PDP 406 CLINICAL TOXICOLOGY

Pharm.D

Fourth Year
GUT DECONTAMINATION

Mr. D. Raju M. Pharm.,
Lecturer
INTRODUCTION

- It is the process of freeing of a person or object of some contaminating substance from intestine which further prevents the absorption of ingested poisons, drugs and chemicals.

- However, no Gut decontamination modalities have been determined to reduce morbidity and mortality by controlled clinical studies.
RECOMMENDATIONS

- **HISTORICAL**
  - Experimental studies in the 1950s & 1960s suggested that syrup of ipecac removed more of an ingested marker than gastric lavage.
  - In the 1980s emergency medical personnel increasingly chose activated charcoal as the initial means of gut decontamination and further studies demonstrated that it reduced the absorption of ingested markers by approximately 50% when administered within 1 hour of ingestion.

- **CURRENT (BOSTON GROUP Suggestions for general treatment of overdose in children in busy emergency departments):**
  - For comatose child with a potentially serious overdose, lavage followed by activated charcoal via an orogastric or nasogastric tube should be instituted within 1-2 hrs of ingestion.
  - In the symptomatic but alert child with a minor ingestion presenting to the emergency department, Activated charcoal alone by mouth appears to be sufficient for gut decontamination.
The use of repetitive doses of activated charcoal depends on specific & proved efficacy of this method in removing the drug ingested.

Syrup of ipecac should now be abandoned in the hospital as there is little evidence of efficacy even in volunteer studies. Furthermore it also leads to serious complications even in conscious patients, particularly Aspiration Pneumonia combined with the diagnostic difficulties.

METHODS OF GUT DECONTAMINATION

EMESIS (VOMITING):

- It can be induced in a poisoned patient by administering the SYRUP OF IPECAC.
- It acts by irritating gastric mucosa as well as through CTZ.

INDICATIONS:

- Administration of syrup of ipecac is recommended for alert patients who would benefit from emesis and who have no contraindications to the use of it.
- Usually it is not effective more than 4-6 hours after ingestion, unless the toxin itself delays absorption.
• DOSE:
  • Infants (6-12 months of age): 5-10ml + 15ml of clear fluids/kg/body weight
  • Children (12 months-12 yrs of age): 15ml + 240ml of clear fluids/kg/body weight
  • Above 12 yrs of age: 30ml + 240-480ml of clear fluids/kg/body weight

• CONTRAINDICATIONS:
  • RELATIVE:
    • Seizure inducing drugs
    • Rapid coma inducing agents
    • Pregnancy
    • Serious heart disease
  • Absolute:
    • Children under 6 months of age
    • Comatose or seizing patients
    • Corrosive substances
    • Coingestion of sharp solid objects
DRAWBACK:
- Usually administration after 60mins is not effective
- Can lead to serious complication even in conscious patients particularly aspiration pneumonia.
- It also delays the emesis and may persist for an hour

ADVERSE EFFECTS:
- Esophagal injury
- Persistant vomiting
- Nausea

GASTRIC LAVAGE: It is the process of irrigation or washing out of the orogastric content.

INDICATIONS:
- It is most effective for patients who ingest life threatening dose or who exhibit significant morbidity & who present soon (within 1-2hrs) after ingestion.
- Involvement of the drugs that delays absorption, ingestion of large quantities of toxic drugs & absence of bowel sounds on physical examination may lead to increased drug recovery at later times postingestion.
EFFICACY: It depends on
- The time elapsed between ingestion and lavage
- The amount ingested
- The inherent toxicity of the substance &
- The rate of absorption

TECHNIQUE:
- It is essential that the staff undertaking the procedure should be experienced in its execution both to reassure the conscious patient and to reduce the risk of complications.
- The procedure should be explained to the patient if conscious and consent obtained.
- Before undertaking the procedure It is essential to ensure that suctioning of the airway is available.
- Endotracheal or nasotracheal intubation should precede GL in the comatose patient without a gag reflex.
An oral airway should be placed between the teeth to prevent biting of the endotracheal tube if the patient recovers consciousness or convulses during the procedure.

- The patient should be placed in the left lateral head down position (20° tilt on the table), which has been shown to produce better lavage returns.
- The length of the tube to be inserted is measured and marked before insertion.
- A wide bore 36-40 French or 30 English gauge tube should be used in adults, and a 16-28 French gauge tube in children. The lavage tube should have a rounded end & be sufficiently firm to be passed into the passage.
- Force should not be used to pass the tube, particularly if the patient is struggling. Once the tube is passed, its position should be checked either by air insufflations, while listening over the stomach, or by aspiration with pH testing of the aspirate. Lavage is carried out using small aliquots of liquid. In an adult, 200-300ml of preferably warm fluid such as saline or water should be used. In a child, 10-20ml/kg/bw of warm fluid should be given.
- Lavage should be continued until no further particulate matter is seen and the efferent lavage solution is clear.
• Contraindications:
• Absolute:
  • Contraindicated in the patient with an unprotected airway
  • such as patients with a depressed state of consciousness &
  • In patients at risk of hemorrhage.
• Relative:
  • Ingestion of a hydrocarbon, alkaline corrosive, acid .
• Precautions:
  • Should not be used in patients who has ingested a non toxic agent or a non toxic amount of a toxic agent
• Complications:
  • Laryngospasm
  • Aspiration pneumonia, sinus bradycardia
ACTIVATED CHARCOAL:
- Administration decreases the absorption of various poisons by adsorbing them onto its surface.
- It is effective to varying extent, depending on the nature of substance ingested.

Multiple dose activated charcoal:
- The principle here is the total dose given may be more critical than the frequency of dosing so repeated doses of activated charcoal is preferred.
- At present it is probably of value in the treatment of Theophylline overdose.
- It can be considered if a life threatening amount of Phenobarbital, quinine, aspirin is ingested.

PRECAUTIONS:
- Concomitant use of cathartics must be avoided otherwise it may lead to intestinal obstruction and also develop electrolyte imbalance. Serious dehydration may result from such repetitive use.
CATHARTICS:

- An agent that empties the bowel
- The goal of cathartics is to decrease intestinal transit time, thereby expelling the poison before it can be absorbed.
- The two main groups of cathartics used in toxicology are:
  - Ionic or saline cathartics
  - Saccharides (sorbitol)

MECHANISM OF ACTION:

- Saline cathartics act by altering the physicochemical forces within the intestinal lumen.
- The osmotic retention of the fluid within the GI tract probably activates motility reflexes and enhances expulsion
- Sorbitol catharsis can lead to liquid stools and abdominal discomfort.

Indications:

- Use of cathartics may reduce the transit time of drugs in the gut & decreases the constipating effects of multiple doses of charcoal.
SORBITOL:
- It is now the cathartic of choice because it may be more effective than saline cathartics.
- In addition it also improves the palatability of activated charcoal.

DOSE:
- Usual dose is 1-2ml of a 70% solution of sorbitol/kg/body weight
- In adults 1g/kg

PRECAUTION:
- Patients especially children, should be carefully monitored for evidence of impaired fluid and electrolyte balance during multiple doses of activated charcoal and sorbitol.

Saline cathartics:
- Magnesium citrate (10% solution, 4ml/kg in child or 250ml in an adult) or
- Magnesium sulfate (250mg/kg in a child or 15-20g in an adult)

ADVERSE EFFECTS:
- Hypermagnesemia may follow excessive intake, impaired excretion, or parenteral administration of magnesium.
• IMPAIRED EXCRETION:
  • Hypermagnesemia is seen in patients with chronic renal failure who have been receiving Mg containing antacids, enemas, or infusions.

• PARENTERAL ADMINISTRATION:
  • Symptoms of excess Mg may be induced by parenteral Mg therapy.
  • A 250ml of bolus containing 20gm of magnesium sulfate administered to an adult over 15mins induced respiratory arrest, hypotension & bradycardia.

• BIOCHEMICAL EFFECTS:
  • The plasma Mg concentration usually exceeds 4mEq/L before any signs or symptoms of Mg excess appear which further leads to nausea, vomiting, electrocardiographic changes, bradycardia, & hypotension.

• NEUROMUSCULAR EFFECTS:
  • Excess Mg decreases impulse transmission across the neuromuscular junction which, further leads to decrease in deep tendon reflexes and flaccid paralysis of voluntary muscles at 10mEq/L or greater levels.
CARDIOVASCULAR EFFECTS:
- Bradycardia and hypotension due to the direct vasodilating and ganglionic blocking effects of Mg on peripheral arteries and arterioles which may be observed at 4-5mEq/L.
- Complete heart block and cardiac asystole may occur at 15mEq/L.

Treatment of Magnesium excess:
- Discontinue administration of Mg.
- Eliminate Mg by enema if it is in the bowel.
- Do not administer aminoglycosides as they may potentiate the neuromuscular blockade of Mg.
- Monitor serum electrolytes, calcium, phosphorous, renal function, fluid intake, urinary output & electrocardiogram.

WHOLE BOWEL IRRIGATION:
- It is useful and rapid method to empty the gut in 4-6 hours.
- It produces more thorough cleansing of the entire intestinal tract.
- High molecular weight (PEG-3350) & isosmolar electrolyte solution is a safe and efficacious method for gut decontamination.
MECHANISM OF ACTION:

- Here PEG does not produce distension of the abdomen like mannitol, which releases hydrogen in the presence of gut bacteria.
- Divalent sulfate ion impairs the active transport of sodium, & PEG prevents the shift of fluid across the intestinal wall by restoring the isotonicity of the solution.

INDICATIONS:

- The concurrent administration of multiple doses of charcoal does not improve the effectiveness of WBI.

POTENTIAL USES FOR WBI AS A DECONTAMINATION MEASURE INCLUDE:

- Ingestion of massive amounts of highly toxic drugs.
- Large overdoses of sustained release preparation.
- Ingestion of substances not absorbed by activated charcoal.
- It is a safe and effective decontamination procedure for potentially lethal iron ingestions, especially if the iron tablets have passed the pylorus.
- It effectively removes the miniature disk batteries (foreign bodies) from the gut.

DOSE:

- The usual rate of fluid administration is 2L/hour in adults.
- 0.5L/hour in children under 12 yrs of age.
• PRECAUTIONS:
  • PEG-ELS should be given at room temperature to prevent hypothermia.
  • Care should be taken during radiographic examination or for surgery in either adults or children.

• CONTRAINDICATIONS:
  • Contraindicated in GI dysfunction (obstruction, hemorrhage &
  • Inadequate airway protection.
REFERENCES

- ELLENHORNS MEDICAL TOXICOLOGY – DIAGNOSIS AND TREATMENT OF POISONING

- ESSENTIALS OF MEDICAL PHARMACOLOGY
  By K. D. TRIPATHI