Review Article

A Review of Paradeniya Organophosphorus Poisoning Scale as a Severity and Prognostic Marker in Patients with Acute Organophosphorus Poisoning

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Introduction:

Organophosphorus compounds are used as pesticides are common causes of accidental and suicidal causes of death worldwide[1]. Different clinical scoring systems are used to predict the outcome of patients with acute organophosphorus compounds poisoning[2]. These are: International Program on Chemical Safety Poison Severity Score (IPCS PSS), Glasgow Coma Scale (GCS), Paradeniya Organophosphorus Poisoning (POP) scale, Acute Physiology and Chronic Heart Evaluation II (APACHE II), Sequential Organ Failure Assessment (SOFA), Simplified Acute Physiology Score II (SAPS II). Among these Paradeniya Organophosphorus Poisoning scale is OPC specific which was developed by Nimal Senanayake, H.J.de Silva and Lakshman Karalliedde in 1993. In this scale, common clinical manifestations of organophosphorus poisoning are selected as parameters and each is assessed on a three points scale varying from 0 to 2. POP score: 0 to 3 = mild, 4 to 7 = moderate, 8 to 11 = severe.

Peradeniya Organophosphorus Poisoning (POP) Scale[3] :

Parameter	Clinical Criteria	Score
Pupil size	>2mm	0
	<2mm	1
	Pin – Point	2
Respiratory rate	<20/min	0
	>20/min	1
	> 20/min with central cyanosis	2
Heart rate	>60/min	0
	41-60/min	1
	<40/min	2
Fasciculation	None	0
	Present, generalized or continuous	1
	Both, generalized and continuous	2
Level of Consciousness	Conscious and rational	0
	Impaired response to verbal commands	1
	No response to verbal commands	2
Seizures	Absent	0
	Present	1

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Methods:

We performed a review of the literature on Paradeniya organophosphorus poisoning scale as a severity and prognostic marker in patients with acute organophosphorus poisoning using the PubMed database including the term "Paradeniya organophosphorus poisoning scale". A total of 9 articles were identified. Of these we selected 3 articles from 1993 to 2024 that had comparative studies of Paradeniya organophosphorus poisoning scale and excluded articles - not related to present review, with inconsistent methodology or with evident selection bias.

Results and Discussion

A clinical scale was developed by Senanayake N, de Silva HJ, Karalliedde L. to assess the severity of OP intoxication[3]. In this study five common clinical manifestations of OP poisoning had been selected as parameters, each to be assessed on a 3 point scale varying from 0-2. The scale consist of 3 grades, mild (score 0-3), moderate (score 4-7), and severe (score 8-11). Sample size of the study was 173 patients with OP poisoning. They have made a correlations between the scores obtained on admission and their outcome variables (death, need for ventilatory support and the dose of atropine required in the first 24 hours after admission). Though laboratory estimation of blood cholinesterase and OP levels are specific to estimate the severity of the patient with OP poisoning but these are not available in most area of developing countries. The Paradeniya organophosphorus poisoning scale can grade severity without laboratory investigations. It can be applied even on non cooperative patients, severely ill patients, It is simple, can be used by paramedics or field workers too. The scale was validated using two consecutive series of 173 patients with OP poisoning. It was a prospective study. Acute OP poisoning patients (admitted within 24 hours of intoxication) were included in their study. In their first series of 84 patients (mild 25 patients, moderate 41 patients, severe 18 patients), severely intoxicated had unfavorable outcomes. More of them died, required ventilatory support and needed higher dose of atropine during the first 24 hours. In a second series of 89 patients (mild 58 patients, moderate 18 patients, severe 13 patients) who were graded moderately poisoned had relatively less unfavorable outcome than severely poisoned patients.

The author stated that the POP scale does not seem to predict the subsequent development of Intermediate syndrome (IMS) as there was weak correlation between development of muscle weakness with the scores and genesis of IMS depends on type of OP agents and the dose ingested. Health care workers need to decide first which patients require ICU and transfer to special center. These health care workers have to depend on clinical assessment and on Paradeniya Organophosphorus Poisoning Scale.

In a prospective observational study[4] which was done during the COVID period and the sample size were 100, evaluated the Peradeniya Organophosphorus Poisoning (POP) scale as a prognostic marker of the outcome of organophosphorus compound poisoning in a tertiary care hospital. In this study it was shown that the incidence of suicidal poisoning using OPC ranges from 10.3% to 43.8% and the incidence rate was same even durung COVID- 19 pandemic. They included the patients over 12 years of age with acute OP poisoning and with clinical signs and symptoms of OP poisoning. The authors excluded the patients with chronic exposure to pesticides and non-OP compound poisoning. All patients were treated according to guideline of OP poisoning treatment. Parameters of clinical outcome were (1) length of hospital stay (LOS) (2) complications (3) dose of atropine required (4) requirement of ventilatory support (5) duration of ventilatoty support and (6) mortality. They studied the correlations between the score obtained on admission and outcome variables. They summarized the continuous variables as mean±SD and categorical variables were the percentages of patients in each category. They applied Pearson's chi square test and odd's ratio. A p-value less than 0.05 were considered statistically significant. It was shown that 78% of the patients were improved and the mortality rate was 22%. The causes of death were (1) ventilator associated pneumonia (VAP) (2) Sepsis (3) multiorgan failure (4) intermediate syndrome (5) acute kidney injury (AKI). On admission, according to Peradeniya Organophosphorus Poisoning (POP) scale 27% patients were mild, 37% were moderate and 36% patients were severe OP poisoning. The study showed that only 11.11% of mild poisoning patients needed ventilatory support, 16.2% of moderate poisoning patients needed ventilator and 100% of severe OP poisoning patients received ventilator as treatment. This results were statistically significant. In mild OP poisoning patients, total dose of atropine needed was 146.37 mg, 176.89 mg in moderate grade of poisoning and it was 323.19 mg in severe OP intoxication which were statistically significant. The authors showed the mortality rate 5.4% in moderate group and 52.8% mortality in severe OP poisoning.

These features were also statistically significant. Respiratory failure was the main cause of death in this study which was due to aspiration of gastric contents, loss of central respiratory drive, bronchorrhea resulting in fluid overload in lungs causing hypoxia and respiratory muscle paralysis.

In a prospective observational study[5], evaluated the value of the POP scale in predicting the severity of OP poisoning, which was assessed over one year during the COVID-19 crisis. The sample size of the study was 60. In this study patients over 12 years of age were included with a history and symptoms of acute OP poisoning and patients who had received atropine and pralidoxime outside the hospital were excluded. Informed written consent was taken. The study aimed to assess the patient's need for mechanical ventilation, and ICU management and to see the final clinical outcome of the patients. In this study, 78.33% of the patients had mild poisoning according to the POP scale and 21.66% of patients had moderate poisoning. 70% of the patients required ventilatory support. The criteria for intubation were: respiratory rate less than 10/minutes. Inadequate chest rise suggests impaired self-respiratory efforts, thoracic-abdominal breathing asynchrony, and failure of non-invasive airway measures to maintain adequate oxygen saturation. In their study, 61.7% with mild poisoning required ventilator support and all patients with moderate poisoning needed ventilator support. They stated the reasons for a higher number of patients with mild poisoning requiring ventilator support are: (1) Majority of patients presented with respiratory failure irrespective of the presence or absence of other parameters of the POP scale and (2) a higher number of patients were diagnosed with mild poisoning. When we compared individual parameters of the POP scale, such as pupil size, respiratory rate, heart rate, fasciculations, level of consciousness, and seizures, all except heart rate, fasciculations, and seizures were significant in requiring ventilator support. 81.66% of the patients were recovered and 18.33% died. Most common cause of mortality in OP poisoning was respiratory failure (82%), followed by hypoxic brain injury, secondary infections such as ventilator associated pneumonia (VAP) and multi-organ failure. There were difficulties to obtain ICU bed, mechanical ventilation as the study was conducted during COVID situation and nationwide lock down. They suggests to incorporate other clinical parameters like bed side spirometry, presence of gurgling sound, pulse oxymetry and biochemical markers (PaO2 and PaCO2) .

	Title	Authors	Year	Country	Study type	Sample size
1.	A scale to assess severity in organophosphorus intoxication	Senanayake N, de Silva HJ, Karalliedde L	1993	Sri Lanka	Prospective study	173
2.	Study of organophosphorus compound poisoning in a tertia ry care hospital and the role of peradeniya organophosphorus poisoning (pop) scale as a prognostic marker of the outcome .	Kamath SD, Gautam VK.	2021	India	Prospective observational study	100
3.	Assessment of the peradeniya organophosphorus poisoning scale as a severity and prognostic marker in patients with acute organophosphorus poisoning presenting to an emergency medicine department	Malaviya NB, Parikh R, Pancholi K, Belim OB	2023	India	Prospective observational study	60

Conclusions

Paradeniya Organophosphorus Poisoning scale (POP) is unique and easy not only for developing countries but for all to predict the severity of acute OP poisoning. But Creatinine phosphokinase, RBC cholinesterase level are also severity and prognostic marker, if available.

Disclosures

All authors have declared that they don't have any financial relationship with any organizations that might have an interest in the submitted work.

Authors' contribution statement

Minhaj Uddin Ahmed: Conceived and designed the article, analyzed and wrote the paper.

Syed Talukder Venus: Analyzed and interpreted the data. Wrote the paper, supervised the artticle.

Umme Tahmina Shima: Designed the clinical component of the study, analyzed and interpreted the article.

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