Caustic and foreign bodies ingestion

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Caustic ingestion: epidemiology

► 50% of toxic exposures in pediatrics

► Children: < 6 years (1-4 yrs)
  accidental, alkalis, at home,
  mortality rate = 0.0022%

► Teenagers and adults:
  > 50% ingestions for suicide attempt (acids)
  mortality rate = 0.12%
Factors involved in tissue injury

- **Critic pH**: < 2 for acids, > 12 for alkalis
- **Concentration** (molarity)
- **Physic properties**: solid, viscous, liquid
- **Time of contact**
- **Amount of caustic ingested**
- **Modality of ingestion**: accidental or voluntary
Mechanism of injury

Alkalis

Fats saponification, protein solubilization

Liquefaction necrosis
  Local heat emission
  vessels thrombosis

Deep penetrating, transmural lesion

Progressive-extensive burns, perforation

Granular form → localized contact → mostly involved organ

esophagus
Mechanism of injury

**Acids**

*Protein dehydration, cellular agglutination*

**Coagulation necrosis**

*Coagulum limiting injury extension*

**Self-limiting burn pattern, superficial lesions**

*Liquid form, low viscosity ➔ rapid transit ➔ mostly involved organ: stomach*
### Caustic products present in domestic environment

<table>
<thead>
<tr>
<th>Products</th>
<th>Main caustic substances</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lye products, drain and oven cleaner, dishwashing</td>
<td>Sodium hydroxides (caustic soda)</td>
<td>Alkali</td>
</tr>
<tr>
<td>detergents, bleaches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dishwashing and laundry detergents</td>
<td>Sodium phosphates</td>
<td>Alkali</td>
</tr>
<tr>
<td>Drain cleaner</td>
<td>Sulfuric acid</td>
<td>Acid</td>
</tr>
<tr>
<td>Toilet bowl cleaner</td>
<td>Hydrochloric acid</td>
<td>Acid</td>
</tr>
<tr>
<td>Toilet bowl cleaner</td>
<td>Sodium bisulfate</td>
<td>Acid</td>
</tr>
<tr>
<td>Metal cleaner</td>
<td>Hydrofluoric acid</td>
<td>Acid</td>
</tr>
<tr>
<td>Household bleach</td>
<td>Sodium hypochlorite</td>
<td>Acid</td>
</tr>
</tbody>
</table>
Modality of ingestion

- Accidental
- Pseudo-voluntary: from a non-original holder/bottle
- Voluntary: suicide attempt
Burn severity and localization can correlate to:

**Ingestion modality**
- **Accidental**
  - Self-limiting
  - Small volumes
  - Mild lesions
- **Pseudo-voluntary /voluntary**
  - High volumes
  - Severe /extended lesions

**Caustic viscosity**
- **Liquids**
  - Rapid transit
  - Antral-pyloric lesions
- **Solids**
  - Mucosal adhesion
  - Severe oral and esophageal lesions
Evolution of lesions due to caustic ingestion

<table>
<thead>
<tr>
<th>Stage</th>
<th>Time</th>
<th>Lesions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflammatory stage</td>
<td>0 – 4° day</td>
<td>Edema, vascular thrombosis, necrosis (max 48 h)</td>
</tr>
<tr>
<td>Granulation stage</td>
<td>4° - 7° day</td>
<td>Wound softening</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mucosal sloughing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High risk of perforation</td>
</tr>
<tr>
<td>Healing stage</td>
<td>2-3 weeks</td>
<td>Collagen deposition</td>
</tr>
<tr>
<td>Scarring stage</td>
<td>&gt; 3° week</td>
<td>Fibrotic tissue, strictures</td>
</tr>
</tbody>
</table>

Avoid endoscopy between 5 and 15 days
Symptoms

Airway and facial burns

Lips-tongue-mouth-pharynx-larynx edema-ulcers
Cough, hoarseness, dyspnea, stridor

Respiratory compromise

ICU: respiratory distress management
Progressing edema and damage → anticipatory attitude

Early intubation

Solid alkali adheres to mouth and pharinx
Liquid form rapidly pass through
Symptoms

Esophageal and GI burns

chest-epigastric-abdominal pain
dysphagia, odynophagia, drooling
vomiting, hematemesis

Symptoms can develop quickly or to become evident several hours after ingestion
Complications

Acute:
- GI bleeding (acids), perforation (alkalis)
- Peritonitis, mediastinitis, pleuritis
- Cardiovascular compromise
- Infections
- Pancreas and liver involvement
- Multiorgan failure
- Death

Chronic:
- Strictures
Role of GI endoscopy

1. Indication and timing?
2. Assessment of burn extension and severity
3. Treatment
Endoscopy indication

**YES**
- Voluntary/pseudo-voluntary ingestion with or without symptoms
  - 1 or more GI symptoms
    - Respiratory symptoms
      - Oropharyngeal sparing → caustic rapid swallowing
    - Severe oral lesions

**NO**
- Asymptomatic with suspected ingestion
  - Clinical observation
- Sure/suspected perforation
Endoscopy timing

- Within 6-24 h after ingestion
- Voluntary or pseudovoluntary: as soon as possible
- Recent meal: at least 4-6 h after
Endoscopy technique

- Increased risk of perforation
- Better performed in operating theatre
- Smallest available endoscope
- Endoscope introduction under direct vision
- Hypopharinx-larinx evaluation
- Esophagus (alkalis): physiological narrowing
- Stomach (acids): antrum and pylorus
## Endoscopic classification of burns

**Italian guidelines**

<table>
<thead>
<tr>
<th>Lesion severity</th>
<th>Lesion extension</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal appearance</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Reddening and edema</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Superficial-mucosal ulcers:</strong></td>
<td><strong>Non-circumferential</strong></td>
<td>2</td>
</tr>
<tr>
<td>whitish pseudomembranes</td>
<td><strong>2A-2B</strong></td>
<td></td>
</tr>
<tr>
<td>(subgrade A)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Deep transmural ulcers:</strong></td>
<td><strong>Circumferential</strong></td>
<td>3</td>
</tr>
<tr>
<td>black-brown necrosis</td>
<td><strong>3A-3B</strong></td>
<td>*</td>
</tr>
<tr>
<td>(subgrade B)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* stricture evolution
Esophageal burns (alkalis)

Grade 1
Reddening and edema

Grade 2A
Localized whitish pseudomembranes
Grade 3A
Circumferential whitish pseudomembranes

Esophageal burns (alkalis)
Esophageal burns
(alkalis)

Grade 3B
Deep ulcers/ black-brown necrosis
Greater curvature necrosis

Gastric burns (acids)

Pyloric stenosis
Endoscopy-prognosis correlation

- Degree of esophageal injury correlates with morbidity and mortality
- ~ nine-fold increase with each increased grade of injury
- **3A-3B lesions:**
  - risk of perforation 4th-7th day after ingestion
  - high risk of stenosis (75%) 3-6 weeks after ingestion
Treatment after endoscopy

Italian guidelines, Airone

Endoscopic lesion

Grade 1

Grade 2

Grade 3

Therapy

Warm-soft meals

• semiliquid diet
• PPI
• clinical observation

• fasting-TPN > 1 week
• antibiotics
• PPI
• steroids
Follow up after endoscopy

Short term after (3-4 wks from ingestion)

- endoscopy

  or

- barium follow-through
  
  → stricture → endoscopic treatment

Long term

- sequential endoscopy for GERD or cancer screening
Treatment of esophageal strictures

1st line treatment: endoscopic dilation

Savary/Balloon dilation

2nd line treatment: association with other techniques

Steroids injection

Mitomycin C application

Esophageal stenting
Foreign bodies ingestion: epidemiology

- **critical age**: 1-5 yrs (max 2yrs):
  - oral phase of development
  - environment exploration
  - brothers

- **underlying disease**:
  - mental retardation, autism
  - previous surgery
Foreign bodies ingestion: premise to endoscopy

➢ Outcome:
  spontaneous passage: 80-90 %
  endoscopic removal: 10–20 %
  surgery: 1–2 %

➢ Typology:
  shape (wounding or not)
  toxicity

➢ Localization:
  hypo-pharynx, esophagus, stomach, small bowel, colon
Pathophysiology of the location

**Disease**

Benign stenosis:
- esophageal anastomosis
- peptic esophagitis
- eosinophilic esophagitis
- congenital
- rings

**Physiology**

- cricopharyngeal muscle
- aortic arch
- left main bronchus
- diaphragmatic jato

achalasia
Clinical manifestations

Food refusal, marked loss of appetite, increased physiological regurgitation

- dysphagia
- odynophagia
- absence
- drooling
- hematemesis
- choking
- mediastinitis
Timing of treatment: guide factors

- location
- nature: harmless, wounding
- toxicity: Pb, disk batteries
- symptoms
- patient size
- underlying disease
Timing of treatment

Hypo-pharinx and esophagus

all FB

emergent removal

In the distal esophagus without symptoms: wait some hrs

Disk batteries, 1 hr mucosal lesions, 4 hrs wall lesions
Timing of treatment

Stomach

- FB > 3-4 cm (risk of pylorus/ICV impact)
  - urgency
  - wait 4 wks

- coins/harmless
  - wait 4 wks

- disk batteries
  - wait 48 hrs
Timing of treatment

FB with lead ➔ urgency

Duodenum:

- wounding FB ➔ urgency
- harmless FB ➔ no treatment
- disk batteries ➔ X-rays every 3-4 d
Equipment

- pentapod grasping forceps
- rat tooth jaws
- basket
- Roth net retrieval
- band ligation device
- rubber cap
- alligator jaw forceps
“Newer” foreign bodies
Classical Urgency

Harmless symptomatic foreign body ingestion
Urgency temporarily "wait"

- spasmodic
- half seated position

After 6 hrs
Food impact

removal in urgency + biopsies:

eosinophilic esophagitis
Foreign bodies images
Endoscopic technique

- in “vitro” test

- in the esophagus:
  - proceed without haste
  - attention to the level of the OT cuff
  - keep the FB close to the tip of the scope
  - UES: curarization

- in the stomach:
  - change the decubitus (anti-TD)
  - keep axial position of the FB
  - caution to the cardia
<table>
<thead>
<tr>
<th>Site</th>
<th>Type of FB</th>
<th>Timing of removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>hypo-pharinx</td>
<td>all</td>
<td>emergency</td>
</tr>
<tr>
<td>esophagus</td>
<td>disk batteries, toxic/wounding FB</td>
<td>urgency</td>
</tr>
<tr>
<td>esophagus</td>
<td>harmless, coins, food impact symptoms</td>
<td>urgency postponed few hrs</td>
</tr>
<tr>
<td>esophagus</td>
<td>harmless, coins, food impact no symptoms</td>
<td>urgency</td>
</tr>
<tr>
<td>stomach</td>
<td>vulneranti o contenenti sostanze tossiche</td>
<td>urgency postponed 48hrs</td>
</tr>
<tr>
<td>stomach</td>
<td>batterie</td>
<td>no indication</td>
</tr>
<tr>
<td>stomach</td>
<td>non vulneranti in paziente asintomatico</td>
<td>X-rays after 4 wks if failure to pass</td>
</tr>
<tr>
<td>duodenum</td>
<td>vulneranti</td>
<td>urgency</td>
</tr>
<tr>
<td>duodenum</td>
<td>non vulneranti</td>
<td>urgency</td>
</tr>
<tr>
<td>any site</td>
<td>CE contenenti piombo</td>
<td>urgency</td>
</tr>
</tbody>
</table>
First aid: symptoms and signs
examination of oral cavity
ORL
X-Rays AP and L

Typology

Localization

Timing of removal

Shape

Toxicity

Esophagus: removal if disease of esophagus, small bowel, colon

Stomach: removal with FB > 3-4 cm.

Duodenum:
- wounding: urgency
- harmless: no indication

FB with Pb:
- always
- everywhere

Harmless

Sym+ Sym-

Wounding

Disk batt

Toxic

Elective

Stomach

Esophagus

cryopharynx

Urgency

Urgency postponed

Some hrs

48 hrs

After 4 wks
Endoscopic timing

Removal in urgency

- Coins, if asymptomatic:
  - spasmolitycs
  - waiting "army"

• sharp or pointed
• containing toxic substances
• voluminous (urgency postponed)

harmful FB is to be removed with a disease of esophagus, small bowel or colon