

Smoke Inhalation Injury

A number of noxious substances that may be inhaled are toxic to humans. They are primarily products of incomplete combustion and cause more deaths from fires than flame injuries. The severity of the injury depends on the nature of the substances generated by the material burned, whether the victim is confined in a closed space, and the duration of contact with the smoke.

Three distinct syndromes of pulmonary complications may occur in children with inhalation injury: (1) early carbon monoxide (CO) poisoning, airway obstruction, and PE; (2) ARDS occurring at 24 to 48 hours or later in some cases; and (3) late complications of pneumonia and pulmonary emboli ([Antoon and Donovan, 2016](#)). Smoke inhalation results in three types of injury: heat, chemical, and systemic.

Heat injury involves thermal injury to the upper airway. Air has low specific heat; therefore, the injury goes no farther than the upper airway. Reflex closure of the glottis prevents injury to the lower airway.

Chemical injury involves gases that may be generated during the combustion of materials, such as clothing, furniture, and floor coverings. Acids, alkalis, and their precursors in smoke can produce chemical burns. These substances can be carried deep into the respiratory tract, including the lower respiratory tract, in the form of insoluble gases. Soluble gases tend to dissolve in the upper respiratory tract. Cyanide poisoning can occur due to burning of certain compounds found in, for example, nylon, wool, and cotton. Chemical burns to the airways are similar to burns on the skin, except they are painless because the tracheobronchial tree is relatively insensitive to pain.

Inhalation of small amounts of noxious irritants produces alveolar and bronchiolar damage that can lead to obstructive bronchiolitis. Severe exposure causes further injury, including alveolocapillary damage with hemorrhage, necrotizing bronchiolitis, inhibited secretion of surfactant, and formation of hyaline membranes, which are all manifestations of ARDS.

Systemic injury occurs from gases that are nontoxic to the airways (e.g., CO, hydrogen cyanide). However, these gases cause injury and death by interfering with or inhibiting cellular