



Research Article

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Iatrogenic airway trauma: A systematic review

Jayita Das Poduval*¹, Ihab E Ali²

¹ Associate Professor, Department of ENT, Pondicherry Institute of Medical Sciences, Kalapet, Puducherry- 605014, India

² Associate Professor ORL H&N, Taylor's Clinical School of Medicine, Selangor, Malaysia

Abstract

Introduction: iatrogenic airway trauma is very common in the modern era due to the increased use of endotracheal intubation. Research in this regard has mainly been in documenting such trauma in operation theatres and critical care centers. However, the results of such research have not percolated down to the multidisciplinary teams managing patients in such settings. **Methodology:** systematic review of the literature using both electronic and manual searches, synthesis of results and recommendations for optimum care. **Results:** About 70,000 studies on iatrogenic airway trauma were found from various sources without language restriction. 12,000 full text articles and abstracts in English were found, out of which 7,000 were full text. Due to the logistics involved, 16 full text articles on PubMed were finally analyzed. **Conclusions:** Iatrogenic airway trauma is common but remains poorly detected and managed. This is mainly due to the lack of multidisciplinary cooperation. Patients suffering from the consequences of such trauma have a poor quality of life.

Keywords: Airway, Iatrogenic, Trauma, Laryngoscopy, Quality of life.

INTRODUCTION

One of the salient areas in effective critical care is management of the airway- both as an acute life- saving measure and also in prolonged ventilation for continued life support. Endotracheal intubation is usually the first line of intervention in most critical care settings, or emergency tracheostomy in cases of known or suspected solid laryngeal obstruction. When rushing to save a life, scant attention is paid to seemingly minor issues like the potential to cause long term airway damage and the problems that could arise from the same.

Injuries to the larynx and trachea during critical care intervention could result from-

- 1) Subluxation or dislocation of the cricoarytenoid joint.^[1]
- 2) Pressure necrosis of the mucosal lining leading to airway narrowing and stenosis or laryngomalacia and tracheomalacia.
- 3) Secondary factors like ingestion of caustic liquids or poisons such as organophosphorus compounds, coupled with laryngopharyngeal reflux.

METHODOLOGY

A systematic review of the literature using both electronic and manual searches was carried out. Various databases were searched using different search engines and the search term "iatrogenic airway trauma". Only high quality studies such as cohort studies, systematic reviews and randomized controlled studies were sought, along with the inclusion of some case series. This was followed by the synthesis of results and recommendations for optimum care.

The first author conceptualized the search, while both the authors independently searched the existing literature. The second author also cross- checked the manuscript for technical errors.

***Corresponding author:**

Dr. Jayita Poduval
Associate Professor,
Department of ENT,
Pondicherry Institute of Medical
Sciences, Kalapet, Puducherry-
605014, India

RESULTS

More than 100,000 hits were found on the topic using Google search. Applying the inclusion criteria of and search terms such as endotracheal intubation and tracheostomy, about 70,000 hits were recorded from various sources without language restriction. About 12,000 studies on the topic were found in the English language. 7,000 hits were recorded for full text articles and abstracts in English. In the final synthesis, only 16 full text articles on PubMed were analyzed for providing clear recommendations and 3 were selected for categorically underlining the role of bronchoscopy or laryngoscopy in the detection of iatrogenic airway trauma.

DISCUSSION

As early as in 1983, the question of whether endotracheal intubation is capable of causing laryngotracheal injury has been investigated [2]. Fiberoptic bronchoscopy detected early lesions in the larynx, such as ulceration and granulomas in the true vocal cords, in 63% of patients (12 out of 19 patients studied). However, at the end of three months, these lesions had settled completely in all the patients except for 3. In 6 patients early tracheal lesions in the form of ring-shaped tracheitis were found, and in 2 of these patients, a tracheal stenosis developed. Severe respiratory insufficiency, high pressure in the cuff of the ET tube, and respiratory infection were found to be significantly related to the occurrence of laryngotracheal injury. With the widespread increase in critical care facilities, interest in the epidemiology of airway intervention also increased [3]. Though reconstruction procedures are well established, the treatment of glottic stenosis remains to be a challenge to this day, and increased cuff pressure is cited as the main reason for this to occur [4]. Mucosal injury following endotracheal intubation is quite common but they heal by primary intention in most of the cases [5]. Granulomas are less common and could be persistent in some cases whereas strictures are the least common but are associated with prolonged intubation, traumatic extubations and tracheostomy. The short-term effects of endotracheal intubation were also studied with the view of ensuring that safe methods of administering anaesthesia were used at all times [6]. It was found that bucking at the time of intubation or extubation and an increase in the internal diameter of the endotracheal tube were the factors most commonly responsible for these injuries. Videolaryngoscopy in the detection and management of airway injury in the critical care scenario was recommended prior to intubation in difficult cases [7].

In a large cohort of patients numbering 654 over a span of 7 years, almost 417 or 88% were found to have injuries, and in 46% of injured patients, that is in 220 patients, the injuries were severe [7]. Severe injuries were in the form of altered vocal cord mobility, stenosis of the larynx or trachea, fibrosis, necrosis, large granulomas, or ulceration. Minor injuries consisted of edema or inflammation, with or without superficial ulceration, or vocal cord granuloma. 280 patients of the 473 were also examined 6 to 12 months following the instrumentation, and 30 of these, that is, 11% were found to be having injuries. There are differences of opinion among various researchers as to whether the severe form of injury makes the patient vulnerable to long-term complications. The authors felt that early detection and treatment of acute injury definitely improves future outcomes. They further argued in favor of early tracheostomy in order to minimize the occurrence of airway injury. Around 50 patients in an Indian critical care setting were studied in order to establish if differences existed between different populations and ethnicities as far as airway injuries due to instrumentation were considered [8]. Any duration of endotracheal intubation greater than 24 hours was considered prolonged and worthy of evaluation for injury. Patients were examined by videolaryngoscopy at the time of extubation and also 3 weeks later, by the patient and endoscopist both blinded to the circumstances of intubation. Almost four-fifths of the patients had injuries on the day of extubation, while this proportion fell to only one-fifth 3 weeks

afterwards. Large tubes, time under intubation, and/or emergency intubation were directly proportional to the incidence of injury. Most of such injuries presented with voice change or hoarseness, difficulty in swallowing or breathing, cough and/or aspiration.

The use of high volume low pressure endotracheal tubes, skill in performing intubation, optimum preparation and sedation of the patient prior to intubation are strongly recommended. Obviously, such is the norm in most critical care settings, but other factors such as tube size and duration of intubation are less rigorously monitored or standardized, and these also play a significant role. A systematic examination for such injuries could improve outcomes by early detection and treatment [8].

Time to tracheostomy shows wide variations even though the dangers of endotracheal intubation are well known [9-11]. Generally, it has been recommended that tracheostomy be performed by day 10 of endotracheal intubation if there is likelihood of the patient needing continued ventilator support. Others have extended the permissible duration of endotracheal intubation to 21 days. Thus the grey zone lies anywhere between day 10 and day 21 [12] and the decision to do a tracheostomy or not is left to the discretion of the individual practitioner [13]. Some have even advocated tracheostomy as early as 7 days if the prognosis is deemed to be poor at the outset [14]. Similarly, medication to control other risk factors such as gastro-oesophageal or laryngopharyngeal reflux in critically ill patients could minimize the chances of chronic airway inflammation and subsequent development of airway scarring or narrowing [15,16]. Antireflux agents and antacids such as proton pump inhibitors are therefore routinely administered to such patients in many critical care centers.

PRISMA checklist for systematic reviews:

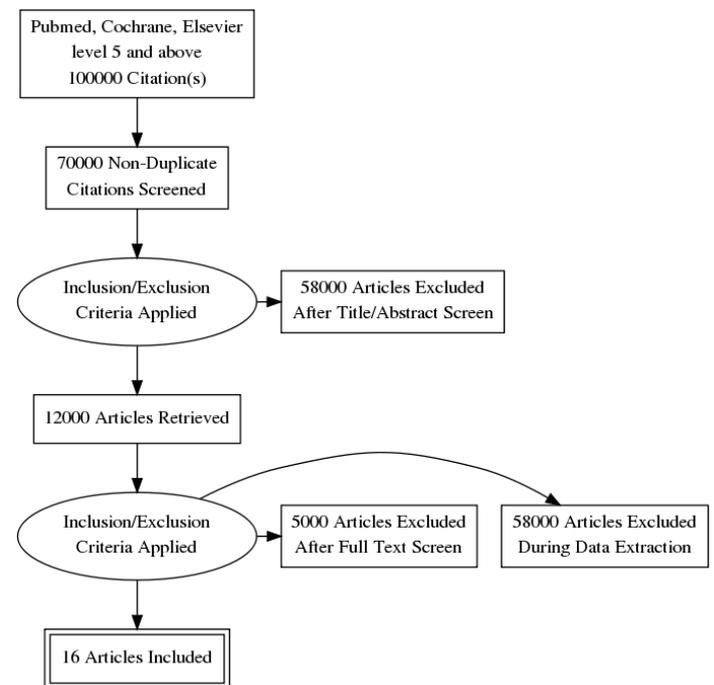


Table of search results for final synthesis:

Investigators	Year of publication	Type of study	Number of patients	Recommendation
Kastanos <i>et al</i>	1983	Case series	19	Fiberoptic bronchoscopy
Esteller More <i>et al</i>	2005	Cohort	654	Videolaryngoscopy
Rangachari <i>et al</i>	2006	Case series	51	Laryngoscopic examination

CONCLUSION

Although iatrogenic airway trauma has been widely studied, very few studies define the recommendations of optimum care for patients undergoing endotracheal intubations. Skill in intubation notwithstanding, prompt detection is equally important and this could be facilitated by screening protocols such as laryngoscopy for patients in critical care. This systematic review paves the way for the same by emphasizing a routine examination of the airway following intervention so as to minimize the sequelae of iatrogenic airway trauma.

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