



Research Article

## THE STUDY ON COMPARATIVE STUDY OF POISONING SEVERITY SCORE AND APACHE II SCORE IN PREDICTING SEVERITY AND CLINICAL OUTCOME IN ORGANOPHOSPHORUS POISONING

Praveen V, Sridhar D, Sowmya T and Sai Karthik K

Medicine, Osmania Medical College / General Hospital, Hyderabad, Telangana State

### ARTICLE INFO

#### Article History:

Received 06<sup>th</sup> January, 2022

Received in revised form 14<sup>th</sup>

February, 2022

Accepted 23<sup>rd</sup> March, 2022

Published online 28<sup>th</sup> April, 2022

#### Key words:

Organophosphate, Poisoning Severity Score (PSS), APACHE II Score.

### ABSTRACT

**Background:** Organophosphorus compound poisoning is the most common poisonings in India because of easy availability often requiring intensive care and ventilator support. Clinical research has indicated that respiratory failure is the most important cause of death due to organophosphorus poisoning. It results in respiratory muscle weakness, pulmonary oedema, respiratory depression, increased secretions and bronchospasm. These complications and death can be prevented by proper assessment and timely institution of ventilator support. **Aim of The Study:** To compare PSS with APACHE-II score in predicting severity and clinical outcome in patients of organophosphorus poisoning. **Methodology:** 50 patients admitted with a history of organophosphorus poisoning at Osmania general hospital, Hyderabad were taken for study after considering the inclusion and exclusion criteria. Detailed history, confirmation of poisoning and all relevant blood investigations are done. The severity and clinical outcomes in OP poisoning is graded by PSS (poison severity score) and APACHE II scoring systems. **Results:** Out of 50 patients 39(78%) patients were males, 11(22%) patients were females. Mortality in age group < 45yrs is 31.7%, Mortality in age group 45-65 yrs is 50%, Mortality in age group >65 yrs is 100%. The minimum APACHE II score obtained in our study is 0 and the maximum score is 35.No patient survived with APACHE II score of more than 20. In this study PSS was graded to all 50 patients, of which 2 patients fall in Grade 0,of which all are survived, 17 patients fall in grade 1of which 16 patients are survived and one patient died,21 patients fall in grade 2 of which 12 patients survived,9 patients died. **Conclusion:** There is a significant linear correlation between APACHE II scores and the PSS scores on marking correlation graph. As the PSS depends mainly on clinical features of patient, there can be differences in grading of PSS from physician to physician.

Copyright©2022 Praveen V et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

### INTRODUCTION

Organo phosphorus compounds (OPC) groups of cholinesterase inhibiting insecticides, most commonly produces toxicity in humans. OPC's act by inhibiting the enzyme acetylcholinesterase thereby increasing the acetylcholine levels in the nicotinic and muscarinic receptors. This increased Ach will produce the features of cholinergic excess syndrome<sup>1</sup>.

Gunnell *et al*<sup>2</sup>. conservatively estimates that there are 258,234 (plausible range 233,997–325,907) deaths from pesticide self-poisoning worldwide each year, accounting for 30% (range 27–37%) of suicides globally.

The most common mode of death in OPC poisoning is respiratory failure. Most common OPC poisonings are suicidal especially in rural Indian populations. Its high mortality and easy availability for the people involved in agriculture related work which makes it ideal suicidal agent for people living in rural India.

Most of the OPC poisoned patients are managed in ICU (intensive care unit) settings and the new advanced treatment modalities have resulted in increased survival in these patients and increases the hospital expenses.

The Acute Physiology and Chronic Health Evaluation (APACHE) Score II is the most widely used scoring system in ICU setting. The APACHE-II score has good discriminatory, reliability and calibration compared to other scores in many range of disease process.

**Poisoning Severity Score (PSS)** is standardized scale for grading the severity of poisoning allows qualitative evaluation of morbidity caused by poisoning, better identification of real risks and comparability of data.

So there is a need of better scoring systems for prognostication of these patients and also for avoiding expensive procedures and treatments.

\*Corresponding author: Praveen V

Medicine, Osmania Medical College / General Hospital,  
Hyderabad, Telangana State

### Aims & Objectives

- To determine poisoning severity score in patients of organophosphorous poisoning.
- To determine APACHE II score in patients of organophosphorous poisoning.
- To compare PSS with APACHE-II score in predicting severity and clinical outcome in patients of organophosphorous poisoning

### MATERIALS & METHODS

This observational study done in 50 patients who were admitted in Osmania General Hospital, Hyderabad Comparing APACHE II SCORE & PSS using correlation in assessing severity and outcome in OP poisoning from June 2019 to May 2021. Patients are subjected to history questioning, clinical examinations and blood sampling.

#### Inclusion Criteria

1. Patient with known organophosphate poisoning, identified as below
  - a. History of consumption of an OPC insecticide.
  - b. Classical clinical features of cholinergic crisis – miosis, hypersalivation, fasciculations, characteristic odour of stomach wash.
2. Identification of the container of the compound consumed.
3. Age above 18 yrs, both sex.

#### Exclusion Criteria

- Patients who have consumed other poisons.
- Patients who have consumed alcohol.

#### Apache II Score<sup>3</sup>

The APACHE II score is severity of disease classification system originally developed from the prototype APACHE score. It consists of 4 components, 1. Acute physiology score 2. Age 3. Glasgow coma scale 4. Chronic health status of that patient The APACHE II score is originally developed from the prototype scoring system APACHE score, the acute physiology score (APS) is derived from the abnormal twelve physiological variable. 12 variables are chosen in the hypothesis that detecting abnormalities in multiple physiological variables helps us to quantify the magnitude of the severity of acute disease process.

APACHE II score is objective type scoring system. The APS is calculated from the worst values obtained during the first 24 hours of ICU admission. The 24 hour time window is necessary to allow us to measure all the needed variables to calculate the APS. Each variable is given the weightage of 0-4. The total score obtained will be in the range of 0-71. The age and chronic health score, if the patient has chronic health history and the patient is admitted any reason other than surgery will be given 5 points.

#### Poisoning Severity Score<sup>4</sup>

The Poisoning Severity Score is a severity grading scale adopted by the IPCS, the Commission of the European Union and the European Association of Poison Centers and Clinical Toxicologists (IPCS/EC/EAPCCT) for grading the severity of poisoning.

Symptoms and signs addressed by the PSS are given in the following categories- gastrointestinal tract, respiratory system, nervous system, cardiovascular system, metabolic balance, liver, kidney, blood, muscular system, local effects on skin, local effects on eye and local effects from bites and stings.

The use of the score is simple. The occurrence of a particular symptom is checked against the chart and the severity grading assigned to a case is determined by the most severe symptoms or signs observed.

#### Severity Grades

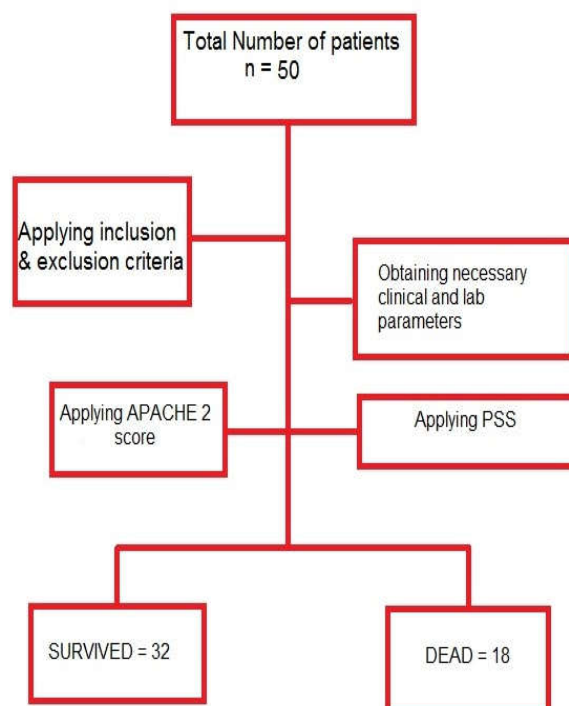
Grade-0	None	No symptoms or signs related to poisoning
Grade-1	Minor	Mild, transient and spontaneously resolving symptoms
Grade-2	Moderate	Pronounced or prolonged symptoms
Grade-3	Severe	Severe or life-threatening symptoms
Grade-4	Fatal	Death

**Poison Severity Score**

**Statistical Methods:** The statistical analysis is done using SPSS software. ‘p’ value obtained is analysed using the SPSS software.

### RESULTS

Flow chart depicting the process of the study



**Table 1 Sex Wise Distribution**

	Male	Female	Total
Number	39	11	50
Percentage	78	22	100

**Table 2 Survival and Mortality**

Total No. of cases	50
Survivors	32
Non Survivors	18
Percentage of Survivors	64%
Percentage of Non Survivors	36%

**Table 3** Showing patient numbers according to the age group

Age Group	No. of patients	Survived	Death	Mortality percentage
Age < 45	41	28	13	31.7
Age 45 – 65	8	4	4	50
Age > 65	1	0	1	100

**Table 4** Fisher’s Exact Test and Chi Square

	Value	Df	Asymp. Sig (2 sided)	Exact Sig (2- sided)	Exact Sig (1- sided)
Pearson Chi square	.810 <sup>a</sup>	1	.368		
Continuity Correction <sup>b</sup>	.248	1	.618		
Likelihood ratio	.784	1	.376		
Fisher’s Exact Test				.436	.303
Linear-by-Linear Association	.794	1	.373		
No of Valid cases	50				

a. 1 cells (25.0% have expected count less than 5. The minimum expected count is 2.88.

b. Computed only for 2 x 2 table

In our study the difference in age among the survivors and non survivors is not significant p value 0.436 (>0.05) as per fishers exact test.

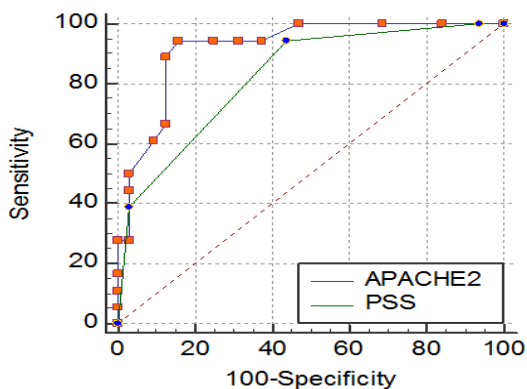
**Table 5** Apache 2 Score

APACHE 2 Score	Survivors	Non Survivors	Total
<= 17	32	15	47
>17	0	3	3

**Table 6** Poisoning Severity Score

PSS	Survivors	Non Survivors	Total
Grade 0	2	0	2
Grade 1	16	1	17
Grade 2	12	9	21
Grade 3	2	8	10

In our study there is no significant difference in assessing severity by PSS and APACHE II score as given by P value=0.8366(>0.05).



**Fig 1** Comparison of PSS With Apache 2 Score In Assessing Outcome (Death)

This is a graph showing curves of APACHE-2 & PSS plotting close to each other.

In our study there is no significant difference in assessing mortality by PSS and APACHE 2 score as given by P value=0.1424 (>0.05).

**DISCUSSION**

Acute organophosphate (OP) poisoning, due to intentional self harm exerts a major burden on the health care system and is responsible for great morbidity and mortality in developing countries. Treating patient and predicting mortality in the ICUs is always a challenge as well as great concern for physicians.

The effect of this prediction is on various aspects of patient care, such as medical treatment, triage, end-of-life ICU care.

For the assessment of patient outcome such as morbidity and mortality, as well as severity of illness in most of the medical intensive care units (MICU), various scoring systems had been studied.

In this study we tried to compare how PSS is correlating with APACHE II score in predicting severity and outcome in OP compound poisoning patients. 50 patients with confirmed or documented OPC poisoning are taken for the study. Out of 50 patients 39(78%) patients were males, 11(22%) patients were females. Sex wise mortality is more in males ( 15patients died - 38%) compared to females(3 patients died- 27%).

Das *et al*<sup>5</sup> suggested that the trend might be because of higher responsibility of males in the family financial issues that contributes to increased exposure to stressful events. Kiran *et al*<sup>6</sup> also observed male dominance in their respective studies in tribal and urban regions of India. Males were more affected than females (Muley *et al*)<sup>7</sup>.

**Age Wise Mortality:** In this study most of the patients belongs to the age group of less than 45yrs(41 patients); 8 patients belongs to age group of 45-65yrs age,1 patient belongs to age group of > 65yrs.Mortality in age group < 45yrs is 31.7%, Mortality in age group 45-65yrs is 50%, Mortality in age group> 65 yrs is 100%.

Fishers exact test shows P value of 0.436 (>0.05) which indicates the difference in age among the survivors and non-survivors is not significant. This is in contrast to many other studies where age is one of the significant factor in determining mortality.

This finding was similar to that of Ahmed *et al*<sup>8</sup>, (2014) and Banday *et al*<sup>9</sup>, (2015) in which the incidence was highest in patients aged less than 40 years

The difference in outcome is because of many other factors playing role in determining the mortality like variable toxicological profiles of OP compound, amount consumed, delay in reaching health care centre.

**Apache 2 Score**

The APACHE II score is objective type scoring system. The score is calculated from the worst values obtained during the first 24 hours of ICU admission.

APACHE II score = APS+ GCS +Age+ chronic health status

**Table 7** The predicted hospital mortality given by APACHE2 score

Apache Ii Score	Predicted Hospital Mortality
0 – 4	4%
5 – 9	8%
10 – 14	15%
15 – 19	24%
20 – 24	40%
25 – 29	55%
30 – 34	73%
35 – 100	85%

The minimum APACHE II score obtained in our study is 0 and the maximum score obtained in our study is 35.No patient survived with APACHE II score of more than 20. In this study most of the patients (47 out of 50 patients) has APACHE II score less than 17,out of which survived were 32 patients (68%) and non survived were 15 patients(31%). APACHE II

score of more than 17 a total of 3 patients all are not survived. Sungurtekin *et al*<sup>10</sup>. observed a significant correlation between the mortality and APACHE II scores and hence recommended the assessment of APACHE II scores in OP poisoning patients. Jabalameli *et al*<sup>11</sup>. reported that died patients had highest APACHE II Score and correlated with the occurrence of complications in OP poisoning.

**Poisoning Severity Score:** The severity of poisoning was assessed using the IPCS-poisoning severity scale (IPCS PSS) from Persson *et al*<sup>12</sup>. Occurrence of a particular symptom was checked against the chart and graded. The severity grading assigned to a case was determined by the most severe symptoms or signs observed.

In this study PSS was graded to all 50 patients, of which 2 patients fall in Grade 0 ( No symptoms & Signs),of which all are survived, 17 patients fall in grade 1(Mild & transient symptoms) of which 16 patients are survived and one patient died,21 patients fall in grade 2(prolonged symptoms) of which 12 patients survived,9 patients died, similar results are obtained by the study done by Sam *et al*<sup>13</sup>.

Similarly there is significant correlation ( $p < 0.001$ ) was found between PSS grades and need for ventilation, with a sensitivity of 81.82% and specificity of 85.71% (Youden index = sensitivity + specificity 1)<sup>14</sup>.

There was no statistically significant difference between APACHE II and PSS in terms of area under Receiver Operating Characteristic Curve [AUC-0.921, 95% confidence interval 0.809-0.978] for APACHE score [(AUC-0.826, 95% confidence interval-0.692-0.918] for PSS in predicting mortality.

There was no statistically significant difference between APACHE II and PSS in terms of area under Receiver Operating Characteristic Curve [AUC-0.878, 95% confidence interval 0.755-0.954] for APACHE II score, [AUC-0.865, 95% confidence interval-0.739-0.945] for PSS to predict need for intubation.

Our study showed a significant linear correlation between APACHE II scores and the PSS scores on marking correlation graph.

Study done by Casey P.B<sup>15</sup> showed that poison severity score recorded at admission or first 24 hours can be used to predict outcome of poisoning patients.

Therefore the PSS provides a simple but relatively robust system for describing the severity of poisoning on the basis of clinical observations. It is not a prognostic score but is instead meant to define the degree of severity at a given point of time when the overall clinical features are most severe.

## CONCLUSION

- PSS helps in early prediction of clinical status of patient so that appropriate treatment can be given to patient.
- There is a significant linear correlation between APACHE II scores and the PSS scores on marking correlation graph
- As the PSS depends mainly on clinical features of patient, there can be differences in grading of PSS from physician to physician.

## References

1. Laurence L. Brunton, Bruce A. Chabner, Bjorn C. Knollmann; Goodman & Gilman's "The Pharmacological Basis of Therapeutics", 12<sup>th</sup> edition, 2011, chapter 10; pg-247
2. Gunnell D, Eddleston M, Phillips MR, Konradsen F. The global distribution of fatal pesticide self-poisoning: systematic review. BMC Public Health. 2007;7:357
3. Vincent J. and Moreno R. (2010): Clinical review: Scoring systems in the critically ill. Critical Care, 14:207
4. Chandrasekhar S, Rahim MA, Quraishi SM, Theja CR, Kiran KS. An observational clinical study of assessing the utility of PSS (Poison Severity Score) and GCS (Glasgow Coma Scale) scoring systems in predicting severity and clinical outcomes in op poisoning. J Evidence Based Med Healthcare. 2017;4:2325-32
5. Ahmed SM, Das B, Nadeem A, Samal RK. Survival pattern in patients with acute organophosphate poisoning on mechanical ventilation: A retrospective intensive care unit-based study in a tertiary care teaching hospital. Indian journal of anaesthesia. 2014;58:11
6. Shreemanta Kumar Dash, AS Raju, Manoj KM, Kiran KM, Sachidananda Mohanty. Sociodemographic profile of poisoning cases. JIAFM 2005; 27(3): P971-3.
7. Muley A., Shah C. and Lakhani J. *et al.* (2014): To identify morbidity and mortality predictors in acute organophosphate poisoning. Indian J Crit Care Med; 18:297-300.
8. Ahmed K., Sainath C. and Ahmed P. (2014): A cross sectional study of estimation of plasma pseudo cholinesterase and its correlation to mortality among organophosphorous poisoning patients. Indian Journal of Basic and Applied Medical Research, 3(3): 285-291.
9. Banday T., Tathineni B. and Desai M. *et al.* (2015): Predictors of morbidity and mortality in organophosphorus poisoning: A case study in rural hospital in Karnataka. Am J med sci; 7(6): 259-265.
10. Sungurtekin H, Gurses E, Balci C. Evaluation of several clinical scoring tools in organophosphate poisoned patients. Clin Toxicol 2006; 44:121-6.
11. Jabalameli M., Eizadi N. and Saghale M. (2006): Predictive outcome of toxicity with organophosphate based on APACHE II scoring system in intensive care unit. European journal of anaesthesiology, 23:206.
12. Persson HE, Sjöberg GK, Haines JA, de Garbino JP. Poisoning severity score. Grading of acute poisoning. Journal of Toxicology: Clinical Toxicology. 1998;36:205-13
13. Sam KG, Kondabolu K, Pati D, *et al.* Poisoning severity score, APACHE II and GCS: effective clinical indices for estimating severity and predicting outcome of acute organophosphorus and carbamate poisoning. J Forensic Leg Med 2009;16(5):239-247
14. Bewick V, Cheek L, Ball J. Statistics review 13: receiver operating characteristic curves. Crit Care 2004; 8:508-12(youden)
15. Casey PB, Dexter EM, Michell J, *et al.* The Prospective Value of the IPCS/EC/EAPCCT Poisoning Severity Score in Cases of Poisoning. J Toxicol Clin Toxicol 1998;36:215-217