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Medicine for Managers

Dr Paul Lambden BSc MB BS BDS FDSRCS MRCS LRCP DRCOG MHSM

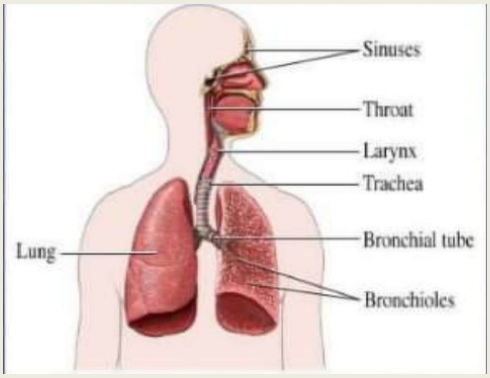
Inhalation Injuries

Inhalation injury is defined as damage to the respiratory tract or lungs from inhaled heat, smoke or chemicals. Smoke inhalation is very much the most common injury. The nature of the injury very much depends on the nature of the source, the size and diameter of inhaled particles, and the chemical properties of any gases. Inhalation injury is commonly a complication of the treatment of patients who have suffered burns.

The injuries sustained during inhalation of noxious substances depends on the part of the respiratory tree that is most involved.

Upper Respiratory Injuries are defined as those above the vocal cords and may affect the sinuses, throat, pharynx and upper part of the larynx.

Damage is commonly the result of intense heat inhaled in burns causing swelling, ulceration and reddening of the areas.



The result is shock, anatomical damage and airway obstruction. The damage to the lining of the affected arteas may predispose the patient to bacterial infection, the risk of which may persist for weeks after the damage was sustained.

Tracheobronchial injury is usually caused by smoke injury and the chemicals contained in it. Other causes include inhalation of toxic gases such as chlorine, liquids such as acid and fire itself. The damage can be considerable resulting in symptoms of persistent coughing, breathlessness which may be severe, gasping for air, shock and collapse.

Reflex constriction of the damaged bronchial tree causes an asthma-like constriction of the airway. Cellular damage may be considerable and risk of infection is again very high.

Parenchymal Injury (pronounced Pah-ren-key-mal) is damage to the lung tissue (parenchyma) itself. Severe injury causes major compromise of the air exchange in the lung.

Areas of lung may collapse, the delicate alveoli in the lungs may be destroyed and blood flow is disrupted. The risk of pneumonia increases considerably.

Systemic Consequences. The inhalation of toxic agents may result in a range of respiratory and other consequences depending on the inhalant. Two common gases associated with increased

morbidity and mortality are carbon monoxide and hydrogen cyanide.

- ***Carbon Monoxide***. A colourless, odourless gas with an affinity for haemoglobin 200 times that of oxygen. Oxygen release to the tissues is therefore impaired, often severely. Symptoms are commonly headache and dizziness, but also confusion, nausea and vomiting, shortage of breath, palpitations, agitation and drowsiness, hallucinations and seizures.
- ***Hydrogen Cyanide*** is a colourless gas which smells of almonds. It is commonly present at a fire scene and its presence is difficult to confirm. Symptoms are non-specific. Anyone at risk of such poisoning should be transported to hospital immediately and monitored for depressed consciousness, respiratory distress and cardiac arrest.

History and examination of patients:

Obtaining a history should include details of possible exposure to flame, smoke or chemicals and the duration of that exposure, together with any loss of consciousness. All symptoms should be recorded.

Examination includes observation of difficulty breathing, breathlessness and productive cough. Examination of any facial burns, damage to the nasal passages, evidence of damage to the upper pharynx, carbonaceous sputum (sputum containing soot), hoarseness or stridor. Signs of lower respiratory tract damage may include decreased breath sounds, wheezing and features of struggling to breathe.

Laboratory tests should include all usual tests as well as a toxicology screen. Arterial blood gases are essential together with carbon monoxide measurements.

Chest radiology is necessary for initial evaluation and CT scanning may also be valuable.

Diagnosis

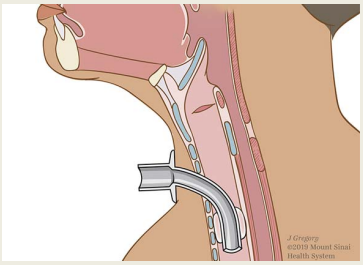
Normally a diagnosis is made on the assessment of the clinical findings and the supporting laboratory findings. The diagnosis may be confirmed by bronchoscopy to assist in the assessment of the degree of injury.

The degree of injury may be recorded on a scale of 0 to 4, where 0 is an injury which is not associated with physical damage or respiratory distress and 4 is a massive injury with destruction of the respiratory tract lining, areas of lung collapse and obliteration and infection.

Management of Inhalation Injury

After the patient has been safely removed from the source of fire or risk of inhalation, first aid involves the basic principles of **A**irway, **B**reathing and **C**irculation (A,B,C). Severity will guide whether or not the patient needs intubation.

The patency of the airway must be maintained because collapse or obstruction would be catastrophic and rapidly fatal. A proportion of patients need a tracheostomy (the placing of a tube into the trachea through an incision in the neck).



Supportive treatment is maintained and may include specific measures in particular circumstances such as, for example, 100% humidified oxygen if carbon monoxide poisoning is suspected.

The necessity for hospitalisation will depend on the condition of the patient once stabilised and removed from the source of inhalation.

Factors such as respiratory distress, collapse, bronchospasm and wheeze and any associated burns in the facial area necessitate admission, as does any person in whom there is any doubt about the degree of possible exposure to inhalation of smoke or toxin.

All sufferers should be monitored for a minimum of 6-9 hours.

Inhalation injuries are often associated with complications which may include:

- Pneumonia
- Respiratory distress as a result of lung damage or fluid accumulation in the damaged areas.
- Difficulty in inspiration of adequate oxygen leading to gasping through air hunger.

Treatment

The management of patients depends on the nature and severity of the injury. For some recovery is rapid; for those with severe injuries, intubation and ventilator respiratory support may be necessary for however long it is deemed to be necessary.

Medication is commonly required:

- ***Steroid drugs*** may be used but their value has been questioned
- ***Bronchodilator drugs*** can improve air flow by relaxing bronchial muscles
- ***Mucolytics*** to soften and loosen mucous accumulation and assist with clearance by chest physiotherapy

Unfortunately there is a significant mortality from inhalation injuries, due to physical lung damage or poisoning. In injuries associated with fire, patients may die because of associated burns and there is data to suggest that patients with twenty percent or more burns are over twenty times more likely to die if they have an associated inhalation injury.

Fortunately, however, most patients do not experience long-term damage or impairment of respiratory function following inhalation injury.

Long term monitoring studies of patients with inhalation damage reveal that long term complications in the group with damage include breathlessness through loss of lung function, lung scarring impairing both lung movement and gas exchange, and bronchiectasis with increased sputum production.

Clearly, the lungs are very delicate organs and exposure to smoke and/or poisons can cause serious and even fatal damage to the respiratory passages and to the delicate tissues which form the lungs and on which we rely for life itself with oxygen and carbon dioxide exchange.

Fortunately, improved workplace health and safety, with reduction in toxic chemicals such as cyanide, and better protection for the intrepid firefighters have reduced to number of serious inhalation injuries but too many still occur.

paullambden@compuserve.com