

# Upper airway obstruction

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## Upper airway obstruction

### Presentation

In a conscious patient, upper airway obstruction (UAO) may present as respiratory distress, stridor, dyspnea, altered voice, cyanosis, cough, decreased or absent breath sounds, wheezing, the hand-to-the-throat choking sign in the case of a foreign body, facial swelling, and distended neck veins. Respiratory depression must be avoided to prevent cardiac arrest and anoxic brain injury. Partial airway obstruction may be mild, as in snoring or nasal congestion, or may be more severe, perhaps requiring the use of airway adjuncts. Complete UAO is usually managed by prompt intubation, but in some situations a surgical airway is life-saving.

### Causes of upper airway obstruction

Although obstruction can occur at any level of the upper respiratory tract, laryngeal obstruction is especially important because the glottis is the narrowest portion of the upper airway (UA). UAO may be anatomical or functional, and may develop acutely or sub acutely (Box [79.1](#)).

#### Box 79.1 Common causes of UAO in adult patients

##### Tumor

- ◆ Vocal cord tumors.
- ◆ Vocal cord paralysis.
- ◆ Laryngeal or pharyngeal tumors.
- ◆ Tracheal stenosis from intratracheal tumors.
- ◆ Tracheal stenosis from compression by extrinsic tumors.

##### Iatrogenic causes

- ◆ Tracheal stenosis following prolonged intubation.

### Traumatic causes

- ◆ Airway burn.
- ◆ Acute laryngeal injury (post-thyroidectomy).
- ◆ Head and neck trauma.
- ◆ Hemorrhage (post-thyroidectomy) **Infections**
- ◆ Retropharyngeal abscess
- ◆ Tonsillar hypertrophy.

The presence of stridor is ominous. Stridor is a noisy inspiration caused by turbulent gas flow in the UA and is common during airway obstruction.

Stridor indicates a serious airway emergency because it can progress rapidly to complete UAO. It is important to establish an etiology of stridor and determine whether the obstruction can be safely treated by positive pressure mask ventilation or requires tracheal intubation.

### Upper airway obstruction during anesthesia

The induction of general anesthesia is accompanied by a decrease in UA muscle tone and possibly even airway collapse. UAO may occur depending on the airway's caliber and shape, extraluminal tissue pressure and airway wall compliance. Light sedation offers some protection against obstruction by maintaining muscle tone, whereas deep sedation is associated with muscle relaxation and lack of reusability, which may result in UAO.

During anesthesia, airway maintenance requires active intervention either by mask ventilation or tracheal intubation until the patient regains the ability to spontaneously maintain a patent airway.

Common causes of UAO during anesthesia include:

- ◆ **Laryngospasm** following tracheal extubation due to an irritable airway (common among smokers). Initial treatment is positive pressure ventilation, but sometimes a small dose of succinylcholine (~20 mg iv) may be necessary to break the laryngospasm.

- ◆ **Residual neuromuscular block** despite the administration of reversal agents. Patients with impaired renal function require special attention because of their decreased ability to clear drugs.
- ◆ **Residual opioid medications** can cause respiratory depression and UAO in the post-anesthesia care unit (PACU).

### ✚ **Obstructive sleep apnea**

Obstructive sleep apnea (OSA) patients are at increased risk of developing UAO. Factors that act to narrow the airway and predispose to OSA are similar to those that predispose to UAO under anesthesia. These include increasing age, male gender distribution of body fat, obesity, increased neck circumference (>17 inches), macroglossia, retrognathia, and maxillary constriction. Loud snoring suggests the presence of a narrow floppy airway that causes recurrent episodes of partial or complete UAO, apnea, and hypoxemic episodes during sleep.

With sleep, sedation or anesthesia, upper airway collapsibility increases as a result of a reduction in pharyngeal dilator muscle activation, loss of the stimulatory effect of wakefulness, reduction in respiratory drive, and depression of negative pressure reflexes. In normal individuals without anatomic compromise, the upper airway is robust and patency is not significantly compromised. However, in individuals with anatomically vulnerable airways, these changes can precipitate partial or complete upper airway obstruction.

Many OSA patients use a continuous positive airway pressure (CPAP) machine to maintain airway patency during sleep. CPAP titrated to the patient's need should be readily available for use in the peri-operative period. The American Society of Anesthesiologists (ASA) has published guidelines for the identification and management of patients with OSA.

### **Obesity**

Obese patients often have a 'bull neck', macroglossia, and/or redundant folds of pharyngeal tissue, rendering them difficult-to-intubate and at increased risk of developing UAO. Mask ventilation may be challenging because of difficulty in maintaining a patent airway, decreased chest wall compliance, decreased FRC, and a high risk of aspiration. If tracheal intubation is not planned, a supraglottic airway device can be effective. If tracheal intubation is planned, adequate pre-oxygenation, and rapid sequence induction with cricoid pressure is

recommended. If there is any concern about securing the airway safely, an awake fiber optic intubation is recommended.

### **Airway polyps**

**Polyps** may occur anywhere in the upper airway and lead to partial or complete UAO. Vocal cord granulomas and polyps may result from traumatic intubation, vocal cord irritation from tracheal tube movement, or from lubricants. Patients with laryngeal papillomatosis may require frequent laser treatments to eradicate the papillomata.

### **Thyroid goiter**

A large thyroid goiter can compress the trachea and, over time, cause tracheomalacia. A retrosternal goiter may exert pressure on the trachea causing partial airway obstruction. The CT scan should be reviewed preoperatively to assess the extent of any tracheal obstruction. If compression is severe, mask ventilation is challenging in these patients, who may progress to complete UAO. If the lesion is anterior to the trachea, the airway obstruction can worsen when the patient is placed supine for induction of general anesthesia. In such cases, an awake fiber optic intubation would probably be best for the patient's safety. A potential complication of thyroidectomy is uni- or bi-lateral recurrent laryngeal nerve injury, which can result in uni- or bi-lateral vocal cord paralysis. Careful evaluation of the airway (vocal cord movement) following tracheal extubating is therefore crucial [9]. Finally, UAO may result from post-thyroidectomy bleeding in the PACU. If this is suspected, immediate re-opening of the surgical incision to relieve the extrinsic tracheal pressure can be life-saving.

### **Mediastinal masses**

When a patient presents with an anterior mediastinal mass, careful evaluation of the degree of tracheal compression is critical. Some cases are associated with superior vena cava obstruction syndrome. Difficulty breathing when supine or pulmonary function tests showing an obstructive pattern, is cause for concern.



Close interaction with the surgeon and review of the CT scan are essential when planning management. Anesthesia is needed primarily for diagnostic biopsies, staging of neoplasms, and (occasionally) for relief of acute airway obstruction. Use of short-acting agents, small doses of opioids, and adequate post-operative pain management should allow the patient to be tracheole extubated when fully awake. Maintaining spontaneous ventilation is preferable. A rigid bronchoscope should be immediately available in case complete airway obstruction develops. Turning the patient to the lateral position decreases pressure on the airway. If the tracheal obstruction is severe, a tracheal stent placed under sedation can provide some protection prior to the induction of general anesthesia.

### **Epiglottitis**

Epiglottitis can occur in adults, but is less symptomatic than in children because the adult airway is larger.

Management is challenging because the swollen epiglottis can act as a valve mechanism and obstruct the airway. For any surgical intervention, awake fiber optic intubation is the safest approach. These patients should not be paralyzed prior to securing the airway because that would only exacerbate the degree of UAO.

### **Rigid and flexible bronchoscopy with direct visualization**

Bronchoscopy is the primary procedure in the diagnostic work-up of tracheal stenosis and is key in defining the characteristic features, extent, and location of the stenosis. Bronchoscopy is performed with the patient awake and breathing spontaneously following adequate airway topicalization. A rigid bronchoscope should be available for emergency use to secure the airway by carefully passing it through the stenotic segment. Flexible bronchoscopy is useful to establish the diagnosis and deliver treatments including laser therapy, electrocautery, electrosurgery, balloon dilatation, and metal stenting once the airway has been secured and the patient stabilized. Light sedation may be used. Dexmedetomidine infusion is useful because respiratory drive is maintained. Performing a fiber optic bronchoscopy in a conscious patient enables examination of vocal cord function and determination if RLN damage is present. It also permits the evaluation of dynamic airway collapse with respiration.

### **Tracheal intubation and tracheostomy**

In most cases of UAO, the airway can be established with tracheal intubation. If the airway is difficult, many video laryngoscopes are commercially available to facilitate the intubation, otherwise fiberoptic intubation may be necessary. If an airway cannot be established, a surgical airway via cricothyrotomy, tracheostomy, or retrograde intubation should be performed. The method of intervention should be individualized for each patient. The intervention chosen will depend on the etiology of UAO and the urgency with which the airway must be secured.

The surgical airway-securing procedures require special expertise. Comparison of emergent versus elective tracheostomy reveals a two-fold complication rate in the former due to time spent isolating the trachea as a result of bleeding.