CORRELATION OF PERADENIYA ORGANOPHOSPHORUS POISONING SCALE (POP) AND OUTCOME OF ORGANOPHOSPHORUS POISONING

Regmi G,1 Arjyal B,1 Khanal K,2 Pyakurel K,1 Shahi R1

ABSTRACT

Introduction
Organophosphorus poisoning is one of the common causes for the intensive care admission in the developing countries. This study was conducted to assess the correlation between Peradeniya Organophosphorus Poisoning (POP) scale and the outcomes in poisoning in a tertiary care hospital in Eastern Nepal.

Objective
To assess the severity and outcome of OP compound poisoning with the correlation of POP score.

Methodology
This was a prospective observational study conducted over 6 months in the intensive care unit at tertiary care hospital in the eastern part of Nepal. The study included all OP poisoning patients presenting in the emergency department and finally admitted to intensive care unit who fulfilled the inclusion criteria. Correlation was made between POP scores and outcomes in terms of intensive care unit (ICU) stay, need of ventilation and mortality was assessed.

Result
Fifty patients with OP poisoning were included in the study. Suicide attempt was the most common reason for poisoning. The incidence of poisoning was more common among males (72%) and significant majority were aged younger than 35 years (84%). On admission, the number of patients in mild, moderate and severe poisoning group were 52%, 30% and 18% respectively. Rates for ICU stay, respiratory failure requiring ventilator and mortality was significantly (p<0.001) higher in severe POP scale.

Conclusion
The POP scale is a useful clinical assessment tool to assess and categorize patients with OP poisoning according to severity and in predicting their clinical outcomes.

KEYWORD
Intensive care unit, mortality, organophosphorus poisoning, poisoning, peradeniya organophosphorus scale, ventilator.
INTRODUCTION

Along with cardiovascular and respiratory emergencies, acute poisoning is one of the major medical emergencies with significant morbidity and mortality. The intention of most of the poisoning is to deliberate self-harm.1,2 Accidental and occupational exposures to the pesticides leading to acute or chronic poisoning have been seen in farmers and children. Various acute poisoning annually accounts for around 0.3 million people death, out of which organophosphorus poisoning alone comprises 200,000 deaths, as reported by the World Health Organization (WHO).1,4 In 2012 an estimated 193,460 people died worldwide from unintentional poisoning out of which 84% occurred in low- and middle-income. Nearly a million people die each year as a result of suicide, estimated that deliberate ingestion of pesticides causes 370,000 deaths each year.3 Rajbanshi LK et al has mentioned that the incidence of organophosphorus acute poisoning was higher in the developing and resource-limited countries.5

Organophosphorus compound poisoning is a major clinical and public problem across rural Asia. Pesticide poisoning accounts for about 60% of the total estimated 500,000 deaths from self-harm each year. Suicidal attempt is seen as with a major cause of organophosphate (OP) toxicity in Nepal. Nepal mainly is an agricultural country. The pesticides and insecticides containing organophosphorus compounds are easily available over the counter. This leads to the misuse of the pesticides and insecticides as poisoning substances. The mortality rate is 7.4% for appropriately treated OP poisoning in Nepal, while 10% worldwide, and 0.18% in the US.6

Organophosphate (OP) inhibits the esterase enzyme, acetyl cholinesterase, which increases acetylcholine in muscarinic and nicotinic receptors in the central and peripheral nervous systems. Patients experience bradycardia, miosis, lacrimation, salivation, bronchorrhea, and bronchospasm within minutes to hours of exposure or ingestion, which are the signs and symptoms of cholinergic excess: 40% of patients may develop fasciculations and bulbar, proximal, and respiratory muscle weakness after 1-4 days of exposure, which are nicotinic symptoms depending upon the stage of organophosphorus poisoning.6

This tool was developed to assess the severity of OP intoxication in Department of Medicine, Faculty of Medicine, University of Peradeniya, Sri Lanka in 1993 which includes five most common signs and symptoms of OP poison like respiratory rate, pulse rate, pupil size, level of consciousness, seizure activity and fasciculation. Parameters were scored from zero to two at initial presentation. The grading of severity was as mild (score 0-3), moderate (score 4-7) and severe (score 8-11).11

As POP scale uses simple clinical parameters of organophosphorus poisoning, this scoring system can easily be used in emergency and ICU by the health care providers. The POP scale has become useful in estimating the outcome on the basis with the severity of the poisoning in developing countries like Nepal.4 Rajbanshi LK et al has observed that the leading cause of acute poisoning requiring admission to the ICU in the eastern part of Nepal is Organophosphorus poisoning. According to them 43.5% of the total poisoning are due to organophosphorus compounds in the eastern Nepal.4 Since organophosphorus compound poisoning is a medical emergency, it is important to know its nature, clinical presentation, severity and outcome in order to initiate appropriate measures including proper planning, treatment and prevention. As mentioned earlier cholinesterase test is not easily available in all the centers in eastern Nepal POP scoring system can be an alternative easy approach for assessing the severity of poisoning in this part of Nepal. Thus, this present study was under taken to assess the severity and outcome of OP compound poisoning with the help of POP score in the eastern part of Nepal and to find out the correlation between POP scale and severity of organophosphorus poisoning.

METHODOLOGY

This was the prospective cross-sectional study conducted in the intensive care unit of the tertiary care hospital in the eastern part of Nepal. We chose convenience sampling method to include study participants. The total duration of this study was 6 months starting from February 15, 2019, to August 15, 2019. After ethical approval was obtained from the institutional ethical board with reference number: NMCTH :248/2019and informed consent for the participation in the study was taken from the next of kin of the patient. All the patient who had the history of organophosphorus compound poisoning with in twenty-four hours of admission and presented with characteristic clinical signs and symptoms of organophosphorus poisoning were

| Clinical Parameters | Score 0 | Score 1 | Score 2 |
|---------------------|---------|---------|---------|
| Pupil size          | >2 mm   | <2 mm   | Pinpoint|
| Respiratory rate    | >20/min | >20/min | >20/min with central Cyanosis |
| Heart rate          | >60/min | 41-60/min | <40/min |
| Fasciculation       | None    | Present, Generalized / Continuous | Both generalized and continuous |
| Level of Consciousness | Conscious and rationale | Impaired responsiveness to verbal commands | No response to verbal commands |
| Seizure             | Absent  | Present | - |

Table 1. Peradeniya Organophosphorus Scale.
included in the study. The specific clinical feature of Organophosphorus poisoning expected to present at the time of poisoning were pupillary changes, excessive salivation, bradycardia, altered sensorium or agitation, fasciculation and seizure.

Poisoning of more than twenty-four hours before admission, poisoning with other compounds along with organophosphates, patient with the comorbid conditions and pregnant women were not included in the study.

The POP scoring system was used to assess the patient severity based on the clinical features presented in the emergency department. The patients were admitted to the intensive care unit after initial resuscitation and atropinization and were managed as per the guideline of management of OP poisoning. The age and sex of the patients, the severity of the poisoning on the basis of POP scoring system and outcome of the patients in terms of duration of ICU stay, hospital stay, need for respiratory support and mortality were studied. Mortality was observed as a number of deaths within the hospital stay.

The data obtained were coded and entered into Microsoft Excel Worksheet. Data were analyzed using Statistical Package for the Social Sciences Version 23.0. The categorical data were expressed as rates, ratios, and proportions; the comparison was done using either Chi-square test or Fisher’s exact test. The continuous data were expressed as mean ± standard deviation, and comparison was done using an independent sample t-test. \( P \leq 0.05 \) was considered statistically significant.

RESULT

In the 6 months duration total of 160 patients who were admitted in the ICU due to poisoning, out of them 89 admission was due to organophosphorus compound poisoning. In this study 50 patients were included and the remaining 39 patients of organophosphorus poisoning were excluded from the study due to various reason as mentioned in Figure 1.

The Figure 2 shows that 26 (52%) patients were between the age group of 16-25, 16 (32%) patients between the age group of 26-35 and remaining 8 (16%) patients were above 35 years age.

Figure 2: Peradeniya Scale with age group

In the present study, organophosphorus poisoning was seen in 72% of the male participants while it was 28% in female participants.

The relationship of Peradeniya scale scoring and development of respiraory failure requiring ventilatory support was shown in table 2. It was observed that 88.9% of the participants with severe Peradeniya scoring developed respiratory failure and required ventilatory support while only 11.5% and 33.3% of the participants with mild and moderate Peradeniya scoring respectively required ventilatory support.

Table 2: Peradeniya organophosphorus Scale vs Respiratory Failure requiring ventilator support

| POP score | Ventilator support (Yes) | Ventilator support (No) | p value |
|-----------|--------------------------|-------------------------|---------|
| Mild      | 3 (11.5%)                | 23 (88.5%)              | <0.001  |
| Moderate  | 5 (33.3%)                | 10 (66.7%)              |         |
| Severe    | 8 (88.9%)                | 1 (11.1%)               |         |

The duration of ICU stay was classified as less than 7 days or more than 7 days as per suggested by Chaudhary R et al. 11

It was observed that 88.9 % of the participant with severe Peradeniya scale has ICU stay more than 7 days while majority of the participants with mild to moderate Peradeniya scale had a ICU stay less than 7 days.

Table 3: Peradeniya organophosphorus Scale vs ICU Stay

| POP score | Duration Less than 7 days | Duration More than 7 days | p value |
|-----------|---------------------------|----------------------------|---------|
| Mild      | 23 (88.5%)                | 3 (11.5%)                  | <0.001  |
| Moderate  | 9 (60.0%)                 | 6 (40.0%)                  |         |
| Severe    | 1 (11.1%)                 | 8 (88.9%)                  |         |

Table number 4 shows the mortality of the participant on the basis of Peradeniya scale. It was observed that the mortality was higher (33.3%) with the severe Peradeniya scale as compared to mild and moderate Peradeniya scale.
DISCUSSION

The organophosphorus compounds are easily available as an insecticide and pesticide for agricultural purpose but unfortunately, they are misused leading to the acute poisoning. It is essential that these poisoning cases should be promptly evaluated, assessed the severity and should be managed promptly for better outcome.

The present study showed the higher incidence of poisoning in males (72%) compared to females (28%) similar to the other studies observed by Selvaraj et al and Subhash et al.\textsuperscript{10-13} The present study showed that majority of the patient with the severe Peradeniya scale developed respiratory failure and required ventilatory support. The sepsis has severe clinical presentation with low sensorium, excessive salivation and hemodynamically unstable. This might be the possible reason requiring ventilatory support. The study conducted by Shashank Tripathi observed that none of the patient with mild symptoms needed ventilator support while five patients with moderate symptoms and seven patients with severe symptoms required ventilator support.\textsuperscript{14} Shah Harsh D et al, in a similar study suggested that ventilator requirement was higher in cases with severe POP score. In a similar study conducted by Goel A et, predicted a higher incidence (34.95%) required assisted ventilation. The study showed 36 out of 103 patients required the ventilator support.\textsuperscript{15}

Similarly, the patient with severe Peradeniya scale had longer ICU stay. As mentioned earlier the patient with severe Peradeniya scale required respiratory support and were more prone to develop other organ failure. This, facts might has contributed the longer duration of ICU stay.

Similar data were extracted in the study conducted by Pradeep v et al,\textsuperscript{17} with 3 patients in mild group, 9 patients in moderate group and 3 patients in severe group stayed in ICU for more than 7 days.

Girish TS et al, reported in their study that a mean days of ICU stay in the severe POP group to be 9.11±3.027 and observed that there was a fall in the duration of ICU stay in mild and moderate group.\textsuperscript{18} Similar data was obtained in the present study where the mean days of stay in ICU patients with mild POP scores were 4.8±1.8. Similarly the mean days of moderate POP score group was 7.27±2.15 while that for severe POP score group was 8.67±2.34.

In present study, we observed higher mortality was higher with the severe peradiniya score patients with higher Peradiniya scale had increased probability of developing respiratory, cardiac and other organ failure leading to specific organ support intervention. This leads to the increased mortality of the patients. This statement was also supported statistically by a study done by Chaudhary S et al, in 2018.\textsuperscript{19} Study done by kavya ST et al also showed similar mortality of 4-30% patient with OP poisoning.\textsuperscript{20} Raddi D et al in his study observed mortality of 33.33% in the severe POP scale group similar to the present study.\textsuperscript{21}

CONCLUSION

In eastern part of Nepal, male showed higher incidence of OP poisoning with higher incidence of respiratory support, longer duration of ICU stay and increased mortality with higher POP score. The mortality, duration of ICU stay and subject requiring ventilation can be predicted early by applying the POP score at the time of admission. Thus, POP scoring system can be beneficial to assess the severity of poisoning in resource limited setup.

LIMITATION OF STUDY

The present study had some limitations. The study was carried out in a single center. Difficulties might arise in categorization of patients in severe poisoning as according to POP scoring, patients with relatively severe OP poisoning, have relatively higher respiratory rate but severe OP poisoning may cause either central respiratory depression decreasing respiratory rate or may cause tachypnoea in the context of bronchorrhea, bronchoconstriction or respiratory muscle weakness. The study may not represent the total population of the country as only 50 cases were enrolled in the study.

ACKNOWLEDGEMENT

Author would like to thank all the participants in the study for their sincere and active participation.

CONFLICTS OF INTEREST

There are no conflicts of interest

FINANCIAL DISCLOSURE

None.

**Table 4: Peradiniya organophosphorus Scale vs Mortality**

| POP score | Mortality |
|-----------|-----------|
| Mild      | 1 (3.8%)  |
| Moderate  | 2 (13.3%) |
| Severe    | 3 (33.3%) |
REFERENCES

1. Konradsen F, Dawson AH, Eddleston M, Gunnell D. Pesticide self-poisoning: Thinking outside the box. Lancet 2007;369(9557):169-70. DOI: 10.1016/S0140-6736(07)60085-3

2. Bertolote J M, Fleischmann A, Butchart A, Besbelli N. Suicide, suicide attempts and pesticides: a major public health problem. Bulletin of the World Health Organization 2006;84(4):260-261. DOI: 10.2471/BLT.06.030668

3. Thundiyil JG, Stober J, Besbelli N, Pronczuk J. Acute pesticide poisoning: A proposed classification tool. Bull World Health Organ 2008;86(3):205-9. DOI: 10.2471/BLT.08.041814

4. Eddleston M, Buckley NA, Eyer P, Dawson AH. Management of acute organophosphorus pesticide poisoning. Lancet 2008;371(9612):597-607. DOI: 10.1016/S0140-6736(07)61202-1

5. World Health Organization. World Health Report 2012. International Programme on Chemical Safety Poisoning Prevention and Management. Geneva, World Health Organization, 2012.

6. Rajbanshi LK, Arjyal B, Mandal R. Clinical profile and outcome of patients with acute poisoning admitted in intensive care unit of tertiary care center in Eastern Nepal. Indian J Crit Care Med.2018;22:691-6. DOI: 10.4103/ICCM.ICCM_207_18.

7. World Health Organization. World Health Report 2002. Reducing risks, promoting healthy life. Geneva, World Health Organization, 2002.

8. Licata C, Liu L, Mole D, Thorp J, Chand R, Chaulagain S. Social and Cultural Factors Leading to Suicide Attempt via Organophosphate Poisoning in Nepal. Case Reports in Psychiatry;2019. DOI: https://doi.org/10.1155/2019/7681309.

9. Amin, D.M., Abaza, M.T., El Azawy, D.S. and Ahmed, A.I. Morbidity and Mortality Indicators in Acute Organophosphate Poisoning in Zagazig University Hospital, Egypt: Retrospective Study. Occupational Diseases and Environmental Medicine. 2018; 6; 130-140. DOI:https://doi.org/10.4236/odem.2018.64011.

10. Chaudhary R, Bhandari R, Malia G, Poudel M, Lamal M. Correlation of Clinical Score and Serum Acetylcholinesterase Level as a Predictor of Outcome among Patients with Acute Organophosphate Poisoning Admitted in Emergency Ward of a Tertiary Hospital. JBPKHS 2019; 2(2): 19-27. DOI: https://doi.org/10.3126/jbphkhs.v2i2.27853

11. Vernekar V, Shivraj K. Peradeniya organophosphorus poisoning scale (POP) as a predictor of respiratory failure and mortality in organophosphorus poisoning. Sch. J. App. Med. Sci;2017; 5(5B): 1841-1844. DOI: 10.21276/sjams

12. Bajracharya S R, Prasad P N, Ghimire R. Management of Organophosphorus Poisoning. J Nepal Health Res Counc 2016; 14 (34): 131-8. PMID: 28327676

13. Selvaraj T, Sudharson T. Demographic and Clinical Profile of Organophosphorus Poisoning cases in a Medical College Hospital, Tamil Nadu. Indian Journal of Forensic and Community Medicine, April-June 2016; 3(2): 124-127. DOI: 10.5958/2394-6776.2016.00028.X

14. Prakash J, Joshi A, Joshi G. Profile of Organophosphorus Poisoning at Tertiary Care Hospital in Uttarakhando. J Indian Acad Forensic Med. 2013; 35(4): 346-348.

15. Chaudhary S, Kalmegh R. Study of role of prognostic markers in the management of organophosphorus poisoning patients. Int J Res Med Sci 2018; 6: 1996-9. DOI: http://dx.doi.org/10.18203/2320-6012.icrms20182276.

16. Shashank Tripathi. “Prognostic Value of Glasgow Coma Scale, Poisoning Severity Score and Serum Acetylcholinesterase Levels in Organophosphorus Poisoning”. Journal of Evolution of Medical and Dental Sciences 2014; 3(13); 3415-3422. DOI: 10.14260/jems/2014/2299.

17. Shah Harsh D et al. Acute organophosphorus poisoning and clinical admission Score association among patients admitted in emergency ward of a tertiary teaching hospital of medical college. JPBMIS. 2012; 17(08); 1-5. DOI:https://www.researchgate.net/publication/227854923.

18. Goel A, Joseph S, Dutta TK. Organophosphate poisoning: predicting the need for ventilator support. The Journal of the Association of Physicians of India. 1998 Sep; 46(9): 786-90. PMID: 11229248.

19. Girish T S, Reddy Y V. To Assess The Severity of Organophosphorus Compound Poisoning ClinicallyUsing Peradeniya Score. Indian Journal of Applied Research. 2016 Apr; 7(6); 617-9.

20. Kayva ST, Srinivas V, Chandana, Madhumati R. Clinical profile of patients with organophosphorus poisoning in an intensive care unit in a tertiary hospital. International Journal of Clinical Cases and Investigations 2012;4(3); 24-31.

21. Raddi D, Anikethana G V. Clinical profile of organophosphorus poisoning in a tertiary care hospital. Indian Journal of Basic and Applied Medical Research.2014; 4(1); 14-22.