

RETROSPECTIVE ANALYSIS OF OUTBREAK OF ORGANOPHOSPHORUS POISONING IN CHILDREN, OUR EXPERIENCE IN A TERTIARY CARE HOSPITALSaif Zil Kibriya¹, Sadaf Rakhshan², Mushaf Muddassir Baig³**HOW TO CITE THIS ARTICLE:**

Saif Zil Kibriya, Sadaf Rakhshan, Mushaf Muddassir Baig. "Retrospective analysis of Outbreak of Organophosphorus Pesticide Poisoning in Children, Our Experience in a Tertiary Care Hospital". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 16, February 23; Page: 2797-2805, DOI: 10.14260/jemds/2015/400

ABSTRACT: BACKGROUND: Organophosphate pesticides are the most important cause of severe toxicity and death worldwide. Outbreaks of organophosphorus poisoning has increased specially in Bihar and south india after introduction of Mid-day meals schemes. **AIM:** To study the clinical profile of patients with organophosphorus poisoning outbreak, and efficacy of poison severity score as a triage to predict complications. **MATERIALS AND METHODS:** Thirty four students referred from primary health care to our tertiary care hospital. Medical History, physical examination and in some cases pseudocholinesterase was done. Medical records were retrospectively analysed and patients were divided into three groups (A, B, C) based on poison severity score. Inclusion and exclusion criteria were developed. The Incidence of complications were studied in each group. Patients were also divide into those achieving early atropinisation versus late atropinisation and compared. Statistical probability of each group was calculated with CHI SQUARE test. **RESULTS:** All patients were male children between 12 to 16 years (mean age being 13.6 years). Group A, Group B, Group C had 11, 20, 3 patients respectively. Overall vomiting (88%), abdominal pain (79%) and depressed mental status (55%) were the commonest symptoms. The rate of complication in Group A, Group B, Group C were 18%, 35% and 100% respectively, however a p value calculated (6.84 Vs 9.49) with CHI SQUARE test was not significant. The commonest complications were cardiovascular, followed by respiratory and renal failure. Two patients developed multiple organ dysfunction and has to be referred. Retrospectively among 18 patients were atropinised early, 3 had complications and among 16 atropinised late, 9 developed complications. By using CHI SQUARE test the p value calculated was significant (3.94 > 3.84). **CONCLUSION:** Poison severity score reliably predicts the incidence of complication and help in triage of patients in outbreaks of organophosphorus poisoning. Early atropinisation should be the goal to reduce complications.

KEYWORDS: Organophosphate poisoning, outbreak, early atropinization, children, triage.

INTRODUCTION: Organophosphate pesticides are the most important cause of severe toxicity and death from acute poisoning worldwide, with more than 200 000 deaths each year in developing countries.¹ Childhood poisoning constituted 2.1 % of the total paediatric admissions and 1.2% of total deaths and poisoning due to insecticides constitute around 14 percent of all pediatric poisoning and an upward trend is observed as use of pesticides has increased in the recent past several folds.²

Organophosphate compounds inhibit numerous enzymes, of which esterases seem to be the most clinically important. Inhibition of acetylcholinesterase leads to the accumulation of acetylcholine at cholinergic synapses, interfering with the normal function of the autonomic, somatic, and central nervous systems.³ Numerous case reports of have been reported of sporadic accidental

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organophosphate poisoning both in India and world-wide.^(4,5,6) Few case reports highlighting the potential of organophosphate compound as an outbreak have been published.⁷ Reports offering a critical clinical analysis has not been found in a scenario of increasing outbreaks specially Indian subcontinent. We would like to submit such an analysis for occurrence of an outbreak of organophosphate, managed in a tertiary care hospital.

MATERIAL AND METHODS: This is a hospital based retrospective analysis of organophosphorus poisoning outbreak occurring in north Karnataka where after dinner on 14th August 2014, 37 students of a government hostel reported sick and treated at a local primary health care Centre. Among these 34 student were referred to Government General Hospital Gulbarga. All students were males with age group of 12 to 16 years. An initial diagnosis of food poisoning outbreak was made, the presence of garlic odour, deterioration of neurological status and fasciculations in many of these patients, prompted a presumptive diagnosis of organophosphorus poisoning. A thorough medical history, meticulous physical examination was done. Complete blood picture, urine examination, electrolytes were done. Plasma pseudocholinesterase levels measured in 10 patients were found to be depressed. The approval of the Committee for Ethics was taken before conducting the study. Inclusion and exclusion criteria to identify cases were set.

INCLUSION CRITERIA:

1. Muscarinic symptoms and clinical findings example including-(Nausea, vomiting, diarrhoea, bradycardia, lacrimation, meiosis, blurring of vision, pain abdomen, urinary retention).
Or
2. Nicotinic symptoms and clinical findings example including-(Twitching, tremor, fasciculation, flaccid paresis, hypertension, tachycardia, respiratory failure, convulsion, cranial nerve palsy).

Patients referred from the particular primary health care center with either muscarinic or nicotinic symptoms or both, on 14th August 2014 from 9pm onwards to 12pm afternoon.

EXCLUSION CRITERIA:

1. Cases of organophosphorus poisoning or food poisoning other than the above said criteria.
2. Cases who were referred to other hospitals and do not reach Government general hospital Gulbarga on 14th august 2014 or after 14th august.

The case records of the above said patients were studied retrospectively and divide into three groups based on Poison severity score (PSS).^(8,9) (Table no-1)

	GRADE 1	GRADE 2	GRADE 3
Respiratory			
Intubated	NO	-	Yes
Others features	Cough, chest x ray normal	Prolonged cough, bronchospasm, requires oxygen	ARDS
Neurological			
GCS	14-15	9-13	3-8

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Seizures	No	-	Yes
Cardiovascular			
Bradycardia	>60BPM	41-50	<40
Tachycardia	140	60-180	>180
Hypotension	mild	pronounced	shock
Blood	Mild hemolysis	Hemolytic anemia, leucopenia	Severe hemolysis

Table 1: poison severity score for grading and triage

The development of complications and prognosis in each group was compared within themselves and patients were divided as those with early Atropinization and those atropinised late (within 5 hours V/s 12 hours) and presence of complications were statistically compared in each group. Patients were treated with Atropine and pralidoxime and supportive care including mechanical ventilation was given in cases of respiratory failure. Two patients were referred due to multi organ dysfunction to higher centre.

OBSERVATION AND RESULTS:

Patients were divided in 3 groups based on Poison severity Score:

	Case no (sl. no)	Total
Group A(Grade 1)	5,6,7,21,22,23,24,25,26,27,32	11
Group B(Grade2)	1,2,3,4,8,9,11,12,13,14,15,16,17,18,19,20,28,29,30,31	20
Group C(Grade3)	10,32,33	03

Table 2: Based on poison severity score (PSS)

SL. NO	Symptoms and clinical features	No. of cases	percentage
1	vomiting	30	88.23
2	Abdominal pain	27	79.41
3	Altered mental status	19	55.68
4	giddiness	11	32.55
5	fasciculation	10	29
6	Twitching	5	14
7	meiosis	4	11.76

Table 3: symptoms and clinical features. Overall distribution

Other features were diarrhea (10%), respiratory failure (8%), bradycardia (5.5%), hypertension (5.5%), convulsion (5.5%).

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Group	No. of cases complicated	Comments
A	2	Acute renal failure was the commonest in this group.
B	7	Cardiovascular complications (hypertension, Shock, arrhythmia, congestive heart failure) were commonest in all complicated cases. 2 patients developed intermediate syndrome, one had respiratory paralysis.
C	3	2 patients had MODS (multiple organ dysfunction syndrome). 1 patient had respiratory failure.

Table 4: Group wise distribution of complicated cases and commonest complication in each group.

Group	Total No. of patients	No. of complicated cases	Percentage	Duration of hospital stay. (mean)
A	11	2	18%	3.4 days
B	20	7	35%	6.3 days
C	3	3	100%	7 hours (2 patients were referred). 5 days. 1 patient improved.

Table 5: percentage of complicated cases in each group and their mean duration of hospital stay

Group	No. of complicated cases	No. of uncomplicated cases	Total No. of cases in each
A	2(E=3.84)	9(E=7.04)	11
B	7(E=7)	13(E=12.8)	20
C	3(E=1.05)	0(E=1.92)	3

Table 6: Applying CHI SQUARE TEST to calculate expected no cases in each group (E), testing the significance of difference between the above two proportions.¹⁰

The degree of freedom for the above table is 4. the calculated value is 6.84 which is less than 9.49 as to be seen for the above degrees of freedom from the contingency table.¹⁰

Atropinised	No. of cases Complicated	No. of cases Uncomplicated	TOTAL
Early	3(E=6.3)	15(E=11.52)	18
Late	9(E=10.24)	7(E=10.2)	16
Total	12	22	34

Table 7: Applying CHI SQUARE TEST to calculate the expected No. of cases in each group (E), testing the significance of difference between the above two proportions.¹⁰

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The degree of freedom for the above table is 1. the calculated value from CHI SQUARE TEST is 3.94 greater than 3.84 the value of p, observed in contingency table for above degree of freedom.¹⁰

Specific Clinical features type	No. of cases complicated with these clinical features	No. of cases Uncomplicated with these clinical features	Total number of cases	percentage
Nicotinergic	4	9	13	30.7%
Muscarenic	9	22	31	29.03%

Table 8: Co-relation between type of clinical features and occurrence of complication in all patients.

Total no. of cases added up in both groups is more than the NO of cases seen because of overlapping of symptoms in both groups.

DISCUSSION: Organophosphate compounds avidly bind to cholinesterase molecules and share a similar chemical structure, acting as irreversible cholinesterase inhibitors because the organophosphate-cholinesterase bond is not spontaneously reversible without pharmacological intervention. The inhibition of cholinesterase activity leads to the accumulation of acetylcholine at synapses, causing overstimulation and subsequent disruption of transmission in both the central and peripheral nervous systems. Exposure to organophosphate compounds will, therefore, interfere with synaptic transmission peripherally at muscarinic neuroeffector junctions and nicotinic receptors within sympathetic ganglia and at skeletal myoneural junctions.^(11,12)

Clinical manifestations are divided into three well defined clinical phases are observed- 1) Initial cholinergic phase. 2) The intermediate syndrome (IMS) 3) Delayed polyneuropathy.⁽¹³⁻¹⁷⁾

Cholinergic phase is mainly due to accumulation of Ach at the cholinergic synapses and may be classified into 1) Muscarinic (all postganglionic nerve endings) 2) Nicotinic (Autonomic ganglia and skeletal muscle end plates). 3) CNS manifestations (synapses in CNS).⁽¹³⁻¹⁷⁾

Anatomic site of action	Physiological effects
1. Bronchial tree	Dyspnea, increased bronchial secretions, cough, wheezing and tightness in chest
2. GIT	Vomiting, diarrhoea, nausea abdominal tightness, cramps tenesmus, faecal incontinence.
3. Sweat glands	Increased sweating
4. pupils	meiosis, occasionally unequal
5. Lacrimal glands	Increased lacrimation
6. Salivary glands	Increased salivation
7. Cardiovascular system	Hypotension, Bradycardia
8. Bladder Frequency and ciliary body	urinary incontinence and Blurring of vision

Table 9: Muscarenic effects ⁽¹³⁻¹⁷⁾

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of sympathetic ganglia	Pallor, tachycardia, hypertension,
of striated muscle	Muscle twitching, cramps, fasciculation, weakness

Table 10: Nicotinic (13-17)

The presenting features of organophosphorus pesticide poisoning in children has varied with studies in both the world and in India. Lifshitz M, shahak et al conducting a retrospective study on 36 Israeli children found predominant symptoms to be central nervous system depression and severe hypotonia. Cholinergic symptoms were rare.¹⁸ Similar reports in India by VP chowdhary, AJ jallali et al support this concept of differing acetylcholinesterase for different age groups being the cause for this different presentation in different age groups.¹⁹ This is in contrast with reports of Lverhulst, Z waggie et al and zwiener RJ, Charles MG et al showing essentially similar presentation of organophosphorus poisoning of children to adults, with commonest features being meiosis, bronchorrhea, tachycardia and decreased level of consciousness.^(20,21)

In our study we observed that the clinical features of organophosphorus poisoning were essentially similar to adults with muscarinic features being commonest, vomiting, pain abdomen, altered mental status. The cause for this difference of presentation could be because of greater age greater age of the pediatric patients included in the study. (refer Table no -3).

Complications of organophosphate pesticides are suggested to be similar both in adults and children except for greater central nervous system involvement in children due small body surface area and weight. In a study by Murat S, Goven m et al involving 47 adults, the commonest complication were respiratory failure, aspiration pneumonia, and urinary tract infection.²² similar are the descriptive reports from Nadia A A, Jamal A et al where aspiration pneumonia, hyperglycemia and respiratory failure were commonest complications.²³

Studies in children by L verhulst, Z waggie et al echoed similar results for incidence of complications in children with organophosphorus poisoning. With respiratory failure being commonest followed by seizure,coma and cardiac complication were significant in them.²⁴ However in our study the commonest complication were of cardiovascular system(shock, hypertension, arrhythmias) followed by respiratory complication including aspiration pneumonia, respiratory failure. Two patients developed acute renal injury in group A due to severe dehydration at the time of admission. This difference in incidence of complication could be due to difference of age in the studied groups Mean age(44 month in L verhulst et al vs 13.6 Years in our group). The study by Murats, Goven et al did not include the use of pralidoxime,²² this could be the cause of increased respiratory complications due to nicotinic toxicity.(as per Table 4).

Multiple studies both descriptive and cohort have demonstrated the efficacy of Poison Severity Score in predicting the prognosis and rate of complication in organophosphorus poisoning. Prominent among these are Persson HE, Sjöberg GK et al tested in fourteen poison centres and found to be effective.²⁵ J O J Davies, Michael E et al tested poison severity score with Glasgow coma scale and found both to be equally effective.⁹ In India studies by Daghari Z J, , Nikitha et al and Kavya S T and srinivas V has similar results^(,26,27)

In our study the group divided on basis of poison severity score were compared with the occurrence of rate of complication in each group. Not only the severity but also the rate of complication were found to increase as the poison severity score increased(Group A < GroupB

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<Group C). The stay in hospital was also progressively lengthened.(Group A < Group B). (Refer Table no 5)

Thus it could be assumed that Poison severity score could reliably predict the rate of complication and help in triage of patient even in time of outbreaks. However when statistically compared with complication rate using CHI SQUARE test p value was found to be less than the predicted value in the contingency table. This limitation could be because of insufficient size of sample being studied.(Refer Table no 6)

Commonest parameters to define Atropinisation (Atleast 3 of the following) Including:

1. Clear chest on auscultation.
2. Heart rate >80 BPM.
3. Systolic blood pressure >80mmhg.
4. Pupils no longer pin point.
5. Dry axillae.

Studies by Micheal E ,Nick AB et al and Balantyne B, Marrs TC et al clearly demonstrated the superiority of Atropinisation as a goal in decreasing complications due to organophosphorus poisoning.^(28,29) In our study patients who achieved Atropinization (at max 5 hrs) as a Goal early were compared with those atropinised later (12hrs). These Groups were compared with rate of complications with a CHI SQUARE TEST, it was found that the difference of proportion was significant, p value was 3.94 greater than 3.84. thus statically significant. Thus pointing towards a early goal of atropinisation is better than a late atropinisation for outbreaks. (Refer Table no.7).

The presence of significant muscarinic or nicotinic features individual does not affect the rate of complication. This can be clearly seen in our study as rate of complications are similar in both groups. (Refer Table no. 8).

CONCLUSION: Outbreaks of food poisoning could be due to organophosphate pesticide contamination, application of Poison severity scale can predict reliably Incidence of complication and help triage. Early atropinisation should be the goal to reduce morbidity and complications.

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