CASE REPORT

An anterior jugular vein variant in a patient requiring tracheostomy, demonstrating the importance of preoperative/procedural ultrasound

Paul Sooby,¹ Laura Pocock,² Trevor King,² George Manjaly³

¹Department of ENT, East Sussex Healthcare NHS Trust, Hastings, UK

²Department of Anaesthesia, Eastbourne District General Hospital, Eastbourne, UK

³Department of ENT, Eastbourne District General Hospital, Eastbourne, UK

Correspondence to

Paul Sooby,
paulsooby@doctors.org.uk

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SUMMARY

A 50-year-old woman was admitted to the intensive care unit (ICU) for a life-threatening exacerbation of asthma requiring intubation and ventilation for 7 days. On day 8, she was stepped down from the ventilator via the insertion of a tracheostomy to aid weaning. It was initially decided that a percutaneous tracheostomy would be attempted on ICU, however, following further consideration, it was decided that due to anatomical factors (short neck) a surgical tracheostomy would be performed by the ear, nose and throat (ENT) team. A periprocedural USS was not performed. At surgery, instead of identifying two superficial anterior jugular veins lying on each side of the trachea, one large anterior jugular vein (median vein) was found overlying the entire anterior surface of the trachea. Had a PCT been attempted without an ultrasound scan being performed, this vessel would have been punctured, creating a significant bleed that could have placed the patient's airway and/or circulatory system at risk.

BACKGROUND

Ultrasound scanning (USS) prior to percutaneous tracheostomy (PCT) insertion remains a controversial area of practice, with only 30% of intensive care consultants performing routine USS prior to tracheostomy insertion. There is, however, a good level of evidence that USS can provide important peri-procedural information. In the case presented we describe a midline median vein that could have been punctured at PCT. The patient was taken for a surgical tracheostomy for separate reasons, without an USS being performed.

CASE PRESENTATION

A 50-year-old woman presented to Eastbourne district general hospital with a life-threatening exacerbation of asthma. She required intubation and ventilation during this admission, and after 7 days of ventilation a decision was made to attempt to wean her from ventilatory support with aid of a tracheostomy. Initially, the decision was made to perform a PCT on the intensive care unit. However, after seeking a second consultant opinion, it was decided to perform a surgical tracheostomy as her neck had a relatively short superior-inferior length. At the time of operation, it was noted shortly after making the skin incision that the anterior jugular veins normally present on either side of the midline in the superficial neck tissues were not present. In their place was one

large median vein overlying the trachea in the superficial neck spaces (figures 1 and 2). In order to proceed with the operation, this vein was carefully dissected, ligated and then divided using an ultrasonic scalpel. The remaining aspects of the operation proceeded without any further unexpected steps or complications, and a variable flange tracheostomy was successfully inserted into the trachea.

INVESTIGATIONS

Of note, no periprocedural USS was performed prior to the insertion of this tracheostomy. Had this been performed, it would have been very likely that the presence of the median vein would have been identified.

OUTCOME AND FOLLOW-UP

Following successful ligation and division of the median jugular vein, the insertion of the tracheostomy proceeded without further unexpected steps or complications. The patient made a full recovery from her life-threatening exacerbation of asthma. The tracheostomy was removed 3 weeks after insertion and the site has, at writing, fully healed.

DISCUSSION

Percutaneous tracheostomy (PCT) insertion has overtaken surgical tracheostomy as the primary technique of insertion. Approximately 12 000 tracheostomies are inserted each year in the UK and of these 70% are performed in critical care.¹ The remaining 30% are performed in theatre, but some of these tracheostomies will still be inserted percutaneously. The method is favoured for a number of reasons, including: shorter procedural time, better cosmetic result, lack of need of transfer to theatre and fewer intraoperative and early complications. There are a number of adjuncts available to intensivists to aid insertion of a PCT, including bronchoscopy, capnography and ultrasound.² Prior to the procedure, USS can be used to assess unfavourable anatomy and to identify major blood vessels. Real time USS has also been used to follow the needle and guidewire to assess the position of the tracheostomy tube, and to also assess for pneumothorax.³ There is no current consensus on the use of USS, but the intensive care societies of Britain and Australia/New Zealand have commented of the benefits of using USS prior to tracheostomy insertion. USS is also readily available, inexpensive and also can be used by the bedside (which is preferable in

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Figure 1 Close-up photograph at the time of surgery of a midline anterior jugular vein overlying the trachea in the midline.

Figure 2 Photograph taken at time of surgery again demonstrating the midline anterior jugular vein.

the intensive care setting). However, despite the benefits, the use of USS is not a care standard.^{4 5} A survey in 2009 found that only 30% of intensivists routinely use ultrasound pre-operatively to identify problematic blood vessels.⁶

The anterior jugular veins are part of the superficial venous drainage system of the head and neck. In normal anatomy, the veins are paired, formed by the confluence of the superficial submandibular veins at the level of the hyoid bone. The veins then extend inferiorly to the left or right of the midline, deep only to the platysma muscle. Finally, the veins either drain into the subclavian or the external jugular veins.

However, anatomical variation in the jugular venous system has been noted by multiple sources. The most common variation is that, instead of a set of paired veins, a single anterior jugular vein forms and lies in the midline. In this instance, the vein is sometimes referred to as the median vein. This was the case in the patient that we present (figures 1 and 2). The second variation that has been noted is that the superior aspect of the anterior jugular veins is replaced by a grid of smaller venous vessels. The exact incidence of these variations is not known but they have been well documented in many anatomy textbooks.

In both of these anatomical variations and the case that we present, the superficial jugular venous system would be at risk of puncture at the time of PCT. Also, both these variations should be visible on USS, and a planned surgical tracheostomy could be undertaken. The risk of bleeding reported is variable in the literature but appears to be between 0.5% and 5%.^{7 8} Also, in a recent meta-analysis of cases where death has been directly attributed to a PCT insertion, haemorrhage was the most common cause of death.⁹ Other anatomical vascular variants in the superficial neck have also been described that could pose a risk of haemorrhage when undertaking PCT. This includes aberrant anterior communicating veins between the anterior jugular veins, prominent inferior thyroid veins and a high-riding brachiocephalic vein; puncture of the latter two have been described as a cause of mortality in PCT. There are also cases of a high-riding innominate artery (brachiocephalic) being present in the operative field in the anterior neck, although puncture of this vessel has not been described. These anomalies are all identifiable on USS and as such haemorrhage from these vessels could be prevented, and these patients could be put forward for surgical tracheostomy.^{10 11}

This case provides further evidence that USS prior to PCT insertion should be performed for all patients. Identifying unfavourable anatomical variations in jugular venous anatomy could prevent potential complications and reduce mortality associated with PCT insertion.

Learning points

- ▶ Percutaneous dilational tracheostomy is now the most common method of inserting a tracheostomy.
- ▶ Anatomy of the superficial jugular venous system is variable, and midline venous structures have been described in the literature.
- ▶ Ultrasound scanning could be used to identify unfavourable venous anatomy.
- ▶ However, only a minority of intensive care consultants use ultrasound scanning routinely prior to PCT insertion.
- ▶ Haemorrhage is the leading cause of death when mortality is directly linked to PCT insertion.

Contributors PS wrote the manuscript and performed several literature searches into the anatomical variation of anterior jugular veins. He also spoke to the patient and gained her consent to use her case and photographs. LP performed several literature searches for the use of percutaneous tracheostomy and its widespread use in intensive care. She also collated data on the complications of tracheostomy. TK and GM provided senior supervision of this paper from intensivist and otolaryngological surgery points of view, respectively. Both have provided comments and edits to this end manuscript.

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