INTUBATION-INDUCED TRACHEAL STENOSIS

- The urgent need for permanent solution -

- Case Report -

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Abstract

The most common site for the occurrence of intubation-induced tracheal damage is at the area in contact with the inflatable cuff. After the change from high-pressure to low-pressure cuffs, major tracheal lesions still continue to occur. This is a case of tracheal stenosis that occurred after 7 days of intubation with standard cuffed tube whose cuff pressure was assessed by subjective means. Three weeks later, patient was in need of reintubation, the trachea was found to be stenotic at the site of the previous tube cuff. Emergency tracheostomy had to be performed and computed axial tomography (CT) confirmed the tracheal stenosis. A month later, the patient had another cardiac arrest from which he did not recover. Our message in this report is to throw light and alert clinicians involved in tracheal intubation, of the presence of the Lanz endotracheal tube whose pilot balloon is designed to automatically regulate the intra-cuff pressure and thus prevent the occurrence of tracheal stenosis due to high pressure. We strongly recommend the presence of Lanz tracheal tubes as standard emergency equipment in intensive care settings and in any situation in which cuff pressure is likely to increase.

Keywords: Tracheal Stenosis, Postintubation Tracheal Stenosis, Tracheostomy.

Introduction

When the high-volume low-pressure cuffed tracheal tubes were introduced into clinical practice more than 3 decades ago, hopes were high that major tracheal damage associated with the previously used high-pressure cuffed tubes would be eliminated. However, tracheal stenosis is still occurring, and in one prospective study of critically ill patients, 11% of patients who had been intubated with high volume low pressure cuffed tubes, developed tracheal stenoses that were 10-50% of their tracheal diameter at the cuff site1. Other reports showed more severe tracheal damage at the cuff site2. This is a case report of tracheal stenosis following a week long intubation.

We believe that tracheal intubation is here to stay, albeit for the foreseeable future. Monitoring tracheal cuff pressure by simple devices has decreased the incidence of cuff-related tracheal damage. However, such practice is tedious and time-consuming, in addition it did not eliminate the occurrence of the damage4. To avoid the occurrence of tracheal stenosis, we strongly recommend anesthesiologists and intensivists to be aware of the presence of the Lanz tracheal tube, whose pilot balloon is designed to automatically regulate the intra-cuff pressure.

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within a similar period if the cuff pressure increases to greater than 40 mmHg. An increase in tracheal cuff pressure occurs when nitrous oxide is administered to an intubated patient under general anesthesia. In the ICU, however, nitrous oxide is rarely used, and in such situations, an increase in cuff pressure is the result of injecting excess air into the cuff or the use of opioids, widely used in intensive care settings. Morphine may result in a 21% increase in cuff pressure, while the increase in cuff pressure after fentanyl may reach 44%.

Tracheal stenosis after intubation usually presents as shortness of breath and either or both inspiratory stridor and expiratory wheeze on exertion. Changes in the flow-volume loop are diagnostic of tracheal stenosis (Fig. 2a & 2b).

Case Report

A 51-year-old, a known hypertensive hospital male employee, developed a cardiac arrest while playing basketball. He received advanced life support resuscitation, at the end of which he was deeply comatose with Glasgow Coma Scale of 4. Patient was mechanically ventilated for seven days until his condition improved then his trachea was extubated. His oxygen saturation was 98% on breathing room air. However, it was noted that he already developed right hemiparesis and dysphasia.

On the 21st post-extubation day, the patient was in obvious respiratory distress with falling oxygen saturation. Attempts at passing decreasing sizes of tracheal tubes were unsuccessful, at which stage tracheal stenosis was diagnosed and an emergency tracheostomy was performed. Computed axial tomography (CT) was done and confirmed the diagnosis (Fig. 1). Unfortunately a month later, the patient had another cardiac arrest from which he could not recover.

Discussion

The introduction of the tracheal tubes with low pressure cuffs has led to the erroneous belief that cuff-related tracheal damage has been prevented. In fact, once the wall of the tracheal tube cuff comes in contact with the mucous lining of the inside of the trachea, small amounts of air injected into the cuff may result in steep increases in cuff pressure. Changes in the tracheal mucosa may occur as early as 15 min after inflation of the cuff, and ischemic damage may result

![Computed axial tomogram at the level of the stenotic trachea](image1)

![Normal Flow-Volume Loop](image2a)

![Fixed Airway Obstruction (as in tracheal stenosis)](image2b)
Tracheal lesions related to excessive cuff pressure may be totally eliminated if the Lanz tracheal tube is used as a standard in intensive care settings and in any situation an increase in cuff pressure is likely. The Lanz pilot balloon has been developed to automatically control and regulate intra-cuff pressure, without the need for additional monitoring. Injecting approximately 40 ml of air to achieve an intra-cuff pressure of 22-25 mm Hg, the system will automatically maintain cuff pressure at a constant level below 25 mm Hg (34 cm H$_2$O). (The mean capillary perfusion pressure in the tracheal wall is about 35 mm Hg [48 cm H$_2$O]). Any increase in the volume of the tracheal cuff will be offset automatically by regulating valve and will move to the pilot balloon which is visible through outer transparent balloon (Fig. 3a & 3b). The balloon and control valve continuously regulate cuff pressure avoiding over-or underinflation. It also maintains safe cuff pressure at varying altitudes during air transportation.

In conclusion, the aim of this presentation is to alert the awareness of the many anesthesiologists and intensivists to the existence and use of the Lanz endotracheal tube whose automatic pilot-balloon regulating of the cuffed-pressure, thus providing quality medical care, and avoiding considerable patients’ morbidity with its associated human and medical costs. In emergency situations where resuscitation takes place by the available means and the standard endotracheal tube (Fig. 4) is used, this tube can be replaced by a Lanz endotube when patent is in the ICU. It is therefore highly recommended that the Lanz tube should be an integral part of emergency equipment in the ICU.
References


