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Corrosives:

(acids + bases) fix, erode & destroy living tissues with which they come in contact with

→ convert hemoglobin to hematin

→ Alkalis are more dangerous than acids

- alkalis ⟹ liquefaction necrosis ⟹ deeper penetration
- acids ⟹ coagulative necrosis ⟹ hard eschar (prevents deeper penetration)

[except hydrofluoric acid ⟹ liquefactive necrosis)

Mineral acids

- HCl
- HNO_3
- H_2SO_4

Organic acids

- Carbolic acid
- Oxalic acid

Caustic alkalis

- Ammonia
- Button battery
- Cement burns (calcium oxide)
- Liquid Lye (NaOH)

Other Corrosives

- $KMnO_4$

Mineral Acids:

→ Acid: tastes sour, reacts with metals & carbonates, turns blue litmus paper red.

→ Mineral acid: derived from one or more inorganic compounds; does not contain a carbon atom.

- release hydrogen ions when dissolved in water
- MoA: protein coagulation → coagulative necrosis → hard eschar formation → limits further penetration of acid → self-limiting
- concentrated forms react with tissue water to generate significant heat → superimposed thermal injury

Hydrochloric Acid (HCl): colourless, fuming, pungent liquid

→ often yellow in colour due to impurities

→ Uses: – Bleaching agent – Dyeing industry
– Descales in boilers – Laboratory reagent

Signs & Symptoms in Acute Poisoning:

→ corrosive action on skin is less than that of H_2SO_4 (skin is not usually corroded)

→ Mucous membrane (MM) is readily corroded & destroyed.

- Grey or grey-white MM → brown, black → blue (due to production of acid hematin)

Inhalation: Same as HNO_3

i) Coughing & dyspnea
ii) Sneezing
iii) Intense irritation of throat & lungs
iv) Suffocation [feeling of asphyxiation]
v) Cyanosis

Contact with eyes: Same as HNO_3

i) Lacrimation
ii) Photophobia

Signs & Symptoms in Chronic Poisoning:

→ occurs due to chronic exposure to fumes

i) Eyes – Conjunctivitis, corneal ulcers
ii) Nose – Coryza (inflammation of nasal mucous membranes)
iii) Oral cavity – inflammation of gums, loosening of teeth
iv) GIT – pharyngitis
v) Respiratory System – bronchitis

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Diagnosis: (For all acid corrosives)

i) Saliva ⇒ pH tested by litmus paper

ii) Stains on clothing / environment → add few drops of Na_2CO_3 / $NaHCO_3$ → bubbles indicate acid

iii) ↓ PT & PTT

iv) Arterial pH < 7.22 ⇒ acid ingestion

v) Chest & abdominal radiographs: may show signs of esophageal or gastric perforation [pneumomediastinum, pneumoperitoneum]

vi) Endoscopy: should be performed within 12 hours [safest during this period; risk of perforation ↑ after 24 hours]

Fatal Dose: 15 - 20 mL

Fatal Period: 12 - 24 hrs

Management: Same as HNO_3 & H_2SO_4

I) **Systemic Ingestion:**

i) Grade 1 esophageal injury:

→ diet as tolerated

→ no further therapy needed; supportive care only

ii) Grade 2A esophageal injury:

→ if unable to tolerate PO → provide nutritional support via nasogastric tube / orogastric tube / percutaneous feeding tube or total parenteral nutrition (TPN)

→ admission recommended; supportive care

iii) Grade 2B & 3 Esophageal Injuries:

→ Admission into ICU

→ Initiate early percutaneous feeding tube or TPN

→ Prevention of stricture formation:

- Antacids
- Antibiotics
- Corticosteroids

→ If stricture has developed:

- Nasogastric tubes
- TPN ; gastrostomy may be required
- Traditional treatment for focal esophageal stricture ⇒ esophageal dilatation with esophagoscopy.

→ Additional imaging or surgical exploration for gastric injuries.

II) Contact with Skin & Eyes:

i) Wash the affected part with:

- plenty of water & soap or
- Sodium / potassium carbonate (in case of eyes, wash with very dilute solution of sodium bicarbonate), then instill a few drops of castor oil or olive oil.

ii) Neutralize ⇒ after washing, apply a thick paste of Magnesium oxide or carbonate.

PM Appearance:

i) Corrosion is less severe than in H_2SO_4

ii) Stomach:
- brownish discolouration of mucosal folds
- contains brownish fluid
- perforation (rare)

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iii) Respiratory passages & lungs: • Acute inflammation
• Edema

Tests:

Ammonia test: place an open bottle of ammonia near stomach contents / vomitus / suspected poison ⟶ thick white fumes of NH_4Cl are seen.

[Normal HCl of stomach is too dilute (0.2 – 0.5%) to produce similar fumes of NH_4Cl.]

Litmus test: suspected solution turns blue litmus red.

Silver Nitrate Test: suspected solution + $AgNO_3$ ⟶ AgCl (thick white ppt.)

MLI:

Suicide: • ingested as such
• used in detergent suicides by producing H_2S

Accident: • Iatrogenic ⇒ may be confused with antiseptics (negligence by medical staff)
• In chemistry class / laboratories

Homicidal: very rare (due to its corrosive nature)

Abortifacient: rarely introduced into vagina to produce abortion.

Nitric Acid [HNO_3]: clear, colourless, fuming, heavy liquid

→ peculiar choking odour.

Xanthoproteic Reaction: [xantho = yellow]

→ conc. HNO_3 + tyrosine / tyrosine-containing proteins → Yellow colour (xanthoproteic/picric acid) + alkali → Intensified orange-yellow

Signs & Symptoms:

i) **Dermal contact:** yellow colour of skin (xanthoproteic reaction)
- → Intense burning pain
- → Immediate corrosion
- → destruction of skin

ii) **Ingestion:** same as H_2SO_4
- → **Immediate:** • Burning pain in mouth • Dysphagia • Epigastric pain (soon spreads all over thorax & abdomen) • Odynophagia • Pharyngeal pain • Salivation • Stridor
- → Intense thirst, eructations
- → Nausea, vomiting ⇒ brownish-black (due to acid hematin)
  - ⇒ mucoid & strongly acidic
  - ⇒ contains shreds of charred wall of stomach
- → Voice ⇒ hoarse & husky (dysphonia)
- → Abdomen ⇒ distended & tender
  - ⇒ tenesmus
- → Features of generalised shock
- → Metabolic acidosis (due to — absorption of acid — shock — severe tissue burns)

→ Leukocytosis

→ Findings of face: • sunken eyes • dilated pupils • swollen lips, excoriated
• angle of mouth shows brown/black streaks from angle of mouth to side of chin
• corroded mucous membranes (mouth, throat, esophagus)
• chalky white teeth • black, sodden, swollen teeth

→ Chemical peritonitis ⟹ if perforation occurs

→ Late signs & symptom & sequelae of recovery: • permanent scars on skin
• stricture of oesophagus & stomach (hour-glass deformity)
• pyloric stenosis • increased propensity for carcinomas

[More eructations & abdominal distension than H_2SO_4 owing to gas formation]

iii) Inhalation: same as HCl

→ coughing & dyspnoea
→ sneezing
→ intense irritation of throat & lungs
→ suffocation (feeling of asphyxiation)
→ cyanosis

iv) Contact with Eyes: same as HCl

→ Lacrimation
→ Photophobia.

Fatal dose: 10-15 mL

Fatal period: 12-24 hours

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Management: same as HCl

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→ diet as tolerated

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ii) Neutralize ⟹ after washing, apply a thick paste of Magnesium oxide or carbonate.

PM Appearance:

→ Orange-yellow to brown stains on:
- skin of mouth (where contact has occurred)

→ Esophagus: • softened mucous membrane
• yellow/brown in colour

→ Stomach & duodenum: • mucous membrane — yellow-brown/green
— soft, friable
— ulcerated, easily detached
• walls may be perforated

→ Inhalation of fumes:
- Larynx, trachea, bronchi ⟹ congested
- lungs ⟹ congested & edematous

Tests:

i) Litmus test: blue litmus turns red

ii) Stomach Contents / Vomit in a test tube + add strong $FeSO_4$ sol. & H_2SO_4 gently from the sides of the test tube ⟶ brown rings forms at the junction of fluids ← HNO_3 is present.

iii) Stomach contents/vomit in a test tube ⟶ drop a small piece of copper ⟶ heat ⟶ pungent dark brown fumes of Nitrogen dioxide ← HNO_3 is present

MLI:

→ mostly suicidal

→ accident & homicide are rare

Sulphuric Acid (H_2SO_4):

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Signs & Symptoms: same as HNO_3

i) **Ingestion:**

→ **Immediate:** • Burning pain in mouth • Dysphagia
• Epigastric pain (soon spreads all over thorax & abdomen)
• Odynophagia • Pharyngeal pain • Salivation • Stridor

→ Intense thirst, eructations

→ Nausea, vomiting ⇒ brownish-black (due to acid hematin)
⇒ mucoid & strongly acidic
⇒ contains shreds of charred wall of stomach

→ Voice ⇒ hoarse & husky (dysphonia)

→ Abdomen ⇒ distended & tender
⇒ tenesmus

→ Features of generalised shock

→ Metabolic acidosis (due to — absorption of acid — shock
— sever tissue burns)

→ Leukocytosis

→ **Findings of face:** • sunken eyes • dilated pupils • swollen lips, excoriated
• angle of mouth shows brown/black streaks from angle of mouth to side of chin
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→ Chemical peritonitis ⇒ if perforation occurs

→ **Late signs & symptom & sequelae of recovery:** • permanent scars on skin
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ii) Contact with Eyes:

→ Conjunctivitis
→ Corneal edema & ulceration
→ Iridocyclitis
→ Necrotizing keratitis
→ Periorbital edema

iii) Contact with Skin:

→ intense burning pain
→ immediate corrosion
→ destruction of skin

Diagnosis: (For all acid corrosives)

i) Saliva ⇒ pH tested by litmus paper
ii) Stains on clothing / environment → add few drops of Na_2CO_3 / $NaHCO_3$ → bubbles indicate acid
iii) ↓ PT & PTT
iv) Arterial pH < 7.22 ⇒ acid ingestion
v) Chest & abdominal radiographs: may show signs of esophageal or gastric perforation [pneumomediastinum, pneumoperitoneum]
vi) Endoscopy: should be performed within 12 hours [safest during this period; risk of perforation ↑ after 24 hours]

Specific for H_2SO_4:

→ vomitus → add 10% $BaCl_2$ → Heavy white ppt. [$BaSO_4$]

Fatal Dose: 10-15 mL

Fatal Period: 12-24 hours.

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Cause of Death:

i) Immediate:
- → Circulatory collapse (due to trauma from corrosive injury)
- → spasm or edema of glottis
- → perforation of stomach

ii) Delayed:
- → Hypostatic pneumonia
- → Renal failure
- → Secondary infection
- → Starvation (due to esophageal strictures)

Complications:

i) Immediate:
- → Atelectasis
- → GI hemorrhage
- → Esophageal & gastric perforation
- → Tracheobronchial necrosis

ii) Late:
- → Esophageal strictures
- → Pyloric stenosis
- → Upper airway obstruction
- → Carcinoma

Management:

I) Systemic Ingestion: same as HCl & HNO_3

i) Grade 1 esophageal injury:
- → diet as tolerated
- → no further therapy needed; supportive care only

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ii) Grade 2A esophageal injury:

→ if unable to tolerate PO ⟶ provide nutritional support via nasogastric tube / orogastric tube / percutaneous feeding tube or total parenteral nutrition (TPN)

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ii) Neutralize ⇒ after washing, apply a thick paste of Magnesium oxide or carbonate.

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Progress of Injury:

→ Perforation occurs immediately.

→ If perforation does not occur, the following events occur

- Immediately to 4th day: inflammation
- 4th day to 3 weeks: neovascularization & fibroblast proliferation take place ⇒ new collagen is laid down, damaged tissue is replaced by granulation tissue.
- 8 weeks onwards: Remodelling occurs.
  - progressive narrowing of esophageal lumen.
  - dense scar formation ⇒ stricture ⇒ dysphagia ⇒ significant nutrient deficit.

PM Appearances:

a) External:

→ clothing: acid burns, stains

→ linear burns: coursing down the angles of the mouth

→ burns: lip / chin / chest / hands

→ Swelling: of lips & mouth (due to inflammation)

→ Colour of burnt areas: grayish white → brown / black & leathery (may simulate abrasions)

b) Internal:

→ Esophagus: perforation is rare

→ Stomach:

- Corrosion & perforation are common
- If corrosion is absent, there will be: – inflammation
  – swelling due to edema – severe interstitial haemorrhages
- Consistency of stomach: soft, spongy, black mass which readily disintegrates when touched

- lesser curvature may be affected more (∵ acid may travel along magenstrasse)
- Pyloric region: acid cannot pass through & collect here (due to pyloric spasm)
- Antral pooling occurs.

→ Mucosal ridges: show more injury (∵ they are raised)

→ Colour of mucosa: black, charred appearance

Preservation of Samples:

i) Organs: vitreous humor, lungs

ii) Clothings: may reveal acid

Tests:

i) Litmus test: suspected solutions turns blue litmus red

ii) Suspect material + $BaCl_2$ or $BaNO_3$ → white ppt. of $BaSO_4$

iii) Pour suspected material over organic matter (eg: cotton) → Charring

MLI:

i) Vitriolage: (aka Vitriol throwing) throwing of a corrosive substance over the face of adversary due to jealousy or revenge

→ aim is not to kill but to disfigure.

→ corrosive is filled inside an easily breakable container & thrown over the victim

→ Outcomes of vitriolage:

- destruction of garments
- disfiguration of face (if not treated promptly)
- blindness (sometimes)
- Contractures around joints (may cause restriction of movements)
- death (may occur)

→ **ML investigation:**

- clothes must be collected & sent for chemical examination
- plain water swabs from affected areas (for chemical examination)

→ **MLI of vitriolage:**

- it is a grievous hurt
- all hospitals must provide immediate first-aid or medical treatment free of cost to any victim of vitriolage [s. 357C, CrPC]
- if treatment is not provided, punishment is 1y or fine or both [s. 166B, IPC].

ii) **Accidental poisoning:**

→ due to H_2SO_4 being mistaken for glycerine / castor oil / linseed oil.

iii) **Suicide:**

→ taken orally for suicide

iv) **Homicide:**

→ cannot be used for homicide (due to its corrosive nature)

v) **Disposal of dead bodies:**

→ H_2SO_4 may be used for criminal disposal of dead bodies after murder.

vi) **For blinding an enemy or to extort confessions** (used by the police)

vii) **Occupational hazard:**

→ inadvertent inhalation of vapour in chemical factories.

viii) **Abortifacient:**

→ injected in vagina for criminal abortion.

ix) **Battery acid:** (30 - 35% H_2SO_4)

→ used in illicit manufacture of several narcotic drugs

x) **Self defense:**

→ acids have been used by women for defending themselves against sexual assault.

Carbolic Acid [Phenol, C_6H_5OH):

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Properties:

→ pure acid consists of short, colourless, prismatic, needle-like crystals
→ commercial phenol is a brownish liquid containing impurities like cresol.
→ on exposure to air ⇒ crystals turn pink & liquefy.
→ characteristic carbolic/phenolic smell
→ taste: burning sweetish
→ sparingly soluble in water
→ Not a true acid (does not turn blue litmus red)
→ used as antiseptic, disinfectant.

Toxicokinetics:

i) Absorption: readily absorbed from all routes
ii) Excretion: phenol is converted to pyrocatechol & hydroxyquinone in the liver → excreted in urine → further oxidation in urine → green-coloured urine

- initially ⇒ colourless/light-green
- later ⇒ dark green
- long-standing ⇒ almost black

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→ time required for complete excretion = 36 hours.

Signs & Symptoms of Acute Poisoning:

i) Local:

a) Skin:

→ numbness (due to damage to nerve endings)

→ Burns: carbolic acid precipitates proteins & coagulates cell contents

- contact with skin → painless white opaque eschar → falls off in a few days → leaves a brown stain
- lysol burns produce a brownish purple colour.

b) Digestive tract:

→ nausea, vomiting

→ hot burning pain extending from mouth to stomach → tingling → anaesthesia

→ corrosion of lips, mouth, tongue → soon harden & become white.

→ difficulty in deglutition & speech.

ii) Systemic:

a) General:

→ pupils are contracted usually

→ stertorous breathing

→ Pulse: feeble, irregular, rapid

→ Face: • covered with cold sweat
• dusky cyanosis.

b) CNS:

→ Initial stimulation → Later: depression (especially respiratory centre)

- agitation
- lockjaw
- convulsions, seizures
- headache, giddiness, confusion
- unconsciousness, coma towards the end.

c) CVS:

→ Hypotension, arrhythmias.

d) Respiratory system:
→ Breathing: slow, laboured, short, infrequent gasps → progresses to respiratory failure & arrest
→ laryngeal & pulmonary edema (due to irritation)
→ bronchitis, bronchopneumonia (due to aspiration of vomit)

e) Liver: signs of hepatotoxicity

f) Blood:
→ Hemolysis
→ Methemoglobinemia

g) Acid-Base Balance:
→ Metabolic acidosis
→ Respiratory alkalosis

h) Urine:
→ Scanty (suppressed)
→ contains albumin & free Hb
→ colour: green

i) Rare symptoms:
→ fine, rapid, rhythmic contractions of the perioral musculature resembling the chewing movements of a rabbit (rabbit syndrome)

Fatal dose: 10-15 g

Fatal period: 3-4 hours

Management:

i) Contact:
→ remove clothing, clean skin
→ Management of dermal burns: irrigation should be done with polyethylene glycol solution (water can worsen the injury)

- If PEG solution is not available ⟹ use water mixed with soap

→ Washing: – ethyl alcohol (10%)
– methylated spirit
– olive oil

ii) Ingestion:

→ Emetics (generally fail due to anaesthetic effect)

→ Gastric lavage:

- wash carefully with lukewarm water mixed with any of the following
  – Castor oil – Glycerine (10%) – saccharated lime
  – Olive oil – Soap solution – Mg / Na sulphate
- continue washing till washings are clear, colourless & odourless
- after completion of lavage, leave – medicinal liquid paraffin (250 cc) (in stomach) – $MgSO_4$ (30g)

→ Demulcents

→ Normal saline with $NaHCO_3$ (7g/L)

→ Hemodialysis (in case of renal failure)

→ To correct methemoglobinemia – methylene blue IV
– exchange transfusion (if meth Hb > 70%)

Cause of death:

i) Asphyxia – failure of respiration
– edema of glottis
– complications (ex: bronchopneumonia)

ii) Syncope

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Signs & Symptoms of Chronic Poisoning: Phenol marasmus

i) General: – Anorexia – Vertigo
– Headache – Weight loss

ii) Dark urine

iii) Pigmentation:

- yellowish (ochre-like) discolouration of cartilage, sclera & skin ⇒ Ochronosis [seen on microscopic examination]
- Macroscopically — affected tissues appear bluish grey
- D/d — Alkaptonuria

MLI:

→ used for suicide
→ homicidal ⇒ rare because of odour & taste
→ Accidental ⇒ due to careleness in storage
⇒ misguided lay treatment
→ introduced into vagina & uterus for criminal abortion.

Tests:

1 ml of solution to be tested (urine) + few drops of 10% ferric chloride → Bluish colour (phenol is present)
(salicylates also give positive test)

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PM Appearance:

i) External:

- smell of phenol from body
- corrosion of skin around mouth; trickling marks at the angle of mouth (grayish/ brownish)
- Tongue: white, swollen, hardened
- Lips, mouth, throat: mucous membrane is coagulated, corrugated, opaque, soddened, shows numerous small submucous haemorrhages.

ii) Internal:

- Esophagus – mucosa same as that of mouth & throat
  - mucosa arranged in longitudinal folds
- Stomach – contains reddish fluid mixed with mucous & sheets of epithelium
  - smell of phenol
  - mucosa is same as that of mouth & throat
  - thick & leathery
  - necrotic mucosa showing partial separation, with severe congestion (furrows show more damage)
- Duodenum, jejunum, upper part of ileum: similar changes (lesser extent)
- Respiratory tract: – coagulation necrosis of mucosa
  - severe congestion of submucous layers
  - laryngeal & pulmonary edema
- Liver, Spleen: – whitish hardened patch where the stomach is in contact with them
- Kidney: haemorrhagic nephritis
- Brain: congested, oedematous
- Blood: dark, semifluid, partially coagulated.

Oxalic Acid:

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→ Two forms: – anhydrous
– dihydrate (more common)

→ colourless, transparent prismatic crystals

→ resembles in appearance to magnesium sulfate & zinc sulfate

→ Oxalic acid may be administered in mistake for Epsom salts.

Feature	Oxalic acid	$MgSO_4$ / $ZnSO_4$
Taste	Sour	Bitter
Reaction	Strongly acidic ($pH < 7$)	Neutral ($pH = 7$)
On heating with sodium	Sublimates	Does not sublimate
On heating with bicarbonate	Effervesces	Does not effervesce
Application on ink stains or iron moulds	Stains disappear	Do not disappear

Occurrence:

→ present in many plants

→ Kidney stones: Calcium oxalate ⇒ most common component

→ Bacteria: produce oxalates from oxidation of carbohydrates.

Uses:

→ book binding
→ bleach
→ cleaning copper
→ ink remover
→ photography
→ Illegal: • removing writing & signature from papers
• removing election stain marks on fingers

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Mechanism of Action:

Locally: acts as a corrosive

Systemically: Reacts with Ca in plasma → forms calcium oxalate

i) Hypocalcemia

ii) Precipitation of Ca oxalate crystals in liver, kidneys, heart & lungs

iii) Excretion of envelop-shaped crystals of calcium oxalate in urine

Signs & Symptoms:

i) Contact:

→ skin: may be damaged &/or discoloured

→ mucosa of eye, mouth: greatly damaged → scalded appearance

(sometimes, production of acid hematin may give rise to black colour)

ii) Ingestion:

* Immediate:

→ burning, sour/bitter taste in mouth

→ sense of constriction around the throat

→ intense thirst

→ mouth may appear scalded or black

→ severe pain begins in epigastrium & soon radiates all over the abdomen

→ abdomen is tender

→ persistent vomiting, eructations & diarrhoea.

- vomitus contains altered blood & mucus ⇒ coffee-ground appearance

→ Signs & symptoms due to hypocalcemia:
- tetany
- numbness & tingling of fingertips & legs
- Chvostek sign positive

* **Delayed:** due to renal failure (calcium oxalate crystals in kidneys)
  → urine: scanty / suppressed
  Contains traces of blood, albumin & Ca oxalate crystals.

Management:

i) Gastric lavage: with Ca salts → converts acid into insoluble calcium oxalate
ii) Antidote: Calcium salts (chloride, gluconate, lactate, chalk powder)
iii) Calcium gluconate IV: 10ml of 10% at frequent intervals
iv) Parathyroid extract: 100 units IM in severe cases (mobilizes Ca^{2+} from bones)
v) Dialysis or exchange transfusion: for renal failure
vi) Miscellaneous: – demulcents – symptomatic
– evacuation of bowel by castor oil / enema

Fatal dose: 600 mg/kg
Fatal period: 1-2 hours

PM appearances:

i) Mucus membrane of tongue, mouth, pharynx, esophagus:
conc. sol. → whitened (as in bleached) → similar to scalded appearance
conc. sol. → sometimes brown/black due to formation of acid hematin
weak sol. → reddened (due to irritation)

ii) Esophagus: corrugated mucosa, longitudinal erosions
iii) Stomach:
→ Mucosa: – soft & reddened – may be black (acid hematin)
– punctate erosions – numerous dark brown/black streaks running longitudinally
– corrosion
→ Contents: gelatinous & brownish (acid hematin)
→ Perforation (rare)

iv) Intestine: corrosion in upper part of duodenum

v) Liver: hepatic centrilobular necrosis

vi) Kidneys:
- congested & swollen by edema
- swelling & retraction of glomeruli
- renal tubules are full of Ca oxalate & necrosed.

vii) Urinary bladder: urine with calcium oxalate crystals (envelope-shaped)

viii) All internal organs: congestion

ix) Crystals of calcium oxalate: in renal cortex & vessels & capillaries of liver, lung, heart.

Test:

Suspected soln + $BaNO_3$ → White ppt. of Barium oxalate (soluble in HCl or HNO_3)

MLI:

→ accidental poisoning: due to mistaken identity with Epsom salt or $ZnSO_4$

→ homicide: rare (due to acrid sour taste)

→ suicide: rare (due to severe pain & burning)

→ Abortifacient: by vaginal injection

Ammonia: (caustic alkali)

→ At room temperature, NH_3 is highly water-soluble, colorless, irritant GAS with a pungent choking odour

→ Ammonium hydroxide (aka Liquor ammonia / ammonia water / aqua ammonia)
- solution of of ammonia in water (~ 30% ammonia)

Signs & Symptoms: (seen on inhalation)

i) Head, ears, eyes, nose, throat (HEENT): facial & oral burns & ulcerations

ii) Respiratory system:
- cough
- oxygen desaturation
- rhonchi
- salivation
- stridor
- tachypnoea
- wheezing

iii) CNS: loss of consciousness

Diagnosis: HCl test

Place an open bottle of conc. HCl near stomach contents / vomitus / suspected poison
→ thick white fumes of NH_4Cl (confirmatory)

Management:

→ mainly supportive ⇒ treating hypoxia, bronchospasm, acute lung injury (ALI), hypovolemia, burns of skin & eyes.

Fatal dose: 15-20 mL

Button Battery Ingestion: (caustic alkali)

Signs & symptoms:
- irritability
- dysphagia
- refusal to eat
- pain
- vomiting

Diagnosis: X-ray

Management: Endoscoping or surgical removal is necessary because of:
- burns
- perforation
- metal poisoning

Cement Burns: (caustic alkali)

Mechanism of Action:

→ cement contains lime (calcium oxide) → penetrates clothing → reacts with sweat → exothermic reaction

→ even when not exposed to moisture → dry powder is very hygroscopic → causes dessication injury

→ Hydrated calcium oxide → converts to → Calcium hydroxide → Hydroxyl ion causes skin damage

Signs & Symptoms: cement burns have an insidious onset
→ only mild irritation initially.

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Management:

→ Remove soaked clothing

→ abundant washing of wounds

→ Neutralization with buffered phosphate solution

Liquid Lye (NaOH / Caustic Soda): (caustic alkali)

→ NaOH is found in many industrial solvents & cleaners

Signs & symptoms: • Burns • Irritation • Necrosis of skin & underlying tissues

Management: As for general alkalis

MLI: may be seen in vehicular accidents as air bag ruptures.

Potassium Permanganate ($KMnO_4$): aka Condy's crystals

→ dark purple slender crystals having a sweet astringent taste

→ strong oxidizing agent ∴ used as a disinfectant

Mechanism of Action:

→ Before absorption (in solid state / strong solution): acts as corrosive / strong irritant → causes coagulation necrosis

→ After absorption: cardiac stoppage

Signs & Symptoms:

i) Ingestion:

→ intense thirst, nausea, vomiting, diarrhea

- Vomitus is purple brown
- Stools are black due to manganese sulfide

→ Burning pain from mouth to stomach

→ Dysarthria, dysphagia

→ RS: severe inflammatory edema → • dyspnea • persistent spasmodic cough
• stridor

→ Purple brown discolouration: of skin, mucus membranes (with which it comes in contact)
• lips, gums, teeth, tongue, tonsils, pharynx
• colour changes to brown in a few moments & then to coal black due to conversion to manganese dioxide.

→ Systemic: • Methemoglobinemia (because of oxidizing nature of $KMnO_4$)

ii) Local Application: locally applied as abortifacient -
• vaginal & cervical burns, erosions & ulcerations → severe scarring
• extensive bleeding → shock

Diagnosis:
i) Stains → Place a drop of H_2O_2 or soln. of oxalic acid & traces of H_2SO_4 → stains disappear
ii) ↑ in serum & urine manganese levels

Fatal dose: 5-10 g

Fatal period: Few hours

Management:
→ Immediate dilution (with water/milk)
→ Activated charcoal
→ Demulcents
→ Gastric lavage:
• may have to be done carefully (since $KMnO_4$ is a corrosive)
• fluids used - dilute H_2O_2
- 20% sodium thiosulphate
• end point - when returning fluid is colourless
→ Methemoglobinemia: treated with methylene blue 1-2 mg/kg IV over 5 min every 4 hours.

→ Chelation: done when manganese toxicity is suspected
- Administer EDTA & sodium para-aminosalicylic acid.

→ Supportive & symptomatic

PM appearances:

→ Mucus membranes of GIT: (from lips to intestines) ⇒ corrosion, necrosis, haemorrhage

→ Liver & kidneys: degenerative changes seen.

MLI:

i) Manner of poisoning:
→ Suicidal: most commonly
→ Accidental: – in children who eat crystals mistaking them for candies
– when ingested/injected as an abortifacient
→ Homicidal: very rare (due to its colour & peculiar taste)

ii) Production of fictitious injuries: by applying a tablet to the skin for 10–20 min
lesions similar to those of tertiary syphilis may be produced ←

	HCl	HNO_3	H_2SO_4
Signs & symptoms	intro + inhalation + eyes + chronic	xanthoproteic + dermal + ingestion + inhalation + eyes	ingestion + eyes + skin
Management	systemic ingestion + skin, eyes	systemic ingestion + skin, eyes	systemic ingestion + skin, eyes
PM appearance	corrosion + stomach + RS	skin + oesophagus + stomach, duodenum inhalation	external + internal
Tests	Ammonia + litmus + $AgNO_3$	litmus + brown ring + Cu, heat	10% $BaCl_2$
MLI	- - -	- - -	- - -