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Original Research Article

Time Dynamics, Intricacies and Paradigms in Organophosphorus (OP) Compound Poisoning Over Decades - Experience from Tertiary Care Referral Hospital

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ABSTRACT

Acute poisoning is an important medical emergency and an important cause of morbidity and mortality all over the world, more so in the developing countries like India. Easy availability of Organophosphorus (OP) compounds as agricultural pesticides in India has contributed for OP compound poisonings.

Aims: Present prospective systematic study involved analysis of socio demographic aspects of OP compound poisoning with critical assessment of symptoms, signs, complications and management of the same. The cases in the past decade were compared with cases of the present to know for the presence of any similarities or differences.

Method: All consecutive cases of acute poisoning with OP compounds admitted under Medicine department at tertiary care referral hospital during Jan-Dec 2004 & Jan-Dec 2014 (Both being prospective studies) were included in the study.

Results: Socio demographic particulars, Predisposing factors, Precipitating factors, Signs, Symptoms, Complications and critical analysis of management in each case were meticulously recorded and analyzed. Role of investigations during hospital stay were also critically analyzed.

Conclusions: OP compound poisoning is showing an ugly raising trend at present compared to the past decade. During treatment, individual titration of atropine for a long duration of 2-3 weeks after poison ingestion is an absolute necessity. All OP poisoning cases should be evaluated for mortality indicators (A new concept highlighted in our study) at admission itself. Judicious use of investigations (Again a concept developed in our present study) during hospital stay should be employed mainly to confirm complications.

Key words: Organophosphorus compound, Poisoning, Atropine titration, Mortality indicators.

INTRODUCTION

Acute poisoning is an important and most common medical emergency carrying high mortality if timely medical intervention and support is not provided.

Poison is any agent which may produce an injurious or deadly effect when introduced in to the living body.

The agents and means used for poisoning vary in different parts of the world and in different parts of the same country depending on several factors such as easy availability of a particular substance, socioeconomic & cultural factors, mental makeup of the individual and the responsiveness of the society interacted with.

Expanding industrialization, Disintegration of the family unit, Remolding of the social values and Mounting stresses are some of the factors which add to the rising toll of poisoning

cases. Organophosphorus (OP) compound poisoning is a global health problem, but more so in the developing world particularly Asia. [1] World Health Organization (WHO) estimates 3 Million cases of OP compound poisoning occurring every year with a death of around 2,50,000 per year. [2] OP compound is an important agricultural pesticide used in India. Readily available highly toxic OP compound pesticides add brunt to the problem with a case fatality rate of more than 15%. Most commonly used OP compounds include Chlorpyrifos, Dimethoate, Methyl Parathion, Monocrotophos, Parathion Etc.

Need For The Present Study: An organized study incorporating Demographic profile of cases, Precipitating factors for the act, Psychiatric aspects with Detailed study of symptoms, signs, along with Critical review of management / treatment helps in reducing the morbidity, mortality of poisoning cases and gives clues for primary prevention and secondary prevention / prophylaxis.

Paucity of such exhaustive systematic work in the field of acute poisoning due to OP compounds and their comparison over decades has prompted for this study.

Aims And Objectives: Present study was undertaken to know whether there exists any obvious similarities & differences pertaining to Demographic profile, Mode of presentation, Pre disposing factors & Treatment outcomes in cases of Acute OP compound poisonings Decade earlier and At present. The Merits of this study being both the observations are Prospective in nature.

Benefits of the Study: Such an analysis gives a broad perspective of the OP compound poisoning and goes a long way in both Primary prevention and management.

MATERIALS AND METHODS

After obtaining necessary approvals and clearances, all consecutive cases of acute poisoning with OP compounds (Both sexes, Aged >18 years) admitted under Medicine department at tertiary care referral hospitals during the year Jan - Dec 2004 (Referred to as Past), and Jan - Dec 2014 (Referred to as Present), were included in the study. Detailed History pertaining to the Name of the compound consumed, Quantity, Time of consumption, Associated medical & psychiatric illnesses, Addictions were sought from each patient. Each patient was subjected to a thorough clinical examination on admission and at frequent intervals. Relevant and necessary standard investigations were carried out. Standard line of Treatment (Atropine and Pralidoxime) was adopted in each case. All the collected data were analyzed and conclusions were drawn.

OBSERVATIONS/ RESULTS

1. OP compound poisoning has shown an ugly rising trend from 24.56% earlier to 41.17% at present (Table 1).

Table 1: General Statistics

	PAST (Jan-Dec 2004)	PRESENT (Jan-Dec 2014)
Total Number of Poisoning Cases	179	119
OP compound poisoning	42 (24.56%) 26 (Male) 16 (Female)	49 (41.17%) 31 (Male) 18 (Female)
OP compound consumed -Baygon -Roger (Dimethoate 30%) -Chlorpyrifos 20%	 21 (50%) 21 (50%)	 49 (100%)
OP compound mortality	Total: 5 (11.9%) Male : 4 Female : 1	Total: 2 (4%) Male : 2 Female : 0

It is amply clear that different varieties of OP compound poisons (Baygon, Roger) were used in the past (earlier decade), whereas only one variety (chlorpyrifos) was available for consumption at present (Table 1) which could be attributed to government norms and regulations.

2 & 3. More than 40% of cases of OP compound poisoning were seen in the age group of 18-30 years among both males and females. The trend remains to be the same both during past and even at present (Table 2). In addition Married marital status has added to the woes which has been the same as seen decades earlier (in past) and even at present (Table 3).

Table 2: Age, Sex Distribution

Age	Past	Past	Present	Present
	Male (n=26)	Female (n=16)	Male (n=31)	Female (n=18)
18-30	18 (42%)	13	20 (41%)	09
31-40	05	02	06	04
41-50	02	00	02	02
51-60	00	00	02	02
>60	01	01	01	01

Table 3: Age, Sex distribution of Mortality cases*

Age	Past	Past	Present	Present
	Male (n=4)	Female (n=1)	Male (n=2)	Female (n=0)
18-30	01	00	00	00
31-40	01	01	00	00
41-50	01	00	00	00
51-60	00	00	01	00
>60	01	00	01	00

*All cases were married (Marital status)

4. Seizure disorder and alcohol addiction continues to be the plaguing predisposing factors for OP compound poisoning both in the past and even at present (Table 4). Among the psychiatric disorders, major psychiatric disorders (like schizophrenia, psychosis) were evident in the OP compound poisoning cases of earlier decade, while simple minor psychiatric disorders (like depression, panic disorder, borderline personality trait, impulsive attacks, adjustment disorder) drove persons to OP compound poisoning in the present decade (Table 4).

Table 4: Physical illness, Psychiatric illness, Addictions and Outcome

	Past (n=42)	Present (n=49)
Physical illness & Outcome	Seizure disorder (n=3) All survived	Seizure disorder (n=2) All survived
Psychiatric illness & Outcome	Schizophrenia & Psychosis (n=4) All survived	Impulsive attacks (n=1) Possession attacks (n=1) Borderline personality trait (n=1) Panic disorder (n=2) Depression (n=3) All survived
Alcohol Addictions & Outcome	n=4(10%) All survived	n=5(10%) All survived

5 & 6. The sole precipitator for OP compound poisoning was situational outbursts, which has been the same both in the past and at present (Table 5). Previous suicidal episodes/poison ingestion was totally absent in our series both in the past and at present also (Table 6).

Table 5: Intent for OP poison ingestion

	Past (n=42)	Present (n=49)
Adjustment disorder (situational outburst)	05 (12%)	12 (25%)
Accidental	01 (2%)	01 (2%)
Strain due to personal causes	36 (86%)	36 (73%)

Table 6: Past history of OP compound ingestion

	Past	Present
Past History of ingestion present	Nil	Nil

7. Maximum cases (38%) consumed poison during 12 Noon-6 PM in the past, while 40% consumed poison between 12 Noon- 12 Midnight at present. Least number of patients (5%) consumed poison in late night & early morning hours (00 Hours- 6 AM), which has remained the same in the past and also in the present (Table 7).

Table 7: Time of consumption of OP compound Poison

	Past (n=42)	Present (n=49)
6AM – 12Noon	13 (30%)	7 (15%)
12Noon – 6PM	16 (38%)	20 (40%)
6PM – 00Hrs	11 (28%)	20 (40%)
00Hrs – 6AM	02 (4%)	02 (5%)

8. Patients reaching hospital within 1-3 Hours of poison ingestion has dramatically gone up to 60% at present from 34% decade ago. Patients reaching hospital after 5 Hours of poison ingestion has drastically come down from 28% decade earlier to 20% at present (Table 8).

Table 8: Duration between OP compound poison consumption & reaching hospital

	Past (n=42)	Present (n=49)
Up to 1 Hour	09 (20%)	10 (20%)
1-3 Hours	14 (34%)	29 (60%)
3-5 Hours	07 (18%)	00 (0%)
5 Hours & Above	12 (28%)	10 (20%)

9. Meiosis (76%), Fasciculations (28%), Vomiting (36%), Altered consciousness (19%), Coma (19%), Labored respiration (24%) constituted the major presenting complaints on admission in the past. The same features were noted, but less frequently with labored respiration not being encountered (0%) at present (Table 9).

Table 9: Clinical features on admission

	Past (n=42)	Present (n=49)
Vomiting	15 (36%)	10 (21%)
Altered consciousness, Coma	08 (19%)	04 (8%)
Labored Respiration	10 (24%)	00 (0%)
Meiosis	32 (76%)	25 (50%)
Fasciculations	12 (28%)	12 (25%)

10. Routine complete haemogram and routine blood biochemistry investigations were non contributory in the OP poisoning both in the past and in the present. However investigations like Urine analysis (for pus cells, culture sensitivity), Chest X-ray (for pulmonary congestion, pneumonia), ECG (for arrhythmia like 2:1 block) were of value mainly in establishing the presence of complications in OP compound poisoning (Table 10,13).

Table 10: Laboratory findings in OP compound poisoning

	Past (n=42)	Present (n=49)
Haemogram	Nothing significant	Nothing significant
Blood biochemistry	Nothing significant	Nothing significant
Urine analysis(Positive pus cells and Culture sensitivity)	05 (12%)	01 (2%)
Chest X ray (Presence of Pulmonary congestion)	08 (19%)	02 (4%)
Chest X ray (Presence of Pneumonia)	05 (12%)	01 (2%)
ECG (Showing Arrhythmia, 2:1 block)	04 (10%)	00 (0%)

Table 11: Total Atropine chart – Quantity & Duration*

	Past- Quantity (Max/Min)	Past- Duration(Max/Min)	Present- Quantity(Max/Min)	Present- Duration(Max/Min)
Baygon	821mg/19mg	96Hrs/84Hrs		
Roger	625mg/6mg	230Hrs/48Hrs		
Chlorpyrifos			1146mg/26mg	192Hrs/42Hrs

*Durations are post poison ingestion durations

11. Atropine as the main stay of treatment was required; 821 mg (Maximum) & 6 mg (Minimum) in the past and at present it was 1146 mg (Max), 26 mg (Min). Maximum and minimum duration of Atropine administration was 230 Hours, 48 Hours in the past, and at present it was 192 Hours, 42 Hours. Wide range of Atropine requirement (quantity) and duration of Atropine administration is evident for different OP compounds both in the past and at present (Table 11). However the Duration of Atropine administration and Quantity of atropine administration have both shown a decreasing trend at present compared to the past (Table 11).

12. The Time required for full papillary dilatation suggestive of full atropinization (88 ± 9 Hrs in the past, 72 ± 16 Hrs at present) has however remained almost the same (Table 12).

13. Respiratory failure/ARDS (31%), Urinary tract infection (12%), Pneumonia (12%), Arrythmia-2:1 block (10%) were the complications encountered, and do occur as early as immediately after admission, to even up to 15 days (2 weeks) after admission. However the occurrence has shown a dramatic declining trend in the present times compared to past (Table 13).

14. Mortality do happen in OP compound poisoning even today in spite of

quick, efficient management. Males succumbed more, which has been the same both in the past and at present (Table 3). Our present study demonstrates a small percentage (4-7%) of mortality. Mortality due to individual OP compound was 7% for Baygon, 5% for Roger, 4% for Chlorpyrifos. However, the mortality due to OP poisoning has come down from 11.9% in the past to 4% at present (Table 14).

Table 12: Atropine chart for Full Pupillary dilatation - Duration* and Quantity

	Past	Present
Baygon	22 ± 17 Hours 250 ± 230 mg	
Roger	18 ± 12 Hours 174 ± 156 mg	
Chlorpyrifos		72 ± 16 Hours 400 ± 200 mg

*Durations are post initiation of atropine

Table 13: Complications in OP compound poisoning

	Past (n=42)	Present (n=49)
Respiratory failure/ARDS	13 (31%) – On arrival to hospital	02 (4%) – As early as 3 days, As late as 6 days post admission
Urinary tract infection (UTI)	05 (12%) – As early as 2 days, As late as 10 days post admission	01 (2%) – On 7th day post admission
Pneumonia	05 (12%) – As early as 8 Hours, As late as 4 days post admission	01 (2%) – On 15th day post admission
Arrythmia (2:1 Block)	04 (10%) – As early as 2 Hours, As late as 2 days post admission	

Table 14: Mortality in OP compound poisoning

	Past (n=42)	Present (n=49)
Total	05 (11.9%)	02 (4%)
Male	04	02
Female	01	00
Baygon	03 (7%)	
Roger	02 (5%)	
Chlorpyrifos		02 (4%)

15. Mortality indicators that were evident at admission itself both in the past and at present included Meiosis(papillary size 3mm & less), Pulmonary edema, Extensor plantar response, all of which were evident in all(100%) mortality cases due to OP compound poisoning. Other on admission clinical signs associated with mortality were - Absent deep tendon reflexes & non elicitable plantar response, which were evident in 40% of mortality cases (Table 15).

Table 15: Mortality indicators on admission

	Past	Present
Meiosis (3 mm & less)	05 (100%)	01 (50%)
Absent Deep Tendon Reflexes	02 (40%)	
Extensor Plantar Response	05 (100%)	
Non Elicitable Plantar Response	02 (40%)	
Pulmonary Edema/ Intermediate Syndrome	01 (20%)	02 (100%)

DISCUSSION

Poisoning as a means of suicide or non fatal deliberate self harm is an important medical emergency carrying high mortality if timely medical intervention is not available.

Among the poisonings, OP compound poisoning is a common variety of poisoning due to the fact that they are easily available as reported by Ponnudurai et al. [3] Even in our study OP compound continued to be the commonest poisoning both in the past & at present with the incidence of 24.56% and 41.17% respectively. This shows a rising trend of OP poisoning at present compared to earlier, mainly due to the social fabric of the society and the underlying individual stress factors.

Our present study is a rare, unique study involving critical analysis of various intricacies related to OP compound poisoning and also critical comparison of the same over decades.

Our study goes a long way in understanding OP compound poisoning in toto and tracking the changes with respect to all critical parameters that has happened over decades.

Male preponderance over females in the OP poisonings and vulnerable age group being 18-30 years has been reported by Ponnudurai R et al. [3] Our study also reiterates the same fact.

Poisoning is reported to be fourth most common cause of death in the age group of 18-30 years as reported by

Ponnudurai R et al. [3] However our study high lights the fact that, presently both young (< 50 Yrs) and elderly (> 50 Yrs) are equally susceptible to mortality due to poisoning.

Suicide rate is reported to be less in the married compared to the unmarried and more in the widowed, as reported by Mc Mohan B et al. [4] However, our present study contradicts this fact as married had more mortality risk and all the mortality cases were among married.

It is reported by Mackay A [5] that Epileptics have four times risk over general population in attempting suicides. In our present study also the same has been noted, both in the past decade and even at present.

Alcoholism, Alcohol dependence is reported by Ponnudurai R et al, [3] Morgan HG et al [6,7] as an important risk factor associated with suicides. In the present series also, addiction to alcohol was commonest and noted in 10% of cases both in the past and at present.

Ponnudurai et al, [3] Barraclough et al [11] have reported the incidence of associated psychiatric diseases in poisonings, to be as high as 33-50%. Reactive depression in the face of situational upset like quarrel, humiliation, bereavement, separation, dissatisfaction, distress, unhappiness, desperation, love failure have been quoted in the literature as factors associated with suicidal tendencies by Morgan HG et al, [7] Cochrane R et al, [8] Robert MA et al [9] and Bancroft JHJ et al. [10] In our present study also major psychiatric illnesses (like schizophrenia, psychosis) were contributory in the past decade , while minor psychiatric illnesses (like personality trait, panic disorder, adjustment disorder) were contributory in the present day as on today, which is a very disturbing trend. This highlights the need for proper counseling even for simple psychiatric disorders to prevent them from leading to poison ingestion.

Risk of poisoning is reported to be greatest in persons who have had previous attempts of suicide, as reported by Barraclough BM et al, [11] Morgan HG et al. [12] However our present study did not confer with this even in the past decade and at present also. This indicates that repeated suicidal attempts are not rampant in our geographical area.

Our study highlights the fact that Time of consumption of OP compound poison has gone for a radical change over decades, as 40% of poison ingestion was noted even during night hours (6PM - 00Hrs) at present, which was much lower (28%) in the past decade. This change is probably due to the change in work culture, occupational pressure, family pressure which is much more prevalent in the present times. Such an analysis is not found in the literature.

In our series maximum number of cases ie 34% in the past decade & 60% at present reached the hospital in 1-3 Hours. This indicates most of the patients “do not wish to die” and reveal their acts so as to get medical aid. This is also an indicator of awareness among relatives and availability of quick transport means, which goes a long way in efficient management of poisoning cases. However no such data is explicitly expressed in the literature.

Various symptoms and signs of OP poisoning (on admission) as reported by Eddleston M et al [13] include Meiosis, Fasciculation, Heart block, Tachycardia and Hypertension. Clinical features found in the present series (both in the past and at present) were in accordance with standard descriptions. However labored respiration was not encountered in the present but which was evident a decade earlier. Meiosis, Fasciculations were also encountered less frequently at present when compared to a decade earlier. This is due to early reaching of OP poisoning cases to medical facilities/hospitals and is a true reflection of the benefits of the same. Surprisingly in our series, Pulse and

BP remained stable till the end (death if so). Thus Pulse, BP did not reflect any severity of OP compound poisoning and should not be employed as clinical parameters to judge the prognosis. Such an analysis is not found anywhere in the literature.

Our present study brings to the fore front, the relevance of "investigations" in OP compound poisoning. It is evident that urine analysis. ECG, Chest X-ray are of value only in the presence of "complications" and thus helps in confirming complications. Thus judicial use of above investigations during hospital course is of paramount importance. Our study has also proved the fact that incidence of complications has shown a declining trend at present as compared to the past due to better, quick, effective management of cases. However no such analysis could be retrieved from the literature.

Eddleston M et al, [14] Pawar KS et al [15] have reported the treatment protocols indicating the need for Atropine 1-2 mg iv/im repeated frequently amounting to a total of 1 gram or more to achieve and maintain atropinization as judged by dry skin, tachycardia(140/min), papillary dilatation and elicitable ankle jerk. The treatment protocol for PAM (pralidoxime) included initial loading dose of 2 gram, then 1 gram every 4 hour for 3-5 days. Our present study also confirms the need for high dose of atropine of around 1 gram (821 mg in the past & 1146 mg at present) for treating OP compound poisoning cases. Our study also indicates that the maximum time required to achieve full papillary dilatation has remained almost the same both in the past and the present (88±9 Hrs in the past, 72±16 Hrs at present). Thus our study confirms the need for long duration (almost 4 days) of close meticulous monitoring and need for titration of Atropine dose for each individual patient. Our study also confirmed a decrease in total duration of Atropine administration and also total quantity of Atropine administered at present compared to the past, which can be attributed to quick initiation of treatment and better management of cases at present times. However such an analysis is not evident in the literature.

Senanayake N et al [16] have reported the occurrence of cardiovascular and respiratory complications in the form of Respiratory failure and Circulatory collapse among OP compound poisoning cases. Our study also confirms the same as there were Respiratory failure /ARDS, Urinary tract infection, Pneumonia, Arrhythmia (2:1 block) as complications. However our present study clearly indicates that OP poisoning cases should be constantly and closely monitored for development of complications, from as early as immediately after admission to even up to 15 days (2 Weeks) after admission. Also our study has shown a dramatic declining trend in the occurrence of complications presently compared to past decade, mainly due to early arrival of poisoning cases to medical setups (Hospital) and Quick, Appropriate, Effective medical management. These aspects have not been highlighted in any of the earlier literatures.

Senanayake N et al [16] have reported a small percentage of mortality in OP poisonings even after treatment particularly due to Respiratory paralysis, Respiratory failure, Circulatory collapse, and convulsions. In our present series however Convulsions as a cause for mortality was not evident. Our study also highlights the fact that mortality due to OP poisoning has come down from 11.9 % in the previous decade to 4 % at present. This proves the fact that mortality do happen, though small percentage (4-7%) in OP compound poisoning even today inspite of quick, efficient management.

Literature does not reveal any analysis of mortality indicators among OP compound poisoning cases. However our

present study highlights the following Mortality indicators: (i) Meiosis, Pulmonary edema, Extensor plantar response had worst prognosis with 100% mortality. (ii) Absent DTR, Non elicitable plantar reflex had 40% mortality risk, it is possible to judge overall mortality risk in OP poisoning cases based on the presence / absence of these mortality indicators. Surprisingly in our study Pulse, Blood pressure (BP) remained stable till the end (death if so). Thus they should not be considered for judging the prognosis in OP compound poisoning cases. Such an observation / analysis is not available in the literature.

CONCLUSIONS

Our present study is a unique study with complete analysis of OP poisoning cases of past decade and at present, and both being Prospective in nature.

After a thorough analysis and comparison, the following conclusions can be drawn:

*OP compound poisoning is the most common variety of poisoning, which is showing an ugly raising trend.

*Young married males in the age group of 18-30 years (Most vulnerable group) should be targeted for regular counseling either at community level or at work or at any other suitable alternative places for stress bursting. Every effort should be made to create a humane society with less adjustment disorders to prevent poisoning episodes.

*Alcohol addictions and psychiatric illnesses do need proper attention & counseling, particularly to avoid poisoning episodes in such persons, even though they are reluctant to accept psychiatric medical help.

*All efforts should be made for early transport of OP poisoning cases to hospitals, as it leads to a dramatic reduction of complications and mortality.

*All OP poisoning cases should be closely monitored and treated with individual titration of Atropine for a long duration of 2-3 Weeks post ingestion, as complications and mortality can happen even after 2-3 weeks of ingestion.

*Investigations like Urine analysis, ECG, Chest X-ray should be judiciously used during hospital stay, mainly to confirm the presence of complications.

*All OP poisoning cases should be evaluated for presence/absence of mortality indicators (at admission itself) mainly comprising of "Extensor plantar response, Meiosis, absent deep tendon reflexes, Non elicitable plantar response and Pulmonary edema". These will aid to judge the prognosis.

*Pulse, Blood pressure (BP) do not reflect any severity of Op compound poisoning and should not be employed as clinical parameters to judge the prognosis.

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