LARYNGEAL INTUBATION TRAUMA

Essay
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Kamla Mahmoud Salah Eldin

الجروح التثيبيه

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مقدمه من
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INTRODUCTION

Endotracheal intubation is one of the most common invasive procedures performed in an Intensive Care Unit, and occurs with frequent complications ***(Thomas, 1995).*** Laryngeal complications that frequently arise following extubation include, but are not limited to, vocal fold edema, erythema, ulceration, paralysis/paresis/bowing of the vocal cords, laryngeal scar, fibrosis, granuloma formation, glottic webs, and superior-laryngeal nerve paralysis ***(Colice, 1989).*** While patients frequently recover from many of these complications rapidly, it is common for some patients to experience enduring or chronic injury, such as paralysis ***(Cavo, 1985).*** Some patients must consult an Otolaryngologist following extubation as a result of certain injuries. Stridor, dysphonia, airway obstruction, and aspiration can all occur as a result of laryngeal injury ***(Stauffer, 1981).*** Furthermore, immediately following extubation, virtually every patient experiences hoarseness of voice for some period of time ***(Santos, 1994).***

Endotracheal intubation for general anaesthesia and mechanical ventilation can be a source of local trauma. Amongst its associated complications are pneumonia, atelectasis and hoarseness. ***(Pneumatikos et al 1995).*** The factors leading

to laryngeal injury due to intubation are not fully understood. Many studies were done to determine if duration of intubation, size of endotracheal tube, and/or type of endotracheal tube has any role in laryngeal trauma.

Many types of injury due to intubation are observed as mucosal ulceration, granuloma and vocal cord immobility. Laryngeal injury due to intubation is observed in early and prolonged intubation without distinguishing the exact cause of this injury. Treatment of injury caused by intubation varies according to severity of injury. It ranges from conservative therapy with observation including voice rest, and systematic administration of corticosteroids and antibiotics to active surgical interference.

PATHOGENESIS OF INTUBATION INDUCED INJURIES

The endotracheal tube lies in the posterior portion of the larynx, hence the structures vulnerable to injuries are:

1. Mucous membrane and mucoperichondrium covering the medial surface of arytenoid cartilages and their vocal processes.
2. Cricoarytenoid joints and adjoining parts of cricoid cartilage below
3. Posterior glottic / interarytenoid regions
4. Supraglottic structures i.e. falsce vocal cords may become oedematous (reversible)
5. Tracheal injuries are uncommon with the advent of high volume / low pressure cuffs
6. Over inflation of cuff of endotracheal tube may cause mucosal injury and ciliary loss in trachea
7. Subglottic stenosis

Blood circulation in the mucosa and mucoperichondrium can be interrupted when the pressure from the endotracheal tube exceeds capillary pressure. This may cause edema / hyperemia /

ulceration of mucosa / necrosis, ultimately leading on to erosion of perichondrium and cartilage [Dr. T. Balasubramanian M.S. D.L.O. voice box complications of endotracheal intubation 2012]

CLASSIFICATION OF INJURIES

I. Acute intubation changes:

a) General, Non specific:

- Inflammation, edema, protrusion of ventricular mucosa
- Pressure necrosis, loss of mucosa, cartilage and muscle

b) Glottic:

- Flaps of granulation tissue
- Granulation tissue
- +Ulceration of vocal process
- Ulcerated troughs and intact median strip
- Posterior ulceration without intact median strip

c) Subglottis:

- Bilateral posterolateral midcricoid ulceration
- Annular inferior cricoid ulceration

II. Chronic long term complications:

a) General:

– Submucosal fibrosis, scarring, stenosis

– Ductal cysts

b) Glottic:

– Granuloma, healed fibrous nodule

– Healed furrows

– Posterior glottic adhesion

– Posterior glottic stenosis

c) Subglottic:

– Posterior glottic stenosis

– Circumferential subglottic stenosis (Dr. T. Balasubramanian M.S. D.L.O.)

Causes

Causes of laryngeal injury due to intubation are not fully understood. The incidence of vocal fold immobility and other laryngeal pathologies (granulomas, laryngeal edema, and

ulcerations) after prolonged intubation has been previously studied, but questions remain. Santos and his colleagues evaluated the risk factors for laryngeal injury after intubation for more than 3 days in 97 patients in a prospective study. They found that 97% of subjects had some form of laryngeal injury, ranging from mild edema to granuloma to vocal fold immobility, and that the associated risks were duration of intubation and presence of a nasogastric tube. They observed a 20% rate of vocal cord immobility that was associated with the duration of intubation and the size of the endotracheal tube (ETT) ***(Santos PM, et al.,1994).*** They also studied laryngeal injury after intubation for more than 4 days and noted a 94% incidence of laryngeal pathology, but the laryngeal findings correlated only to presence of neuromotor activity and performance of a tracheostomy, not to the duration of intubation or size of endotracheal tube ***(Colice GL et al.,1989).***

A number of studies have shown that Hi-Lo tubes may reduce ventilator-associated pneumonia due to continuous suctioning of subglottic secretions (***Valles J., et al)***. However, the outer diameter of the Hi-Lo ETT, for any given inner diameter, is approximately 1 mm greater than the equivalent outer diameter for the corresponding standard endotracheal tube. To date, there have not been any prospective studies in humans that evaluate whether these tubes result in any additional laryngeal injury, although Berra et al. in 2004 showed an increase in tracheal mucosal injury

in sheep intubated with a Hi-Lo ETT when compared to a standard ETT. Numerous reports indicate that tracheal tube damage may be influenced by the cuff pressure and duration of cuff inflation, together with movement of the tracheal tube during respiration ***(Kollef MH., et al 1991).***

Accordingly, prolonged intubation and excessive cuff pressure are risk factors for tracheal damage, but even with good intubating conditions, mucosal ulceration of the trachea is sometimes observed. ***(Benjamin B, 1992).*** The tracheal mucosa is extremely fragile and even the benign act of pulling a cotton swab along it causes loss of epithelium. ***(Kollef MH, et al., 1991)*** The source of intubation damage is probably mucosal abrasion caused by adhesion and friction between the moving tube and trachea ***(Kollef MH, et al., 1991).*** As the simple act of respiration causes appreciable cephalocaudal laryngeal movement many times a minute, significant abrasion can occur. Mechanical abrasion of this nature induces a marked increase in the number of goblet cells and subsequent hypersecretion of mucus. ***(Freeman BD, et al 2005).***

Risk factors

I. Extrinsic factors:

1. Diameter, shape and contour of endotracheal tube: Safe sizes of ET tubes that can be used are 8mm in males and 7mm in females.

2. Plastic tubes of siliconized rubber: smooth-walled and less irritating

3. Duration of intubation: Adults 5-7 days, children 7-14 days are more prone

4. High volume low pressure cuffed tubes minimize risk of laryngeal trauma.

5. Traumatic intubation / multiple reintubations: Traumatic intubation can cause various complications. They include Hematoma, laceration, perforation due to use of excessive force, subluxation / dislocation of arytenoid cartilage.

6. Subsequent tracheostomy

II. Patient factors:

1. Poor tissue perfusion, sepsis, organ failure, malnutrition

2. Laryngopharyngeal reflux

3. Abnormal larynx: congenital stenosis, croup, crushed / burnt larynx

4. Wound healing, keloid formation

5. Preintubation status: Smoking causes increased risk of intubation induced granulomas

III. Movement:

- During ventilator use
- During application of suction
- During coughing
- During transport

Pathology:

Laryngeal edema and hyperemia follows irritation of laryngeal mucosa by endotracheal tube. Edema occurs very early during ET intubation. Supraglottic and glottic oedema very rarely causes permanent morbidity. Subglottic oedema especially in children usually causes airway obstruction.