Forensic Science International 259 (2016) e5–e8

Contents lists available at ScienceDirect

Forensic Science International

journal homepage: www.elsevier.com/locate/forsciint

Case Report

A fatal case of iatrogenic aortic arch rupture occurred during a tracheostomy

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ARTICLE INFO

Article history:
Received 23 July 2015
Received in revised form 27 November 2015
Accepted 28 November 2015
Available online 12 December 2015

Keywords:
Aortic arch rupture
Tracheostomy
Hemorrhagic hypovolemic shock

ABSTRACT

The authors illustrate a rare case of aortic arch rupture in a 60-year-old woman, occurred during a tracheostomy performed using the Griggs method. The autopsy examination showed an aortic arch rupture in an intermediate position situated in the area between the brachiocephalic artery *ostium* and the left common carotid artery *ostium*, associated to a hemorrhage filling of the adjacent connective and muscular tissue.

The death was therefore determined by cardiac arrest secondary to massive hemorrhagic hypovolemic shock caused by the aortic arch rupture. The lethal iatrogenic lesion was determined by the aortic arch traction caused by the dilatation. The surgeon's incautious use of the Howard–Kelly forceps introduced in the *mediastinum* was therefore hypothesized.

1. Introduction

Tracheostomy is one of the most ancient cervical–facial surgery procedures. It allows the communication between the trachea and the external environment bypassing the upper airways [1].

Regardless of the various techniques used during the operation, the surgical procedures are commonly categorized in emergency or in election, based on timing.

The emergency procedure is performed when orotracheal intubation cannot be used in patients undergoing acute respiratory distress. This type of procedure is strongly influenced by time and it is carried out by making an incision on the cricothyroid membrane (cricothyroidotomy).

The elective tracheostomy is a non-urgent procedure: it is performed in patients that need a too long term respiratory assistance to use an orotracheal intubation, in patients that are undergoing a major head–neck surgery and in those who present serious swallowing impairment with high risk of aspiration of gastric contents [2,3].

Therefore the choice for performing tracheostomy is based on a series of indications used to achieve the clinical benefit in the patient.

Although literature does not determine whether and how tracheostomy performing time influences the clinical outcome of patient undergoing mechanical ventilation [4], many authors recommend performing tracheostomy after about 7/21 days from oro- or nasal-tracheal intubation, unless there are clinical reasons to proceed with an extubation [5].

Tracheostomy is often required as a first step in treating surgically several cases of head and neck neoplasia. This type of procedure is also recommended to keep the respiratory ways open bypassing possible obstructions, to reduce the endotracheal tube trauma in patients affected by grave respiratory insufficiency, to facilitate secretion removal and to prevent inhalation episodes when deglutition disorders are present [6].

Tracheostomy is performed in general anaesthesia or in local anaesthesia when intubation is impossible.

A 5 cm vertical skin incision is made along the medium line, starting from the jugular sternum incision to the thyroid cartilage, or a 3–4 cm horizontal incision above the jugular notch of the sternum. This procedure allows to expose and to divaricate the perilaryngeal muscles. It is possible to perform a trans-isthmic tracheostomy by dissecting the thyroid isthmus and suturing the two halves, or to perform an incision above or below the isthmus to elevate and retract the thyroid isthmus superiorly or inferiorly. Once the trachea is exposed, an incision is performed through the first two tracheal rings and a tube is introduced and secured to the skin above with two sutures.

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http://dx.doi.org/10.1016/j.forsciint.2015.11.016
0379-0738/

It is essential to check the curvature of the tube so that it fits the neck shape of the patient, as a too high curvature can damage the brachiocephalic trunk and can provoke hemorrhage.

In emergency cases an inter-cricothyroid laryngectomy is performed introducing a specific tube through the cricothyroid membrane incision [7].

2. Case report

A 60-year-old woman was admitted to the intensive care unit after a cardiorespiratory arrest. The coronarography showed an acute occlusion of the right coronary treated with angioplasty and stent insertion. In the following days the vital parameters were kept stable. The patient remained unconscious regardless of whether she was receiving a pharmacological sedation. After 7 days an endoscopic tracheostomy with Griggs method was performed on the woman (Fig. 1). At the end of the operations a copious and incessant bleeding leading to hypotension and bradycardia occurred. The patient was treated with the administration of blood, liquids and vasoactive drugs. Despite therapy and CPR (cardiopulmonary resuscitation), unfortunately, the patient's clinical condition deteriorated and she died in spite of vigorous efforts at resuscitation.

The external examination showed a 7 cm horizontal and linear surgical incision below the thyroid isthmus.

The autopsy revealed a surgical incision between the third and fourth tracheal rings, and, moreover, showed an aortic arch rupture in the area between the brachiocephalic artery *ostium* and the left common carotid artery *ostium*, associated to a hemorrhage filling of the near connective and muscular tissue and to a surgical incision of the muscular tissue and of the trachea (Figs. 2 and 3).

The aortic arch rupture found during the autopsy was 3 cm long with a linear shape and clear-cut irregular margins, oriented roughly perpendicular to the axis of the artery and along the longitudinal axis of the body.

In addition to this, the autopsy showed hemorrhage filling of both the apical portions of the parietal pleura, and of the pericardium at the base of the heart, presence of blood along the airways and diffuse bilateral pulmonary edema.

According to the autopsy findings death was determine by cardiac arrest secondary to massive hemorrhagic hypovolemic shock caused by the aortic arch rupture.

3. Discussion

Percutaneous tracheostomy is emerging as a method to secure a definitive airway in ventilated patients in critical care units as an alternative to surgical tracheostomy. It offers several advantages such as small skin incision, less tissue trauma and lower infection rate [8].

The Griggs technique, described in 1990, is a single-step dilation technique using a modified Howard–Kelly forceps as tracheal dilator.

According to this technique the neck is palpated, and the landmarks, including the thyroid cartilage, cricoid cartilage, and sternal notch, are identified. The patient is positioned with a roll under the shoulders and the neck is extended. Skin was infiltrated with 2% lignocaine in adrenaline, midway between cricoid and suprasternal notch, corresponding to the space between second and third tracheal rings. A horizontal incision, 1–1.5 cm, was made with scalpel.

A 14-gauge needle and a cannula attached to syringe filled with fluid are inserted in the midline and advanced until withdrawal of air bubbles into the syringe confirms placement in the trachea. At this point, the cannula is advanced into the lumen of the trachea, and the needle is withdrawn. The introducer is inserted into the cannula, and the J-tipped Seldinger wire is placed into trachea. The cannula is removed, leaving the wire in the trachea. The dilator is passed over the guidewire through the soft tissues until the tracheal wall is felt. The Howard–Kelly forceps is clamped, and the guidewire is threaded through the bore at the tip. This is advanced through the soft tissues until resistance is felt. It is then inserted into the hole in the anterior tracheal wall. The forceps handles are raised vertically for the tip to penetrate the tracheal wall and lie

Fig. 1. A general view of tracheostomy. (A) Orizontal tracheostomy skin incision. (B) The muscles are separated and retracted laterally, exposing the tracheal stoma. (C) Tracheal wall and muscles incision with hemorrhagic infiltration. (D) Particular area of interest: muscles incision and tracheal stoma.