Just-In-Time Learning Series:

MANAGEMENT OF CHEMICAL AGEN INJURIES - **BREATH/ INHALANTS & IRRITANTS**

Region 8 MOUNTAIN PLAINS Regional Disaster Health Response System

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HISTOLOGY AND EXPOSURE

Dependent on their physical and thermal properties, gases and fumes may damage mucous membranes, ciliated upper airways, terminal bronchioles, and alveoli. In thin cell layers, *alveolar type 1 cells* are the gas exchange interface with capillaries. By releasing surfactant that deceases surface tension, cuboidal supportive *alveolar type 2 cells* maintain alveoli spherical shape enhancing oxygenation. Irritants may injure theses structural cells leading to coughing, wheezing, hypoxia and possibly respiratory failure.

Particle exposure, whether inert or as absorbed-gas carriers, may cause physical or chemical injury to the lungs. The larger the particles, the more likely they will be filtered out of inspired air in the upper airway. Exposure to and absorption of irritants can result in local or systemic toxicity. The pulmonary system acts as both a target organ and a portal of entry to the systemic circulation.

DETERMINANTS OF TOXICITY

Dose *Dose = concentration × minute ventilation*

Health of the individual exposed

Properties of the agent:

- pH
- Water solubility
- Volatility/Vapor density
- Mixtures and particle size
- Warning properties

GAS AND FUME WARNING PROPERTIES

LOW WATER SOLUBLE GASES

- Poor warning properties
- Onset of irritating effects is delayed
- Upper airway irritation
- ex: phosgene

HIGH WATER SOLUBLE GASES

- Good warning properties
- Onset of irritating effects is rapid/immediate
- Lower lung injury
- ex: ammonia, methylisocyanate, hydrofluoride

MANAGEMENT OF PATIENTS EXPOSED TO IRRITANTS

- Self-protection: In order to effectively treat patients and avoid self-injury, responders must use appropriate PPEs to create a safe environment.
- Remove patient from the exposure.
  - Provide attention to the airway, breathing and circulation of the patient.
- Decontaminate the patient
  - Typically, gas exposures typically less decontamination than liquid or dust exposures.
- Examine patient and if the eyes and/or skin is involved, then irrigation is required.
- Control the airway early and often. Treat bronchospasm inflammation like asthmatic patients. Hypoxic patients may need supplemental oxygen and possibly either non-invasive or invasive ventilation.
- Because toxicant injuries, especially to low-water-soluble gases, are dynamic, over the course of hours, a patient may have evolving lung injuries, and so observation is required.

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