Brachiocephalic artery haemorrhage during percutaneous tracheostomy

SD Sharma, G Kumar, CS Hill, H Kaddour

Barking, Havering and Redbridge University Hospitals NHS Trust, UK

ABSTRACT

Percutaneous tracheostomy was performed on a 69-year-old woman to facilitate weaning. Insertion of the size 7 tracheostomy tube resulted in profuse bleeding around the tracheostomy site. On inflation of the tracheostomy balloon, the bleeding stopped. Urgent computed tomography demonstrated the brachiocephalic artery was abnormally high and lying in an oblique fashion over the trachea, and the tracheostomy tube was displacing the trachea posteriorly. Surgical repair of the defect in the brachiocephalic artery was undertaken and a surgical tracheostomy was performed in theatre. This case raises important issues about the potential dangers of percutaneous tracheostomy in cases of abnormal anatomy. It also emphasises the importance of direct visualisation of the seeker needle using the endoscope. In cases where there is a suspicion of abnormal anatomy, it is safer to obtain preprocedural imaging or perform a surgical tracheostomy.

KEYWORDS

Percutaneous tracheostomy – Brachiocephalic artery

Accepted 22 October 2014; published online XXX

CORRESPONDENCE TO

Sunil Sharma, E: sunilsharma@doctors.org.uk

Percutaneous tracheostomy was described originally in 1985.¹ It is considered a safe alternative to surgical tracheostomy in selected patients in the critical care unit setting. It usually involves the concurrent use of a seeker needle and a flexible endoscope to visualise the tracheal lumen and confirm the correct needle entry site. A Seldinger technique is used and a single dilator is passed over the guidewire before the tracheostomy tube is inserted between either the first and second or second and third tracheal rings.

Case History

A 69-year-old woman required admission to the intensive care unit with traumatic brain injury. In view of poor neurological recovery, it was decided that she would benefit from a tracheostomy. Assessment of the patient revealed a long neck with minimal subcutaneous fat. A decision was made to perform a percutaneous tracheostomy in the intensive care unit to protect the respiratory tract and facilitate weaning. This was undertaken with her neck slightly extended on a pillow. The sternal notch, thyroid cartilage and planned tracheostomy site were easily identifiable and marked. A lidocaine and adrenaline mix was infiltrated, and a flexible endoscope was passed through the endotracheal tube after preoxygenation to visualise the tracheal lumen as far as the carina.

The endotracheal tube was partially withdrawn and a needle inserted between the tracheal rings but not visualised in the tracheal lumen. A standard Seldinger technique

was used to dilate the tract. At this point, the endoscope was fully withdrawn. Insertion of the size 7 tracheostomy tube and removal of the introducer resulted in profuse bleeding from around the tracheostomy. The balloon was inflated and the bleeding stopped immediately. Ventilation was maintained via the existing endotracheal tube. An emergency otolaryngology consultation was requested. On arrival, the tracheostomy tube had visible rhythmic motion in keeping with an arterial pulsation. The patient was transferred for immediate computed tomography (CT) (Figs 1 and 2).

Direct transfer to theatre for further management was arranged. In theatre, the neck was exposed, skin edges were retracted with a Joll thyroid retractor and the tracheostomy tube was removed. The brachiocephalic artery was identified superficially and at an oblique angle to the trachea (Fig 3). When the tracheostomy tube was deflated and removed, there was brisk arterial bleeding. The defect was closed with 6/0 Prolene® (Ethicon, Somerville, NJ, US) after gaining proximal control at the manubrial edge. A surgical tracheostomy was completed in standard fashion during the same anaesthetic. The patient did not have any further complications relating to the tracheostomy site or brachiocephalic injury.

Discussion

This case raises important issues about the potential dangers of percutaneous tracheostomy and the importance of

Figure 1 Parasagittal non-contrast computed tomography demonstrating the endotracheal tube in the trachea far beyond the glottis at the T2/3 junction. The tracheostomy tube is seen just arching superior to the sternal notch and running parallel to the trachea. It is displacing the trachea posteriorly. The hypodensity at its distal end is the inflated balloon. Note the proximity of the aortic arch to the tracheostomy.

Figure 2 Coronal contrast enhanced computed tomography demonstrating the endotracheal tube filled with air. Beneath and parallel to this is the hyperdense ring of the tracheostomy tube. It is filled with isodense blood and its lower border can be seen to traverse the brachiocephalic artery as it exits the aortic arch.

correct technique. It also highlights the difficulties that can be encountered if simple anatomical variations are not identified.

Various anatomical variations of the brachiocephalic artery have been described. These include abnormal length, bifurcation points, configuration and size. There may be some warning of aberrant high neck vessels by a visible pulsation but this is not reliable.²

There have been several previous reports of immediate fatal haemorrhage during percutaneous tracheostomy due to entry into the aorta, brachiocephalic and subclavian arteries. In some but not all cases, this was a result of post-operative fibrosis or abnormal vascular anatomy. Delayed haemorrhage can also occur, often as a result of a brachio-tracheal fistula due to pressure necrosis from the tracheostomy tube or cuff.³

The use of a flexible or rigid endoscope is now considered a standard requirement in the technique, unlike ultrasonography guidance. It allows visual confirmation that the guidewire and subsequent tracheostomy tube is sited correctly in the trachea with appropriate cuff inflation and without bleeding.

The use of ultrasonography is a recent modification of the percutaneous tracheostomy that has not been fully adopted. It has the potential benefits of identifying the level of the tracheal rings, the midline of the trachea, and the size and location of the thyroid and blood vessels.⁴ Preoperative CT or magnetic resonance imaging have not been identified as being routinely necessary but these are also radiographic tools that may give further information about abnormal neck anatomy in selected cases.⁵

There are multiple factors that led to the complication presented in this case. First, when the seeker needle was inserted, the endotracheal tube was not partially withdrawn, as is usually advised. This forced the operator to advance the seeker needle further caudally than is typical to avoid puncture of the endotracheal tube. Second, owing to this more caudal entry point, the trachea had already begun its natural curve posteriorly as it travelled inferiorly in the mediastinum. This increased depth of trachea will have made an accurate midline seeker needle placement more difficult. Third, although a flexible endoscope was used in this case and the seeker needle seen initially in the trachea, the endoscope was removed prior to dilation and tube insertion. This window of time, during which instrumentation was blind,

Figure 3 Intraoperative photograph showing the oblique path of the injured brachiocephalic artery directly overlying the posteriorly placed trachea

will almost certainly have contributed to the malpositioning of the tube. A fourth contributing factor is likely to be the high riding brachiocephalic artery. Portable ultrasonography assessment was not undertaken in this case and it is reasonable to believe that this would have allowed recognition of the brachiocephalic artery position, thereby reducing the risk of inadvertent puncture.

Conclusions

It is vital for otolaryngologists to have a good understanding of the percutaneous tracheostomy technique, its limitations and the complications that can occur. They are likely to be consulted in the instance of any complications occurring, often in a time-pressured emergency situation. For this reason, it is recommended that all percutaneous tracheostomies are performed whenever possible during working hours, only when there is the availability of surgical expertise and theatre staff.

Acknowledgement

The authors are grateful to the administrative staff in the ENT Department in Queen's Hospital, Romford.

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