with significantly increased mortality with statistically significant p value.



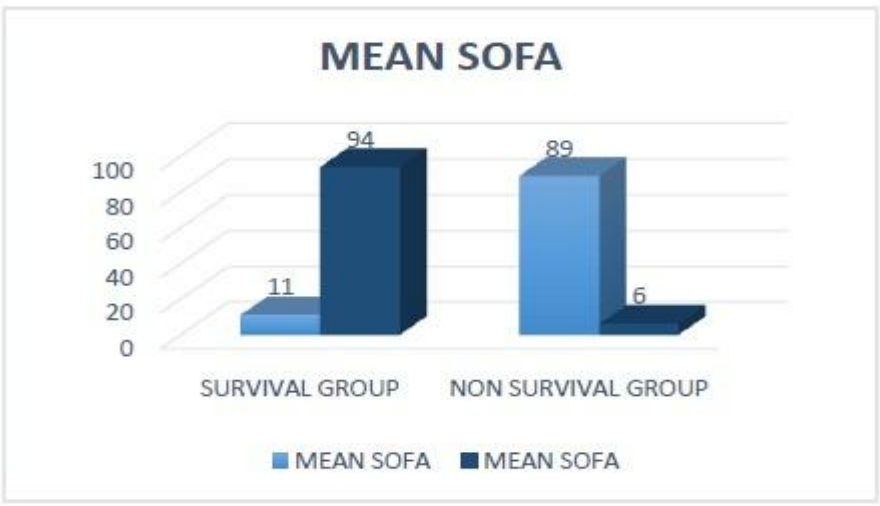


Table No 7: Shows statistical analysis of SOFA score

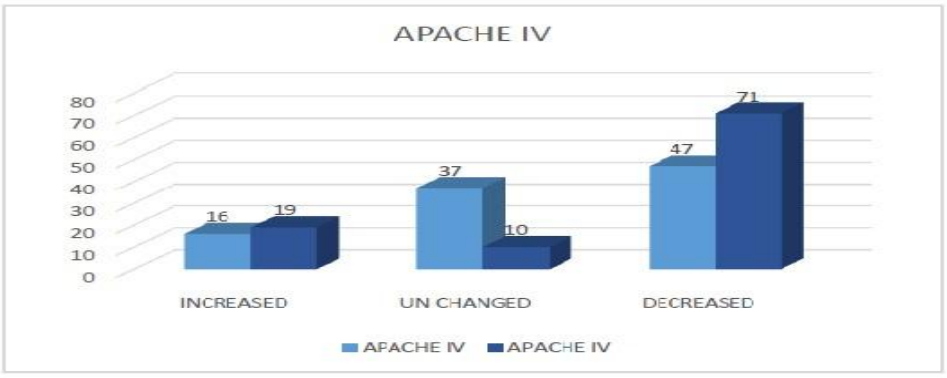
SOFA SCORE	ODDS RATIO	95% CI FOR OR	p VALUE
INITIAL>11	38.75	4.30-348.91	**<0.0001**
MEAN>7	120	15.42-933.79	**<0.0001**
HIGH>11	75	11.29-498.21	**<0.0001**

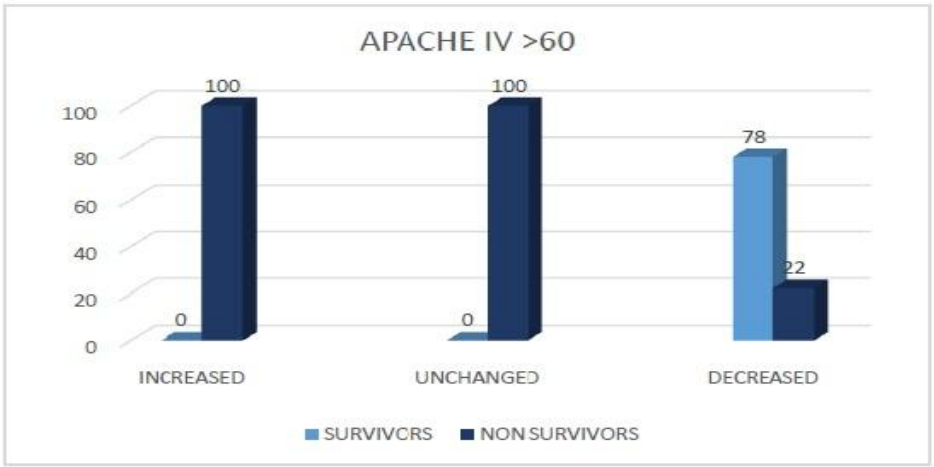
Apache Iv Score: The evolution of the APACHE IV score has been divided into three classes: scores that increased, remained unchanged or decreased. In the present study APACHE IV score was calculated on daily basis and we estimated outcome of patients by evolution of score. In present study initial APACHE IV score <30 were less in number (only 5 patients) so we calculated the outcome by number of patients with initial APACHE IV scores >60 and <60. 19 cases (38%) had APACHE IV sore of >60 at the time of ICU admission, among these cases it was observed that all the patients died when APACHE IV score either remained the same or increased in the subsequent days. In 9 cases (47%) where there was a decrease in score it was observed that 7 cases (78%) had survived and 2 cases (22%) died.The other 31 cases (62%) had APACHE IV score <60 at the time of ICU admission, among these cases it was observed that all the patients survived when the score either decreased or remained the same. In 6 cases (19%) where the score increased in subsequent days it was observed that 5 cases (83%) died whereas 1 cases (17%) survived.

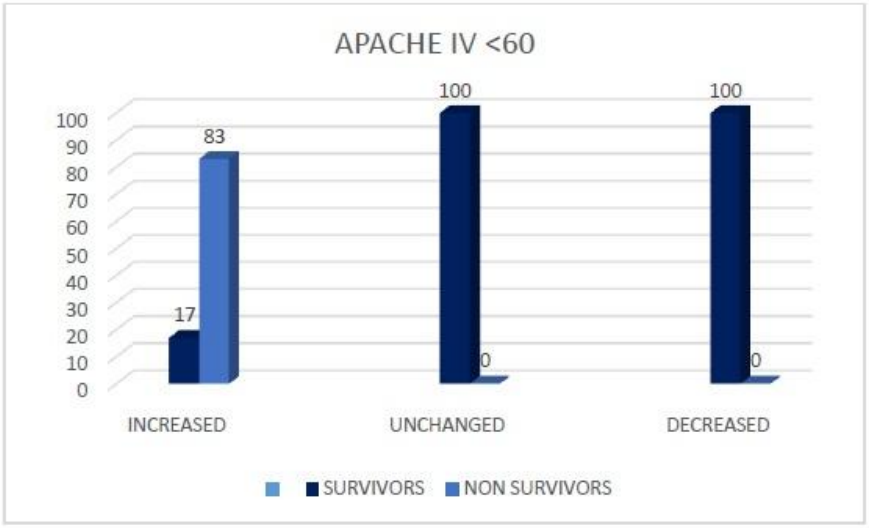
Table No. 8: Showing APACHE IV score

SCORE	NO of patients N (%)	Score Evolution	No. of patients N (%)	Expired N (%)	Survivors N (%)	P value
>60	19 (38)	Increased Score	3(16)	3(100)	0	
		Unchanged	7(37)	7(100)	0	
		Decreased	9(47)	2(22)	7(78)	**<0.0001**
<60	31 (62)	Increased	6(19)	5(83)	1(17)	**<0.0001**
		Unchanged	3(10)	0(0)	3(100)	
		Decreased	22(71)	0(0)	22(100)	

Conclusion: With Initial APACHE IV score >60 and decreased score on subsequent days of ICU chances of survival high, and with Initial APACHE IV score <60, increased score on subsequent days of ICU associated with significant mortality rate.







Icu length of stay (los):
In present study by using APACHE IV the mean predicted ICU LOS was 4.6 days, the actual ICU LOS was 3. 33 days

Table No. 9: Showing ICU LOS

Actual ICU LOS Mean ± SD	**Predicted ICU LOS Mean ± SD**	**P-Value**
3.33 ± 1.43 days	4.6 ± 1.55 days	**<0.0001**

Among survivors ICU LOS:

Table No. 10: Showing ICU LOS among survivors

Actual ICU LOS Median	**Predicted ICU LOS Median**	**Correlation (r)**
3 days	4 days	0.1

Among the survivors the actual ICU LOS was 3 days, and predicted ICU LOS was 4 days but the correlation between them was very poor (r= 0.1) .

Sofa score:
We applied FISCHER EXACT test and the p value (2-tail) is highly significant (**0.00007668**).
Apache iv score:
We applied YATES CORRECTED CHI SQUARE test for APACHE IV score the results showed p value (2-tail) (0.003667)

Table No 11: Shows SOFA VS APACHE IV sensitivity and specificity

Score	**Sensitivity**	**Specificity**
Sofa	**24.3 %**	**88.8%**
Apache Iv	**66.6%**	**78.1%**

APACHE IV is better than SOFA score in predicting mortality as an outcome in patients admitted to ICUs.

IV. Discussion

Despite a series of physiological alterations in pregnancy, most women complete pregnancy uneventfully, but a few of them develop complications that may require ICU admissions.

Indication for icu admission:
Most of the patients admitted in the ICU were in the antepartum period, majority for obstetrics reasons, of which pregnancy-related hypertensive disorders comprise 48% of all ICU admissions (n=24).

Sofa score:

In our study SOFA scoring was done daily for all patients and we have analyzed the initial SOFA, mean SOFA, highest SOFT scores as compared to survivors. P value (0.0001, <0.0001, 0.0001) respectively. These results were similar to the study of Ferreira et al[2] and Acharya et al[8]. Regarding prediction of mortality, the initial SOFA i.e. SOFA scores at diagnosis when > 11, predicted mortality of 91%. Which was similar to the study of Ferreira et al [95%] and Acharya et al. [90%].

Initial Sofa Score >11

Table No 12: Initial sofa score>11 comparison with other studies

STUDY	PREDICTED MORTALITY
Ferreira et al.	95%
Acharya et al.	90%
Present study	91%

Mean Sofa Score>7

In our study the Mean SOFA i.e. the average of SOFA score during the stay in ICU When it is >7, predicted mortality of 89% which was comparable to Acharya et al[8].[73.9%].

Table No. 13 : Mean sofa score >7 comparison with other studies

Study	Predicted Mortality
Acharya Et Al.	73.9%
Present Study	89%

Highest Sofa>11

In our study highest SOFA score that is high score of SOFA recorded during ICU stay if it is> 11 had a predicted mortality of 88%, which was comparable to Acharya et al[8]. [87.5%] and Ferreira et al[2]. [>80.0%].

Table No. 14 : Highest sofa score>11 comparison with other studies

STUDY	PREDICTED MORTALITY
Ferreira et al.	>80%
Acharya et al.	87.5%
Present study	88%

In our study Initial, Mean, and Highest SOFA scores were the reliable predictors of ICU outcome throughout the ICU stay which was similar to the study of Ferreira et al., Acharya.et al.

Apache iv score:

The evolution of the APACHE IV score has been divided into three classes: scores that increased, remained unchanged or decreased. Based on this evolution of score, the overall outcome of the patients was recorded. Initial APACHE IV score was compared with the scores of subsequent days of stay in ICU. By this inspection there was unfavourable outcome to all of the patients who had an initial APACHE IV score of >60 and whose score either increased or did not evolve at all. Out of the 19 patients (38%) who initially showed a score of >60, there was an increase in the overall score in 3 patients (16%) and 3 (100%) of them died. Similar results were seen in the patients whose APACHE IV scores remained unchanged throughout the period of stay {7 patients (37%)} with a mortality rate of 100%. However, in contrast to this there was a statistically significant (p value- <0.0001) difference in the survival rate for those patients who came with initial APACHE IV score of >60 which was decreased over the stay. There were 9 patients (47%) with decreased scores out of which 7 patients (78%) survived.

For the patients who presented with initial APACHE IV <60 a similar pattern ensued, with increase in score leading to a diminished survival rate, out of the 6 patients (19%) who had initial score <60 there were 5 deaths (83%) and one patient who survived (17%) which is statistically significant (p-value: 0.0001). In those patients whose initial APACHE IV score of <60 with score remained unchanged throughout the study, there was a better prognosis depicted with 3 patients (10%) in this group who showed a 100% survival rate. the patients whose initial APACHE IV score was <60 but the score diminished further (22 patients – 71%) through their stay showed a survival of 100%. The mean APACHE IV score in present study among survival group was 47 ± 16.4, and among the expired group 74.5 ± 33.9.

Table No. 15: Comparative studies on mean APACHE IV score

Study	Total Mean Score ± Sd	Survival Group Mean ± Sd	Non-Survival Group Mean ± Sd	P-Value
Yueyun Hu Et Al.(2013)[9]	41.32 ± 21.95	35.86 ± 15.58	75.26 ± 25.47	<0.001
Amr Elhadidy[10]	51 ± 21	48.2 ± 16.2	107.3±29	0.0001
T Dahhan Et Al[11]	42.32 ± 21.95	35.86 ± 15.58	75.26 ± 25.47	0.0001
Present Study	54.5 ± 29.2	47 ± 16.4	74.5 ± 33.9	0.003

Table No. 16: Comparison of sensitivity and specificity of APACHE IV score with other studies:

Study	Sensitivity	Specificity	P-Value
Mustafa Kamal et al. (2012) [12]	94.73	93.74	<0.0001
Ayazoglu et al. (2011) [13]	94.7	94.4	<0.0001
Present Study	66.6	78.1	0.00367

Apache iv vs. Sofa score

Table No. 17: Comparison of sensitivity and specificity of APACHE IV with SOFA score

Score	Sensitivity	Specificity	P –Value	Test
Sofa	24.3%	88.8%	0.000076	Fischer Exact
Apache Iv	66.6%	78.1%	0.00367	Yates Corrected Chi-Square

Regarding the analysis of the scoring systems of the present study, the SOFA scoring system has a sensitivity of 24.3% and a specificity of 88.8% with a highly significant p-value. The APACHE IV score had a sensitivity of 66.6% and a specificity of 78.1% with a significant p-value. By these results it was evident that the APACHE IV score was more significant in predicting mortality than the SOFA scoring system.

V. Conclusion

Accurate predictive scores in the ICUs apart from providing aggressive management in those predicted for a poor outcome, could also lead to better productive utilization of the limited resources. A better scoring system especially applicable to the critically ill obstetric patients in the Indian scenario could lead to accurate monitoring of quality care and risk stratification for the clinical and therapeutic trials. In this study patients with initial SOFA>11, mean SOFA>7 and Highest SOFA >11 were associated with significant mortality. For APACHE IV score if the initial APACHE IV score>60, and initial APACHE IV score<60 but with increased score evolution on subsequent days of ICU was associated with significant mortality. SOFA score requires daily evaluation and monitoring and helps to assess the progress of the patient in ICU, while APACHE IV had better sensitivity in predicting mortality. In this study APACHE IV score was better for predicting mortality in ICU compared to SOFA score, as it had a sensitivity of 66.6% and specificity of 78.1% compared to SOFA which had a sensitivity of 24% and specificity of 88.8% . Both APACHE IV and SOFA score were found to be applicable to the critically ill obstetric patients for risk stratification and improved the quality of monitoring.

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