Case Report

Elective tracheostomy in intensive care unit: Looking between techniques, a three cases report

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Access this article online

Website: www.ijaweb.org

DOI: 10.4103/0019-5049.130826

Quick response code

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ABSTRACT

There is no optimal tracheostomy (TS) technique, proved to be the best. For this reason, operators' skills, clinical anatomical and physio-pathological features of the patient should be considered as discriminating factors in the choice of percutaneous dilation tracheostomy (PDT) technique. This article includes reports of three cases of PDT: In the first case distance between jugular notch and the first tracheal ring was too long, the second case involving a patient with mild ectasia of the ascending aorta and aortic regurgitation with De Musset's sign with great risk of perioperative bleeding and a third case, of tracheomalacia with inflammatory stenosis at the 4th tracheal ring. All together, this case series describes how decisions were made by an experienced staff, in which the patient characteristics were assessed and techniques best suited for each case were implemented.

Key words: Acute respiratory failure, bronchoscopy, inflammatory stenosis, mechanical ventilation, orotracheal intubation, percutaneous tracheostomy, video-assisted endoscopy and ultrasound

INTRODUCTION

Tracheostomy is an elective technique in intensive care unit (ICU) for the management of patients requiring prolonged mechanical ventilation (MV).[1] Several methods are proposed but there is no agreement regarding the best technique.[2] Operators' skills, clinical anatomical and physio-pathological features of the patient should be evaluated before deciding to attempt the percutaneous dilation tracheostomy (PDT) technique. We report three cases of PDT in which we attempted different methods in the light of different clinical features of each patient. The aim of these reports is to emphasize the need for choosing the tracheostomy method adapted to the characteristics of each critically ill patient in order to reduce complications. Informed consent was obtained from the patients or their next of kin before each procedure.

CASE REPORTS

Case 1

An 83-year-old patient mechanically ventilated by endotracheal tube was admitted in our general ICU because of acute respiratory failure due to chronic bronchitis. He had undergone a previous lung resection for tuberculosis 40 years ago. He had advanced pulmonary emphysema and prominent barrel chest. Mycotic pneumonia was diagnosed. Due to weaning failure and persistent dependency on MV, the patient was scheduled for video-assisted TS. Surgical TS and translaryngeal TS (TLT) were excluded because neck palpation revealed cricoid prominence at jugular notch level, so the first tracheal ring was in a retro-sternal position. For this video bronchoscopy failed to provide transillumination. Percutwist TS was excluded because of the short, rigid dilator (4 cm). Ciaglia Blu-Rhino™ TS set (CBR) was chosen along with total intravenous anesthesia (TIVA).[3] The guide wire was introduced through the needle between the first and second tracheal ring. Because the CBR introducer catheter was too short to reach the tracheal lumen due to very long distance between jugular notch and the first tracheal ring, a central venous catheter (8.5 Fr.x5-1/8") vessel dilator was used to carry out the initial dilatation on the guide wire and to allow the placement of the white guiding catheter in the trachea. The CBR dilator was not indicated because the distance from tracheal lumen to

How to cite this article: Ferraro F, Marullo L, d'Elia A, Izzo G. Elective tracheostomy in intensive care unit: Looking between techniques, a three cases report. Indian J Anaesth 2014;58:190-2.

skin of the neck was 9 cm [Figure 1]. It was necessary to advance beyond the black skin level mark of the dilator for proper dilatation of the tracheal wall and it appeared dangerous to pass it. Tracheal dilatation was carried out using basic Ciaglia (BC) multiple dilators. BC has long dilators with an extremely distal dilatation cone that allows deeper tracheal dilation. An extra long-armed tube was placed to assure the correct positioning inside the tracheal lumen.[4]

Case 2

A 76-year-old-female patient mechanically ventilated with endotracheal tube *in situ* was admitted in our ICU after craniotomy for a cerebellar haematoma. We decided to place TS. The patient had mild ectasia of the ascending aorta and aortic regurgitation with De Musset's sign. The anomaly of the aortic arch could be a contraindication to tracheostomy due to increased risk of perioperative bleeding.[5] A Doppler US study of the neck showed anatomic alteration of the neck. The pulse was not transmitted but there was vascular ectasia encroaching onto the right sterno-clavicular articulation. Following weaning failure on the 10th day of ventilation, we chose to perform a TLT because of the low bleeding risk of this technique. At the beginning of the procedure we placed the 4 mm I.D. oro-tracheal tube by tube exchange with video endoscopy assistance, necessary for a modified TLT technique.[3] Anatomical structures (vessels, cartilage and bones) were marked on the skin of the neck. Under endoscopic guidance and transillumination, vessels were identified in the free space between the tracheal rings for safe insertion of TS. Since no vessel free space was seen under Doppler, TS with paramedian access was decided. So we chose a left side US guided entrance to perform the TS in the neck. The stoma was placed about 2 cm from the aortic ectasia on the medial side of sternocleidomastoid muscle, and 2 cm from the left carotid artery. No perioperative complication was observed, despite the unusual access. On the 42nd post-operative day the patient started spontaneous breathing through the tracheostomy tube with affixed artificial nose. On the 55th day the patient was discharged from ICU and referred to a respiratory rehabilitation recovery unit [Figure 2].

Case 3

A 49-years-old patient was admitted in our ICU with diagnosis of chronic obstructive pulmonary disease and exacerbation with obstructive and restrictive respiratory failure. The bronchoscopy, before the TS,[3] detected tracheomalacia with inflammatory stenosis at the 4th tracheal ring, and the upper right lobar bronchus taking off from trachea instead of the right bronchus. The patient was scheduled for video-assisted TS on 11th day of timing. We chose to use Ciaglia Blue Dolphin™ (CBD) Balloon Percutaneous Tracheostomy Introducer kit for a modified TS. The dilator of this kit has a balloon on catheter tip which produces mainly radial force to widen the tracheostoma.[6] So after having performed the radial expansion through the CBD, the balloon was inserted through the stoma in the tracheal lumen to reach the stenosis at the 4th tracheal ring. We decided to use the CBD's balloon dilator to treat the stenosis by the expansion, before placing the tracheostomy tube. Then the second cuff of the TS tube was inflated with water to 11 atmospheres and it was used to dilate the tracheal stenosis. The bronchoscopic view showed the dilatation of the stenosis and the proper position of the tracheostomy tube. Two checks, first at 10 days and then at 20 days after the procedure showed no recurrence of stenosis [Figure 3].

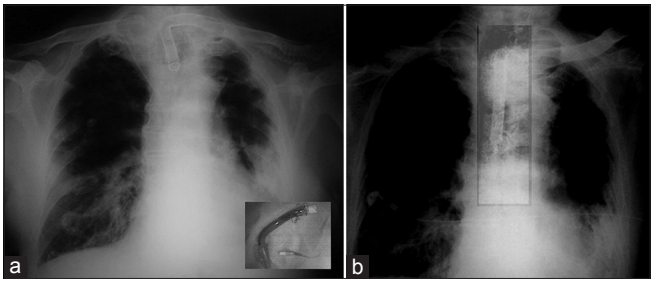

Figure 1: (a) Armed tracheostomy tube (I.D. 9 mm), too short. (b) Extra long-armed tube placed inside the tracheal lumen

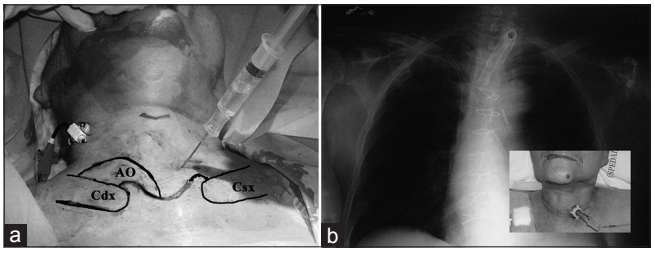

Figure 2: (a) Anatomical structures marked on the neck skin and needle placed under US guide. (b) TS performed by a paramedian entrance

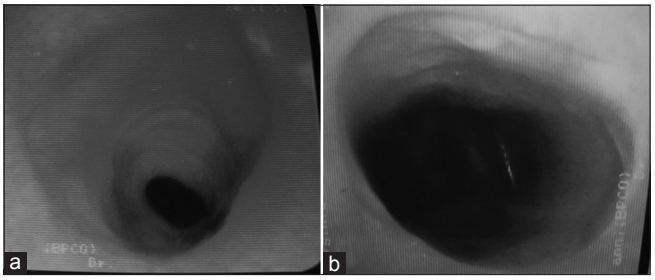

Figure 3: Ferraro. (a) The tracheal stenosis. (b) Stenosis treated with CBD balloon tracheoplasty

DISCUSSION

The first case was unusual due to the anatomical alterations caused by disease. The TS was placed quickly and safely, combining a good techniques of main procedures and devices available in ICU. In this way, we avoided serious complications. Surgical TS and Griggs techniques were excluded because of the retrosternal position of the first tracheal ring which may potentially have required a sternotomy. The Percutwist TS and the CBD were excluded because of the short dilator (4 and 5 cm respectively), and the CBR dilator was ineffective due to its shape. TLT was excluded because once the first space between rings is reached by the needle, it would have been difficult to direct it through the larynx (because of the acute angle between the tracheal axis and needle axis potentially causing dangerous traction on the tracheal tissue).[7] In addition, even if it had been possible to capture the guide wire with an endoscopical clamp and draw it out through the mouth by video bronchoscopy, some additional difficulties might have occurred during dilation and the drawing out of the cone-cannula.

In the second case TLT was preferred because the cannula is stripped from inside to outside (extrusive technique).[8] TLT is indicated in patients with a risk of bleeding (anatomical peculiarities or altered coagulation). Furthermore the stoma tissue's strong seal to the cannula, along with Doppler US and transillumination guides, reduces bleeding risk.[9]

In the third case we chose CBD because the dilator allows the balloon tracheoplasty in the treatment of the stenosis[10] with dual dilators effectively (the balloon tipped introducer and the TS tube). Balloon tracheoplasty can be an effective or a temporary measure, as many patients require additional treatment.[6]

The most frequent TS complications are bleeding, infection and stenosis.[11-13] Video-assisted endoscopy and Doppler ultrasound facilitate TS techniques and reduce complications.[1,9,14]

CONCLUSIONS

The patient characteristics should be evaluated before deciding the best technique to use. We chose the most appropriate technique in relation to patient's features and device characteristics. It reduced the incidence of complications, and consequently the ICU stay and costs in each of the three reported cases here. Generally inexperienced operators use techniques with which they are more familiar, but elective tracheostomy in ICU can be delayed and carried out by experienced staff ensuring that the most suitable technique is applied and that this learning curve will be completed.

However, a multicentre study is wanted in order to corroborate our modified techniques.

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Source of Support: Nil, **Conflict of Interest:** None declared