

J01: Approach to Chemical or Toxic Exposures

Robert MacMillan and Mike Sugimoto (ed)

Updated: December 07, 2020

Reviewed:

Introduction

This clinical practice guideline is intended to provide general advice for paramedics managing toxic or chemical exposures, where the substances involved can be classified as irritants, asphyxiants, acids, or alkalis.

Separate practice guidelines exist for specific agents:

- [→ J02: Carbon Monoxide](#)
- [→ J03: Cyanide](#)
- [→ J04: Hydrogen Sulfide](#)
- [→ J05: Organophosphates and Carbamates](#)

Essentials

- The safety of paramedics is paramount. Every patient's need for decontamination must be carefully evaluated, and measures taken to control or eliminate ongoing contamination hazards. Do not attempt to transport patients who have been insufficiently decontaminated. **Consult with CliniCall for guidance** on decontamination procedures.
- **UNDER NO CIRCUMSTANCES WILL BCEHS PARAMEDICS PROVIDE CARE IN HOT OR WARM ZONES.**
- Avoid contaminating ambulances or downstream health care providers and facilities: ensure that an appropriate decontamination is completed prior to loading a patient for transport. Downstream contamination can cause significant systemic disruption and must be avoided.
- Chemical exposures require a collaborative approach between agencies. Paramedics will need to rely on the expertise of other responders at these scenes.
- The vast majority of toxic or chemical exposures can be managed symptomatically. Very few agents have specific prehospital treatments. Supportive basic care (airway control, support for oxygenation and ventilation, and management of hypotension) are often more important than antidote administration.
- Apply a staged approach to all aspects of management, including airway control.

General Information

In all cases of chemical exposure, consultation with CliniCall for decontamination requirements and care planning is mandatory. If there is uncertainty over the need for decontamination, the patient should undergo dry decontamination and then be re-assessed. Collaborate with other providers at scene.

Pulmonary Irritants

These agents primarily affect the respiratory tract and mucosal membranes, and include industrial chemicals like chlorine, ammonia, and phosgene. Mixing of household cleaning products, such as bleach and toilet bowl cleaners, can result in the production of irritant gases. Their effects vary depending upon their solubility in water. Upon contact with the mucosal membranes, they tend to dissociate into associated acids or bases, producing irritation. Bronchospasm is common, and severe exposures can result in non-cardiogenic pulmonary edema.

Asphyxiants

Asphyxiants are primarily gases whose dangerous properties relate to their ability to displace oxygen from a space. As the oxygen concentration falls, mental acuity among affected individuals begin to decrease; coordination and balance also begin to fail. Loss of consciousness occurs at concentrations below 10%, and death can occur quickly where oxygen concentrations are below 6%. Patients who are removed from oxygen-deficient environments can be confused, agitated, combative, or comatose – all related to hypoxia.

Many asphyxiants have no warning properties such as taste, odor, or color. Some of these gases are flammable or explosive. Examples include hydrogen, helium, ethane, ethylene, nitrogen, neon, carbon dioxide, argon, acetylene,

methane, propane, and propylene. Exposure to an asphyxiant does not generally require decontamination; where decontamination is required, dry decontamination and removal of clothing will generally suffice. If patients are swiftly removed from an oxygen-deficient environment, recovery can be rapid; prolonged exposure to hypoxic environments can lead to irreversible end-organ damage.

Acids

Widely used in both household and industrial applications, acids can be found in products as diverse as toilet bowl cleaners, drain cleaners, metal polishes, electroplating and descaling solutions, and battery fluid. Exposure to acids generally involves splashes on to the skin or into the eyes, which results in corrosive burns; ingestion of acid solutions or inhalation of acid fumes occurs occasionally.

All patients who have been exposed to acids must be decontaminated. The most effective method is to remove clothing and flush with copious amounts of running water. Acids attack proteins in tissue, causing a coagulation necrosis and inflammation; airway compromise may occur and should be managed conservatively. Bronchospasm should be treated as required.

Alkalis

Like their acid counterparts, alkaline corrosives are found in numerous household and industrial products and processes. Common examples include drain and oven cleaners, detergents, bleaches, and hair care products. "Lye" and "caustic soda" both refer to any strong alkali, generally either sodium hydroxide or potassium hydroxide, or a carbonate compound. Alkaline corrosives disrupt the lipid membranes of tissues, causing significant damage. As with other substances discussed in this guideline, the degree of damage depends heavily on the concentration of the substance, the duration of contact, and the total time of exposure.

These patients must be decontaminated. Brush off powdered material before removing clothing and flushing with water. Skin may feel "soapy" during flushing; continue flushing until the soapiness subsides. In cases of ingestion, and in consultation with CliniCall, consider giving 100-200 mL of milk or water to dilute the substance, but do not give in cases of nausea or vomiting.

SUPRAGLOTTIC AIRWAY DEVICES ARE CONTRAINDICATED DUE TO THE POTENTIAL FOR PATIENTS WHO HAVE INGESTED CAUSTIC SUBSTANCES.

Interventions

First Responder

Scene control:

- Protect responders and the public. Isolate large-scale incidents, such as transportation accidents, according to the initial protective distances in the Emergency Response Guidebook (orange book). Stage in a safe environment until the scene is sufficiently controlled.
- Assess and communicate the need for additional resources. Identify the number of patients affected.
- Ensure appropriate decontamination is performed prior to any patient assessment. Consult CliniCall for additional information on decontamination steps and requirements.
 - → [PR05: Patient Decontamination](#)
- Apply a staged approach to the management of the airway, oxygenation, and ventilation
 - → [B01: Airway Management](#)
- Apply supplemental oxygen to maintain SpO₂ ≥ 94%
 - → [A07: Oxygen and Medication Administration](#)
- Ventilate using bag-valve mask if respirations are inadequate or absent
- Do not attempt to remove clothing that has frozen to the skin. Thaw first with warm water.
- Flush skin and mucous membranes exposed to chemical agents with copious amounts of warm water. Flushing should be done for at least 15 minutes and may take place concurrently with decontamination.
- If eye exposure has taken place, gently remove contact lenses if not adherent to the cornea. Flush eyes with water. Do not attempt to open eyelids frozen shut by exposure to cryogenic liquids.

Emergency Medical Responder – All FR interventions, plus:

- Contact CliniCall to discuss initial steps and plan care for affected individuals
- Do not enter the hot or warm zones

General patient management:

- Ensure appropriate decontamination is performed prior to any patient assessment. Consult CliniCall for additional information on decontamination steps and requirements.
 - → [PR05: Patient Decontamination](#)
- Apply a staged approach to the management of the airway, oxygenation, and ventilation
 - → [B01: Airway Management](#)
- Use appropriate pharyngeal adjuncts (NPA/OPA) where required
 - → [PR07: Nasopharyngeal Airways](#)
- Apply supplemental oxygen to maintain SpO₂ ≥ 94%.
 - → [A07: Oxygen and Medication Administration](#)
- Ventilate using bag-valve mask if respirations are inadequate or absent

Primary Care Paramedic – All FR and EMR interventions, plus:

- Continue to apply a staged approach to airway management
 - → [PR08: Supraglottic Airways](#)
 - → [PR09: Continuous Positive Airway Pressure](#)
 - → [PR10: Positive End Expiratory Pressure](#)
- Do not use supraglottic airway devices in cases of caustic (acid or alkaline) ingestion
- Consider the use of CPAP for patients who meet the appropriate criteria in consultation with CliniCall
- Consider the use of PEEP with a bag-valve mask to support oxygenation in patients whose respirations are inadequate
- Consider treating bronchospasm as required
 - → [B03: Bronchospasm and Asthma](#)
- Consider pain management
 - → [E08: Pain Management](#)
- For ongoing hypotension, consider vascular access and fluid administration to a systolic blood pressure of 90 mmHg
 - → [D03: Vascular Access](#)

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Continue to apply a staged approach to airway management
 - Endotracheal intubation is unlikely to be required in most cases; graded application of interventions will support oxygenation and ventilation in the majority of patients.

