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A STUDY OF SERUM CHOLINESTERASE LEVELS IN ORGANO PHOSPHOROUS POISONING

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Abstract

We conducted study from 01-09-2013 to 31-08-2014 i.e., for 12 months. 35 cases of organ phosphorus poisoning were admitted at Government General Hospital, Rajiv Gandhi Institute of Medical Sciences, Ongole, Andhra Pradesh, India. The cases were studied on various epidemiological parameters and Proforma prepared for detailed data. In our study the majority of victims were males, married, Hindu, Literate, from rural area, medium socioeconomic group and common age of victims is 21 to 30 years. The common mode of poisoning is suicidal, one is accidental poison in child and one is occupational as contact poison while spraying. No homicidal poison was reported in our study. Majority victims have consumed poison in day time, commonly abused poison is monochrotophos, and approximate amount of poison consumed by majority of the victims is 200 ml to 500ml and majority were admitted within 3to6hours of consumption of poison. The common motive of poisoning was suicidal in both male (24cases) and female (10cases), especially young victims from rural domicile with agricultural occupation. The majority of victims consumed poison in summer followed by winter season. The probable reason is rain dependent agricultural occupation, unemployment, joint family and medium socioeconomic status of population of this area.

Keywords: Organo Phosphorus Compounds, Epidemiology, Serum Cholinesterase, Victim

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INTRODUCTION

The Organo Phosphates which were first discovered more than a hundred years ago at present the predominant group of insecticides employed globally for pest control. The compounds are toxic to humans and represent an important source of poison as a suicidal agent domestically, and in some occupations. Organophosphates are used extensively in horticulture and agriculture; hence they are occupying the top position among the poisoning cases worldwide including India. As reported by WHO 3 million people consume these compounds resulting in 40,000 deaths annually. An attempt has been made in the present study to find out epidemiology of poison and estimation of serum cholinesterase levels. Organo phosphorus compounds are powerful inhibitors of the enzyme acetylcholinesterases which are present in plasma on the membranes or cytoplasm of cells. These enzymes are two types, one is true cholinesterase found in red cells, nervous tissue and skeletal muscles and another one is pseudo cholinesterase found in plasma, liver, heart, pancreas and brain. These compounds inhibit the cholinesterase in all parts of body, due to which acetylcholine accumulates at the parasympathetic, sympathetic and somatic sites and preventing the nerve impulse at myoneural junction.

Phosphorylated acetyl cholinesterase loses an alkyl group, due to which the enzyme cannot spontaneously hydrolyze and become permanently inactivated and enzymes become irreversible. These compounds are usually consumed orally so the absorption and the onset of action is immediate. Because of the easy availability and rapid lethal action in smaller doses, they are chosen as suicidal poisons and these are leading to peaceful death.

MATERIALS AND METHODS

During an 12 months period that is from 01-09-2013 to 31-08-2014, 35 cases of Organo Phosphorous poisoning were admitted at Government General Hospital, Rajiv Gandhi Institute of Medical Sciences, Ongole, Andhra Pradesh, India. Study conducted includes Age, Sex, Religion, Marital status, Occupation, Diurnal, Seasonal variation, serum cholinesterase levels and associated diseases. Blood samples were collected on the day of admission for estimating serum cholinesterase levels by Kinetic calorimetric method at central laboratory of Government general hospital, Ongole.

RESULTS

In the present study, 50 poisoning cases were admitted in the Government General Hospital, Ongole, out of which 35 cases were Organo Phosphorous compounds (Table 1).

Table 1. Organo phosphorus poisoning cases

No. of poisoning cases	No. of organophosphorus cases (%)
50	35(68.62)

Table No. 2 shows age wise distributions of Organo Phosphorous poisoning out of 35 cases, majority victims 27 was in the age group of 15-30 years, next in the age group of 31-60 years and least one in the age group of 1-5 years.

Table 2. Age wise distributions

Age in yrs	Common (m/f)	%	Female	Male
1 to 5	1	0.28	0	1
15 to 30	27	77.14	10	17
31 to 60	7	20	0	7
Total	35		10	25

Table No. 3 shows sex wise distribution, in which 25 were male victims including male child and 10 were female victims.

Table 3. Sex wise distributions

Sex	No. of victims (%)
Male	24 (68.57)
Female	10(28.57)
Male child	1(2.85)
Total	35

Table No. 4 shows marital status of victims, out of 35, 25 males were admitted, majority 25 males were married and 4 were unmarried. Out of 35, 10 females were admitted, 5 females were married 5 were unmarried.

Table 4. Marital status of victims

Marital status	No. of victims	percentage
Married	26	74.28%
Un married	9	25.71%
Total	35	

Table No. 5 shows area wise distribution, majority 28 victims belong to rural area and 7 victims belong to urban area.

Table 5. Area wise distribution

Domicile	No. of victims	Percentage
Rural	28	80.00%
Urban	7	20.00%
Total	35	

Table No. 6 giving information regarding literacy status of victims, out of 35, 25 males were admitted, 22 males were literates and remaining are illiterates. 10 females were admitted, 8 were literates and remaining are illiterates.

Table 6. Literacy status of victims

Sex	No. of literate victims	No. of illiterate victims (%)
Male	22(62.85)	2(5.71)
Female	8(22.85)	3(8.57)
Total	30(87.71)	5(14.28)

Table No. 7 shows the socioeconomic status of victims, out of 35, 27 victims belong to medium socioeconomic class, next is 6 victims were low socioeconomic class and 2 victims belong to high socioeconomic class.

Table 7. Socioeconomic status of victims

Socioeconomic status	No. of victims (%)
Low	6(17.14)
Medium	27(77.14)
High	2(5.71)
Total	35

Table No. 8 giving information about place of incidence, majority 27 consumed poison at home followed by 7 victims at work place and 01 victim at out side of home have consumed poison.

Table 8. Place of incidence

Place of incidence	No. of victims (%)
Home	27(77.14)
Workplace	7(20.00)
Outside home	1(2.85)
Total	35

Table No. 9 showing occupation wise distribution of poisoning, majority 17 victims belong to farmers followed by 7 were unemployed, next 5 were house wife and last 2 were student victims

Table 9. Occupation wise distributions

Occupation of victim	No. of victims (%)
Farmers	17(48.57)
unemployment	7(20.11)
House wife	5(14.28)
Daily labor	4(11.42)
student	2(5.71)
Total	35

Table No. 10 showing the incidence of day and night time of poisoning, majority victims 32 were consumed poison during day (6am to 6pm) time and remaining were consumed poison during Nighttime (6pm to 6am).

Table 10. Diurnal variation

Time	No. of victims (%)
6 am to 6pm	32(91.42)
6pm to 6am	3(8.54)
Total	35

Table No. 11 showing religion wise distribution of victims, majority 26 victims were Hindus next is 05 Muslims victims and 04 christian community. In India, majority population is Hindu community.

Table 11. Religion wise distribution

Religion	No. of victims (%)
Hindu	26(74.28)
Muslim	5(14.28)
Christian	4(11.42)
Total	35

Table No. 12 showing seasonal variation, majority victims 26 has consumed poison during summer followed by 8 during winter and one is in during monsoon season.

Table 12. Seasonal variation

Season	No. of victims (%)
Summer	26(74.28)
monsoon	8(22.85)
winter	1(2.85)
Total	35

Table No.13 giving information about mode of poisoning, common mode is suicidal 33; followed by accidental 01 and 01 is in occupational in nature. No homicidal poisoning is not reported in our study.

Table 13. Mode of poisoning

Mode of poisoning	No. of cases (%)
Suicidal	33(94.28)
Accidental	2(5.71)
homicidal	Nil
Total	35

Table No. 14 showing the period of survival, majority 33 victims admitted in Government general hospital with in 3 to 6 hours, 01 victim after 8 hours and 01 victim admitted after 24 hours after consumed poison.

Table 14. Period of survived

Period of survival	No. of victims (%)
Within 3 to 6 hrs	33(94.28)
More than 8 hrs	1(2.85)
Less than 24 hrs	1(2.85)
Total	35

Table No.15 shows majority 33 victims have consumed approximate amount of poison is 250ml to 500ml followed by 10 ml by 01 victim and 01 victim become a contact poison during (occupational poisoning) spraying insecticide

Table 15. Amount of poison consumed

Mode of poison	Approximate amount of poison consumed	No. of victims (%)
suicidal	250ml to 500ml	33(94.28)
Accidental	10ml	1(2.85)
occupational	Contact poison	1(2.85)
homicidal	Nil	Nil
Total		35

Table 16. Serum cholinesterase levels in death 8 cases

Sl.No	Age/sex	Approximate amount of poison consumed	Serum cholinesterase levels
1	60/M	500ml	70u/l
2	15 / M	450ml	110 u/l
3	22/M	500ml	80u/l
4	43 /M	500ml	70u/l
5	23/M	500ml	130u/l
6	22/M	500ml	134u/l
7	25/M	500ml	70u/l
8	50/M	500ml	878u/l

Table No. 16 giving information about levels of serum cholinesterase in Organo phosphorus poisoning death cases, death with fatal doses eighty (8) out of thirty-five (35) are not compatible with life, show low levels of serum cholinesterase (70 to 878 u/L). Serial no.8 inspired of 878 u/L of serum cholinesterase, victim already suffering with pulmonary tuberculosis.

Table No.17 giving information regarding survived male victims serum cholinesterase levels 814 u/ L to 9056 u/L (17 cases)

Table 17. Serum cholinesterase levels in survived male

Sl. No	Serum cholinesterase levels	Mode of poisoning	prognosis
1	4850u/l	suicidal	Recovered
2	5400u/l	Suicidal	Recovered
3	1981u/l	Suicidal	Recovered
4	814u/l	Suicidal	Recovered
5	1434u/l	Suicidal	Recovered
6	3501u/l	Suicidal	Recovered
7	4014u/l	Suicidal	Recovered
8	1356u/l	Suicidal	Recovered
9	990u/l	Suicidal	Recovered
10	2616u/l	Accidental	Recovered
11	1155u/l	Contact poison	Recovered
12	2976u/l	Suicidal	Recovered
13	1050u/l	Suicidal	Recovered
14	9056u/l	Suicidal	Recovered
15	1030u/l	Suicidal	Recovered
16	5600u/l	Suicidal	Recovered
17	2010u/l	Suicidal	Recovered

Table No. 18 giving information regarding survived female victims serum cholinesterase levels 1078 u/ L to 9240u/L (08 cases).

Table 18. Serum cholinesterase levels in survived female

Sl. No	Serum cholinesterase levels	Mode of poisoning	Prognosis
1	1166u/l	Suicidal	Recovered
2	1113u/l	Suicidal	Recovered
3	6136u/l	Suicidal	Recovered
4	3486u/l	Suicidal	Recovered
5	2180u/l	Suicidal	Recovered
6	9240u/l	Suicidal	Recovered
7	1156u/l	Suicidal	Recovered
8	5833u/l	Suicidal	Recovered
9	7210u/l	Suicidal	Recovered
10	1078u/l	Suicidal	Recovered

Table No. 19 showing the pattern of poisoning, commonest is organ phosphorus insecticide 35, followed by aluminum phosphide 11 and 5 were snake bite poisoning.

Table 19. Pattern of poisoning

Sl. No	Poison	Male victims	Female victims	Total (%)
1	Insecticide organophosphorus	25	10	35(68.62)
2	Aluminum phosphide	2	8	10(19.60)
3	Snake bite	4	1	5(9.80)
4	Unknown poison	1	Nil	1(1.96)

Table No. 20 showing trade names of different Organo phosphorus compounds and no. of cases, commonly consumed insecticide is Monochrotophos, followed by Malathion (Murari and Sharma, 2000) next Chlorpyrifos (Dhattarwal

and Harnam Singh, 2001) and Quinalphos (Gupta, 2005) least is Dimethoate (Aggarwal and Aggarwal, 1998).

Table 20. Trade names of O. P. Compounds

Sl. No.	Trade name of different organophosphorus compounds	No of victims consumed poison (%)
1	monochrotophos	18(51.42)
2	malathion	10(28.57)
3	Chlorpyrifos	4(11.42)
4	Quinalphos	2(5.71)
5	Dimethoate	1(2.85)
	Total	35

DISCUSSION AND CONCLUSION

In the present study, total no of poisoning cases 51 admitted, out of 35 was organophosphorus poison cases were studied in detailed of epidemiology and serum cholinesterase levels. Males (71.57%) were more prone to suicide by poisoning compare to females (28.57%) and they were in age group of 15-30years (77.14%) next age group is 31-60years (20%) and 8 deaths was(22.85%) occur in age group of 21-40year ,similar results are reported by other studies (Aggarwal and Aggarwal, 1998; Gupta, 2005; Dalal, 1998 and Kapila *et al.*, 2003). This age group is more active stage of life and more vulnerable for suicidal poisoning. This study reveals male preponderance (71.14%) compare to female (28.57%). These are consistent with other studies (Aggarwal and Aggarwal, 1998; Gupta, 2005; Dalal, 1998; Gargi *et al.*, 2003; Kar amjit Singh, 2003).

The majority of victims are married (74.28%)and remaining were unmarried (25.71%), this report suggest that ,more victims among married compared to the unmarried population, because married population exposure to more problems of social, financial, occupational and as well as domestic worries. Similar results are observed by other studies (Aggarwal and Aggarwal, 1998; Gupta, 2005; Dalal, 1998; Dhatarwal and Harnam Singh, 2001; Eddleston and Philips, 2004; Gargi *et al.*, 2003). The majority of victims were from rural (80 %) and urban (20%) domicile variation is reported. These are consistent with other studies (Kar amjit Singh, 2003; Dhatarwal and Harnam Singh, 2001). The higher incidence was observed in literate (85.71%) compared to illiterate (14.28%). These are consistent with other studies (Kar amjit Singh, 2003; Dhatarwal and Harnam Singh, 2001) because they can easily get poison by trade name.

Most of victims were belong to (77.14%) medium socioeconomic class. This might be due to modern life style, stress, tension, family and social problems more common in this class. These similar finding is made by other studies (Gupta, 2005; Kar amjit Singh, 2003; Shreemanta Kumar Dash, 2005). The majority of victims are consumed poison at home (77.14%), (Shreemanta Kumar Dash, 2005) this might be due to a firm decision was taken in the mind of victims to die that is why there are only stay at home. The high incidence was observed in farmers (48.57%) compare to that in people of other occupation (Gupta, 2005; Kar amjit Singh, 2003). More victims are committed suicide during day time (91.42%) (Shreemanta Kumar Dash, 2005) compare to night time (8.57%). These results are reported by Indian authors. Most of the victims were Hindu, because the major population of India is Hindu. (Dalal, 1998; Kar amjit Singh, 2003). The most of

victims committed suicide in summer season (Kar amjit Singh, 2003; Shreemanta Kumar Dash, 2005) (74.28%) compare to other seasons. The commonest mode of poisoning is suicidal (Aggarwal and Aggarwal, 1998; Gupta, 2005; Dalal, 1998; Eddleston and Philips, 2004; Gargi *et al.*, 2003; Kapila *et al.*, 2003; Kar amjit Singh, 2003)(94.28%) followed by accidental (5.71%) (Dalal, 1998) and homicidal poisoning was not reported in present study. It is observed that 33 cases were admitted in hospital with in 3 to 6 hours (94.28%) after consumption of poison (Kar amjit Singh, 2003; Niga *et al.*, 2004).

Most of victims (98.28%) consumed the approximate amount of poison is 250ml to 500ml is based on history given either by victims or and relatives. Incidence of deaths was found in 22.85% (8cases) followed by 3-6hours of period of survival, and serum cholinesterase levels found 70 u/l to 878u/l. Present study shows that serum cholinesterase levels 814u/l to 9056u/l in survived male victims and in survived female (Murari and Sharma, 2000) victims 1078u/l to 9240u/l. From the study it was observed that, organophosphorus insecticide was the commonest poison (68.62%) followed by aluminum phosphide (19.60%) and snake bite (9.80%). Similar observations made by other studies. (1-15) Majority of victims (51.42%) were consumed monochrotophos (Dhatarwal and Harnam Singh, 2001) followed by Malathion (28.57%) and Quinalphos (5.71%) among the different trade names of organophosphorus compounds. Serum cholinesterase levels between 70 U/L to 130 U/L appears to be incompatible with life except in 1 case where death occurred with 878 U/L levels. But he was found suffering from pulmonary tuberculosis.

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