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Evaluating the Use of Apache II Score in Predicting the Severity and Clinical Outcomes of Organophosphorous Poisoning-Original Study

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ABSTRACT

Objectives: To identify predictors of mortality in OPC poisoned patients and also to evaluate the performance of APACHE II scoring system for predicting severity and the outcome of patients poisoned with OPC who were admitted to the ICU.

Methods: A single centre observational study conducted in ICU of a tertiary care teaching hospital in chennai,INDIA. Patients are subjected to history questioning, clinical examinations and blood sampling for complete blood count,renal function test,serum sodium and potassium,arterial blood gas and also vital parameters including rectal temperature, oxygen saturation, respiratory rate, pulse rate and blood pressure were recorded.The APACHE score 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 APACHE score.Each variable is given the weightage of 0-4. The total score obtained will be in the range of 0-71.

Results: 75 patients with confirmed history or documented OPC poisoning were enrolled for study. The difference in APACHE *II* score is statistically significant among the survivors(5.70 ± 3.01) and non survivors(19.57 ± 3.93) with p value(<0.0001). Other parameters which are shown to be statistically significant [p<0.05] in our study are age, Glasgow coma scale, rectal temperature, respiratory rate, pH, oxygenation, serum urea, serum creatinine and serum potassium.

Conclusion: APACHE II score predicts the severity of acute physiological dysfunction due to multi organ involvement in OPC poisoning and can be recommended as a useful scoring system in OPC poisonings in ICU settings.

Keywords: APACHE scoring;ICU; Organophosphorus (OPC)

INTRODUCTION

Organic phosphorus compounds (OPC) groups of cholinesterase-inhibiting insecticides that most commonly produce 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[1].The most common mode of death in OPC poisoning is respiratory failure. Most of the severely poisoned patients need intubation and mechanical ventilation

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and must be closely monitored in ICU settings. Multiple organ system involvement is common in OPC poisoning as this muscarinic and nicotinic receptors are virtually present in almost all organ systems. Many studies[2,3,4,5] shown the discriminative value of APACHE *II* score in the assessment of outcomes of OPC poisoning. The APACHE *II* score is useful especially in patients with multiple organ dysfunction due to acute insult like OPC poisoning. Most of the OPC poisoned patients are managed in ICU settings. And the new advanced treatment modalities have resulted in increased survival in these patients. Such measures also prolong the in-hospital stay and increases the hospital expenses. So there is a need of scoring system for prognostication of these patients and also for avoiding expensive procedures and treatments.

The Acute Physiology and Chronic Health Evaluation (APACHE) Score[6] is the most widely used scoring system in ICU setting. It has 12 variables and each variable's score ranges from 0-4. It includes the acute physiology score which represents the severity of present illness, the Glasgow coma scale and the chronic health status of the patients. The maximum score is 71. The score must be calculated using the worst clinical parameters obtained in the first 24 hours of ICU admission. The APACHE-II score has good discriminatory, reliability and calibration compared to other scores in many range of disease process[7]. The objective of our study was to identify predictors of mortality in OPC poisoned patients and also to evaluate the performance of APACHE II scoring systems for predicting severity and the outcome of patients poisoned with OPC who were admitted to the ICU.

MATERIALS AND METHODS

SELECTION OF PATIENTS

Patients admitted to toxicology unit of tertiary hospital with confirmed history of OPC poisoning are included in the study. On admission 10 cc of blood is withdrawn from the patient after obtaining informed consent either from the patient or the relatives. The sample is tested for complete blood count, renal function tests, liver function tests, arterial blood gases and serum electrolytes.

STUDY DESIGN: Observational study conducted in tertiary care centre, Chennai, INDIA during the period of 3 months.

DATA COLLECTION AND METHODS:

Patients are subjected to history questioning, clinical examinations and blood sampling for complete blood count,renal function test,serum sodium and potassium,arterial blood gas and also vital parameters including rectal temperature, oxygen saturation, respiratory rate, pulse rate and blood pressure were recorded.

The APACHE score 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 APACHE score.

Each variable is given the weightage of 0-4. The total score obtained will be in the range of 0-71.

INCLUSION CRITERIA

- Age: above 15 years.
- Sex-both genders.
- Patients presenting with confirmed consumption of organophosphorous compounds.
- Patients willing to give written informed consent.

EXCLUSION CRITERIA

- Age less than 16 years.

Patients who consumed substances other than organophosphates andmixed compound poisonings.

STATISTICAL METHODS

The statistical analysis is done using SPSS software. Baseline variables and clinical characteristics were summarized with frequencies (percentages) for categorical variables and mean (standard deviation

Table 1: Table showing baseline characteristics of the study

S. No	Parameters		Survived	Not survived	Mortality
1.	Age (years)	< 45	43	5	10.41%
		45-54	11	3	21.42%
		55-64	5	3	37.5%
		65-74	0	3	100%
2.	Sex	Male	46	13	22.03%
		Female	13	1	6.25%

[SD]) for continuous variables. All statistics were two-tailed, and a P <0.05 was considered to be significant.

RESULTS

We enrolled 75 patients in our study.78.6% were males and 21.4% were females.Among them ,less than 45 years(64%) constituted larger group. Higher mortality(100%) is seen in age group of 65-74 years.18.66% of study population expired.(TABLE 1). As per WHO class about 50% of the poisonings belong to class II group, 33% belong to class Ib group. And only one patient in class III group.Among OPC compounds,patients consumed Monocrotophos(20%) were higher. 56(75%) of patients were presented to hospital within 6 hours of consumption. There was a significant difference among survivors and non survivors in relation to variables like age,rectal temperature, GCS scoring,respiratory rate, oxygenation, pH, serum urea and creatinine,serum potassium and APACHE II scoring. (TABLE 3)

Median GCS scoring among survivors was 12(8-15) ± 1.576 and non survivors was 8(6-12) ± 1.557. Though the initial rate is normal in OPC poisoned patients. They develop bradycardia at some point of time during the first 24 hours of hospital admission. As our patients are not maintained in atropine infusion and atropine was given as per the atropine requirement chart.

DISCUSSION

75 patients with confirmed history or documented OPC poisoning is taken for study. Most of the severely poisoned patients

Table 2: Table showing the number of patients who consumed each OPCs

OPC	Number of patients(%)
1. Methyl parathion	11(15)
2. Phorate	2(3)
3. Monocrotophos	15(20)
4. Trizophos	5(7)
5. Dichlorvas	5(7)
6. Quinalphos	2(3)
7. Chlorpyriphos	8(10)
8. Dimethoate	7(9)
9. Fenthion	2(3)
10. Prophenophos	8(10)
11. Phenthoate	7(9)
12. Acephate	1(1.3)
13. Ethion	1(1.3)
14. Malathion	1(1.3)

are referred cases from nearby government hospitals in view of respiratory failure .The minimum APACHE *II* score obtained in our study was 0 and the maximum score obtained in our study was 27. The mean APACHE II score in survivors was 5.70 with standard deviation of 3.01 and in non survivors was 19.57 with standard deviation of 3.93. No one patient survived with APACHE *II* score of more than 15. The difference in APACHE *II* score was statistically significant among the survivors and non survivors. Other parameters which are shown to be statistically significant [p<0.05] in our study are age, Glasgow coma scale, rectal temperature, respiratory rate, pH, oxygenation, serum urea, serum creatinine and serum potassium. Patients with a low GCS had higher mortality than those with

Table 3: Table showing comparison of variables among survivors and non survivors:

S. no	Variables	Survivors	Non survivors	P value
1.	Age(years)	37.18 ± 12.92	47.28 ± 15.3	0.001
2.	Rectal temperature(^{o}C)	37.53±0.76	36.47±0.72	<0.0001
3.	GCS	12(8-15) ± 1.576	8(6-12) ± 1.557	<0.0001
4.	MAP(mmhg)	87.57±15.76	82±26.70	0.30
5.	Heart rate(per minute)	67.91±13.62	62.71±22.30	0.262
6.	Respiratory rate(per minute)	18.88±4.15	23.50±7.37	0.002
7.	pH	7.381±0.05	7.25±0.04	<0.0001
8.	Oxygenation(mmhg)	111.88±28.66	60.57±26.78	<0.0001
9.	Serum urea(mg/dl)	33.75±7.99	53.35±18.40	<0.0001
10.	Serum creatinine(mg/dl)	0.95±0.19	1.50±0.59	<0.0001
11.	Serum sodium(meq/L)	136.50±5.91	137.42±4.41	0.586
12.	Serum potassium(meq/L)	3.73±0.53	4.23±0.79	0.005
13.	Haematocrit	38.08±5.01	38.07±4.25	0.994
14.	WBC count(per cu.mm)	6667.21±2171.23	9228.57±2893.42	1.993
15.	APACHE II score	5.70 ± 3.01	19.57 ± 3.93	<0.0001

better GCS[8].Though insignificant the WBC count is increased in non survivors group may be due to aspiration pneumonia.

Parameters that are responsible for increased APACHE II score in survivors group is age, GCS, oxygenation and pH. The chronic health history is present in only two of our patients. Both have immunodeficiency one due to retroviral disease and the other active malignancy and was on chemotherapy and both patients expired.

There are no validated scoring systems for categorizing severity of predicating outcome, although many have been proposed. The highly variable history and the fact to determine the ingested dose make it difficult to predict the outcome for an individual. Hence, early discovery, quick access to medical care careful maintenance of patency of airway, meticulous attention towards presenting aspiration pneumonia and aggressive oxime and atropine therapy may reduce morbidity and mortality.

LIMITATIONS OF THE STUDY:

Further studies with large sample size and multicentre studies with different population are needed to confirm the use of *APACHE II* score in predicting the severity and clinical outcomes of organophosphorous poisoning.

CONCLUSIONS

APACHE II score predicts the severity of acute physiological dysfunction due to multi organ involvement in OPC poisoning and can be recommended as a useful scoring system in OPC poisonings in ICU settings.

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ETHICS APPROVAL:

- The Institutional Ethics Committee approval was obtained before starting the study ECR/270/Inst./TN/2013/NO. 55072014/DATED 01.07.2014.

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