

A Clinico-epidemiological Study on Chlorinated Hydrocarbon Poisoning Cases in Nepal

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Abstract

Introduction	Chlorinated hydrocarbons are commonly used agricultural insecticide. Lindane is also used as an ectoparasiticide and ovicide in lotion and shampoo formulations. Some of the chlorinated hydrocarbons are banned in Nepal due to their long term persistent in the environment. Due to widespread use and easy availability, suicidal poisoning by this group of insecticides is not uncommon.
Objective	This study sought to analyze chlorinated hydrocarbon poisoning calls to the Nepal Drug and Poison Information Center (NDPIC).
Method	A retrospective study was carried out for all Chlorinated hydrocarbon-poisoning calls to the NDPIC for five years. There were 238 cases of which 211 were chlorinated hydrocarbons alone. 27 cases were excluded from the study due to co-ingestants involved and for those patient who were lost on follow up; 15 of these cases involved ethanol in addition to chlorinated hydrocarbons and 12 cases were lost on follow up.
Results	There were 121 females (57%) and 90 males (43%). Ages ranged from 2 years to 67 years. Reasons of exposure were intentional self-poisoning (72%), unintentional (24%) and unknown (3%). 68%, 20%, and 8% of patients on arrival to hospital emergency department were asymptomatic, mild, and moderately ill respectively. The most frequent initial presenting sign were abdominal pain followed by vomiting, dizziness, seizure, and headache.
Conclusion	Most chlorinated hydrocarbon exposure calls involved either asymptomatic or mild symptoms regardless of reason of exposure. Reduction of unnecessary hospital observation for asymptomatic patients is expected to save already over stretched public health resource.
Keywords	Chlorinated hydrocarbons, Poisoning, Nepal Drug and Poison Information Center (NDPIC).

Introduction

Deliberate self-poisoning is an individual act but has a profound social implication. It may also lead to suicide contagion if reported inappropriately. In Nepal, suicidal poisoning is a common means in both completed and attempted suicide. In the 1940s and 1960s the chlorinated

hydrocarbon insecticides enjoyed widespread use in agriculture, soil and structure insect control, and in malaria control programs. However, they have, as a class, come in to disfavor because they are very persistent in the environment and tend to accumulate in biologic as well as non-biologic

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media. Chlorinated hydrocarbons are commonly used agricultural insecticides. Lindane is also used as an ectoparasiticide and ovicide in lotion and shampoo formulations. Some of the chlorinated hydrocarbons are banned in Nepal due to their long term persistent in the environment. Due to widespread use and easy availability, suicidal poisoning by this group of insecticides is not uncommon. There have been limited studies on epidemiology of the specific group of poisons in Nepal. In this background, this study attempts to highlight the demographics, reason of exposure, initial severity, clinical effects, and medical outcome due to chlorinated hydrocarbon poisoning.

Methods

This is an uncontrolled retrospective case series for the five-year period from July 1997 to June 2002. A retrospective chart review was performed to locate all exposures due to chlorinated hydrocarbons that were reported to

the Nepal Drug and Poison Information Center. The specific information retrieved for the study included age, sex, marital and occupational status, dose ingested, reason of exposure, route of exposure, concomitant ingestions, symptoms, vital signs, whether direct medical evaluation occur, treatment provided and medical outcome. Exclusion criteria were concomitant ingestants and patients who were lost on follow up.

Results

There were 238 cases of which 211 were chlorinated hydrocarbon alone. 27 cases were excluded from the study due to co-ingestants involved and those patient who were lost on follow up; 15 of these cases involved ethanol, and 12 cases were lost on follow up. The treating physicians reported all cases. The study populations comprised of 121 (57%) females and 90 (43%) males. Ages ranged from 2 years to 67 years.

Table 1

Age	Range : 2 years to 67 years		
Age breakdown	21 children (<12 years)	32 adolescents (12 to 17 years)	158 adults (> 18 years)
Gender	Female : 121	Male : 90	Total (N=211)
<u>Marital status</u>			
Married	81	48	129 (61%)
Unmarried	36	39	75 (35%)
Widowed	2	0	2 (1%)
Divorced	1	2	3 (1%)
Unknown	1	1	2 (1%)

Out of 211 cases, 61% (N=129) of the study subjects were married of which females (67%;

N=81) outnumbered the males (37%; N=48) as shown in the table 1.

Table 2

	Female (N=114)	Male (N=85)	Total (N=199)
<u>Occupational status</u>			
Housewife	68	---	68(34%)
Student	17	27	44(22%)
Unemployed	13	21	34(17%)
Service	11	15	26(13%)
Business	2	14	16(8%)
Farmer	1	5	6 (3%)
Laborer	1	2	3 (1%)
Unknown	1	1	2 (1%)

	Female (N=121)	Male (N=90)	Total (N=211)
<u>Reasons of exposure</u>			
Intentional	101	51	152(72%)
Unintentional	17	35	52 (24%)
Unknown	3	4	7 (3%)
<u>Initial Severity</u>			
<u>during presentation</u>			
Asymptomatic	83	61	144(68%)
Minor symptoms	22	20	42(19%)
Moderate symptoms	11	7	18(8%)
Major symptoms	5	2	7(3%)

Out of 211 cases, 12 children who were under the age of 3 years were excluded while analyzing the

occupational status of the study population. Out of 199 cases, 68 study subjects were housewives and topped the list with 34% followed by student 22% (N=44), unemployed 17% (N=34), service holder 13% (N=26) and Business 8% (N=16).

The most frequent initial presenting sign were abdominal pain followed by vomiting, dizziness, seizure, and headache as listed in Table 3.

Reasons of exposure were intentional self-poisoning (72%), unintentional (24%) and unknown (3%) (Table 2). 68%, 20%, and 8% of patients on arrival to hospital emergency department were asymptomatic, mild, and moderately ill respectively (Table 3).

Table 3

	No. of patients
<u>Clinical effects</u>	
Abdominal pain	35
Vomiting	21
Dizziness	19
Seizure	13
Headache	6
<u>Medical Outcome</u>	
No effect	144 (68%)
Minor effect	42 (20%)
Moderate effect	18 (8%)
Death	7 (3%)

Eighty two per cent of the patients had undergone gastric lavage of which 93% received a dose of activated charcoal in addition. Majority of the patients were managed with symptomatic and supportive care after calling to the poison center although 7% (N=15) were given atropine beforehand.

Discussion

Chlorinated hydrocarbons are easily available and commonly used agricultural insecticide and in the household, Lindane is used as an ectoparasiticide and ovicide in lotion and shampoo formulations. It is available both in liquid and powder form. In Nepal, it is available in different brand names viz *Endocell, Thiokill, Sufan, Remedon* etc. Ingestion is the most common route of exposure to this compound although inhalation of dust or absorption from broken skin also produces toxicity.

Chlorinated hydrocarbons are generally less acutely toxic, but of greater potential for chronic toxicity than Organophosphates and Carbamates¹. This group of insecticides can be divided into four categories: (1) Dichlorodiphenyltrichloro-

thane (DDT) and related analogs, (2) Hexachlorocyclohexene (BHC, Lindane), (3) Cyclodienes and related compounds (Endosulfan), and (4) Toxaphene and related compounds. These compounds differ substantially between and within groups with respect to toxic doses, dermal absorption, fat storage, metabolism and elimination. Organochlorins are usually highly lipid soluble and some of these agents undergo entero-hepatic circulation and enteroenteric re-circulation².

This class of agents lowers the seizure threshold and produce CNS stimulation, which can result in seizures. Other symptoms include nausea, vomiting, hyperesthesia of the mouth and face, paresthesia of face, tongue and extremities, headache, dizziness, dysrhythmic ocular movements, leg weakness, agitation and confusion which may occur prior to or independent of seizures^{1,3,4}. The seizures are often self-limited but may recur and result in status epilepticus⁵. The principle neurotoxic action of these compounds is that of an axon poison, affecting primarily the CNS nerve cells. Essentially, the chlorinated hydrocarbons interfere with the normal flux of Na⁺ and K⁺ ions across the axon membrane as nerve impulses pass. This results in irritability, disturbance of mental processes, sensory aberrations, and seizures. Effects of DDT include lengthening the time the sodium channel is open, thus affecting sodium conductance. Depression of the medullary respiratory center drive often occurs concurrently leading to asphyxia. Depending on dosage, these effects may be fatal, or entirely reversible within minutes or hours. These insecticides do not depress Cholinesterase enzyme, therefore Atropine and 2 PAM are useless as therapy. An important property of the chlorinated hydrocarbons, particularly Toxaphene, Chlordane, DDT, and Lindane is their capacity to induce the drug-metabolizing enzymes of the liver after chronic exposure. The neurotoxic mechanism of endosulfan involves inhibition of the Calmodulin dependent Ca²⁺-ATPase activity, alterations in the serotonergic system, and inhibition of GABA receptors³.

The majority of patients with chlorinated hydrocarbon poisoning in this case series were asymptomatic and despite the reason and amount of exposure ninety seven percent of patients had a favorable outcome except in 7 fatal cases. Gastrointestinal decontamination should be considered for large ingestions. Repeat dose activated Charcoal or Cholestyramine resin may be administered to enhance elimination by interrupting enterohepatic circulation⁶. Supportive care is the mainstay of therapy in

chlorinated hydrocarbon poisoning as there is no specific antidotes. Patients with altered mental status should receive Dextrose, Thiamine and Naloxone. If the patient remains asymptomatic with normal vital signs for 6-8 hours, then they may be discharged with the suggestion to return if symptoms of toxicity develop. Prior to discharge, patients must be evaluated by psychiatrist if the reason of exposure is intentional. In case of unintentional exposure involving children, child abuse must be ruled-out before discharging patient to parent's care. Poison prevention education should be given to parents to prevent recurrence.

Conclusion

Patients poisoned with chlorinated hydrocarbons have mild and self-limiting symptoms unless massive amount is ingested or in case of a mixed ingestion. Patient who presents to hospital emergency asymptomatic and remains asymptomatic for 6-8 hours of observation is most unlikely to develop late toxicity. Therefore, reduction of unnecessary hospital observation for asymptomatic patients is expected to save public health resource. Supportive and symptomatic care is the mainstay of the therapy, even after symptomatic chlorinated hydrocarbon poisoning. All intentional self-poisoning cases should be referred to psychiatric/psychological counseling. The psychiatric/psychological evaluation should include assessment of all associated factors of suicidal attempt such as severity of suicidal attempt, depression inventory, stressful life events, personality factor and associated mental illness. The detail evaluation of those factors will help clinicians to take necessary therapeutic intervention so as to reduce reattempt.

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