Rigid bronchoscopy-guided percutaneous tracheostomy

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We describe a case series of seven patients that demonstrates the usefulness of rigid bronchoscopy in percutaneous tracheostomy. The technique was used in selected patients who had a previous tracheostomy, a difficult airway, high risk of bleeding, or a tracheal stent in place.

Keywords: anaesthetic techniques, rigid bronchoscopy; equipment, tubes; tracheostomy surgery, percutaneous tracheostomy

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Percutaneous tracheostomy is an important technique with which intensive care doctors should be familiar. Although a variety of approaches have been described, we present seven patients who demonstrate the benefits of rigid bronchoscopy-assisted percutaneous tracheostomy.

The rigid bronchoscope affords excellent visibility throughout the procedure, provides a secure airway without risk of cuff puncture or damage to the fibre-optic bronchoscope (if also being used), provides good access for haemostatic control, and a rigid support for the trachea, reducing the risk of posterior tracheal wall perforation or damage to tracheal stents if present.

We suggest that bedside rigid bronchoscopy to assist percutaneous tracheostomy should be considered for selected patients, e.g. those who have had a previous tracheostomy, abnormal neck anatomy due to previous surgery or radiotherapy, risk of difficult airway or bleeding, or existing tracheal stents.

Case reports

Seven of our patients who were considered for percutaneous tracheostomy had comorbidities which increased the difficulty and risk of the procedure (Table 1). Given our large endobronchial intervention programme, we believed that the use of the rigid bronchoscope during the procedure would be of benefit (Table 2).

The rigid bronchoscope was used to assist a modified percutaneous tracheostomy, based upon the method described by Ciaglia and colleagues,1 and in each case the same operator performed the rigid bronchoscopy, and the technique was identical.

The patient was anaesthetized and the site prepared in the standard fashion. The patient’s endotracheal tube was removed and a rigid bronchoscope was inserted into the upper trachea, and jet insufflation ventilation was commenced with 100% oxygen. The rigid bronchoscope was used to displace the trachea anteriorly and thereby to facilitate optimal insertion of the guide-wire. The procedure was continuously visualized and correct placement of the tracheostomy was confirmed.

Successful tracheostomy was performed in each patient without complication. The duration of the procedure was 15–30 (median 20) min. The rigid bronchoscopy-guided percutaneous tracheostomy technique provided a more secure airway, ease of obtaining haemostasis, and excellent visibility and support protecting the tracheal stents from displacement or damage during the procedure.

Discussion

Tracheostomy for long-term management of airway and ventilatory problems is a recognized technique and percutaneous insertion of a tracheostomy tube was described by Sheldon and colleagues2 in 1955. Complications arising from this procedure include haematoma formation and subsequent compromise of a patent airway, external bleeding, bleeding into the trachea, formation of false airway passages and displacement of tracheal stents.

Flexible bronchoscopy guidance was advocated by Marelli and colleagues,3 and is commonly performed to ensure the correct placement of the tracheostomy, and to identify potential problems such as bleeding.

We are aware of the literature regarding the use of the rigid bronchoscope,4-5 and seek to further define the subset of patients in which this technique should be considered.

The technique is not suitable for every patient. It requires familiarity with the use of a rigid bronchoscope. The lack of...
a sealed airway may be a contraindication if the risk of tracheal aspiration is high, or if the patient is dependent on positive end-expiratory pressure. While the insertion of the rigid bronchoscope may cause bleeding, this is usually easily controlled.

Where the operator is not skilled in the use of the rigid bronchoscope, the procedure may be scheduled when the ENT or thoracic surgeons are available for handling the rigid bronchoscope. Otherwise another method must be used (Fig. 1).

Table 1 Patient characteristics and indications for use of rigid bronchoscope. MVR, mitral valve replacement; AVR, aortic valve replacement; CABG, coronary artery bypass graft; TV, tricuspid valve

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age (yr)/sex</th>
<th>Interventions</th>
<th>Comorbid disease</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>68 M</td>
<td>Rib fractures and haemothorax after trauma</td>
<td>Carcinoma of larynx treated with radiotherapy, resulting in scarring with fixed flexion of the neck</td>
<td>Difficult airway</td>
</tr>
<tr>
<td>2</td>
<td>74 M</td>
<td>MVR complicated by aortic dissection during operation and left hemispheric infarction</td>
<td>Suspected tracheal perforation (subsequently excluded)</td>
<td>Ability to exclude tracheal perforation and potential to deploy stent if indicated</td>
</tr>
<tr>
<td>3</td>
<td>81 F</td>
<td>Tissue AVR and CABG × 3</td>
<td>Previous tracheostomy because of pneumonia after operation</td>
<td>Thickened granulation tissue at previous tracheostomy site</td>
</tr>
<tr>
<td>4</td>
<td>76 M</td>
<td>CABG × 2, TV annuloplasty, MVR</td>
<td>Thrombocytopenia</td>
<td>Potential for haemostatic control</td>
</tr>
<tr>
<td>5</td>
<td>38 F</td>
<td>Intravenous drug abuse, prolonged ventilatory support</td>
<td>Previous tracheostomy</td>
<td>Thickened granulation tissue at previous tracheostomy site</td>
</tr>
<tr>
<td>6</td>
<td>64 F</td>
<td>Type A aortic dissection</td>
<td>Stent for tracheomalacia after operation</td>
<td>Visualisation and protection of stent</td>
</tr>
<tr>
<td>7</td>
<td>64 M</td>
<td>CABG × 4</td>
<td>Short neck and impalpable tracheal rings</td>
<td>Difficult airway</td>
</tr>
</tbody>
</table>

Table 2 Rigid bronchoscope-guided percutaneous tracheostomy

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
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</thead>
<tbody>
<tr>
<td>Secure airway</td>
<td>Requires familiarity with rigid bronchoscope</td>
</tr>
<tr>
<td>Supports trachea</td>
<td>No cuffed airway to provide high PEEP or prevent risk of aspiration</td>
</tr>
<tr>
<td>Excellent visibility</td>
<td>Bronchoscope insertion may cause bleeding</td>
</tr>
<tr>
<td>No risk of damage to bronchoscope</td>
<td></td>
</tr>
<tr>
<td>Good haemostatic control</td>
<td></td>
</tr>
<tr>
<td>Easy to manipulate tube</td>
<td></td>
</tr>
<tr>
<td>No problem with cuff leak</td>
<td></td>
</tr>
</tbody>
</table>

Table 3 Patients for whom rigid bronchoscopy guidance should be considered

<table>
<thead>
<tr>
<th>Type of patient</th>
<th>Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous tracheostomy</td>
<td>Support for trachea</td>
</tr>
<tr>
<td>Tracheal stent in place</td>
<td>Excellent visibility reduces risk of displacement or compression of tracheal stent and confirms guide-wire position</td>
</tr>
<tr>
<td>Difficult airway</td>
<td>Secure airway, ease of tube manipulation, no risk of cuff puncture during tracheal cannulation</td>
</tr>
<tr>
<td>High risk of bleeding</td>
<td>Ease of haemostatic control</td>
</tr>
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</table>

Fig 1 Flowchart for selection of technique for tracheostomy.
Suitable patients should be selected based on the potential advantages of the procedure (Table 3): in patients in whom tracheostomy has been performed previously, the rigid bronchoscope supports the softer structures, reducing the risk of tracheo-oesophageal puncture and fistula formation. Furthermore, anterior leverage of the trachea facilitates tracheal cannulation; where tracheal stents are in place, the greater visibility and the rigidity of the bronchoscope prevents dislodgement or compression of the stents; in patients with difficult airways the rigid bronchoscope provides a secure airway with excellent views without risk of cuff puncture or inadvertent dislodgement of the endotracheal tube; where the risk of bleeding is deemed high, the larger diameter of the rigid bronchoscope and excellent visibility allow easy haemostatic control.

We feel that rigid bronchoscopy for guidance of percutaneous tracheostomy is an invaluable technique and should be considered in selected patients who have had a previous tracheostomy, have stents in place, an expected difficult airway, or a high risk of bleeding.

References