GUIDELINES FOR PATIENTS WITH SMOKE INHALATION INJURY IN THE REMOTE ENVIRONMENT

PURPOSE
This document is intended as a supplement and is not intended as a substitute to communication with medical control, but is intended as a guide in instances where communication with medical control is not possible.

REMEMBER: smoke inhalation injuries will be evacuated to the nearest BURN **CENTER** with **HYPERBARIC CAPABILITIES** whenever possible.

The **START** of this cascade is inflammation. The resultant changes in tissue and vascular permeability result in pulmonary edema and later, abnormalities of cellular function with loss of ability to produce substances like surfactant. Resultant ventilation-perfusion mismatch, impaired gas exchange, and increased work of breathing occur. Finally, hypoxic injury to the patient may result in academia and perhaps death.

The **FINAL** common pathway for injury and death from smoke inhalation is **HYPOXIA**.

1. Assess the site where the injury occurred if possible
    a. Obtain an accurate history from the rescuer or the patient if possible
    b. Determine the type of exposure (e.g. electrical fire, fuel fire, chemical fire, etc.)
    c. Determine the length of exposure
    d. Determine the ventilation in the area at the time
        i. Is it a closed space injury?

Note: Thermal Injury to the airway is almost universally limited to the supraglottic structures. Air is a very poor conductor of heat and the membranes of the airway are efficient at dissipating heat. Thus, unless liquid heat (steam) is inhaled, the extent of **THERMAL** injury will be supraglottic.

Result: **EDEMA** and possible upper airway obstruction.

Hypoxic Injury is - Asphyxia
Smoke contains irritants which replace some of the oxygen in the air mixture. A resultant relative hypoxic gas for breathing is available. This occurs in addition to the change in oxygen content occurring as the result of the ongoing combustion process.

Chemical Inhalation Injury
In general, the therapy for a chemical inhalation injury is the same regardless of the inhalant. An obvious exception to this generality is the management of carbon monoxide injury.

Chemical asphyxiants: cause damage to a wide variety of cells and impair oxygen utilization at the **TISSUE** level.

Chemical Irritants: cause local respiratory irritation.
These chemicals react at the tissue level to form caustic substances when they contact the respiratory epithelium.

Examples: ammonia, chlorine, acrolein, phosgene, sulfur dioxide.
The chemical effect is largely determined by the water solubility of the substance. Gases with low solubility like phosgene (yeah, like in WWI) are not absorbed readily and travel all the way to the terminal bronchioles. You should remember that phosgene gas is produced with the combustion of wool products, polyvinyl chloride, and some plastics. Patients with inhalation injury from burning of these materials are at high risk for DELAYED pulmonary collapse.

2. Observe
    a. Overall appearance
        i. Does the patient have singed hair on the eyebrows, nasal hairs, or facial hair?
        ii. Distress?
    b. Airway
        i. Does the patient have carbonaceous sputum or deposits in the nose?
    c. Breathing
        i. Work of breathing, use of accessory muscles, tripod position, or grimace in pain with breathing?
        ii. Cyanosis?
    d. Disability
        i. Level of mentation; not only if the patient is alert, but the appropriateness of answers
    e. Expose - look for burns, trauma from falls
    f. Does the patient have associated burn injuries?

3. Document frequent vital signs
    a. Trends
        i. Change in vitals is as much or more important than the absolute number.

4. Immediate treatment:
    a. Place HUMIDIFIED Oxygen by nasal cannula for patients with possible exposure and no signs of distress
    b. Place an adjustable mask or non-rebreather mask for symptomatic patients.
    c. Again, humidified oxygen is used to avoid further trauma to tissues by dessication.
    d. CONSIDER INTUBATION
        i. Persistent respiratory rate above 35, disoriented and combative (altered mental status), unstable vitals
        ii. Early airway security is even more important for the patient you know will require evacuation.
        iii. Use the biggest E-T tube possible without causing tissue trauma.
            1. WHY? No one will want to remove it until the acute phase is resolved and pulmonary toilet (excuse me – Hygiene via bronchoscopy may be required for airway support and diagnostics
    e. Place MULTIPLE IV's
        i. Always hang an isotonic fluid (never LR) 0.9% Normal Saline
            1. You do not want to add potassium to a crush or burn victim.
            2. Rate: 2 liter / 24 hour rate for inhalation injuries only.
                a. Fluid rate will need to be adjusted up for concomitant traumatic or burn injuries.
                b. You must use the burn volume resuscitation algorithms when the patient has a concomitant burn.
    f. Treat wheezing with bronchodilators. If you do not get a response, consider airway edema as the cause.
        i. Dose: Albuterol 2.5 mg INH/NEB
            1. You may repeat dose in 10 minutes.
    g. Do not administer steroids by injection or inhalation in the remote environment as treatment for inhalation or burn injuries.

5. Immediate Monitoring
    a. Cardiac monitor for hypoxia induced arrhythmias
        i. Observe for wave abnormalities which may result from hyperkalemia associated with large surface area burns.
    b. 12 Lead EKG
        i. Patients with heart disease, loss of consciousness, chest pain, and arrhythmias would benefit from the study.

c. Pulse Oximetry
    i. This WILL BE artificially elevated if the patient has inhaled a significant amount of carbon monoxide.
    ii. DO NOT trust the pulse oximeter. Treat the symptoms that you observe in your patient.

Carboxyhemoglobin Levels: not an option in the remote site

Carboxyhemoglobin is mentioned here for teaching purposes and to say that if you can draw a red top tube at line placement, it could be sent for determination of carboxyhemoglobin levels at the trauma center.

Signs of toxicity occur in patients with levels above 25%