Accidental Outbreak of Non-Bacterial Food Poisoning

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Abstract

Background: Troops deployed in isolated garrisons face erratic supply of rations. At times they resort to use of locally grown plants without knowledge of local flora, resulting in accidental food poisoning.

Methods: This is a descriptive, analytical and epidemiological study of one such outbreak of food poisoning, due to use of a locally grown plant as vegetable, amongst soldiers of a unit in high altitude. An epidemiological case sheet was made and food specific attack rates of those exposed and not exposed were calculated to identify the food item. The toxicological analysis of food item established the cause.

Results: Of the 39 people who consumed the meal, 29 fell ill with an attack rate of 74.35 %. All the cases presented with classical features of atropine poisoning and were managed with sedatives, physostigmine and supportive care. Twenty one had symptoms severe enough to warrant hospitalization. All the cases made complete recovery. The attack rate for food item containing plant poison was 96.4%. The toxicological analysis of food sample established the presence of atropine alkaloids. The plant was identified on flowering as *Atropa acuminata*.

Conclusion: An outbreak of non-bacterial food poisoning in soldiers at high altitude, caused by accidental ingestion of a dish made out of *Atropa acuminata* plant leaves containing atropine related alkaloids was investigated and conclusively established.

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Key Words : Food poisoning; Non-bacterial; *Atropa acuminata*; High altitude

Introduction

Food poisoning is characterized by consumption of common meal, sharing of symptoms and affliction of a sizeable proportion of population involved in a short interval of time. After viral hepatitis, food poisoning is the second most common cause of disease outbreaks in Army. There have been 19 outbreaks affecting 1281 individuals from 1992 to 2005 [1]. Food poisoning can be caused by bacteria, bacterial toxins, inorganic poisons, plant and animal poisons. Most of the reported outbreaks are bacterial in origin [2-4]. The present study describes an outbreak of accidental non-bacterial food poisoning at high altitude, caused by ingestion of a wild plant containing atropine related alkaloids.

Material and Methods

The report of occurrence of a large number of cases of food poisoning from a unit at high altitude in Kashmir valley after consumption of lunch was received and the matter was investigated. Epidemiological case sheet including details of individual, clinical features, food history and environmental factors was prepared for each case. Distribution of cases in parameters of time, place and person was studied. Case definition used in this outbreak was anyone who had dryness of throat, blurring of vision, drunken behavior, agitation, dryness and flushing of skin. Apart from 23 cases which

reported to hospital, search was made for detecting additional cases that were either milder or could not be brought to hospital. Leftover food sample and sample of fresh leaves were obtained and sealed for analysis and refrigerated. The food histories were obtained from the cases on the next day as the clinical condition due to altered sensorium did not allow correct recall on the day of admission. A sample of leftover food was sent for toxicological analysis at Kochi, Kerala. A visit to the unit cookhouse was made and circumstantial and environmental data was collected. On admission to hospital, relevant laboratory investigations were carried out. With the clinical profile suggesting an atropine like poisoning, other investigations on food handlers and water were not considered. The data on food history was collected and food specific attack rates were calculated. The difference in attack rates (Risk difference) of those exposed and those not exposed was worked out. Since the attack rate was 96.6% in those who consumed the incriminated food item, no other test of significance were applied. The plant sample was taken to Agriculture University Kashmir for identification.

Results

Out of the 43 individuals who were dining in the same cook house, 39 persons consumed the meal and 29 suffered from food poisoning with an attack rate of 74.35%. Four people who did not consume meal were excluded. Of those affected,

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seven were civil porters and 22 were soldiers. Of these 29 cases, 21 including five civil porters had severe symptoms warranting admission to hospital. The cook and the mess staff who had arranged the locally grown vegetable also suffered. The index case who had early lunch at 1200 h as he was on duty, presented within 30 minutes of consumption of lunch at 1230 h on 23 May 2007. The incubation period ranged from thirty minutes to four hours with an average of around one hour. The epidemic curve was typical of a short explosive point source outbreak (Fig. 1). The cases had classical features of atropine poisoning. The symptoms (Table 1) most frequently seen were dryness of throat (100%), blurred vision (89.6 %), drunken gait (79.3 %) and flushing of face, delirium and agitation. On examination, they had tachycardia, dilated pupils, dry and warm skin, and bounding pulse. Most were agitated, restless, delirious and had retention of urine with overflow incontinence. One of the patients had an episode of generalized seizures. Of the 29 affected, 21 were hospitalized and managed conservatively with supportive care, diazepam and physostigmine and were discharged after three to five days with complete recovery without any sequelae. The attack rates for each food item are given in Table 2. Attack rates for those who had consumed vegetable containing the wild spinach like plant was found to be highest (96.6%). There was only one person who tasted the dish and did not suffer because he immediately spat out after finding it sweet due to sugar added by the cook to mask the taste of the wild vegetable. The illness was also not observed amongst those who were pure egg eaters and those who did not consume the vegetable. The difference in attack rate of those who had eaten this dish compared to those who had not consumed this dish was also found to be highest.

Table 1**Clinical profile of cases**

Symptom	number	(%)	Sign	number	(%)
Dryness of throat	29 / 29	100 %	Dilated pupils	29 / 29	100 %
Difficulty in maintaining posture	29 / 29	100 %	Tachycardia	29 / 29	100 %
Blurring of vision	26 / 29	89.6 %	Dryness of tongue	23 / 29	79.3 %
Drunken gait	23 / 29	79.3 %	Muttering delirium	15 / 29	51.7 %
Dry and warm skin	23 / 29	79.3 %	Agitation	15 / 29	51.7 %
Diplopia	12 / 29	41.3 %	Retention of urine and overflow incontinence	08 / 29	27.6 %
Vomiting	07 / 29	24.1 %	Cardiac arrhythmia	03 / 29	10.3 %
Drowsiness	03 / 29	10.3 %	Seizure	02 / 29	6.9 %

Table 2**Calculation of food specific attack rates**

Food items	Persons who ate the specific item of food			Persons who did not eat the specific item of food			Difference between attack rates (AR) (a-b)
	Number who ate	Number ill	Attack rate % (a)	Number who did not eat	Number ill	Attack rate % (b)	
Egg curry	34	24	70.5	05	05	100	- 29.5
Alu-Palak (wild plant)	30	29	96.6	09	0	0	96.6
Rice	39	29	74.3	0	0	-	Not defined
Roti	39	29	74.3	0	0	-	Not defined
Rajma	39	29	74.3	0	0	-	Not defined
Alcohol	08	05	62.5	31	24	77.4	- 14.9

χ^2 test could not be applied since values of cells in those not exposed were less than 5.

Four persons, who did not consume meal at all, were excluded from the data.

Since no other food item had similar attack rates and difference in attack rate, no further analysis was required. The confounding effect due to alcohol was not considered as it was consumed only by eight persons and of which only five suffered. The sample of leftover food was collected, sealed, refrigerated and transported to a toxicology laboratory in Kochi, Kerala for analysis. The sample was analyzed by colour test (Lieberman's reaction), thin layer chromatography and Reverse phase chromatography by High Performance Liquid Chromatograph (HPLC) and tested positive for atropine compound (Fig. 2). The plant sample was also sent to

Fig. 1 : Epidemic curve

**Toxicology report on
Food Sample containing Wild Plant**

Date of receipt of samples - 13-06-07

Observation

Sample: Food material and leaves of unknown plant
Method: Colour test, TLC, HPLC
Test for: Anticholinergic alkaloids

ANALYTICAL REPORT

1, Colour test (Test for alkaloids)

LIEBERMANS reaction gives a slight positive colouration in food sample, but not in the standard leaves.

2, Thin Layer Chromatography (TLC)

R_f value of food sample matching with datura, and atropine. Unidentified leaves also gave a positive result.

3, HPLC (Qualitative detection)

Method – Reversed phase chromatography.

Atropine compound tested positive in the Food sample.

Signature of HOD
21.06.07
Chief
Poison Control Centre
Amrita Institute of Medical Sciences
and Research Centre
Amrita Lane, Elamakkara, Kochi-26

Date: 21.06.07

Fig. 2 : Chromatographs of food sample

Agriculture University, Kashmir for identification of plant before and after flowering. The plant was identified as *Atropa acuminata*.

On investigation, it was revealed that fresh vegetables were supplied twice a week. For last three days, since there was no convoy, no fresh vegetable could be collected and supplied. In the affected unit the mess cook decided to cook a wildly growing plant, specifically for vegetarians, which appeared like spinach. The alcohol was also issued on the same day to the troops before lunch, as is practiced in operational areas. The vegetable dish probably did not have an agreeable taste. The cook added a bit of sugar and tamarind to mask the taste and improve palatability. The cook house sanitation, hygiene of preparation and water supply were found to be satisfactory.

Discussion

Food poisoning is one of the most common causes and instances of non-bacterial food poisoning caused by plant poisons are rare. The author had seen two more such instances of food poisoning from the Kashmir valley. In one episode six persons were affected due to consumption of wild species of mushroom. They had

Fig. 3 : *Atropa acuminata* plant. Note the yellow colored, bell shaped flowers and berry shaped fruit in its early stage. Leaves closely resemble spinach.

presented with clinical features of vomiting, drowsiness, altered sensorium and transient loss of consciousness. The species of this wild mushroom could not be identified due to non availability of the sample. Another episode was caused due to consumption of wild species of a plant resembling spinach. Three persons were affected with symptoms suggestive of datura/atropine poisoning. The plant was identified as *Hyoscyamus niger*. No analysis of food sample could be done. This episode of plant poisoning, caused due to ingestion of *Atropa acuminata* leaves was conclusively established.

The use of plants for the existence of human being is as old a practice as the human race itself. The plant poisons or phytotoxins are found in angiosperms or flowering plants. These phytotoxins comprise a vast range of biologically active substances such as alkaloids, polypeptides, amines, glycosides, oxalates, resins, toxalbumins etc. Alkaloids are nitrogen-bearing alkaline chemicals that originate in plants. Alkaloids are derived from amino acids and affect the nervous system commonly. They occur in at least 10% of all plants. Most are bitter-tasting [5]. Plants belonging to Solanaceae family are commonly associated with poisoning.

Common sources of deliriant plant poisons are *Datura stramonium*, *Atropa belladonna*, *Hyoscyamus niger* and *Cannabis indica*. Datura plant grows in waste places all over the country. The active principle contains the alkaloids levohyoscyamine, hyoscyne, scopolamine and atropine. The clinical features due to its poisoning produce anti-cholinergic syndrome with features like dryness of throat, difficulty in talking

and dysphagia. The flushed face, dilated pupils, dry and warm skin, vomiting and unsteady gait is often confused for drunkenness. In India, Dhatura is employed mainly as a stupefying poison for robbery, kidnapping and other criminal offences.

Hyoscyamus niger or henbane or locally called as “Bagar bhang” and khorsani ajwayan, grows at high altitudes in Himalayan ranges. This plant also contains similar alkaloids and produces symptoms akin to Dhatura poisoning [6]. The mushroom species producing anticholinergic symptoms are *Amanita muscaria* (Fly agaric) and *Amanita pantherina* [7]. Cannabis is also abundantly found in Kashmir.

Deadly Nightshade grows abundantly in the Himalayas at an altitude of 6000 to 12000 feet above sea level. All parts of the plant are poisonous [8]. *Atropa acuminata*, commonly called as Indian belladonna is found in Himalayan region from Kashmir to Baluchistan at elevations between 1800 and 3600 metres. All parts of the plant contain tropane alkaloids and content of alkaloids varies according to development of plant, being low when the plant is flowering and very high when bearing green berries [9].

Soldiers by virtue of their task are required to be trained on aspects of edibility of natural flora and fauna since inadequate knowledge on this subject will not only hinder their mission success but also put their personal safety at risk. The procedure for trying new plants as food includes inspection, smell, skin irritation and lips, mouth and tongue test. The plants that must be avoided include those with milky sap, red plants, fruits which are divided into five segments, tiny barbs on stems and leaves and old wilted leaves as some plants develop deadly toxins when they wilt, e.g. blackberry, raspberry, plum, peach and cherry [10].

The importance of carrying and consuming calorie dense foods by soldiers during operations needs to be stressed. There are also a variety of “meals ready to eat” available, which can be used to overcome this period of lack of fresh food supply.

The hazard of consuming wild species of plants without adequate knowledge is fraught with danger especially when operating in counter- insurgency mode/stand alone

operations. There is a need for generating awareness amongst medical personnel on the issue of suspecting non-bacterial food poisoning especially affecting small group of soldiers away on long operations or independent missions in jungles.

Conflicts of Interest

None identified

Intellectual Contribution of Authors

Study Concept : Lt Col AS Kushwaha, Brig SK Aggarwal

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Statistical Analysis : Lt Col AS Kushwaha, Maj R Nimonkar

Study Supervision : Brig M Singh, Brig SK Aggarwal

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