

Accidental Exposure of Farmers to Pesticide Poisons-A Retrospective Study at Tertiary Health Care Centre of Maharashtra

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Abstract: *Indian agriculture has witnessed green revolution. Since then use of pesticides is at its peak. During period July to November 2017 around 32 deaths occurred in Yavatmal and near districts due to accidental exposure to pesticides. Hence there is need for giving special attention to accidental exposure of farmers to pesticides. We carried out a retrospective study of patients admitted to General Medicine units of our tertiary care Government hospital due to accidental exposure to pesticides during the period January to November 2017. We found total 81 patients were admitted due to same, maximum no. of exposure occurred in the months of September and August. 42% of total patients belonged to the age group 21-30 years and 88% were male. Poisoning due to ingestion due to non-washing of hands was found to be most common route of poisoning. Less number of patients were coming from more peripheral areas suggestive of less awareness at more peripheral areas. 10.53%(8) patients had severe illness and required ventilator support and 2 patients died despite standard care and treatment. Mean duration of hospitalisation was 4.56 days. There is need for educating farmers about safe methods of handling pesticides also it important to strongly enforce health education.*

Keywords: pesticides, accidental exposure, farmer

1. Introduction

An India is the country where maximum population is dependent on agriculture for their livelihood, mostly in the huge rural areas. It is also a major contributor to the Gross Domestic Product (GDP). Agriculture and allied sectors has undergone a green revolution.

A pesticide is any substance or a mixture of substances intended for preventing, destroying, repelling or mitigating any pest. Such chemical or biological substances widely used in agricultural production to control pests, disease, weeds etc. [1]

The introduction of synthetic pesticides contributed greatly to pest control. Ideally a pesticide must be lethal to the targeted pests, but not to non-target species, including man. Unfortunately, this is not the case. The irrational use of such chemicals has created widespread devastation of human and other life forms. The production of pesticides started in India in 1952 with the establishment of a plant for the production of BHC near Calcutta, and India is now the second largest manufacturer of pesticides in Asia after China and ranks twelfth globally (Mathur, 1999). Statistics show steady growth in the production of pesticides in India, from 5,000 metric tons in 1958 to 102,240 metric tons in 1998. The trend of pesticide usage in India is different from the world, in India 76% of the pesticide used is insecticide, in comparison 44% globally (Mathur, 1999). The use of other pesticides like herbicide or fungicides is comparatively very less. In India pesticides mainly used for cotton crops, followed by paddy and wheat.

There are different types of pesticides designed to kill specific pests –

- Insecticides (for killing insects) e.g. organochlorines, organophosphates and carbamates.
- Herbicides or weed killers (e.g. paraquat, glyphosate and propanil).
- Fungicides (to kill mould or fungi)
- Rodenticides (to kill mice, rats, moles and other rodents).
- Fumigants are pesticides which exist as a gas or a vapour at room temperature and may be used as insecticides, fungicides or rodenticides, especially in closed storage places – (e.g. cyanide, aluminium phosphate and methyl bromide).

Other pesticides include algaecides (to kill algae), miticides (to kill moths) and acaricides (to kill ticks). [2]

Farmers are at high risk of getting exposed to these chemicals while handling at farms and are prone to develop poisoning. Pesticide poisoning may occur via different routes like inhalational, ingestion, dermal contact etc. Farm is a place where more than one route of exposure can occur. Some pesticides are capable to cross the epithelium of the skin and mucous membranes of the respiratory or gastrointestinal tracts. The rate of absorption depends on the chemical properties, amount of the chemical, length of exposure and the physical state of the molecule. Some other factors also affect absorption of pesticides for example maximum skin absorption occurs when there is vasodilatation (e.g. in summer, or with heating). Respiratory absorption is many times higher when respiration is more rapid (e.g. when more physical activity).[3]

Mechanism of acute toxicity of pesticides:

- Irritation
- Allergic sensitisation (fungicides)
- Enzyme inhibition (OPs, carbamates)

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- Oxidative damage (paraquat)
- Inhibition of neurotransmission (organochlorides)
- Uncoupling of oxidative phosphorylation (glyphosate) [2]

WHO CLASSIFICATION OF PESTICIDES

- WHO CLASS 1A- Extremely hazardous.
- WHO CLASS 1B- Highly hazardous.
- WHO CLASS 2- Moderately hazardous.
- WHO CLASS 3- Slightly hazardous.
- WHO CLASS U- Unlikely to present acute hazard[4]

OP pesticides inhibit acetylcholinesterase (AChE) at the muscarinic and nicotinic synapses by depositing a phosphoryl group at the enzyme's active site. The enzyme AChE, located at nerve terminals, normally hydrolyses acetylcholine. This results in an accumulation of acetylcholine and uncontrolled activation of cholinergic synapses producing nicotinic and muscarinic signs.

Muscarinic effects like bradycardia, miosis, diarrhoea, vomiting, sweating, bronchial secretions can be countered by atropine (or glycopyrolate). Nicotinic signs like muscle fasciculation's, weakness, diaphragmatic palsy, hypertension, tachycardia do not respond to atropine and if neuroparalysis leading to respiratory muscle paralysis occurs, artificial ventilation is the only remedy. Oximes like P2AM displace the organophosphates from acetylcholine esterase and bind to the enzyme. They then dissociate and reactivate cholinesterase. P2AM works best in the first 36-48 hours and best given as bolus doses.

There are 234 pesticides registered in India. Out of which 4 are WHO Class IA pesticides,

Some commonly used pesticide believed to be responsible for the deaths and illness in Maharashtra:

- 1) chlorpyrifos: lethal
- 2) Imadicloprid: victor
- 3) Monocrotophos: monocil
- 4) Phoret: thimet
- 5) Dichlorvas : nuvan
- 6) Dimethoate: rogorin

Pesticides like Monocrotophos and Oxydemeton-methyl are considered Class-I pesticides. Class-I pesticides are fatal at a very low dose, hence most of these are banned in several countries but most of these are still used in India in large scales [5].

2. Literature Survey

During period July to November 2017 around 32 deaths occurred in Yavatmal and near districts due to accidental exposure to pesticides. [6] Which indicates need for prime attention towards the problem being addressed in this study. This is particularly true of the developing countries because most toxic materials are often used. Necessary and complicated precautionary regulations are most difficult to enforce in developing countries. Many accidents can and do happen without reaching the medical press or even the ears of the local practitioners. Since data on the occurrence of pesticide-related illnesses in developing countries are scanty, this retrospective study focuses on pesticide related acute

illness. This study throws light on necessity of intervention strategies designed to lower the incidence of acute poisoning. Acute organophosphate poisoning (OPP) causes tens of thousands of deaths each year across the world. The mortality rate of acute OPP is 10–20% [7, 8, 9.] and the World Health Organization (WHO) has estimated that 200,000 people die each year from pesticide poisoning. The world-wide deaths and chronic diseases due to pesticide poisoning number about 1 million per year (Envirenews Forum, 1999)

The Aurangabad- the area of the present study:

Out of total 10.08 lakh ha. area around 8.52 Lakh Ha. is under cultivation.

The total population of Aurangabad district is 40.83 lakh and out of which, 84.2 % population is dependent on agriculture. No. farmers is around 9.16 lakhs, of which, 47 % and 31 % are marginal farmers and small farmers

Wide range of crops are grown in this district. Major food grains are Jowar, pearl millet, wheat & gram, Soybean while Cotton is major cash crops. [10]

3. Subjects and Methods

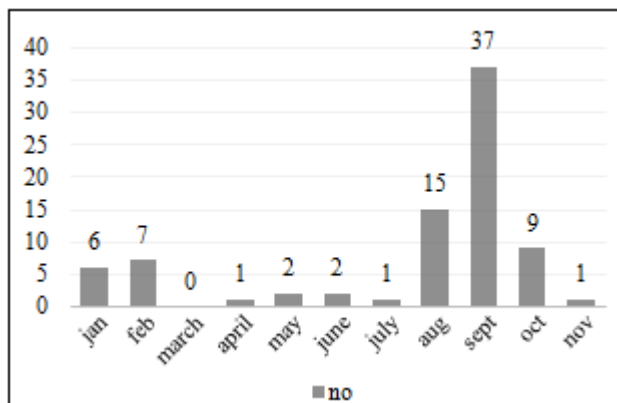
A retrospective study of patient's case paper records conducted at Government medical college and hospital Aurangabad. Data is collected from case sheets of patients of accidental exposure to insecticidal poison during the period January 2017 to November 2017. Clinical notes of resident doctors, lecturers and professors evaluated in detail and data is formulated. Since data of 5 cases from the month of January was incomplete hence those 5 cases has been excluded and rest all cases (76) recorded as accidental exposure of farmers to insecticides has been included in the present study.

Since acetyl choline esterase levels testing is not available free of cost at study centre, test is not performed routinely hence data on Acetyl choline esterase levels is not available.

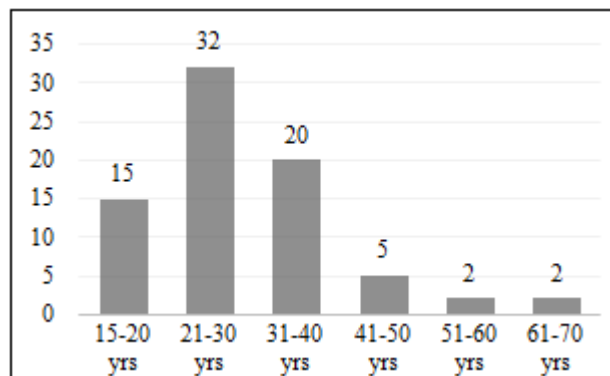
4. Results

1) Seasonal trend of cases

Month	No.	percent
Jan	6	7.41
Feb	7	8.64
March	0	0.00
April	1	1.23
May	2	2.47
June	2	2.47
July	1	1.23
Aug.	15	18.52
Sept	37	45.68
Oct	9	11.11
Nov	1	1.23
Total	81	100

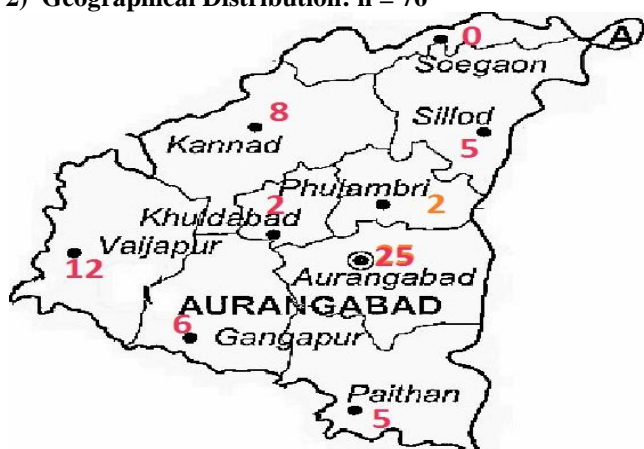


Maximum number of cases of acute accidental exposure to insecticidal poisons occurred in the month of September followed by August and October. Which is the peak period for pesticides use at farms.



Among total 76 patients maximum no of patients(32) were in the age group of 21-30 years. Indicating young population is at higher risk to get exposed accidentally to pesticide poisons.

2) Geographical Distribution: n = 76



Other districts:
 Jalna: 8
 Nashik: 2
 Daulatabad: 1

Most cases recorded were from Aurangabad tehsil itself and less number of cases were recorded from more peripheral and rural areas indicating less awareness at peripheral and more rural areas.

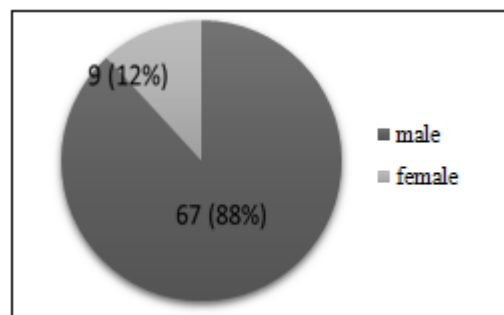
3) Demographical Profile

Age wise distribution of study population (n=76)

age group	No.	percent
15-20 years	15	19.74
21-30 years	32	42.11
31-40 years	20	26.32
41-50 years	5	6.58
51-60 years	2	2.63
61-70 years	2	2.63
total	76	100.00

Sex distribution (n=76)

Sex	No.	Percent
Male	67	88%
Female	9	12%
Total	76	100%



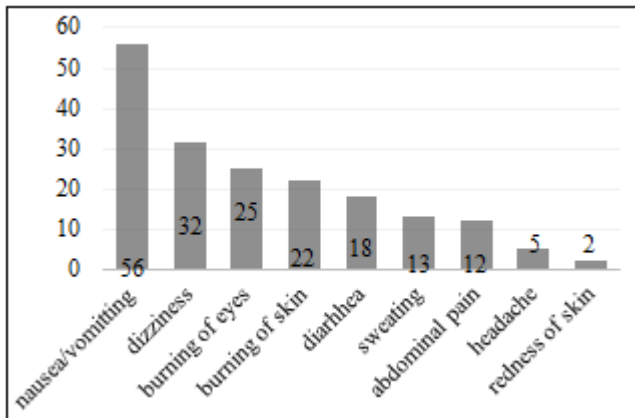
Males are at much greater risk for accidental exposure to pesticides poisons than females but no. of females is also significant.

4) Compounds used:

In 55 cases among total 76, compound to which farmer was exposed was unknown and among known compounds monocrotofos was the most common followed by cypermethrin and delta methrin. Maximum no. of poisons were belonged to organophosphate group.

1.Presentation of acute poisoning due to exposure to pesticide poisons and route of exposure:

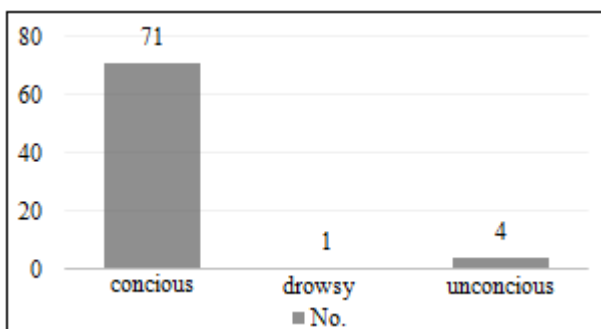
Symptoms	No.	%
nausea/vomiting	56	73.68
dizziness	32	42.11
burning of eyes	25	32.89
burning of skin	22	28.95
diarrhoea	18	23.68
sweating	13	17.11
abdominal pain	12	15.79
headache	5	6.58
redness of skin	2	2.63



Nausea and vomiting were most common presenting complaints among patients of this study. As it is well known that presentation depends on route of poisoning, hence above findings are suggestive of ingestion is the most common route of poisoning for this study group.

2. Level of Consciousness (n=76)

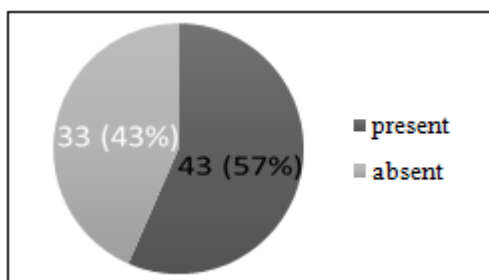
level of consciousness	No.	%
conscious	71	93.4
drowsy	1	1.3
unconscious	4	5.3



Most of patients were conscious at the time of presentation and very small no. (4) of patients were unconscious at presentation or during the course in hospital and only 1 patient was drowsy at the time of presentation.

3. Fasciculations (n=76)

Fasciculation's	No	%
Present	43	56.58
Absent	33	43.42

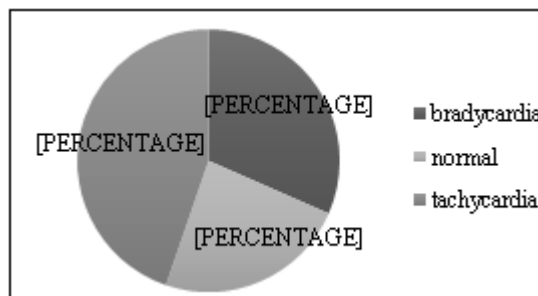


Forty three of seventy six patients developed fasciculation's indicating exposure to organophosphate insecticidal poisons.

Thirty one (41%) out of seventy six patients had miosis at the time of presentation.

4. Heart rate

Heart Rate	NO.	%
Bradycardia	24	31.58
Normal	18	23.68
Tachycardia	34	44.74
Total	76	100.00



Tachycardia was found in 45% of patients which is an autonomic nicotinic effect.

5. Respiratory failure:

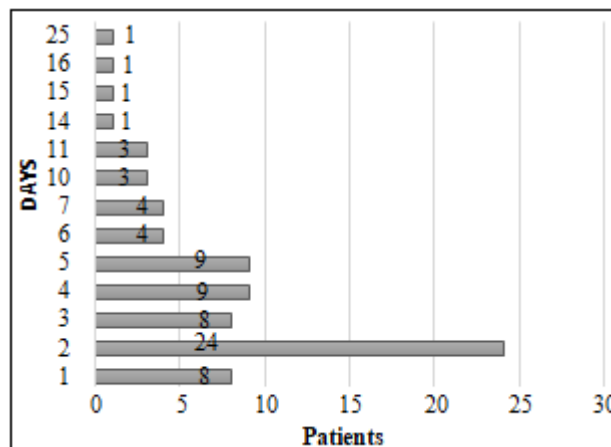
Eight of seventy six patients developed respiratory failure and all of them required endotracheal intubation followed by ventilator support and ICU management. Acute OPP-induced respiratory failure usually develops within 24 hours. In some case, it develops 24–96 hours after poisoning [11]. All cases of respiratory failure occurred within 48 hours in our study. Patients presented with signs and symptoms of opp were treated with atropine and PAM along with standard protocol and patients with respiratory failure were given mechanical ventilation.

6. Outcome :

Unfortunately two of seventy six patients died during the course in hospital. The usual causes of death were chiefly related to CNS depression causing respiratory failure [12]and ventricular arrhythmias [13-14]

7. Duration of stay:

Mean duration of stay was 4.56 days and Max duration of stay was 25 days; Min duration of stay was 1 day. Maximum no. of patients (24) stayed for 2 days.



5. Discussion

Severity of toxicity due to pesticide spraying depends upon:-

- 1) Pesticide Toxicity- WHO class of pesticide
- 2) Exposure Time
- 3) Volume of spraying solution in litres
- 4) Operation- activity performed during working session-
- 5) Profession- employed individuals remain in contact with the poison for more time than the owners of the field
- 6) Height of crop: higher the height more is the risk
- 7) Use of power pumps: power pumps can spray up to 10 acres/day while normal sprayers can spray 2 acres/day. These sprayers have fine holes and spray like mist that easily envelopes the person's body.[6]
- 8) Extending the crop beyond Dec. till Feb-March causes "failure to break the pest cycle" which in terms "increase in the spread of pests" ultimately responsible for increased exposure to pesticides.[6]

Maximum no of accidental exposure occurred in the month of September followed by August. Because of excess of humidity, the farmers probably didn't cover themselves properly to escape from humidity also it indicates temporal correlation of period of maximum requirement of pesticides at farms. Humidity also multiplies pest's again increasing requirement of pesticides.

Since nausea and vomiting was the commonest symptoms and presentation of poisoning depends on route of poisoning, accidental ingestion as a result of not washing of hands after pesticide use is likely to be most common route for accidental poisoning of farmers due to pesticides.

Use of power pumps has also increased risk of accidental poisoning. Also extending the crop till next season increases the risk.

Our data indicates that there is less awareness regarding accidental poisoning at more peripheral areas and most of patients go unnoticed.

We recommend Legal approach to cut down the accidental exposure to pesticides in terms of the acts and regulations concerning the manufacture, distribution, storage and application of pesticides needs to be modified and strictly implemented. Alternative methods than chemical insecticides needs to be developed and implemented.

Early diagnosis and periodical examinations are necessary and blood tests for AChE activity are recommended. But as the AChE levels testing is not available in government set up, Government should provide funding for complete evaluation of poisoning victims e.g. acetylcholine esterase level testing and there is need for finding residue levels in body fluids and tissues of the exposed population.

It is also recommended that accidental poisoning of farmers with pesticides should be notifiable illness.

All activities concerning pesticides should be based on scientific judgement and not on commercial considerations. First aid and early treatment needs to be provided for all accidental poisoning patients.

Precautions to be taken while spraying are as discussed below:

- 1) Care while preparing the solution and filling the pump.
- 2) Proper protective gear
- 3) Avoid hot sunny days, strong windy or foggy weather and just before or after rains.
- 4) Do not spray against the wind.
- 5) Keep the hose of the pump close to the target.
- 6) Awareness of surrounding people.
- 7) Learn the proper technique before you start spraying
- 8) See that the equipment is appropriate and well-maintained.

Farmers needs to be educated regarding above precautions and more stress needs to be given to prevent accidental ingestion of pesticides due to non-washing of hands after handling of pesticides as accidental ingestion is the most common route of accidental poisoning due to pesticides.

6. Conclusion

Health education needs to be strongly enforced among illiterate farmers population of India. There is a need to convey the message that prevention of adverse health effects and promotion of health are profitable investments for farmers and government as a support to a sustainable development of economics.

References

- [1] Effects of pesticides on human beings & farm animals: A case study. Mridula chaturvedi, chetna sharma, mamta chaturvedi
- [2] PESTICIDES Children's Health and the Environment WHO Training Package for the Health Sector World Health Organization www.who.int/ceh July 2008 version
- [3] Health Council of the Netherlands. Pesticides in food: assessing the risk to children. The Hague: Health Council of the Netherlands, 2004.
- [4] "Agriculture -use of pesticides/plant protection products." *Oshwiki*, 29 May 2017, 10:29UTC.19Aug.2017, 06:10<https://oshwiki.Eu/index.Php?Title=agriculture_use_of_pesticides/plant_protection_products&oldid=247392>.
- [5] <https://timesofindia.Indiatimes.Com/india/7-deadly-pesticides-world-has-banned-used-in-india/articleshow/61138491.Cms>
- [6] <http://indianexpress.Com/article/india/yavatmal-farmers-deaths-pesticide-yavatmal-humidity-pesticide-cocktails-new-sprayer-reasons-for-cotton-farmer-deaths-experts-4881173/>
- [7] Senanayake N, Karalliedde L. Neurotoxic effects of organophosphorus insecticides. An intermediate syndrome. *N Engl J Med* 1987; 316:761-3.
- [8] Nouira S, Abroug F, Elatrous S, et al. Prognostic value of serum cholinesterase in organophosphate poisoning. *Chest* 1994; 106:1811-4.
- [9] Tsao TC, Juang YC, Lan RS, et al. Respiratory failure of acute organophosphate and carbamate poisoning. *Chest* 1990;98:631-6

- [10] Macp 1st midterm review (22nd April – 03rd may 2013)
Aurangabad district progress report prepared by project implementation unit (agricultural marketing).
- [11] Tsao TC, Juang YC, Lan RS, et al. Respiratory failure of acute organophosphate and carbamate poisoning. Chest 1990;98:631–6
- [12] Stewart WC, Anderson EA. Effect of a cholinesterase inhibitor when injected into the medulla of the rabbit. J Pharmacol Exp Ther 1968; 162:309–18. 20
- [13] Wang MH, Tseng CD, Bair SY. Q-T interval prolongation and pleomorphic ventricular tachyarrhythmia ('Torsade de pointes') in organophosphate poisoning: report of a case. Hum Exp Toxicol 1998;17:587–90
- [14] Tsao TC, Juang YC, Lan RS, et al. Respiratory failure of acute organophosphate and carbamate poisoning. Chest 1990;98:631–6