

Postintubation Tracheal Stenosis: A Devastating Complication!

Mechanical ventilation is a life-saving measure for a patient in respiratory failure. Endotracheal (ETT) intubation is a common procedure performed to gain access to the trachea and enable ventilation. When prolonged ventilation is required, the ETT tube is replaced by a tracheostomy tube. Both these tubes have an inflatable cuff, the primary function of which is to provide protection against the aspiration of regurgitated gastric contents. It also helps to deliver the respiratory gases directly to the lungs. When the critical illness has passed, and the patients regain their ability to breathe and maintain their airways, their tracheas are extubated. It is very gratifying when these patients recover and go home.

Rarely, some of these patients develop postintubation tracheal stenosis (PITS). This may follow ETT intubation or tracheostomy. The stenosis may be at the larynx, tracheostoma, or at the trachea below the larynx. When the pressure exerted by the inflated cuff exceeds the capillary pressure, the tracheal mucosa and possibly the cartilage underneath become ischemic. If prolonged, necrosis of the mucosa follows. A change of the “high pressure-low volume cuffs” to the “high volume-low pressure cuffs” may have reduced its incidence but not eliminated its occurrence. The incidence of PITS was found to be 4.9 cases per million per year in the UK.^[1]

Tracheal stenosis can be classified based on the degree of obstruction into the following four grades:^[2] Grade 1 – <50% obstruction, Grade 2 – 51%–70% obstruction, Grade 3 – 71%–99% obstruction, and Grade 4 – there is no detectable lumen. The tracheal diameter must be reduced by 75% for the patient to be symptomatic. It is likely that lesser degrees of tracheal stenosis may not prompt the patients to seek treatment and may be missed, unless computed tomography (CT) scans or other imaging is obtained for any reason. Lano *et al.* described the following three types of tracheal stenosis based on the extent of stenosis through the larynx, the subglottic region, and the trachea: Grade 1: Only one site involved, Grade 2: Two sites involved, and Grade 3: More than two sites involved.^[3] McCaffrey described four grades namely Grade 1 – Subglottis or trachea <1 cm; Grade 2 – Subglottis >1 cm; Grade III – Subglottis or trachea >1 cm; and Grade IV – Any lesion involving glottis.^[4]

Gerbard *et al.* described 150 cases of tracheal stenosis.^[5] The causes of tracheal stenosis were iatrogenic (50%) followed by idiopathic (18.5%), autoimmune (18.5%) and trauma (8%). They found that cardiovascular comorbidities (i.e., myocardial infarction, congestive heart failure, peripheral vascular disease, and cerebrovascular disease) and type II diabetes were significantly more prevalent in the iatrogenic strata than in other etiologies. Nearly 66% of them were tracheostomy dependent.

Necrosis followed by healing can lead to tracheal stenosis over the next 3–6 weeks. It can be a long segment or a short segment and is more likely to follow prolonged intubation. Occasionally, these can become tracheo-esophageal fistulas. Chang *et al.* recently published their study on the development of tracheal stenosis following ETT intubation and tracheostomy.^[6] They found 133 patients developing tracheal stenosis from 218,573 patients who were intubated for surgery. They found that patients who had a tendency to develop keloids had higher incidence, faster onset, and greater severity and needed higher frequency of treatment for tracheal stenosis.

Tracheal stenosis must be suspected when patients who were previously intubated present to the hospital with dyspnea and wheeze. They are often mistaken to have asthma. The diagnosis is evident with endoscopy although pulmonary function tests and CT may indicate it. The flow volume loops may show fixed airway obstruction.

Tracheal stenosis is better prevented than treated. While low cuff pressures may lead to leak of pharyngeal secretions across the folds and microaspiration, high pressures lead to tracheal mucosal injury and stenosis. Eti Ajit *et al.* reported two cases of tracheal stenosis in this issue of IJRC accompanied by literature review. They mentioned the following recommendations to reduce the incidence of tracheal stenosis: “The incidence of tracheal stenosis can be reduced by preventing trauma during intubation. This can be achieved by the use of adequate sedation or muscle relaxant during intubation and avoidance of using large-sized ETT tube (>8 mm in men and >7 mm in women). Measures such as maintaining good oral hygiene in intubated patients using oral antiseptics such as oral chlorhexidine, regular oral and ETT suctioning, and antireflux measures should be undertaken to prevent microaspiration. Achieving swift hemodynamic stabilization is of paramount importance in patients with hypovolemic shock.” These points are well known, but we need to stress upon them often to ensure that the primary caregivers such as junior doctors, nurses, and respiratory therapists follow them.

Treatment can be with balloon dilatation in the early stages (within 3 months). In severe cases or late stages, insertion of endoluminal stents or tracheal resection and reconstruction are advised. Tracheo-esophageal fistulas may require surgeries such as colonic pull-up. The procedures are extensive and expensive, may require multiple surgeries, have a high morbidity, and are available only in a select few centers.^[7] The quality of life may be so affected that patients become depressed and commit suicide.^[6]

The incidence quoted by Eti Ajit *et al.* ranges from 10% to 22% of prolonged intubation. This seems a little high, but

these numbers were from the 1980s. With the advent of better ETT and tracheostomy tubes, monitoring of patients, and sedation techniques, we hope that the incidence of tracheal stenosis has reduced. The actual incidence will remain difficult to detect as mentioned earlier. Large trials such as that mentioned by Chang *et al.*^[6] where every patient who has been admitted, intubated, and ventilated is educated at discharge and followed up after a specified period of time (3–4 weeks) may be required.

In the meanwhile, it is more important for all caregivers in the operation theaters and intensive care units to be aware of this devastating complication and avoid the factors that can lead to it. Tracheal intubation must be atraumatic and cuff pressures must be routinely checked and kept below 30 cmH₂O.

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