Journal of Toxicology and Environmental Health Sciences Vol. 2(5), pp. 73-76, October 2010
Available online at http://www.academicjournals.org/JTEHS
ISSN 2006-9820 ©2010 Academic Journals

Full Length Research Paper

Evaluation of incidence, clinical characteristics and management in organophosphorus poisoning patients in a tertiary care hospital

Girish Thunga[1]*, Kishore Ganna Sam[1], Kanav Khera[1], Sureshwar Pandey[2] and Sudha Vidya Sagar[3]

[1]College of Pharmaceutical Sciences, Manipal, India.
[2]Acting Director, School of Pharmacy, University of the West Indies.
[3]Kasturba Hospital Manipal, India.

Accepted 15 September, 2010

Acute poisoning with agricultural pesticides is an emerging global public health problem particularly in developing countries like India. Among the acute poisoning, organophosphorus poisoning (OP) is the most common and responsible for majority of deaths. In the present study, we aimed to correlate the incidence of acute OP poisoning with the type of pesticides, its clinical characteristics and quality of management provided with subsequent outcomes in the patients. A prospective study was conducted with OP poisoning patients admitted to our emergency department between January 2008 and 2009. Information regarding the age, sex, occupation, type of agent, route of poisoning, clinical, laboratory findings, type of management and subsequent outcomes were recorded from the patient medical records. During the study period, 100 patients were followed admitted in the emergency ward with acute OP poisoning. The most predominant of the affected age groups was 21-30 years (60.5%). The most common reason for poisoning was attempted suicide (98%). The most common OP compounds exposed were methyl parathion and Quinolophos. The most frequent clinical signs were salivation, miosis, fasciculations, respiratory system findings, tachycardia, and hypertension. The total mortality rate of the study population was found to be 25%. Medical management mainly involved administration of pralidoxime and atropine along with supportive management. There was always correlation with type of compound, pre-hospitalization period and the type of management may be useful for preventing the mortality rate in developing countries like India.

Key words: Organophosphorus poisoning, management, pralidoxime, developing country, incidence.

INTRODUCTION

Pesticides comprise a wide range of compounds including insecticides, herbicides, fungicides and others. Thus, far more than 1,000 active substances have been incorporated in approximately 35,000 preparations of pesticides used in agriculture. Organophosphate compounds (OPCs), are most commonly used among them and are gradually increasing cause of accidental and suicidal poisoning, with high morbidity and mortality rates, especially in developing countries. OPCs may be taken via the oral, respiratory, or transdermal routes (Poojara et al., 2003; Bardin et al., 1994). Organo-phosphorus (OP) pesticide self-poisoning is estimated to kill around 200,000 people each year, largely in the Asia-Pacific region and the mortality rate varies from 10-20% (Karalliedde, 1999). The principal pharmacological action of all OPCs is the inhibition of acetylcholinesterase, and inhibition of this enzyme leads to accumulation of acetylcholine at nerve synapses and neuromuscular junctions, resulting in over- stimulation of acetylcholine receptors.

The initial over-stimulation is followed by paralysis of cholinergic synaptic transmission in the central nervous system (CNS), in autonomic ganglia, at parasympathetic

*Corresponding author. E-mail: girishthunga77@gmail.com.

and some sympathetic nerve endings (e.g., sweat glands), and in somatic nerves (Robey and Meggs, 2000; Tsao et al., 1990). Signs of organophosphate poisoning (OPP) may be classified into effects of secondary to muscarinic, nicotinic, and central nervous system receptor over-stimulation. Muscarinic over- stimulation is manifested as hyperactivity of the parasympathetic system, including miosis, bradycardia, lacrimation and bronchial secretion. Nicotinic effects include muscle fasciculations, cramping, and weakness while respiratory depression, seizures, and unconsciousness are the consequence of central nervous system effects (Nouira et al., 1994). In the present study, we evaluated 100 patients who were admitted to our emergency department (ED) with diagnosis of OPP and discussed clinical, social and demographic features.

Objectives

In the present study, we aimed to correlate the incidence of acute OP poisoning with the type of pesticides, its clinical characteristics and type of management provided with subsequent outcomes in the patients.

METHODOLOGY

A prospective study was conducted on patients with OPP admitted in Emergency ward between January 2008 and 2009. One hundred patients were included in the study. Patients were assessed at the time of admission. A detailed history had been taken from the patient or patient's family. The diagnosis of acute OPP was based on the following criteria: (1) history of exposure to or contact with insecticide; (2) signs and symptoms of OPP; (3) improvement of signs and symptoms with atropine and oximes, and (4) decreased psuedocholinesterase activity. Biochemical parameters along with complete blood count, serum amylase, serum cholinesterase level were measured. Gastric levage was done for all the patients in the emergency ward as an initial gut decontamination procedure. After initial gut decontamination process all cases were treated with continuous infusion of intravenous atropine and pralidoxime. Data regarding the age, sex, occupation, type of agent, route of poisoning, clinical effects of cholinergic overactivity, laboratory findings, and mortality rate were obtained from the patient files. These were recorded using standardized data collection forms and were analyzed with SPSS version 17.

RESULTS

During the study period, 100 patients who had OPP with a known agent were admitted to the emergency ward of Kasturba Hospital, Manipal. Majority of the admissions were due to ingestion of methyl-parathion (30%). Table 1 presents the distribution of patients according to age and sex. There were 68 male and 32 female patients and the male/female ratio was 2.1:1. The most frequently affected age group was 21-30 years in both sexes (40%). Out of 100 patients 60% were married. Residency distribution patterns showed that 64.5% of the patients came from rural areas, while 35.5% were from urban areas. The estimated mean pre-hospitalization period after the exposure was 2.5 ± 2.1 h (Min: 1 h, Max: 12 h). The average approximate volume of OPCs consumed was 48.9 ± 52.5 ml. The approximate volume of OPCs consumed obtained either from patient or patient party. Oral ingestion (98%) was found to be the most common route of poisoning. But, the most frequent reason for poisoning was attempted suicide (98%). The clinical findings at the time of admission are summarized in Table 2. The most frequent clinical signs were sweating, fasciculation, miosis, respiratory depression, tachycardia, loss of consciousness, and hypertension. The average Psuedocholinesterase level was 992.6 ±734.9 IU in the study population. The mortality rate of the study population was 25%. Out of 25 patients, 11 (36%) had sudden respiratory failure, 7 (28%) patients had respiratory and cardiac arrest, 6 (25%) of them had septic shock and 3(5%) of them had CNS depression (Table 3). The treatment involved in the management of organophosphorus poisoning mainly includes gut decontamination at initial stages either by gastric levage or administration of activated charcoal. Atropine and pralidoxime administered as antidotes along with other supportive therapy. All the 100 patients received gastric lavage at initial stage of therapy. Only 30 patients received activated charcoal every 6^{th} hourly for 1-2 days. This is mainly because most of the patients who were admitted in this hospital from primary care centers. All the 80 patients received atropine alone, while 20 patients had received both atropine and glycopyrrolate. A total of 70 patients received ventilatory support. PAM was administered in all patients.

Atropine dosing

Atropine was administered in different dosage regimen. The mean atropine requirement for the study population was 1184.86 ± 166.03 ml. A bolus dose of 5 mg was administered and followed by continuous infusion at different doses to 50 patients like 5, 10, 15 ml and maximum up to 80 ml per hour. However 30 patients received continuous infusion of atropine without bolus dose at different infusion rates like 5, 10 and 15 ml per hour and maximum up to 80 ml per hour. The dose of atropine was tapered based on clear chest on auscultation, heart rate > 80 /min, Systolic BP>80 mm Hg, Pupils no longer pinpoint and dry axillae.

Glycopyrolate

Out of the 100 patients, 20 of them received glycopyrrolate along with the atropine. The mean glycopyrrolate requirement for these patients was 30.11 ± 14.76 ml. It was given as a bolus injection of 1 ml hourly. It was observed that total dose of atropine required

Table 1. Age and gender distribution of OP poisoning.

Age (Years)	Gender		Total
	Male	Female	
<10	1	0	1
11-20	3	1	4
21-30	32	8	40
31-40	16	10	26
41-50	10	3	13
51-60	3	5	8
61-70	3	5	8
Total	68	32	100

Table 2. Clinical characteristic in OP poisoning.

Clinical characteristics	Frequency	Percentage
Sweating	69	69
Fasciculation	34	34
Miosis	78	78
Respiratory system findings	22	22
Tachycardia	34	34
Loss of consciousness	28	28
Hypertension	12	12
Seizure	1	1
Hypotension	2	2

Table 3. Secondary complications and mortality.

Secondary complication	Number of deaths (n =25)
Respiratory paralysis	9 (36%)
Respiratory and cardiac arrest	7(28%)
Septic Shock	6(25%)
CNS depression	3(5%)

in this group was reduced when compared in the patients who received atropine alone.

Pralidoxime

PAM was administered in all patients intermittently as 1 g/8th hourly. The mean PAM requirement for the study population was 12.1 ± 7.07 gm and was administered for mean 3.36 ± 2.25 days. 80% of the study population received intermittent dosing of atropine, while 20% received continuous infusion of pralidoxime.

DISCUSSION

OPCs have largely been used as pesticides in many parts of the world. They are readily available because of inadequate regulations controlling their sale. This easy availability of the compounds has resulted in a gradual increase in accidental and suicidal poisoning. In this study, the majority of patients were admitted due to ingestion of WHO class Ia type of pesticide (extremely hazardous chemical) which accounted for total 41.6% of acute OP exposure. Methylparathion (31%) was most common among them. A similar study in South India by Rao et al. (2005) showed that majority of the cases were admitted due to ingestion of WHO class Ib pesticides. Monocrotophos contributed major portion among them (Rao et al., 2005). Similar study in Sri Lanka by Hoek and Flemming (2006), showed that majority of cases admitted due to WHO II type of pesticides **(**Hoek and Flemming, 2006). Gender-wise distribution of study population showed that males (69.9%) predominated over females (30.1%). The male to female ratio was 2.3:1 with mean

age of be 33.59 ± 14.11 years. Out of 100 patients majority n =42 (37.2%) of patients were between the age group of 21-30 years. An Indian study by Nilamadhab (2006) showed similar results with male to female ration of 2.1:1; mean age of males was 31.5 ± 12.37 years and mean age of female was 29.7 ± 15.62 years (Nilamadhab, 2006).

Another study by Rao et al. (2005) showed that about two-third of the patients, admitted in Warangal due to acute exposure of OP poisoning were less than 30 years and males predominated over females (Rao et al*.,* 2005). But the study carried out in Turkey by Avni et al. (2003) showed that females predominated among the acute exposure of OP compounds with a mean age of 22.19 ±/9.2 years (Avni et al*.,* 2003).

In the present study majority of patients admitted, due to OP poisoning were agriculturists. Out of 100 patients, 51 patients were (45.1%) agriculture workers. A study in Sri Lanka in 2006 by Hoek and Flemming showed that majority of acute poisoning occurs in Agricultural group **(**Hoek and Flemming, 2006; Eddleston, 2000). An Indian study by Gannur et al. (2008) showed that 37.8% of the total OP poisoning occurred among agricultural workers (Gannur et al*.,* 2008).

The symptoms of OPP are related to subsequent accumulation of acetylcholine, which is usually termed cholinergic crisis. The signs of OPP may be classified as effects secondary to muscarinic, nicotinic, and central nervous system receptor overstimulation (Nouira et al., 1994). Clinical presentation depends on the specific agent involved, the quantity absorbed, and the type of exposure (Robey and Meggs, 2000). The most frequent sign in OPP in this study was salivation (90%), sweating (80%) and miosis (80%) (Gannur et al*.,* 2008). Fasciculations were seen in 50% of the patients. The respiratory depression and tachycardia were other frequent finding in the study population. A similar study on acute anticholinesterase poisoning showed miosis, bronchorrhoea and respiratory failure as initial predominant clinical features during the admission. The mortality rate was 25% in the study group. (Verhulst et al., 2002) The rate of mortality is similar to study by Nilamadhab Kar in 2006 (Nilamadhab, 2006). It is slightly higher than mortality rate reported by WHO in developing countries. The mean psuedocholinesterase level was low in mortality group when compared to survivors. The sudden respiratory failure, cardiac arrest and septic shock major cause for mortality. Like other studies treatment mainly involved gut decontamination followed by administration of atropine and PAM as an antidote.

PAM was given intermittently every 8th hour for 3-4 days and atropine as a continuous infusion which help in maintaining constant plasma concentration of the drug. Glycopyrrolate also used in 20 patients which reduced the atropine requirement in the patients. Glycopyrrolate in combination with atropine reduces the atropine toxicity and also improves the quality of treatment (Xavier et al., 2008).

Conclusion

This study showed that there was different opinion regarding management of OP poisoning and most of the cases admitted with young age group with suicidal intention. There was always correlation with type of compound that patient consumed, pre-hospitalization period and the type of management provided to the patients. This information may be useful in future for preventing the incidence of poisoning by educating the target population in developing countries like India.

ACKNOWLEDGEMENTS

The author expresses his gratitude to Manipal University, Medicine Department of Kasturba Hospital, Manipal and College of Pharmaceutical Sciences, Manipal.

REFERENCES

Poojara L, Vasudevan D, Arun Kumar AS, Kamat V (2003). Organophosphate poisoning: Diagnosis of intermediate syndrome. Indian J. Crit. Care Med., 7: 94-102.

Bardin PG, van Eeden SF, Moolman JA, Foden AP, Joubert JR (1994). Organophosphate and carbamate poisoning. Arch. Int. Med., 154: 1433-1441.

Karalliedde L (1999). Organophosphorus poisoning and anaesthesia. Anaesthesia, 54: 1073-1088.

Robey WC Meggs WJ (2000). Insecticides, Herbides, Rodenticides. In: Emergency Medicine: A Comprehensive Study Guide. Tintinalli JE, Kelen GD, Stopczyski JS, Eds. Mc Graw Hill, New York, pp. 1174-1176.

Tsao TC, Juang YC, Lan RS, Shieh WB, Lee CH (1990). Respiratory failure of acute organophosphate and carbamate poisoning. Chest. 98: 631-636.

Nouira S, Abroug F, Elatrous S, Boujdaria R, Bouchoucha S (1994). Prognostic value of serum cholinesterase in organophosphate poisoning. Chest, 106: 1811-1814.

Rao S, Venkateswarl CH, Eddleston M (2005). Pesticide poisoning in south India:opportunities for prevention and improved medical management. Tropical Med. Int. Health, 10: 581–588.

Hoek W, Flemming K (2006). Analysis of 8000 Hospital Admissions for Acute Poisoning in a Rural Area of Sri Lanka. Clinical Toxicol.. 44: 225-231.

Nilamadhab K (2006). Lethality of suicidal organophosphorus poisoning in an Indian population: exploring preventability. Ann Gen Psychiatry, 5: 321-76.

Avni SH, Idris S, Filiz A (2003). Sociodemographic factors in organophosphate poisonings: a prospective study. Human Experimental Toxicol., 22: 349-53.

Gannur DG, Maka P, Reddy N (2008). Organophosphorus compound poisoning in Gulbargaregion - A five year study. Indian J. Forensic Med. Toxicol. [Online]. [Cited 2010 Apr 12]; Avilable from: URL: http://www.indmedica.com/journals.php?journalid=11&issueid=120&articleid=1596&action=article.

Verhulst L, Waggie Z, Haterill M, Reynolds L, Argent A (2002). Presentation and outcome of severe anticholinesterase insecticide poisoning. Archives of Disease in Childhood. 86: 352-355.

Xavier VR, Thunga G, Sam GK, Pandey S, Kehra K (2010). Effect of Concomitant Atropine and Glycopyrrolate Infusion in Organophosphorus Poisoning. Available from: URL