Study to Evaluate Time of Death after Suicidal Poisoning as a Surrogate Indicator of Virulence of a Poison.

Dr. Sanjeev Chaudhary\textsuperscript{1} Dr. H.M. Mangal\textsuperscript{1} and Dr. G.L. Dad\textsuperscript{1}

Associate Professor\textsuperscript{1}, Forensic Medicine Department, Geetanjali Medical College and Hospital, Udaipur, Rajasthan.
Professor\textsuperscript{2}, Forensic Medicine Department, PDU Medical College, Rajkot, Gujarat
Professor\textsuperscript{3}, Forensic Medicine Department, Geetanjali Medical College and Hospital, Udaipur, Rajasthan.

ABSTRACT:

Background: Mean time to virulence is a common indicator to judge the virulence of a poison in animal studies. In humans this type of study is not possible due to design challenges and ethical considerations.

Aims & Objectives: In the present study, we tried to ascertain the value of time to death as a surrogate marker for virulence of a poison after taking into account the human factors responsible for self-harm.

Methods: The present study is a prospective study, which was done in the department of forensic medicine, PDU Medical College and Hospital Rajkot, Gujarat. All the fatal poisoning cases referred to us for medicolegal autopsy (208 cases) were taken into the study and detailed and complete autopsy examination was done by routine instruments and methods. The exact types of poisons responsible in fatal cases were confirmed by cross checking with chemical analyzer’s report whenever possible.

Results: We found interesting patterns and identified Aluminium phosphide the most fatal and important poison from a public health perspective.

Conclusion: Based on the results of our study, we can say that availability of aluminium phosphide should be extremely restricted.

Keywords: Virulence, Poisoning, Public health and Time to death.

Corresponding Author:
Dr Sanjeev Chaudhary, Associate Professor, Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India., Mail: drsanjeevkumar73@yahoo.com, Contact No.: 09462700505

INTRODUCTION:

The virulence of a poison is usually assessed by studies on animals or living organisms. Due to ethical considerations such studies are not possible for human subjects. More recently, advances in techniques of molecular biology have enabled tracing of pathways of metabolism of compounds. Certain chemicals like pesticides are designed in a way that they are highly toxic to pests and metabolic toxicity pattern for humans is quite different from that of insects. Thus, high effectiveness and low human toxicity are theoretically achieved. Incidences of both suicidal and homicidal poisoning are more common in India as compared to western countries, owing to facility with which
poisons can be obtained from anywhere (in spite of certain restrictions that have been brought about for their sale).¹

People having suicidal ideation frequently use concentrated forms of pesticides and other commonly available poisons for inflicting self-harm. Based on animal studies, a grading of toxicity of pesticides is available.² Pattern of poisoning has been a frequent topic of research arising from forensic departments.³⁴⁵⁶⁷ Although these researchers are indicative of preferences of people about agents of self-harm, they are not very informative about comparative virulence of poisons. In animal studies, to assess virulence poison is administered in pre-determined doses without consideration of palatability of poison or taking into consideration volition of the animal. In human suicidal poisonings color, odor, taste, form of poison and easy availability form important determinants for ultimate poison being chosen and ingested for deliberate self harm. The virulence of pesticides in field condition can be quite different from estimated toxicity based on virulence studies due to the involvement of human factors. We planned a study in which the investigating officer and dead subjects' relatives or friends were interviewed to judge time of death after the act of self-harm and tried to correlate it with the type of poisonous compounds.

METHOD:

Rajkot is a district in Gujarat state of India with a population of 10 lakhs as per 1991 census. The present prospective study was conducted by the Department of Forensic Medicine and toxicology, PDU medical college and hospital, Rajkot for a period of one year from 1st January 2007 to 31st December 2007. All the fatal poisoning cases referred to PDU Medical College and Hospital, Rajkot, was taken into the study. In all 208 poisoning death cases were studied and postmortem conducted. Information about age, gender, residence, marital status and type of poison responsible in fatal poisoning cases was duly recorded. Information from relatives and accompanying police records were used to record the manner of poisoning, whether suicide, accidental or homicidal. Detailed and complete post mortem examination was done by routine instruments and methods. The exact types of poisons responsible in fatal cases were confirmed by cross checking with chemical analyzer's report whenever possible.

RESULTS:

Suicidal poisonings far outnumbered (93%) accidental poisonings and deaths for which no cause could be determined. In cases of accidental poisoning hydrochloric acid was found to be most potent with a mean time to death of 3.5 hours. In cases of suicidal poisoning aluminium phosphide was found to be fatal in 7.2 hours after poisoning. Another notable group of fatal poisons was malathion, parathion and ethion which proved fatal in 11.8 hours, 6 hours and 4 hours respectively. Highest virulence was observed for pyrethrroids with time to death
of 2 hours for fenvalerate in suicidal poisoning and almost death at spot for one other case in which nature of poisoning could not be determined. Dichlorvas and Dimethoate also appeared fatal after short time of 6 hours on an average. (Table 1) Large number of subjects (70) choosing Aluminium phosphide for self harm made it the most preferred and effective agent for self harm after taking into account the human factor.

DISCUSSION:

An overview of the findings and the table 1 broadly deciphered a pattern. Commonly used agricultural pesticides were common choices for self harm but except for Aluminium phosphide, virulence was observed after lapse of considerable time. This phenomenon indicates that a therapeutic window for management and intervention of poisoning episodes exists for less fatal poisons. A notable feature was very high virulence of pyrethroids with time to death of 2 hours. Other pesticides of public health importance like malathion, parathion, ethion and contact poisons like dimethoate and dichlorvas are much more fatal on the scale of time to death than common choices for self harm like endosulphan, quinalphos, propoxur and phosphamidon. Methyl parathion did not appear very fatal on the time to death scale although it has been classified highly toxic. The possible mechanism of higher virulence of poisons is not a topic of frequent investigation. Only anecdotal reports are available which hypothesize cardiac involvement as a cause of lower time to death. We should not ignore the human factor, which becomes very important in suicidal poisonings. Although, our findings might have been influenced by variability in the dose and amount of poison and management of these cases before death. Still these factors were distal determinants as compared to the ultimate act of self-harm being proximal determinant.

Policy makers should focus on
differentiating highly fatal poisons from less fatal ones. Our study highlights the point that a subset of commonly used agricultural poisons was less fatal. This group comprised of endosulphan, methyl parathion, monocrotophos, phosphamidon, quinalphos and propoxur. These pesticides might be more appropriate for routine use in agricultural and availability of rest of the pesticides should be severely restricted. Only licensed persons having sufficient protective gear should be allowed to use more fatal pesticides. Public health officials using malathion, parathion, ethion and pyrethroids in vector control should probably rethink their strategies on the basis of studies which take human factors into consideration. Aluminium phosphide was observed to be a commonly available highly fatal poison, which is also accepted by most of the other authors also due to UN availability of its specific antidote. This poison can be easily banned for general use, as it does not find much use in routine agricultural practices. Its widespread availability is a threat to public health.

CONCLUSION:

Based on our findings, Aluminium phosphide is overall the most fatal poison on the scale of time to death because of its low time to death and widespread availability. Our study is perhaps the first to analyze time to death as a surrogate marker of virulence of a poison. More studies in different parts of world are needed to establish time to death as a universal indicator of virulence in humans.

Source of Funding: Nil.
Conflict of Interest: None.

References: