Introduction
Acute poisoning is the most common cause of non-traumatic coma in patients younger than 35 years and accounting for 10% of all acute medical admissions and 30% of admissions to intensive care units. Importance of poisoning is, if recognized correctly in time and effective supportive and specific treatment is given, reversion of the poisoning is possible and life saving is a reality. A good knowledge of the poisoning in the particular region, their toxic effects and possible antidote and prompt emergency medical services are the cornerstone of poisoning management.

Poisoning can be acute, sub acute, chronic. This brief communication will enlighten the newer guidelines in recognizing the type of poisoning and management to be initiated in acute poisoning. For detailed description of individual poisons you are requested to look into standard text books of Medicine / Toxicology.

What is poisoning?
Poisoning refers to the development of dose-related adverse effects following exposure to chemicals, drugs, or other xenobiotics. The dose makes the poison, in excessive amounts, substances that are usually innocuous can cause poisoning. Conversely in small doses substances commonly regarded as poisons, can be consumed without ill effect.

Epidemiology
In the United States more than 5 million cases sought medical advice or treatment per year. Most exposures are acute and accidental. Commonest route of exposure is ingestion(74%). Exposures most frequently involve household chemicals like cleaning agents, cosmetics and over the counter drugs. Carbon monoxide is the leading cause of death. In India pesticides especially organophosphorus compounds are the commonest poisons, apart from plant poisons, sedatives, methanol, metallic salts, heavy metals, etc. About 5% of exposures require hospitalization. They account for 5 to 10% of all ambulance transports, and 30% of intensive care unit admissions.
Classification of poisons in India
Group I - Gases – cyanide, Sulphur dioxide, etc.
Group II - Volatile substances – Ethanol, methanol, etc.
Group III - Drugs - Barbiturates, beta blockers, etc.
Group IV - Metals – Arsenic, antimony, lead, etc.
Group V - Pesticides - Organophosphorus (Parathion, Malathion), Carbamates
Group VI - Anions – Sulphites, nitrites, etc.
Group VII - Miscellaneous – Plant poison (Oleander, cerebra etc.)
Foods – Fish, mushrooms (Amanita phalloides).

Routes of entry
Ingestion
Dermal exposure
Inhalation
Envenomation
Injection

Emergency Diagnosis
Correct diagnosis of poisoning and the recognition of the specific toxic agent requires a high index of suspicion and careful clinical examination. The correct diagnosis can usually be established by the history, physical examination, routine/toxicologic laboratory evaluations and characteristic clinical course.

1. History
   Upto 50% of all initial poisoning histories may be incorrect. Seek identification of the poison or poisons, their dosage, time of exposure, route, duration and circumstances. Required details should be sought from patients family, friends, family physician, paramedical persons and most importantly from the patient if possible. Obtain supporting materials (eg containers, packets, syringes etc.) and clues regarding the time of exposure.

2. Bedside Recognition of Poisoning

   Bedside clues
   Coma - Large doses of Sedatives, Alcohol, Organophosphorus compounds (OPC)
   In Bed - Delirious and Agitated – Belladona, Alcoholism, Cerebral Stimulants
   - One half of body is acid with foot turned outward- Hypoglycemia
   Hypothermia - Opioids, Ethanol, Hypoglycemic Agents, Sedatives/hypnotics
   Hyperthermia - Belladona, Salicylates, Strychnine, Antidepressants
   Breathing - Smell of - Alcohol
   - Kerosene
   - OPC
   - Cheyne-stokes Breathing – Cardio toxins, Severe Coma
   - Stertorous Breathing – Sedatives
   - Acidotic – Methanol / Salicylates
   Pupils - Always spared in poisoning and reacting (Verify with lens)
   - Pin Point - Opioids
   - Constricted - OPC
   - Dilated - Atropine Group
   Pulse - Bradycardia/AV block (Regular/ Irregular) – Digitalis, Beta
Blockers (BB), Calcium Channel blockers (CCB), OPC, Oleander, Digitalis, Tricyclic antidepressants
Tachycardia – Theophylline, anticholinergics
Blood pressure
- Hypotension - Alcoholism, Sedatives, Hypotensives
- Hypertension - Antidepressants, Anticholinergic
Convulsion
- OPC Poisoning
- Hypoglycemia
- Post Cardiac Arrhythmia, INH.
Cyanosis
- Cyanide Poisoning
- Respiratory Failure – OPC
Absent EOM
- Brain Stem depression - Sedatives
Puncture marks
- Addiction – Narcotics
RT Aspirate
- Blue – CuSO₄
- OPC – Smell
Corrosive Scar
- Mouth / Chest - Corrosives

3. Bio-Chemical Recognition of Poisoning
Biochemical clues
Hypoglycemia
- Antidiabetic drugs, ethanol, insulin, quinine, BB
Hyperglycemia
- CCB, acetone, iron, theophylline
Hyponatremia
- Ethanol, severe vomiting
Hypokalemia
- Barium, diuretic, toluene
Hyperkalemia
- Betablockers, cardiac glycosides, alpha agonist, uroride
Anion gap
- High-Ethanol, ethylene glycol, salicylate
- Low-Calcium, iodine, lithium, magnesium
Osmolal Gap
- >10mmol/L - Alcohol, ethylene glycol
Serum cholinesterase
- Low-OPC
Elevated Liver Enzymes
- Ethanol, Copper Sulphate, Alcoholism
Renal Profile
- Copper Sulphate & heavy metals
Meth Hb
- Cyanide
Urine
- Blood – Copper Sulphate liver failure
- Bile Salt – Hemolysis/ liver failure
Bleeding Profile
- Elevated in CuSO₄
- Sepsis
Serum Level of Drugs
- Cardiac Glycosides
- Anti Epileptics
- Sedatives/Hypnotics

Radiology
Look for aspiration pneumonia, ARDS. Radio opaque pills (such as iron, calcium, heavy metals) may be visible on abdomen x-ray.

ECG
Obtain an ECG and monitor the cardiac rhythm continuously. AV block may occur in patients poisoned with Beta Blockers (BB), Calcium Channel blockers (CCB), OPC, Oleander, Digitalis, or Tricyclic antidepressants. QRS and QT interval prolongation may be caused by hyperkalemia and membrane active drugs like amantidine, uroride, lithium, meperidine. Ventricular tachycardia may be seen in poisoning with sympathomimetics, cardiac glycosides, etc.
Five steps constitute the fundamentals of poisoning management.

1. Supportive care
2. Prevention of further poison absorption
3. Enhancement of poison elimination
4. Administration of antidotes
5. Prevention of reexposure

1. Supportive Care

The goal is to maintain physiologic hemostasis until detoxification is accomplished and to prevent and treat secondary complications such as aspiration, pulmonary edema, renal failure, sepsis, hypoxia and shock.

Maintain a patent airway and adequate ventilation. Intubate if necessary. Don’t hesitate to intubate.

Maintain normal tissue perfusion. Hypotension usually responds to intravenous fluids, although vasopressors may be required in refractory cases or in the presence of pulmonary edema. CNS depression or coma occurs frequently. When present, administer naloxone (2mg iv) for possible narcotic overdose. Give 25% or 50% dextrose water 50-100 ml iv unless otherwise you are sure the blood glucose level is more than 100 mg%. Administer 100mg thiamin by iv push for possible Wernickes-Korsakoff syndrome and give humidified oxygen through mask.

Intensive care in acute poisoning

Subsequent management comprises mainly of vital system support and patients should preferably be nursed in an ICU. Critical Care in these patients should have a multidisciplinary approach involving physician, toxicologist, radiologist, hematologist, and anesthesiologist. The main goals are:

a. Respiratory Support

Respiratory complications are the commonest causes of death after acute poisoning and respiratory care, therefore, takes priority over all other systems.

Aims:

* Improvement in oxygenation
  * Humidified O² by face-mask
  * IPPV with or without PEEP as per the patient’s requirement
b. Cardiovascular Support
Cardiovascular complications include hypotension, dysrhythmias and myocardial depression, which are caused by direct effect of the toxin or are secondary to hypoxemia. Attempt should be made to optimize cardiac output by ensuring adequate intravascular volume. Myocardial contractility can be enhanced with the use of inotropes and transvenous/percutaneous pacing where indicated. Correction of dysrhythmias can be achieved by the appropriate use of antiarrhythmic agents and / or DC shock.

c. Renal Support
Renal complications result from the direct effects of toxin, from a period of hypotension, from myoglobinuria or from secondary sepsis.
Urine output should be maintained at the rate of >0.5ml/kg/hour. Patient should have an indwelling catheter for exact measurement of output. Dopamine infusion in the dose of 2-4µg/kg/minute and diuretics like frusemide or mannitol may be used to achieve effective diuresis whenever required.

d. Neurological care
Seizure control is achieved by diazepam and phenytoin sodium; thiopentone infusion may be required for refractory cases. Keeping head titled up, proper ventilation, and help of pharmacological agents like mannitol may be required to regulate intracranial pressure.

e. Metabolic support
Metabolic support envisages maintenance of uid, electrolyte and acid-base balance; temperature regulation is also mandatory. For hypothermia, electrical blankets/air warmers, warm IV uids and inspired gases may be used. For hyperthermia active cooling and antipyretics may be useful. In severe cases, patient may need sedation and ventilation.
• Nutritional support by nasogastric tube/feeding jejunostomy. TPN may be done through a central venous catheter.

2. Prevention of poison absorption (Decontamination)

Decontamination of Skin
All contaminated clothing should be removed immediately and exposed areas of skin should be thoroughly washed with water. A triple wash (water, soap, water) may be the best dermal decontamination.

Gastric Lavage
Gastric emptying procedure should be initiated within one hour of the ingestion. Gastric lavage is performed by sequentially administering and aspirating 200ml boluses of warm saline (Tap water is acceptable except for infants) through a large orogastric tube (No 40 Fr for adults and No 28 Fr for children), repeat until the effluent is clear.

Activated Charcoal (Gut dialysis)
Use of activated charcoal is the preferred and recommended primary GI decontamination procedure. The recommended dose is 1 mg/kg body weight using 8ml of diluent per gram of charcoal. Activated charcoal can be administered before gastric lavage and then removed as described above and followed by another dose of active charcoal. This is more effective than either lavage or charcoal alone.

Whole Bowel Irrigation
This is performed by administering commercially available polyethylene glycol solution at the rate of 0.5 L/hr in children and 2L/hr in adults until rectal effluent is clear. It may be appropriate
for ingestion of enteric coated tablets, cocaine body packing and agents that are poorly adsorbed by active charcoal (heavy metals).

**Syrup of Ipecac**
Administered orally in a dose of 30ml for adults, 15ml for children and 10ml for infants. Clear liquids should also be given. It should not be used if even minimal risk of aspiration is present.

**Cathartic Salts**
These act by promoting the rectal evacuation of gastrointestinal contents. They should not be used as a gut decontaminant, since they do not prevent ingestant absorption. Their primary use is to prevent constipation following charcoal administration. Sorbitol in a dose of 1g/kg of body weight is usually used.

**Dilution**
Used for dilution of corrosives as soon as possible after ingestion. 5ml/kg body weight of water is used.

**Decontamination of Other Sites**
Flushing with water or saline is the initial treatment for topical exposures (except alkali metals, phosphorus). Inhalational exposures should be treated with fresh air or oxygen. Liquids and solids from body cavities should be removed by irrigation if necessary manually, preferably with visual guidance. For corneal or conjunctival exposure, irrigate eye with normal saline.

3. **Enhancement of poison elimination**
   a) **Multiple dose activated charcoal**
   Repetitive oral dosing with activated charcoal enhance the elimination of previously absorbed substances by binding them within the gut as they are excreted in the bile. Doses of 0.5 -1g/kg body weight is used.

   b) **Forced diuresis and alteration of urinary PH**
   Saline diuresis can enhance the renal excretion of alcohols, bromide, calcium, lithium, potassium and isoniazid.
   Forced alkaline diuresis enhances the elimination of chlorpropamide, salicylates, methotrexate, phenobarbital and sulphonamides. It should be aimed to achieve a urinary pH $\geq 7.5$ and a urine output of 3–6 ml/kg/hr. Contraindications include congestive heart failure, renal failure, and cerebral edema. Acid diuresis is no longer recommended.

   c) **Extracorporeal removal of specific poisons (Table 2)**
   Dialysis or Hemoperfusion is indicated when
   * Clinical deterioration persists despite intensive supportive therapy
   * Blood levels reach potentially lethal concentration.
   * Renal or hepatic failure impairs clearance of toxin.
   Hemodialysis or peritoneal dialysis should be considered in cases of severe poisoning due to barbiturates, bromide, chloral hydrate, ethanol, isopropyl alcohol, salicylates and heavy metals. Hemoperfusion may be more effective in removing certain poisons, but it does not correct acid-base and electrolyte abnormalities. Exchange transfusion removes poisons affecting red blood cells (methemoglobin or arsenic induced hemolysis).
Other techniques

Heavy metals can be eliminated by chelation (e.g., Copper by N-pencillamine, Mercury by B.A.L, Iron by desferroxamine, etc)

4. Administration of Antidotes
Specific antidotes are available that neutralize or prevent the toxic effect of certain drugs (Table 3 and 4).

5. Prevention of reexposure
Victims of accidental exposures should be instructed regarding safety measures and advised to avoid circumstances that result in poisoning. Poisons should be kept in places inaccessible
to children. Depressed or psychotic patients should receive psychiatric assessment and regular follow-ups. Prescriptions should be given for a limited supply of drugs.

Conclusion
Poisoning is a preventable and reversible illness. Of all the medical emergencies as per our experience of three decades, poisoning is more rewarding both to the patient and physician. Hence a good scientific knowledge of local poisons and its management is vital.

Concentrate on
1. Unconscious patient is always seriously ill, evaluate quickly and reverse immediately.
2. Clear airway is imperative and will improve ventilation and level of consciousness.
3. Monitor oxygenation by pulse oximeter, if possible ABG and correct them promptly.
4. Hypotension usually responds to adequate volume replacement.
5. Monitor for cardiac arrhythmias and correct them promptly.
6. Antidotes for narcotics, paracetamol and digoxin will be rewarding.
7. Never attempt gastric lavage, if the airway cannot be protected.
8. Forced alkaline diuresis is the method of choice for enhancing elimination of phenobarbitone and salicylates.
9. Charcoal hemoperfusion should be used for poisoning due to CNS depressants.
10. Remember sub acute and chronic effects of consumed poison and reexposure.

Suggested Further Reading
1. Harrisons Principles and Practice of Medicine, 15th edition, Page 2595-2601