

COMMENTARY

Ultrasound-guided tracheostomy - not for the many, but perhaps the few... or the one

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See related research by Rajajee *et al.*, <http://ccforum.com/content/15/1/R67>

Abstract

Percutaneous tracheostomy has become a routine procedure in most intensive care units, and point of care ultrasound is becoming used with greater frequency to augment diagnosis and therapy for critically ill patients. The case series from Rajajee and colleagues incorporates 'real-time' ultrasound in an effort to improve the safety of percutaneous tracheostomy. While their report does not prove that ultrasound should be used prior to or during all percutaneous tracheostomies, it does reinforce several important safety considerations concerning the anatomy of the neck, and in particular the potential to encounter bleeding complications during these procedures.

The study by Rajajee and colleagues [1] published in the previous issue of *Critical Care*, 'Real-time ultrasound-guided percutaneous dilatational tracheostomy', is certainly thought provoking. Although both percutaneous tracheostomy and ultrasound for critically ill patients have been studied for decades, Rajajee and colleagues have added a new twist: they incorporate 'real-time' ultrasound in an effort to improve the safety of percutaneous tracheostomy in a heterogeneous case series of 13 patients, some of whom have problems known to make inserting a tracheostomy more challenging (for example, two patients under cervical spine precautions, and six obese patients, of whom four had unclear anatomy by palpation). Of importance, in this case series palpation and bronchoscopy were also used to determine anatomy (that is, ultrasound alone was not tested) and bronchoscopy was used to rule out injury to the posterior

tracheal wall prior to passing the dilators. This small feasibility study does not allow us to draw any conclusions about the incremental benefits or harms of using 'real-time' ultrasound over standard approaches in higher-risk tracheostomy patients, as few patients were included and there was no comparison group. Furthermore, this pilot series does not prove that we should all fire up the ultrasound before performing our next tracheostomy, but it does reinforce several important messages.

The first message is that neck ultrasound can provide useful additional information about variations in neck anatomy [2,3], which might lead to modifications of the planned surgical approach. As Figure 3 in the study nicely illustrates [1], ultrasound can be used to measure the distance from skin to trachea, allowing the choice of an appropriately sized tracheostomy tube (that is, regular or extended length), which certainly might be beneficial for patients with larger necks. However, it can be difficult to visualize the actual needle and its tract during an ultrasound-guided tracheostomy (Figure 4 in [1]) since the needle must enter the trachea almost directly below the skin puncture site, rather than being passed beneath the probe at an angle as is typically the case when using ultrasound to guide a biopsy or a central venous catheter insertion. Indeed, Rajajee and colleagues [1] only saw the needle indentation of the tracheal wall in 4 of 13 patients. Another important limitation of ultrasound is that it does not image across air interfaces, and thus cannot be used to rule out injury to the posterior wall of the trachea.

Second, this study reminds us that multiple bleeding structures, such as the thyroid isthmus and anterior jugular and inferior thyroid vessels, may lie between the skin and the trachea [2]. Unfortunately, the case series from Rajajee and colleagues is unable to conclude whether or not knowing about the location of these structures as a result of 'real-time' ultrasound, versus either pre-procedure ultrasound or no ultrasound at all, will actually reduce risks such as bleeding or, paradoxically, increase complications. Most of the randomized trials and cohort studies conducted to date on percutaneous tracheostomy (of which few used ultrasound) have shown that the incidence of bleeding with

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percutaneous tracheostomy is quite low and rarely requires surgical intervention [4,5]. The infrequent bleeding observed in these studies likely stems from a combination of factors, including careful selection of patients, few patients having midline neck vessels, the tamponade effect of the tracheostomy tube and dressings, and the surgical technique, including minimal or more extensive clearing of the midline prior to tracheostomy insertion. In Rajajee and colleagues' case series some of the tracheostomy tubes were placed through more caudal tracheal rings in order to avoid 'pretracheal' vessels visualized by ultrasound. Readers should be cautioned that routinely inserting tracheostomy tubes between tracheal rings lying low in the neck has been associated with an increased risk of tracheoinnominate fistula (which has a mortality of up to 80%) [6,7]. Indeed, this is the reason most surgeons performing open or surgical tracheostomies will either displace overlying vessels laterally or ligate them rather than using a lower insertion. A similar approach should be considered during ultrasound-guided percutaneous tracheostomies.

The case series from Rajajee and colleagues is thought provoking, but further study is required to determine whether routine use of 'real-time' ultrasound will confer any significant benefit (or harm) over current percutaneous tracheostomy approaches. Considering the low rate of complications reported in most previous studies of percutaneous tracheostomy, we think a future study will be unlikely to detect a clinically important benefit from routine use of 'real-time' ultrasound for all patients undergoing the procedure. However, perhaps there exist subsets of patients having more challenging neck anatomy for whom ultrasound-guided needle passage might be safer than passing the needle blindly. We encourage readers to become more familiar with neck

ultrasound as an additional strategy to help plan a safe tracheostomy approach, and continue to use good clinical judgment when placing percutaneous tracheostomy tubes.

Competing interests

The authors declare that they have no competing interests. DCS holds a New Investigator Award from the Canadian Institutes for Health Research.

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