

Risk

- From 1999 to 2008, 3% of all reported burn injuries.
- Risk increases with age: 1% of burn injuries from birth to age 16; 3.7% from 20–30; and 5% from 30–50, according to the National Burn Repository Report on Data from 1999 to 2008.
- Majority of chemical exposures occupational, occurring in men of working age, whereas assaults with caustic chemicals are more likely to occur against women.
- American Association of Poison Control Centers reports approximately 130,000 exposures to caustic substances in 2007.

Perioperative Risks

- Morbidity varies by exposure type and substance. Surface burns may be regarded like thermal burns after decontamination.
- Caustic ingestion may result in perforation and/or bleeding, and respiratory compromise from upper-airway edema.

Worry About

- Identify injury setting, chemical(s) involved, areas of exposure, and duration before decontamination.

- Airway compromise may arise from face/ingestion exposures; develop an airway management plan early.
- Occupational exposures may have associated traumatic injuries (from explosions, fire, falls, etc.).
- Chemical burns may produce more tissue necrosis than their initial appearance would suggest.

Overview

- A large number of different chemicals can potentially cause injury, including acids, bases, and organic and inorganic compounds.
- Acid burns generally produce coagulative necrosis; depth may be limited by formation of coagulated proteins at base of burn.
- Bases typically generate liquefactive necrosis; depth often much deeper than in acid burns.
- Organic compounds cause direct heat production and chemical reactions that disrupt skin.
- Inorganic compounds bind directly to the skin and create salts that damage skin integrity.
- Severity of burn is related to a variety of factors including the pH, concentration, volume, physical form, and contact-time duration of the offending agent.

Etiology

- Surface burns: Most commonly work-related injury and accidental; upper limbs are more commonly injured because these substances are usually handled or carried; injuries to the lower limbs and face can occur through splashing
- Ingestions: Pediatric most commonly accidental; adults most frequently a suicidal gesture

Usual Treatment

- Remove contaminated clothes.
- Early decontamination with water or saline irrigation for surface exposures; elemental metals (potassium, lithium) should not be exposed to moisture due to strong exothermic reaction.
- Prevent contaminated irrigation solution from running onto unaffected skin.
- After initial decontamination, pt is treated as a typical burn pt.
- Ensure adequate fluid resuscitation for large BSA burns.
- Take measures to prevent complications (e.g., hypothermia, infection, rhabdomyolysis).

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEENT	Face and airway burns; eye injuries	Dysphonia, odynophagia, dysphagia Visual changes	Denuded or inflamed oral mucosa and conjunctivitis	Endoscopy, ophthalmologic evaluation
RESP	Chemical pneumonitis, ARDS	Dyspnea	Hypoxemia, possible rales or evidence of edema, auscultation may be normal	CXR, ABG
CV	Arrhythmias, hypovolemic shock	Palpitations Chest pain Dyspnea	Tachycardia or irregular rhythms	EKG, CXR
GI	Esophagogastritis, perforated viscus	Odynophagia/dysphagia, hematemesis, epigastric pain	Abdominal tenderness/guarding	Endoscopy, contrast CT scan, x-ray
RENAL	Electrolyte disturbances, RF, acute tubular necrosis	Deep or large surface area burns. Associated crush injuries	Myoglobinuria, oliguria	Basic metabolic profile (BUN/Cr), urine myoglobin
MS	Rhabdomyolysis, compartment syndromes	Deep or large surface area burns; associated crush injuries	Evolving loss of motor/sensory function	Serum myoglobin, compartment pressure monitoring

Key References: Seth R, Chester D, Moimen N: A review of chemical burns, *Trauma* 9:81–94, 2007; Diez C, Varon AJ: Anesthetic management of the burn patient, *Curr Anesthesiol Rep* 6:16–21, 2016.

Perioperative Implications

Preinduction/Induction/Maintenance

- Review history of the current injury, including the amount of associated TBSA burn and time elapsed since injury.
- Reliable vascular access is essential for adequate fluid resuscitation.
- Normalize electrolytes, if possible.
- Preop medication should be used to alleviate anxiety, reduce pain, and facilitate pt comfort during transfer and transport.

Monitoring

- Adequate intraop monitoring is essential due to the potential for extensive blood loss, frequent changes of position, and duration of surgery.
- Placement of surface monitors can be difficult due to location of burns.
- Try to place invasive lines away from injury, not through damaged skin.
- Consider arterial line placement for extensive debridements/grafting to allow beat-to-beat monitoring and frequent sampling of arterial blood.

- Presence of an arterial line should not preclude placement of NIBP cuff (backup if arterial line fails during procedure). Negotiate with surgeon the best location for NIBP cuff.

General Anesthesia

- Most surface chemical burns that proceed to OR are extensive enough to be treated as thermal injuries.
- Choices for induction and maintenance of general anesthesia depend on associated hemodynamic instability and airway status.
- Muscle relaxants; avoid succinylcholine after acute phase (first 24 hours); resistance to non-depolarizers may evolve after acute phase.
- Narcotic tolerance may be higher in chronic phase.
- Transfusions may be required in extensive debridement procedures.
- Epinephrine-soaked pads may be applied by surgeon to decrease bleeding. This may result in tachycardia and a falsely stable BP that deteriorates after removal of pads.
- Thermoregulation is impaired. Warm OR as much as possible. Apply forced-air heating blankets. Administer warmed fluids and blood products.

- Extubation in the acute phase should be carefully considered if there is suspicion of airway edema or difficult reintubation.

Regional Anesthesia

- No contraindication in small or peripheral injuries.
- Placing block through intact skin preferable.
- Excision and grafting procedures may be accompanied by large fluid shifts and blood loss, in which case, the loss of sympathetic tone resulting from a neuraxial block may be undesirable.

Postoperative Period

- Acute, extensive injury may require ICU care.
- Pain management can be challenging in chronic phase.

Anticipated Problems/Concerns

- Early, goal-directed resuscitation and correction of electrolyte abnormalities.
- Careful monitoring of airway and early airway intervention, if needed.
- Maintain normothermia.