Poison Control System and Toxicological Services in Nepal

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Citation

A Agnihotri, S Ramchandran, H Joshi. *Poison Control System and Toxicological Services in Nepal*. The Internet Journal of Toxicology. 2005 Volume 3 Number 1.

Abstract

The poison control centers have been established with the main objectives of an improvement in poisoned cases and prevention of poisoning. Toxicological laboratory services are essential component of a poisoned control program. In most of developing countries, these services are not commonly available in hospitals. Establishment of analytical toxicological laboratory services, communication between clinicians and toxicologists, and availability of antidotes could be helpful in reducing morbidity and mortality in cases of poisoning.

INTRODUCTION

Poisoning due to chemical, pharmaceutical, plants and animal toxins is a worldwide phenomenon and has heavy social and economic impact on country's health care system. It is mainly of two types:

1. Poisoning that affects the community e.g. Environmental & Industrial Poisoning.
2. Poisoning that involves individual only e.g. Suicidal, Homicidal, Iatrogenic & Accidental.

The last category has certainly the greatest medico-legal significance. Poisoning is a medical emergency and the cases are quickly rushed to nearest available hospital. The common poisoning cases that have been brought to the hospital are pesticides, opium, tranquilizers, alcohol, toxic mushroom etc. Most of these cases are suicidal or accidental in nature but rarely homicidal. The role of Forensic Toxicologist is the detection, identification and measurement for poisons in human biological material.[1] The first and foremost duty of physician is to save the life of patient. This article aimed to speed up diagnosis and to reduce mortality in poisoning cases.

SCENARIO IN NEPAL

The facilities of toxicological analysis are not commonly available in most hospital of developing countries. Even, if they are present, the results of analysis are rarely available in time to guide the initial treatment of poisoning cases. Nepal is located among the southern slopes of the Himalayan Mountains in the Southern Asia, between China and India. This country covers an area about 145,391 Sq Km (5, 6136 Sq Mi). The estimated resident population 27,070,666 (July 2004 est.) showing average population growth rate 2.23% (2004 est.).[2] The statistics of "poisoning cases" in Nepal obtained from 'Annual Report 2001/2002'[3] shows that majority of patients (45%) were admitted to the hospitals with the history of poisoning due to unspecified substances followed by contact with venomous animals particularly snakes (26.4%). Youth of age group (20-49 years) was predominantly (56%) affected. Females outnumbered males (Table 1).

Figure 1

Table 1: Age and Sex wise distribution of Poisoning Cases

Type of poisoning	0-14yrs		15-19yrs		20-49yrs		50-69yrs		>70yrs		Total
	M	F	M	F	M	F	M	F	M	F	
Alcohol	1	-	-	-	2	-	-	-	-	-	3
Organic solvents	21	14	-	1	2	-	2	-	-	-	40
Halogen derivatives	-	1	-	-	-	-	-	-	-	-	1
Metals	1	2	2	9	3	17	1	-	-	-	35
Pesticides	-	2	6	5	15	10	4	-	-	-	42
Other noxious subs	12	11	5	3	11	13	2	3	1	-	61
Contact with venomous	29	24	25	29	107	110	21	17	5	1	368
Aflatoxin and others	-	-	-	-	-	-	-	1	-	-	1
Pharmaceutical subs	28	13	4	9	51	71	15	19	5	4	219
Unspecified	45	26	49	76	173	198	29	22	6	2	626
	137	93	91	132	364	419	74	62	17	7	1396

In Nepal, The Nepal Poison Information Center (NPIC) is affiliated with and functions much as its sister center in North America, the Central Ohio Poison Center. When additional funding is available for a full staffing and equipment, the Center will be a 24-hour per day, seven day per week Internet, telephone and facsimile accessible poison and chemical information resource for the citizens, health care professionals and travelers to Nepal. The Center's efforts will especially help children as the vast majority of poison exposures affected children. However, all members

of the population will be able to take advantage of its resources. First of this kind of center in Nepal established in Jawalakhel, Lalitpur, is equipped with state of the art computer and information technologies. It is linked 24-hours a day/7 days a week to Central Ohio Poison Center and can provide important information to questions regarding poisoning, drug interactions, snake and insect bites, or any other chemical exposure. This service is provided for both health care professionals and the general public.[4]

DISCUSSION

Poison Control Center: The primary objective of poison control centers has always been an improvement in the poisoned patients' care and prevention of poisoning. Poison control centers are well positioned to provide specialized services to both public and health professionals alike so as to ease this public heath burden.[5] In developing countries, the main challenges of poison centers are still treatment information, formal training, laboratory services accessibility and availability of antidotes, but at the same time they should accomplish their public health mission through strengthening and expansion of some well-defined roles like toxic-surveillance and environmental health monitoring according to the prevailing and future toxicological problems.[6] To operate in a satisfying way a poison information center is dependent on two cornerstones- a well educated and specifically trained staff on one hand, and reliable, updated and easily manageable information sources on the others.[7] The purpose of a poison center are as follows[4]

- Decreasing incidence
- Improving outcome and survival
- Preventing recurrence
- Decreasing unnecessary treatments and costs
- Providing data on incidence and most effective therapies
- Educating the public and health care providers

Emergency Management: When a patient is bought to the hospital with a history of poisoning or suspicion of poisoning, the following main steps should be taken by attending doctor:

- Register the case as Medico-legal Case and inform the nearest police station.
- Emergency aids to stabilize the patient by maintaining A(Airway), B(Breathing) and C(Circulation).
- History of the case especially regarding possible source of poison and proper clinical evaluation.
- Removal of unabsorbed poison: It depends upon route of intake such as: Ingested poisons: Stomach wash is very important and life saving if it is done within 4-6 hours after ingestion unless contraindicated. Inhaled poisons: The patient should be removed to fresh air and artificial ventilation started. Injected poisons: If the poison is injected e.g. snake bite, the tourniquet should be applied proximal to the point of injection. The wound should be excised and suctioned to remove unabsorbed poison. Contact poisons: The surface should be washed with plain water and neutralized chemically.
- Sample Collection: Collection of specimens should preferably occur before any drugs/antidotes are administered in treatment. The following specimens are advised to be collected in all cases:8
- Blood: 5ml of lithium heparinized blood, 2ml of blood with sodium fluoride preservative and 5ml of blood without anti-coagulant. Avoid the use of swabs containing alcohol and heparin containing phenolic preservative. Protect from light and freeze at -20°C after separation of plasma/serum.
- Urine: Send the first sample of urine passed and then collect a 24hr urine sample. Avoid preservatives- thymol, sodium azide, etc., and refrigerate at 4°C. Note whether collection involved catheterization.
- Gastric contents: Note whether this is vomit, gastric aspirate or first stomach wash. Centrifuge or filter and carry out test on supernatant/filtrates. Gastric contents can be extremely useful if collected shortly after the poison was ingested.
- Others: The samples may be hair, nails, saliva, sweat and meconium depending on the nature of poisoning. Summit and retain any material found with the patient or that may be implicated in the poisoning (bottles, labels, capsules/tablets, suicide note and any other suspected material).

Toxicology request form should be carefully filled and accompany the specimens to the laboratory. Essential information that can be obtained through a request form includes clinical summary (condition of patient including symptoms and signs), drugs/poison suspected, current treatment and all the drugs administered prior to sample collection.[9]

- Removal of absorbed poison by forced diuresis, dialysis or exchange transfusion.
- Administration of specific antidote if available.
- Symptomatic treatment and assessment of clinical improvement.

Toxicological Services: Emergency toxicology deals with the problems involved in the rapid presumptive diagnosis and treatment of suspected poisoning.[10,11,12,13] The most frequent request by clinicians in poisoning cases is for identification of the toxin.[8] It requires collaboration Analytical toxicology laboratory. Emergency qualitative and/or quantitative assays for certain poisons may influence treatment. There are following criteria for laboratory:

- The laboratory should be headed by a toxicologist having at least ‘5 years' experience in clinical analytical toxicology.
- The laboratory should offer a 24-hour emergency service and should be associated with a poison center providing an information service and patient care.
- The ideal location for an analytical toxicology is within/or close to the department where poisoned patients are admitted for treatment. This may facilitate the rapid transport of samples and consultation on specific cases between clinicians and toxicologists.
- Equipments: The basis equipments for toxicology laboratory are balances, centrifuges, vortex mixer, water-bath, refrigerator, freezer, fume cupboards, incubator, hot-air oven, colorimeter, spectrophotometer, thin-layer chromatography and breathe alcohol analyzer.The use of more sophisticated analytical techniques requires immunoassay, gas chromatography, high-performance liquid chromatography and atomic absorption spectrophotometer. A high degree of operator expertise in both the use and maintenance of such equipment is also required.
- Techniques: The following techniques should be readily available-
    - Simple spot tests
    - Liquid and solid-phase extraction techniques
    - Thin layer chromatography (after absorption of the agent in the absorbing media, the poison is detected by spraying coloring reagent)
    - Scanning ultraviolet/visible spectrophotometer
    - Immunochemical analysis (radioimmunoassay, enzyme-multiplied immunoassay, fluorescence polarization immunoassay)
    - Gas chromatography (flame ionization, electron capture and nitrogen/phosphorous detection)
    - High-performance liquid chromatography
    - Atomic absorption spectrophotometer
- There should be proper laboratory management and the reliability of analytical data should be ensured by employing certain quality assurance procedures.

RECOMMENDATIONS

Poisoning and toxic exposures worldwide account for tremendous suffering and unnecessary deaths. In our opinion, each tertiary care hospital should have as least following facilities so that such eventualities can be precisely diagnosed and accurately managed:

1. Simple spot tests: It is highly desirable if the attending physician and/or toxicologist had access to simple, sensitive, rapid and specific tests requiring a minimum of equipment and yielding results in minutes- i.e. spot tests. Generally, because spot tests lack absolute specificity, false positives occur much more frequently than false negatives.[14] Some commonly used important ‘spot tests' are as follows:[15]

2. Ferric chloride test: 2ml urine + 1ml 5% ferric chloride solution purple color indicates presence phenol, phenothiazine, phenylbutazone, oxyphenbutazone or salicylates.

- FPN test: 1ml urine + 1ml FPN reagent (mixture of 5ml aqueous ferric chloride, 45ml aqueous perchloric acid and 50ml aqueous nitric acid) mix it for five second, color ranging from pink, red, violet to blue indicates phenothiazine and green or blue color may be due to tricyclics.
- Trinder's test: 2ml urine + 100ml of Trinder's reagent (40mg mercuric chloride in 850ml water and 120ml aqueous HCl mixed with 40gm hydrated ferric nitrate diluted to 1 liter with warm water) violet or purple color indicates presence of salicylates.
- Lee Jones test: 20ml gastric fluid + few crystals ferrous sulfate and 4-5 drops of 2% NaOH boil and cool then add 8-10 drops of 10% HCl greenish blue color indicates cyanides and purple color indicates salicylates.
- O-cresol test: 5ml urine + 5ml concentrated HCl heat in boiling water bath then cool. Now take .2ml of this hydrolysate solution and then add 1ml aqueous o-cresol solution (10gm/L) followed by 2ml ammonium hydroxide. After that mix it for 5 second blue or bluish black color indicates the presence of paracetamol or phenacetin.
- Dichromate test: 2ml urine + 5ml solution of 10% sodium dichromate in 50% sulfuric acid green color indicates Ethanol.
- Marquis test: 5ml gastric fluid + mixture of 3ml con. H2SO4 and 3 drops of formalin purple color gradually turns blue that indicates presence of opium and its derivatives.
- Reinisch test: 2ml gastric fluid/urine in conical flask along with 10ml HCl and dip small strip of copper silvery deposit indicates Hg, black deposit As or Bi and purplish black deposit indicates Sb.
- Desferrioxamine color test: 2ml gastric fluid + 2 drops of 30% hydrogen-peroxide are placed in two test tubes. In one test tube add 5ml desferrioxamine solution and color change should be compared with other tube (control) Orange/red color indicates Fe toxicity.
- Thin layer chromatography: This is a qualitative technique which involves the movement of liquid phase (usually an organic solvent) by capillary action through a thin, uniform layer of stationary phase (usually silica gel) held on rigid support such as- glass, aluminum or plastic sheet. Using absorbing media, the poison is detected by spraying coloring reagent.

The spot tests described here do not constitute complete and unambiguous screening methods. They are outline for the purpose of helping to provide a tentative diagnosis in the emergency treatment of acute poisoning.

3. Antidotes Availability: There is a list (Table 2) of some common antidote that should be available in the emergency department.

Figure 2

Table 2: List of antidotes and their applications

Antidote	Poisoning	Route	Dose[16]
Atropine	Organophosphorus	Parental	2mg IM/IV every 30mins as per clinical response. Children- .05-.1mg/kg
Pralidoxime chloride	Organophosphorus	Parental	1-2gm of pralidoxime along with 2-4mg of atropine given IM or IV 5% sol. in over 5-10mins or infuse in 100ml normal saline over 15-30mins. Repeat after 1 hour.
D-penicillamine	Copper and Lead	Oral	Children-20-40mg/kg 1-2gm daily before food
Deferiprone	Iron	Oral	Children- 20mg/kg/day
Desferrioxamine	Iron	Parental	75mg/kg/day in 2-4 divided doses (50-100mg/kg/day)
Dimercaprol	Heavy metal (As, Pb, Hg, etc.)	Deep IM	Pt not in shock- IM 1gm initially followed by 500mg every 4hrs for 2 doses. Subsequent doses 500mg 4-12hrly (max 6gm in 24hrs)
Nailoxone	Opium and its derivatives	Parental	10mg 4hrly for 48hrs followed by 100mg t.i.d. for 8-10days In sever poisoning- 5mg/kg every 4hrs may be required during first 1-2days
Naltraxone	Opium and its derivatives	Oral	Reversal of respiratory depression- .4-2mg IV/IM/SC every 3mins Opiod dependence- to prevent relapse and pt should be opiod free for at least 7-10days.
Amyl nitrite & Na nitrite	Cyanide	Parental	25mg initially and then 50mg daily. Once stabilized total dose may be divided on 3days in a week.
Physostigmine	Anti-cholinergic agents	Parental	Amyl nitrite inhalation. Inject IV 10 ml of Sodium nitrite solution, 35ml at the rate of 2.5 to 5 ml/minute, and then inject IV 20-100 ml of sodium thiosulfate solution, 10%. 0.5 to 2mg IM/IV/SC, Children-0.01-0.03mg/kg.

4. Record Maintenance: Each hospital should maintain proper record of all poisoning cases. Giunta F, Brunelli GF, Giron GP, et al [17] presented a proposed Statistical-epidemiological form for recording acute toxicological case histories for statistical purposes which includes personal data, case history, social & environmental data, characteristics of the poison, history of the intoxication, general & prevailing signs and symptoms, criteria of diagnosis, emergency measures, specific and antagonistic treatment before and during hospitalization, clinical laboratory findings, toxicological analysis and progression of symptoms until full or partial recovery or death. It can be used as a part of clinical file.

CONCLUSION

Due to rapid development in the field of science and technology and vast growth in the industrial and agricultural sector, the poisoning is spreading like wild fire. Management of poisoning cases requires cooperation between analytical toxicology laboratory services and physicians dealing with poisoning cases. If the hospitals in a country do not have proper toxicology services, help should be taken from the countries with well established analytical toxicology services. This article may be helpful in establishing toxicology laboratory at primary level.

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