

Old problem new approach- malposition of tracheostomy tube in patient with anatomical deformity

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The size of the tracheostomy tube (TT) in relation to the airway should be guided by the underlying anatomical deformity. The optimal choices in tracheostomy tube selection in such patients are not defined. This case report describes some discernible issues involved in the management of a patient with restrictive lung disease due to severe kypho-scoliosis with type II respiratory failure admitted in the ICU of our institution. Computed tomography (CT) scan was instrumental in measuring the infraglottic length and diameter of trachea. This expedited the weaning process of patient and her discharge from ICU.

Keywords: tracheostomy tube; anatomical deformity; computed tomography

Introduction

A patient spends as much as 42% of the time during weaning from mechanical ventilation with a likely higher percentage in patients with lung disease.¹ Malpositioning of tracheostomy tubes (TT) occurs in 10% of intensive care unit (ICU) patients.² Early tracheostomy can significantly hasten the process of weaning from mechanical ventilation but issues regarding TT needs to be considered.²

Case report

A 32 year old female patient was admitted in the ICU with severe restrictive lung disease and kypho-scoliosis involving thoracic vertebrae (T4-T11). She had dyspnoea on exertion since last ten days which worsened to type II respiratory failure. On admission, the patient's Glasgow coma scale (GCS) was 8 (E3V1M4) with a pulse rate of 120/min and non invasive blood pressure of 70/50mmHg. On auscultation of lung, bilateral rhonchi were present. Her arterial blood gas (ABG) analysis showed uncompensated metabolic and respiratory acidosis. Trachea was intubated with 7.0mm ID endotracheal tube and respiration was supported with synchronized intermittent mandatory ventilation (SIMV) (frequency-16/min, tidal volume -180ml, peak inspiratory pressure - 23cm H₂O, positive end expiratory pressure - 5cm H₂O). Supportive ICU treatment was started. Her routine laboratory blood investigations were normal. Chest X-ray showed severe thoracic

scoliosis with crowding of ribs on left side of chest and left hypoplastic lung. On the fifth day, surgical tracheostomy was done and a 7.0mm ID TT (cuffed blue line ultra, Portex®) was inserted in anticipation of prolonged ventilatory support. Following tracheostomy, patient had decreased air entry on left side of the chest, SpO₂ decreased to 80% with static compliance of 15 ml/cm H₂O and resistance of 30cm. Ultrasonography (USG) and X ray chest ruled out the possibility of pneumothrax. On fiberoptic bronchoscopy the TT was endobronchial in right principle bronchus and its distal end was abutting the mucosa. We immediately pulled out the tube by approximately 2cm and secured its new position by applying cotton padding under the flange of the tube, as the TT with adjustable flange was not available. Ventilation was supported but patient still had hypoxemia and hypercarbia on blood gas analysis. Thereafter computed tomography (CT) scan of the chest was done which showed severe kyphoscoliosis (T4-T11), left lung collapse with mediastinal shift, minimal pleural effusion, and calcific lesions in left collapsed lung (Figure-1).



The tracheal length was of 8.00cm with variable diameter of 10mm infraglottic to 6mm at the level of TT and the distance from the tip of TT to carina was 1.5cm. We eventually planned to insert a TT of 6.0mm ID. Subsequent flexible fiberoptic bronchoscopy confirmed correct placement of TT. Patient received weaning trials over a period for next four weeks and her trachea was decannulated after three months of ICU stay.

Discussion

Patients with severe kyphoscoliosis are difficult to manage in ICU due to compensatory changes that occur in these patients. Hypoxemia and secondary hypercapnia occurs rapidly with haemodynamic instability. These patients adopt low tidal volume, high respiratory rate which increases the ventilator work.³

Ideally TT must fit the airway without causing any undue pressure on any portion of the neck or trachea and should fulfil the functional needs of the patient. The OD of a TT needs to be no more than the two-thirds to three-quarters of internal diameter of trachea as a bigger tube impedes air flow when the cuff is deflated and a smaller tube can increase pressure on surrounding mucosa after cuff inflation.⁴ A 10mm outer diameter (OD) and 7.00mm ID TT for adult women is usually appropriate as an initial size.⁵

Other better options in this patient would have been a silicon tube which easily fits to the contour of airway and TT with adjustable flange.

The correct placement of TT warrants tip of the TT to be halfway between stoma and carina, should be 2/3rd of the width of trachea diameter and cuff should not cause any bulge on the tracheal wall.⁶ Tracheal anatomic length in adults is 10.5 to 13cm with height of 1.50 to 1.80m.⁷ Patients with a shorter height are at increased risk of malposition.⁷ Hence, TT 6.00mm ID with an OD of 8.5mm, an angle of 90-105° and length of 64mm was beneficial for the patient.

Computed tomography scans aids to determine estimation of tracheal diameter, cross-sectional area, volume and length in vivo and can be an invaluable asset in size estimations of tracheostomy tubes for the intensivist.⁷

To conclude, an individualized approach for TT size is required in these patients to expedite patient's liberation from ventilator and discharge from ICU.

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