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

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ABSTRACT

BACKGROUND

Organophosphorus compound poisoning is the most common poisonings in India because of easy availability often requiring ICU 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 with timely institution of ventilator support.

MATERIALS AND METHODS

Hundred consecutive patients admitted with a history of organophosphorus poisoning at Kurnool Medical College, Kurnool, were taken for study after considering the inclusion and exclusion criteria. Detailed history, confirmation of poisoning, examination and other than routine investigations, serum pseudocholinesterase and arterial blood gas analysis was done. The severity and clinical outcomes in OP poisoning is graded by PSS (poison severity score) and GCS (Glasgow coma scale) scoring systems.

RESULTS

This study was conducted in 100 patients with male preponderance. Majority of poisoning occurred in 21-30 age group (n=5). Most common compound consumed in our study was methyl parathion and least common was phosphoran. Slightly more than half of the patients consumed less than 50 mL of poison. 21 patients consumed between 50 to 100 mL. Distribution of poison severity score of patients studied showed 45 cases of grade 1 poisoning. 26 cases of grade 2 poisoning, 23 cases of grade 3 poisoning and 6 cases of grade 4 poisoning (death within first 24 hours). Distribution of GCS score of patients studied GCS scores were <10 in 25 patients at admission and 24 patients after 24 hours. GCS scores were ≥10 in 75 patients at admission and 76 patients after 24 hours. Poison severity score is not prognostic, but merely defines severity of OP poisoning at a given time.

CONCLUSION

Both Glasgow coma scale and poison severity scoring systems are effective in predicting severity and outcome of OP compound poisoning. Glasgow coma scale maybe more helpful as it is easy to use, does not require any laboratory investigations. GCS being less time consuming and can be done easily can be used in peripheral areas to identify high-risk patients for urgent referral to tertiary care centers.

KEYWORDS

Anticholinesterases, Organophosphorus, Pseudocholinesterase, Bronchosecretion.

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BACKGROUND

Worldwide, an estimated 3,000,000 people are exposed to organophosphate or carbamate agents each year with upto 3,00,000 fatalities.[1] The organophosphate compounds account for more than 80% of pesticide-related hospitalisations. The WHO estimates based on 2001 data suggest that 8,49,000 people die globally from self-harm each year. However, poisoning is the commonest form of fatal self-harm in rural Asia accounting for over 60% of all deaths and is of far greater importance than hanging and other physical forms of self-harm.

Nearly, 90% of the poisoning are suicidal with a fatality rate of >10%, 8-10% accidental and <1% homicidal. Occupational exposure accounts for 1/5th of accidental poisoning with fatalities of <1%.[2] Only 70 to 80% of patients admitted to hospitals due to OP poisoning survive.[3]

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An organophosphate (sometimes abbreviated OP) is the general name for esters of phosphoric acid. Organophosphates are the basis of many insecticides, herbicides and nerve gases.

Organophosphate pesticides degrade rapidly by hydrolysis on exposure to sunlight, air and soil, although small amounts can be detected in food and drinking water. Their ability to degrade made them an attractive alternative to the persistent organochlorine pesticides, such as DDT, aldrin and dieldrin. Although, organophosphates degrade faster than the organochlorines, they have greater acute toxicity, posing risks to people who may be exposed to large amounts.

In order to estimate the severity and prognostication, this study tries to assess the use of scoring systems.

Aims and Objectives of the Study

a. To develop uniform and effective management guidelines for assessing severity of OP poisoning.
b. To assess the utility of PSS and GCS scoring systems in predicting severity and clinical outcomes in OP poisoning.

MATERIALS AND METHODS

Method of Collection of Data (Including Sampling Procedure)

100 patients of organophosphorus poisoning who are presented at Department of Medicine, Government General Hospital, Kurnool, to were included for the study. Patients above 18 years of age of either sex presenting with organophosphorus or carbamate poisoning admitted to emergency department or ICU were assessed and demographic data and prehospitalisation period data, clinical data including laboratory data, PSS and GCS scores was assessed on admission and again after 24 hours and subsequently patient was reviewed daily till discharge or death assessed. Regarding outcomes, patients will be divided into groups like survived without intubation, survived but required intubation and ventilation, death in spite of intubation and ventilation.

Inclusion Criteria

1. Patients >18 years admitted to Emergency Department of Government General Hospital, Kurnool, with organophosphorus or carbamate poisoning.
2. Patient presenting with history of consumption of an unknown compound presenting with clinical features of OP poisoning.

Exclusion Criteria

Patients <18 years and patients presenting with poisoning other than organophosphorus/carbamate poisoning.

Sample Size- 100.

Sample Design- Purposive sampling.

Study Design- Observational study.

Study Period- May 2014-April 2015.

Need for Scoring Systems

Studies are necessary as to whether it was possible to predict inpatient mortality in OP poisoning using a scoring system based on simple clinical parameters recorded solely at admission and enable clinicians to identify patients at high risk of dying soon after presentation allowing more intensive monitoring and treatment.[4]

The International Program on Chemical Safety (IPCS)/EC/EAPCCT Poison Severity Score (IPCS PSS) was developed by the International Program on Chemical Safety, the European Community and the European Association of Poisons Centers and Clinical Toxicologists.

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

Table 1. Poison Severity Score

Use of PSS

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.

Glasgow Coma Scale

The Glasgow coma scale or GCS is a neurological scale that aims to give a reliable, objective way of recording the conscious state of a person for initial as well as subsequent assessment.

RESULTS

Hundred patients diagnosed to have consumed organophosphorus compound poison were studied regarding age majority of poisoning occurred in 21-30 age group (n=59), followed by 31-40 age group (n=17), 18-20 (n=13).

The youngest patient being 18 yrs. and the oldest patient being 67 years.

This is because patients below 18 years were excluded and our study showed male preponderance.

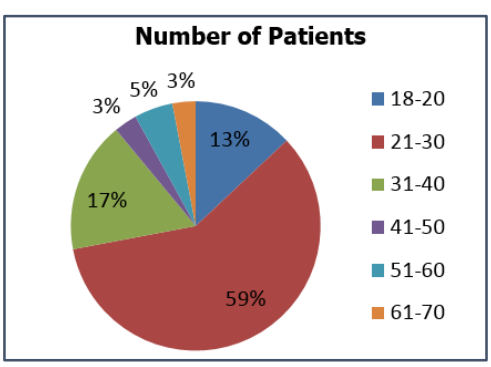

Figure 1. Age Distribution of Patients Studied

67 patients reached hospital within 6 hours of consumption of poison. 22 patients reached between 7-12 hours. Around 11 patients came after more than 12 hours after consumption.

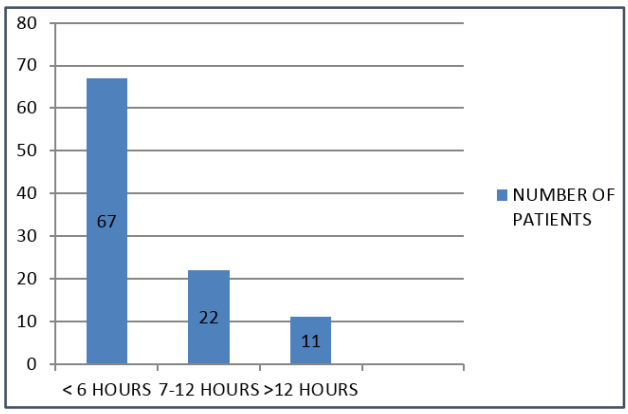

Figure 2. Distribution of Prehospitalisation Period in Hours of Patients Studied

Most common compound consumed in our study was methyl parathion and least common was phosphoran. Slightly more than half of the patients consumed less than 50 mL of poison. 21 patients consumed between 50 to 100 mL.

All except one case, all were due ingestion of OP poison due to suicidal intent.

89% were nonalcoholics and 11% of patients in the study were alcoholics.

Pseudocholinesterase levels were <500 in 40 patients, between 500-1000 in 18 patients, between 1000-5000 in 25 patients and >5000 in 17 patients.

Distribution of poison severity score of patients studied showed 45 cases of grade 1 poisoning, 26 cases of grade 2 poisoning, 23 cases of grade 3 poisoning and 6 cases of grade 4 poisoning (death within first 24 hours).

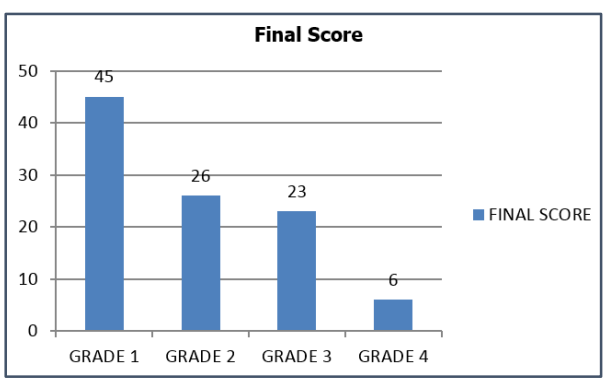

Figure 3. Distribution of Poison Severity Score of Patients Studied

Distribution of GCS score of patients studied GCS scores were <10 in 25 patients at admission and 24 patients after 24 hours. GCS scores were ≥10 in 75 patients at admission and 76 patients after 24 hours.

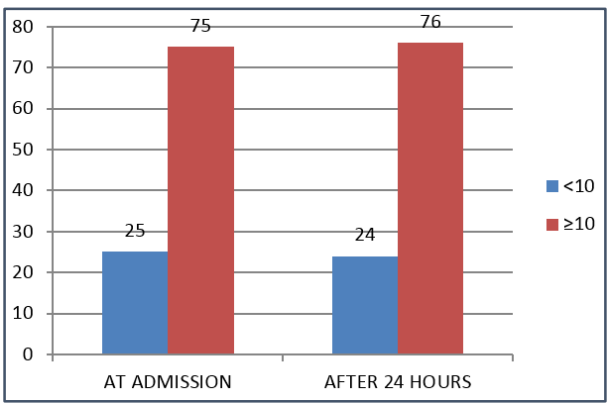

Figure 4. Distribution of GCS Score of Patients Studied

A total of 29 patients were intubated out of which overwhelming majority of patients were intubated within first 2 days.

Out of 100 patients, 69 survived without intubation; 14 survived, but needed intubation and prolonged stay in ICU. There were 17 deaths. Complications of patients like VAP etc. developed only in 7% of cases.

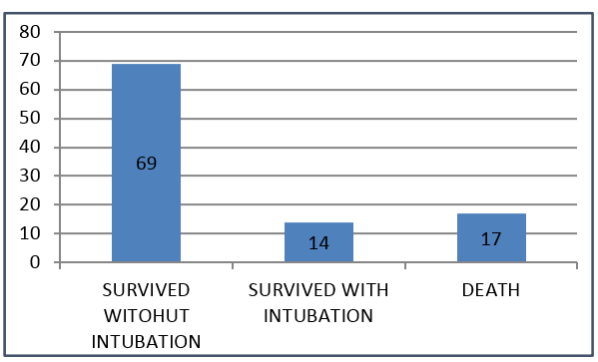

Figure 5. Distribution of Outcome of Patients Studied

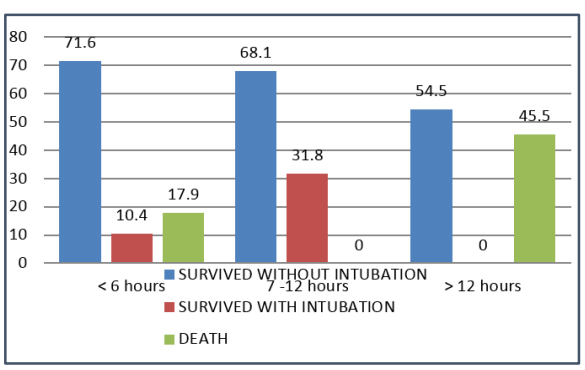

Figure 6. Distribution of Prehospitalisation (Hours) with Outcome in Three Groups of Patients Studied

Figure 6 shows distribution of prehospitalisation period in hours with outcome in three groups of patients studied. There was no association found between prehospitalisation period and outcome of OP poisoning (p=0.595). Actually, as this duration increases, poisoning severity is expected to rise, because the delay in treatment enables poison to increase its initial peak serum level, which leads to irreversible tissue damage.

Pseudocholinesterase	Outcome			Total
	Survived without Intubation	Survived with Intubation	Death	
<500	24 (60%)	8 (20%)	8 (20%)	40 (100%)
500-1000	14 (77.8%)	3 (16.7%)	1 (5.5%)	18 (100%)
1000-5000	16 (64%)	3 (12%)	6 (24%)	25 (100%)
>5000	15 (88.2%)	0 (0%)	2 (11.8%)	17 (100%)
Total	**69**	**14**	**17**	**100**
Mean ± SE	**2208.83 ± 298.59**	**838.86 ± 279.43**	**1711.41 ± 524.88**	

Table 2. Distribution of Pseudocholinesterase with Outcome in Patients Studied

Table 2 and Figure 7 shows distribution of pseudocholinesterase levels with outcome of OP poisoning. There was no statistical association (p=0.118) between pseudocholinesterase levels and outcomes of OP poisoning. In studies similar to ours, the relationship between acetyl cholinesterase level and the severity of OP poisoning has been examined, but there has been no common conclusion.

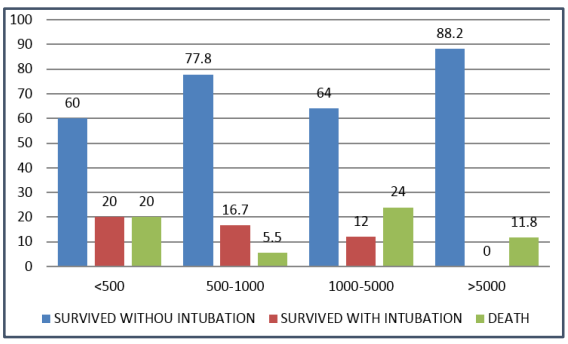

Figure 7. Distribution of Pseudocholinesterase with Outcome in Patients Studied

Poison Severity Score	Outcome			Total
	Survived without Intubation (n=69)	Survived with Intubation (n=14)	Death (n=17)	
Grade 1	45 (100%)	0 (0%)	0 (0%)	45 (100%)
Grade 2	23 (88.5%)	0 (0%)	3 (11.5%)	26 (100%)
Grade 3	1 (4.3%)	14 (60.9%)	8 (34.8%)	23 (100%)
Grade 4	0 (0%)	0 (0%)	6 (100%)	6 (100%)

Table 3. Distribution of Poison Severity Score with Outcome in Patients Studied

p = <0.001**

Table 3, figure 8 shows distribution of poison severity score with outcome of OP poisoning. All the patients presenting grade 1 poisoning survived without intubation. Out of all patients, grade 2 poisoning patients 88.5% survived without intubation and 11.5% of patients died. In patients with grade 3 poisoning, 14.8% of patients survived without intubation, 60.9% of patients survived with intubation and 34.8% of patients died. Our study tried to find out association of poison severity score within first 24 hours with outcome of OP poisoning. Poison severity score is not prognostic, but merely defines severity of OP poisoning at a given time. Study by Casey PB et al[5] supports prospective use poison severity score in poisoning. Present study found significant association between poison severity score within first 24 hours and outcome of OP poisoning (p=<0.001). This corroborates findings of previous studies by Sam et al,[1] Davis et al[4] and Akdur et al.[6] This is one of the main findings of our study.

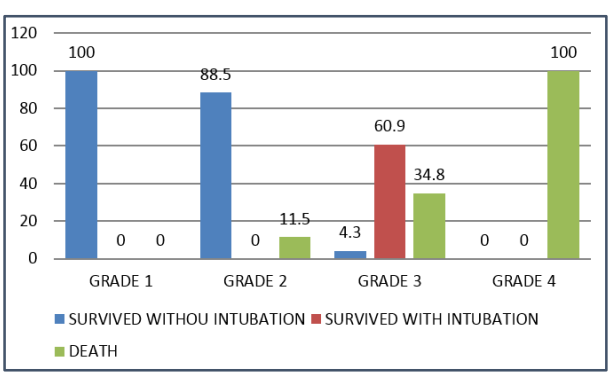

Figure 8. Distribution of Poison Severity Score with Outcome in Patients Studied

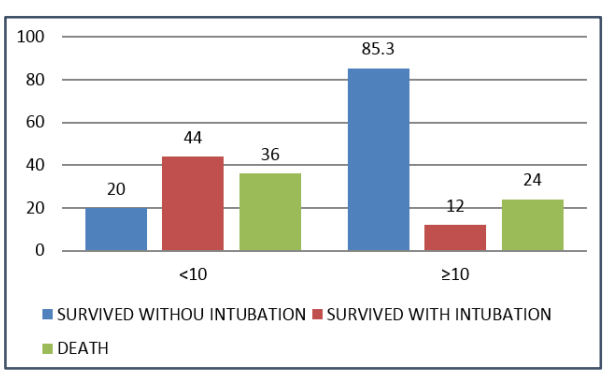

Figure 9. Distribution of GCS Score at Admission with Outcome in Patients Studied

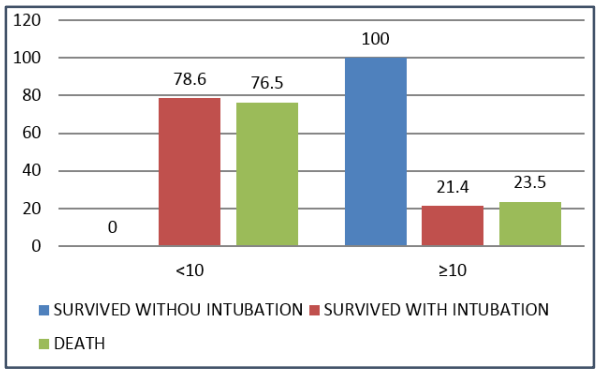

Figure 10. Distribution of GCS Score after 24 Hours with Outcome in Patients Studied

GCS Score	Outcome			Total
	Survived without Intubation (n=69)	Survived with Intubation (n=14)	Death (n=17)	
At admission				
<10	5 (20%)	11 (44%)	9 (36%)	25 (100%)
≥10	64 (85.3%)	3 (4%)	8 (10.7%)	75 (100%)
Mean ± SD	12.92 ± 1.44	7.85 ± 1.51	8.76 ± 2.81	

Table 4. Distribution of GCS Score at Admission with Outcome in Patients Studied

p=<0.001**

GCS Score	Outcome			Total
	Survived without Intubation (n=69)	Survived with Intubation (n=14)	Death (n=17)	
After 24 hours				
<10	0 (0%)	11 (78.6%)	13 (76.5%)	24
≥10	69 (100%)	3 (21.4%)	4 (23.5%)	76
Total	**69 (100%)**	**14 (100%)**	**17 (100%)**	**100**
Mean ± SD	**13.73 ± 0.79**	**8.00 ± 1.70**	**6.91 ± 3.75**	

Table 5. Distribution of GCS Score after 24 Hours with Outcome in Patients Studied

P=<0.001**

Table 4, figure 9, table 5 and figure 10 show distribution of GCS at admission and after 24 hours with outcome in patients studied. For the assessment of severity and mortality of OP poisoning patients in an emergency situation, the GCS score is the best indicator (simple, less time consuming and effective). Thus, GCS can serve as a reliable tool for the evaluation of mental status and the severity of poisoned patients in the emergency department, several studies on therapies used in OP poisonings employed the GCS for evaluating brain injury. In present study, there is strong association between GCS <10 both at admission (p=<0.001) and after 24 hours (p=0.001) and outcome of OP poisoning. GCS <10 denoted worse outcome. Although, GCS score of <8 is generally accepted as an indication for intubation, there is no accepted criterion/standard.[6] In the present study, intubation and ventilatory support was considered only when the patient had Respiratory Failure (RF) and not on the basis of GCS values. This finding has a lot of significance as GCS is simple easy to use and can be used in peripheral setups were infrastructure is minimal.

The findings of this study highlights the usefulness of few clinical indices like GCS and poisoning severity scoring systems for predicting severity, which in turn can be used to predict outcome of poisoning in patients especially during triage. Identification of severity at an early stage followed by prompt treatment can prevent the late respiratory and cardiac failures associated with OP poisoning.

DISCUSSION

The present study was conducted to assess the efficacy of clinical scoring system, mainly GCS and PSS to predict severity and clinical outcome of OP poisoning. The possible outcomes and risks at different exposure levels were predicted by evaluating clinical effects, poisoning severity and severity of mental injury. Organophosphorus compounds poisoning are most common among various compounds that have been consumed both intentionally and accidentally among South Indian population.[7]

The present study was conducted among patients presented with consumption of OP compounds to Emergency Department of Government General Hospital, Kurnool, a tertiary care teaching hospital. The study period was from May 2014 - April 2015.

Patient Demographics and Exposure Characteristics

Mean age of the patients presenting to our emergency department was 30.07 ± 10.91 years. Majority of cases presented were in age group of 21-30 years (n=59%) and least was in age group of 61-70 years (n=3%). Youngest patient had age of 18 years and oldest of 67 years. In studies by Kishore Thunga et al,[8] Nilamadhab et al[9] and Kora SA et al,[10] majority of patients were from age group of 21-30 years. Another study by Rao et al (2005)[7] showed that about two-third of the patients admitted in Warangal due to acute exposure of OP poisoning were less than 30 years.

Gender Distribution of Patients

Present study showed male gender preponderance, 71% of the patients were males and 29% were females. This corroborates with the previous study of Sam et al (2009), wherein 76% were males and 24% were females. Even in studies of Kishore Thunga et al,[8] Nilamadhab et al[9] and Rao et al, there was male predominance. Even in study by Kora S A et al[10] and study by Indranil Banerjee et al,[11] there was female predominance.

The average time lapse between exposure to the time of admission at the emergency department (prehospitalisation period) was 6.43 ± 4.80 hours and the median was 5 hours. In study done by Banerjee et al,[11] mean prehospitalisation period was 4 hours. In study done by Kishore Thunga et al,[8] it was 3 hours, and in study by Kora et al,[10] it was 4 hours. The average prehospitalisation time was higher in our study as compared to other studies.

Distributions of various types of OP compounds were consumed in our referral population are 38% cases. The compound could not be ascertained and diagnosis was made on ground of history of pesticide consumption, clinical features of cholinergic excess. Among the rest 62% cases, the most common compound consumed was methyl parathion, followed by chlorpyrifos and the least consumed was phosphoran. In studies done by Akdur et al[6] and Davis et al,[4] commonest compound was chlorpyrifos.

Amount of poison consumed is an important parameter in judging the severity of poisoning. 54% of patients came with consumption of <50 mL of OP poison. Around 21% of patients came with consumption of between 50 to 100 mL of OP poison. Only one came with consumption of more than 100 mL of OP poison. Most of the other studies also do not mention the amount of poison consumed.

Almost, all patients in study population presented with ingestion of OP poison with suicidal intent. Only one patient presented with inhalation while spraying OP poison in fields that is occupational exposure to OP compounds. Most of the other studies done support our findings.[4,6,7,8,9,10,11]

In current study, 89% of patients who presented were nonalcoholics and 11% were alcoholics. This was recorded because coingestion of alcohol and OP poison is common. This was not recorded in previous studies.

In our study, 40% of patients presented with pseudocholinesterase levels <500, 18% had levels between 500 to 1000, 25% of patients had levels between 1000 to 5000 and 17% of patients had levels >5000.

A number of systems have been proposed for predicting outcome in organophosphorus poisoning.

There is a need to assess the usefulness of the GCS, APACHE II, Predicted Mortality Rate and the International Program on Chemical Safety Poison Severity Score (IPCS PSS) to predict death in patients poisoned by OP pesticides. A simple system based on clinical features is likely to be most useful in low income countries where the majority of OP poisoning occurs.[1]

Poison Severity Score and GCS

The Poisoning Severity Score (PSS) 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.

PSS is not a prognostic score, but is instead meant to define the degree of severity when the overall clinical features are most severe.[1,12,13] Study done by Casey P.B.[5] showed that poison severity score recorded at admission can be used to predict outcome of poisoning patients.

In the present study, the poison severity score on admission and 24 hours after admission was recorded and the worst score recorded as final poison severity score. Out of 100 cases, 45% were grade 1 cases, 26% were grade 2 cases, 23% were grade 3 cases and 6% were grade 4 or death. Study by Casey et al[5] found that PSS at admission or first 24 hours was able to prospectively predict clinical subsequent deterioration or the clinical outcome.[7]

For the assessment of severity and mortality of OP poisoning patients in an emergency situation, the GCS score is the best indicator (simple, less time consuming and effective). Several studies on therapies used in OP poisonings employed the GCS for evaluating brain injury.[14,15,16,17]

In our study, GCS was recorded at admission and after 24 hours. GCS scores were <10 in 25 patients at admission and in 24 patients after 24 hours. GCS scores were >10 in 75 patients at admission and in 76 patients after 24 hours.

71 of patients did not require to be intubated. Out of the rest 29 patients, 26 patients had to be intubated within first 2 days and another 3 patients had to be intubated between 3-5 days. An overwhelming majority of patients who were intubated had to be intubated within first 2 days during the cholinergic crisis phase of OP poisoning. Study by Davis et al[2] also showed that intubation at admission or first 24 hours was highly specific for mortality.

Complications

7 patients presented with complications, 3 had intermediate syndrome, 1 had delayed OP-induced neuropathy, 1 had ventilator associated pneumonia, 1 was hepatitis B antigen positive and 1 developed status epilepticus.

Outcomes

Out of 100 patients studied, 69% survived without intubation, 14% patients survived, but required intubation and prolonged ICU stay, 17% patients died. The percentage of mortality was more in present study compared to previous studies of Sam et al,[1] Akdur et al[6] and Davis et al.[4]

Our study showed that as age increases number of deaths increases and number of patients needed intubation to survive increases. In other studies, association of age with outcomes has not been described.[4,6,8,9,10,11,17] Also, mean age in patients who survived without intubation is 27.35 ± 8.27, mean age of patients who survived, but required intubation is 33.86 ± 12.34 and mean age of patients who

died was 38.00 ± 14.56. Hence, association of age with outcome of OP poisoning was significant (p=<0.001).

In males, 66.2% survived without intubation; 14.1% survived, but required intubation and 19.7% died. In females, 75.9% of patients survived without intubation; 13.8% patients survived, but required intubation and 10.3% patients died. Gender was not found to be associated (p=0.587) with outcomes of OP poisoning. This corroborates the findings of previous studies by Sam et al, Akdur et al and Davis et al. The studies done by Girish Thunga et al[8] and Nilamadhab et al[9] had similar mortality rate of around 25%.

There was no statistical correlation found between alcohol consumption and outcome of OP poisoning.

There was no statistical association (p=0.118) between pseudocholinesterase levels and outcomes of OP poisoning. In a study conducted by Aygun et al[18] on patients with OP poisoning and low levels of serum acetyl cholinesterase were reported to support the diagnosis of acute OP poisoning, but acetyl cholinesterase levels were not related to clinical severity. A study by Nouira et al[19] also found no correlation between levels of pseudocholinesterase and severity or outcome of OP poisoning. In our study, we find no correlation between pseudocholinesterase levels and outcome of OP poisoning, in fact mean pseudocholinesterase levels in patients who died are more than patients who survived with intubation.

As per the poison severity score(PSS) score, all the patients presenting grade 1 poisoning survived without intubation. In patients with grade 2 poisoning patients, 88.5% survived without intubation and 11.5% of patients died. In patients with grade 3 poisoning, 14.8% of patients survived without intubation, 60.9% of patients survived with intubation and 34.8% of patients died. Present study found significant association between poison severity score within first 24 hours and outcome of OP poisoning (p=<0.001). This corroborates findings of previous studies by Sam et al,[1] Davis et al[4] and Akdur et al.[6] This is one of the main findings of our study.

For the assessment of severity and mortality of OP poisoning patients in an emergency situation, the GCS score is the best indicator (simple, less time consuming and effective). In present study, there is strong association between GCS <10 both at admission (p=<0.001) and after 24 hours (p=0.001) and outcome of OP poisoning. GCS <10 denoted worse outcome.

CONCLUSION

.Based on the findings of the current study,the following conclusions can be drawn.

- Both Glasgow coma scale and poison severity scoring systems are effective in predicting severity and outcome of OP compound poisoning.
- Glasgow coma scale maybe more helpful as it is easy to use, does not require any laboratory investigations. GCS being less time consuming and can be done easily, can be used in peripheral areas to identify high-risk patients for urgent referral to tertiary care centers.
- OP poisoning is associated with worse outcomes with increasing age.
- Plasma pseudocholinesterase levels at admission had no significant association with outcome of OP poisoning.
- Since methyl parathion and chlorpyrifos were the commonest compounds consumed and they were responsible for most number of deaths, banning or restricting their use may decrease mortality and morbidity of OP poisoning.

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