

OPERATIONAL GUIDELINES: Airway Management for Inhalation Injuries in Pediatrics

OBJECTIVE:

A standardized protocol for airway management in a patient with inhalation injuries.

Disclaimer: The protocols recommended in this document are not a substitute for the expert judgment of the Emergency Department attending. The variable availability of personnel and equipment in the Emergency Department must be integrated into decisions of what is best for the patient.

Airway Management

INHALATION INJURIES WILL BE ADMITTED TO THE BURN SERVICE.

Inhalation injuries are one of the leading causes of death in burn victims. While assessing a patient's airway, the patient's c-spine should be stabilized for suspected trauma.

Upper airway edema following a burn-related injury can occur rapidly. Among patients who manifest signs of smoke inhalation, a sizable percentage develop complete airway obstruction and there is no clinical means to determine which patients will do so.

Fluid resuscitation can exacerbate laryngeal swelling, increasing the difficulty of tracheal intubation. Intubation should not be delayed if severe inhalation injury or respiratory distress is present or anticipated. Intubation prior to transport is prudent for many patients who require transfer to a burn center.

In pediatric patients, airway compromise is the most common cause of severe morbidity and mortality, likely due to the small size of the airway.

1. Frequently evaluates for swelling in the face and neck to prevent airway compromise.
The threshold for intubation needs to be lower in pediatric patients due to the potential for rapid development of airway edema.
2. Endotracheal tube size needs to be specifically tailored for the pediatric patient.
3. Securement of the endotracheal tube is essential to maintaining a patent airway.
4. Monitoring of end-tidal CO₂ (EtCO₂) using capnometry or capnography will provide useful information-respiratory status, adequacy of resuscitation, and potential cyanide toxicity.
5. A serum lactate concentration should also be obtained if cyanide poisoning is a concern.

Diagnosis- diagnosis of an inhalation injury can be suspected with clinical findings such as soot in the mouth and nares, cough, shortness of breath, hoarseness, altered mental status. However, a definitive diagnosis relies upon a direct airway examination. A bronchoscopy needs to be performed within 6-24 hours of intubated patient's arrival to determine injury severity and best treatment. The Burn team performs the bronchoscopy for these patients. Confirmation of an inhalation injury in a pediatric patient with small diameter ETT is confirmed through CO levels and soot in the oral/nasal airways.

AIS grading of inhalation injury by bronchoscopy is as follows:

- 0 (no injury) – Absence of carbonaceous deposits, erythema, edema, bronchorrhea or obstruction
- 1 (mild injury) – Minor or patchy areas of erythema or carbonaceous deposits in the proximal or distal bronchi
- 2 (moderate injury) – Moderate degree of erythema, carbonaceous deposits, bronchorrhea, or bronchial obstruction
- 3 (severe injury) – Severe inflammation with friability, copious carbonaceous deposits, bronchorrhea or obstruction
- 4 (massive injury) – Evidence of mucosal sloughing, necrosis, endoluminal obliteration

Treatment for non-intubated patients:

1. If any above criteria are met patient should receive 100 percent oxygen by face mask. Titrate to oxygen saturation of 90 percent.
2. Carbon monoxide poisoning should be presumed in any patient who presents following smoke inhalation until it is excluded by a normal carboxyhemoglobin. <1.5 percent.
3. Bronchodilators for wheezing. Heparin and Mycomist need to be ordered for the treatment of inhalation injuries. These can be discontinued after an inhalation injury is ruled out.
4. Monitor airway, encourage coughing and deep breathing.
5. Reposition patient every two hours.
6. Encourage early ambulation

Treatment for intubated patients:

1. Determining to intubate should be based upon any of the following signs: deep burns to the face or neck, blisters or edema of the oropharynx, stridor, use of accessory muscles, respiratory distress, sub- and suprasternal retractions, or hypoventilation
2. Attending of record will determine optimal provider to perform the intubation as inhalation injuries cause the airways to swell and increase the difficulty of intubation.
3. Once intubated the airway needs to be properly secured to ensure it does not slip. If the patient has burns on their face burn tapes should be utilized to secure the airway.
4. Patients should receive hydroxocobalamin for the treatment of Cyanide poisoning. (Treatment will be determined by the Burn Attending).
5. Patients intubated for inhalation injuries are also placed nebulized heparin.

REFER TO SMOKE INHALATION INJURY TREATMENT GUIDELINE:

<https://upstate.ellucid.com/documents/view/3870>

6. If patient has facial burns, burn tapes need to be used to ensure that the ETT is secured.
7. **The burn attending will coordinate with the PICU to arrange for the patient to be placed on 12F. The patient will be admitted under the burn service with the PICU team consulting.**

Burn Tapes

Supplies: tape, 4x4's, tongue depressors, skin prep, scissors

Procedure: (Respiratory Therapists are trained on burn tapes)

1. Measure the tape to the length of your arms spread.
2. Cut a slit at each end and fold over for easy release
3. Place a tongue depressor at the end of each piece of tape, fold over once so that the tongue depressor is covered.
4. Unfold 4x4's and fold in half, length wise
5. Wipe the base of the tube with skin prep and any non-burned areas
6. Slide one tongue depressor under the patients head through to the other side until even length on both sides. Place 4x4's across cheeks where tapes will come across the face. This is to protect the burned skin.
7. Remove the tongue depressor from one side, split the tape where slit was made. Bring the tape across the patient's upper lip. One piece will lay flat, the other needs to be wrapped around the base of the tube.
8. Repeat step 7 for the other side.
9. If there is an OG tube-obtain a piece of tape, spit the tape and secure device.
10. Obtain a piece of tape and put across the patients face from ear to ear.
11. Tapes are often changed twice a day to ensure they remain secured.

References

Albright JM, Davis CS, Bird MD, et al. The acute pulmonary inflammatory response to the graded severity of smoke inhalation injury. *Crit Care Med* 2012; 40:1113.

Porro LJ, Demling RH, Pierira CT, Herndon DN. Care of the geriatric patient. In: *Total Burn Care*, 4 ed, Herndon DN (Ed), 2009. p.415.