

## Tracheo-carotid and oesophageal fistula following prolonged endotracheal intubation

**Maria P. Ntalouka<sup>1,2</sup>, Miltiadis Matsagkas<sup>3,4</sup>, George Kouvelos<sup>3,4</sup>, Konstantinos Stamoulis<sup>1</sup>, Vasileios Koulouras<sup>5</sup>, Elena Arnaoutoglou<sup>1,2</sup>**

<sup>1</sup>Department of Anesthesiology, Faculty of Medicine, School of Health Sciences, University of Thessaly, Larissa University Hospital, Larissa, Greece

<sup>2</sup>Department of Anesthesiology, Faculty of Medicine, School of Health Sciences, University of Ioannina, Ioannina University Hospital, Ioannina, Greece

<sup>3</sup>Vascular Surgery Department, Faculty of Medicine, School of Health Sciences, University of Thessaly, Larissa University Hospital, Larissa, Greece

<sup>4</sup>Vascular Surgery Unit, Faculty of Medicine, School of Health Sciences, University of Ioannina, Ioannina University Hospital, Ioannina, Greece

<sup>5</sup>Intensive Care Unit Department of ICU, University Hospital of Ioannina, Ioannina, Greece

### Abstract:

Tracheo-carotid and tracheo-oesophageal fistula are rare and devastating complications of inappropriate endotracheal tube cuff handling. We report a case of a patient presented with intermitted bleeding episodes through the mouth and the endotracheal tube. The patient suffered the initial episode of hemorrhage 15 days after intubation, which was controlled with volume expansion of the endotracheal tube cuff. Afterwards she underwent several other hemorrhagic episodes, which were also managed each time with further cuff expansion. At last, during many repeated surgical attempts to control the repeated and profound haemorrhage, the diagnosis of tracheo-carotid and tracheo-oesophageal fistula were subsequently made. Despite the aggressive efforts, the patient died due to septic shock and multiple organ failure. Optimal endotracheal tube cuff handling followed by immediate and stepwise therapeutic approach in case of a complication, along with the very high suspicion index can prove lifesaving in patients requiring prolonged endotracheal intubation.

### INTRODUCTION

The improvement of endotracheal tubes (ETTs) and the advances in mechanical ventilation have shortened the duration of ventilatory support. Cuffed ETTs remain the cornerstone for securing the airway and facilitating gas exchange. Inappropriate ETT handling remains one of the leading causes of complications related to mechanical ventilation, with cuff pressure, accidental extubation, mucosal ulcerations, granulomas, tracheal stenosis, and tracheo-oesophageal fistulae being the most frequent.

The first tracheo-carotid artery fistula following endotracheal intubation was reported in 1984. In 2007 tracheo-oesophageal fistula (TEF) and massive haemorrhage from tracheo-arterial (left subclavian artery) fistula (TAF) described

together for the first time.<sup>1,2</sup> Both TAF (abnormal linking between the trachea and an artery) and TEF (between the trachea and the oesophagus) are rare (0.1-1% and 0.5-1%), with extremely low survival rates (14,3%) and may develop even within a few hours of intubation. The incidence of hemorrhage complicating the fistula between the trachea and the common carotid artery is 4.3% [1, 2, 3, 4, 5].

### CASE

A 37-year-old female with Guillain-Barre syndrome (GBS), leading to progressive respiratory failure, was transferred intubated to our hospital from another country, after several failed extubation attempts, due to several episodes of profound bleeding through the mouth and the endotracheal tube (ETT), which were managed with further volume expansion of the ETT cuff each time.

During admission the patient was mechanically ventilated and a small (~150ml) and repeated bleeding through the ETT and the mouth was observed. Chest x-ray revealed a right pneumothorax (a right chest tube was placed), and round distention of trachea (extra thoracic segment) corresponding to the ETT cuff (Fig. 1). Lab findings were not specific, except for a mild impairment of hepatic function (INR:1.22, aPTT:31.9, AST/ALT:199/240, ALP:274,  $\gamma$ GT:644, LDH:1461, CPK:230 CK-MB:26). As far as the antibiotics are concerned the patient was treated

### Author for correspondence:

**Maria P. Ntalouka**

Department of Anaesthesiology, Faculty of Medicine, School of Health Sciences, University of Thessaly, Larissa, 41334, Greece

Tel: +30 6973688099, Fax: +30 2413502953,

E-mail: maria.ntalouka@icloud.com

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with ceftazidime which was changed to sultamicillin and finally to cefotaxime (all three of them at maximum dosage).



Figure 1. Chest Xray revealing the large endotracheal tube cuff

An urgent angiography of aortic arch revealed leak of contrast from the proximal segment of the right common carotid artery along with great external deviation of the vessel (Fig. 2), and the patient underwent emergency operation. A partial sternotomy and a right oblique cervical incision parallel to sternocleidomastoid muscle confirmed the longitudinal erosion of the right common carotid 1 cm after its origin and revealed a fusiform disruption of the trachea around the ETT cuff, ipsilateral complete erosion of the anterior tracheal wall and protrusion of the cuff through the deficit (Fig. 3). The carotid artery erosion was treated with a patch angioplasty with bovine pericardium and a tracheostomy was performed at the level of the lesion.

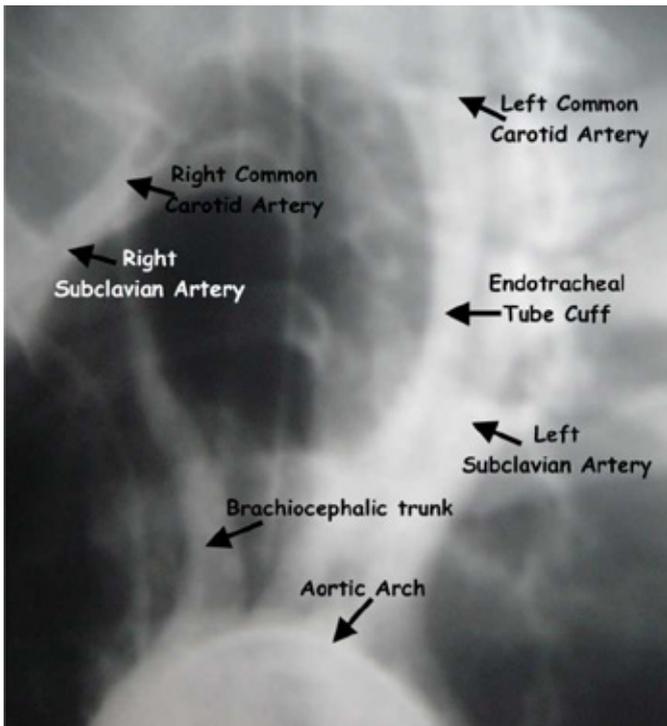


Figure 2. Angiography revealing the right carotid leak of contrast from the proximal segment and the great external deviation of the vessel

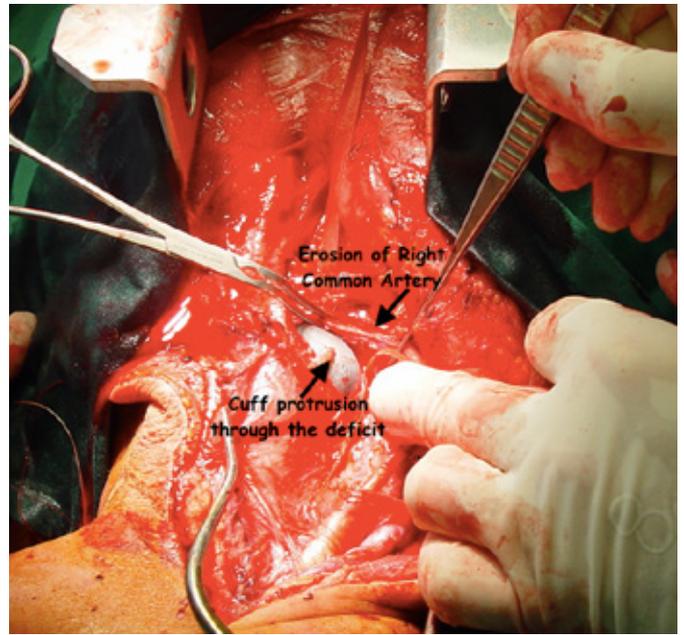


Figure 3. Oblong erosion of the right common carotid 1 cm after its origin, fusiform distention of the trachea around the ETT cuff, ipsilateral complete erosion of the anterior tracheal wall and protrusion of the cuff through the deficit after the partial sternotomy and the supraclavicular incision parallel to sternocleidomastoid muscle.

On the 6<sup>th</sup> postoperative day two new episodes of bleeding were observed. However, CT angiography revealed no leak of contrast. A second operation through a median sternotomy this time revealed an extensive longitudinal oesophageal erosion along the nasogastric tube with suppuration and mediastinitis, which was treated with left extomosis of the central segment, mediastinal lavage, and insertion of drainage tubes. A new erosion of the right common carotid artery at its origin was revealed and was treated with ligation of the right common carotid and closure of its ostium at the level of innominate artery (Fig. 4).

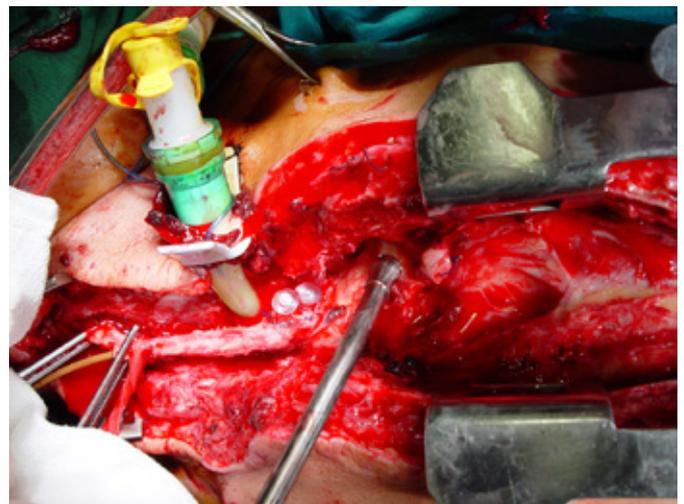


Figure 4. Extensive longitudinal oesophageal erosion along the nasogastric tube treated with left extomosis of the central segment, mediastinal lavage, and insertion of drainage tubes. Right common carotid artery erosion at its origin.

Postoperatively in an attempt to control the septic shock the patient was treated with broad spectrum antibiotics and aggressive support. Despite the efforts she unfortunately died twenty-one days after the admission to our Hospital due to septic shock and multiple organ failure.

## DISCUSSION

We present the existence of non-traumatic, iatrogenic tracheo-carotid and a tracheo-oesophageal fistula due to prolonged endotracheal intubation and inappropriate handling of the ETT cuff volume and pressure (continuous further volume expansion of the ETT cuff). Nowadays, cuffed ETTs remain the cornerstone for securing the airway and facilitating gas exchange, while the improvement of endotracheal tubes and the advances in mechanical ventilation have shortened the duration of ventilatory support [4]. However, prolonged endotracheal intubation and inappropriate ETT handling compose the leading causes of complications related to mechanical ventilation [6, 7]. According to the current literature, early tracheostomy is suggested, if possible at 7 days after initial intubation [8]. Inappropriate handling of the ETT and ETT cuff volume and pressure may lead to mucosal injury, derangement of microcirculation, mucosal ulceration and eventually tracheal wall necrosis, and TAF formation, especially when combined with hypotension, a high-positioned innominate artery and excessive tube movements [1]. When it comes to TEF formation steroids, advanced age, high airway pressure, nasogastric tubes and respiratory and oesophageal infections have been considered as the main causes [7, 9].

As far as the prevention of TAF and TEF is concerned, endotracheal tubes with high compliance, low pressure cuff with careful intra-cuff pressure monitoring, intermittent deflation of the cuff, prevention of infection and hypotension, and improvement in the patient's nutritional and immunologic status are strongly advised to be part of the routine management of any patient requiring intubation [7]. In our patient inappropriate ETT handling (an early tracheostomy was not performed) and the continuous increases in the cuff volume, as a measure to control the bleeding, were the main causes for both the fistulae. Prolonged mechanical ventilation, nasogastric tube placement, steroid administration and septic and hemorrhagic shock further compromised the tracheal wall necrosis [1, 3, 7].

Early diagnosis of TAF and TEF is difficult, requiring a high suspicion index. Any patient with an ETT or tracheostomy tube, with >10 ml of haemorrhage from the tip of the tube or unexplained upper airway leak should be immediately evaluated for TAF or TEF, respectively. Once massive intra-tracheal bleeding is observed, the patient should be transferred to the operating room immediately, without manipulating the ETT or expanding the volume of the ETT cuff, for explorative thoracotomy (median sternotomy with cervical expansion) [1, 3, 10].

Both lesions' management remain challenging, with extremely high mortality rates and early treatment is fundamental for survival. The over-inflation of the cuff should be one

of our main concerns, followed by digital compression of the artery for TAF. If TEF co-exists, the ETT cuff should be placed distal to the TEF within the trachea, while endotracheal and oesophageal stenting may be necessary [3, 7, 10]. Post-operatively, the cuff's pressure should be 20-30 cmH<sub>2</sub>O with the tip of the tube not being compressed against the tracheal wall, while only flexible nasogastric tubes should be used. Frequent cuff pressure monitoring, minimal endotracheal tube movement during suctioning, optimal nutrition, and spontaneous breathing when possible are essential for a favourable result [7].

## CONCLUSION

We report the co-existence of non traumatic, iatrogenic TAF and TEF due to inappropriate ETT cuff handling. Preventive measures, high suspicion index, early diagnosis and surgical treatment proves of utmost importance when dealing with TAF and TEF.

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