

Comparison of cricothyroid membrane identification with two ultrasound techniques in patients with neck pathology

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Introduction

Cricothyroidotomy is performed through the cricothyroid membrane (CTM). The CTM is usually inaccurately identified with the landmark technique, especially in obese subjects. Two ultrasound techniques have been described to identify the CTM: sagittal and transverse approaches. These ultrasound techniques have been shown to increase the accuracy in identifying the CTM but are associated with longer identification times¹. We evaluated these ultrasound techniques on two subjects with different neck pathology.

Methods

This study was approved by London Research Ethics Committee (16/LO/2068) and registered with UK Clinical Trials (ISRCTN 11036029). A randomised crossover study was performed, comparing the sagittal and transverse ultrasound techniques on two subjects with different neck pathology in identifying their CTM.

Subject A had previous hemi-mandibulectomy, neck dissection and radiotherapy and Subject B has an enlarged thyroid gland (Figure 1). Anaesthetists (ST3 level and above) were recruited from a single centre to participate in the study. Training of the ultrasound techniques were provided to the anaesthetists and adequate training time were permitted until they were confident with each technique before proceeding to the study subjects.

The CTM of both subjects were demarcated by a radiologist with an invisible ultraviolet marker pen, which was only revealed with an ultraviolet torch (Figure 2). The main outcomes measured were time and accuracy of CTM identification with the sagittal and transverse ultrasound techniques. Ultrasound images of both subjects are as shown (Figure 3 and 4).



Figure 1: Subjects' anterior neck appearances

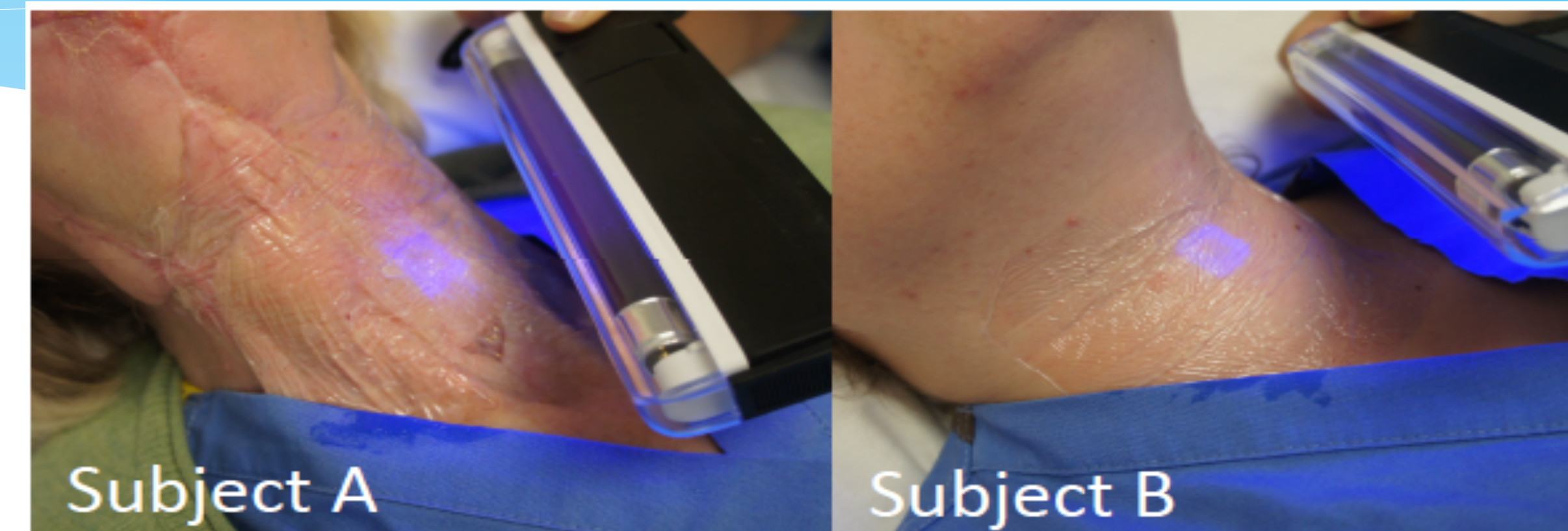


Figure 2: CTM demarcation with UV torch

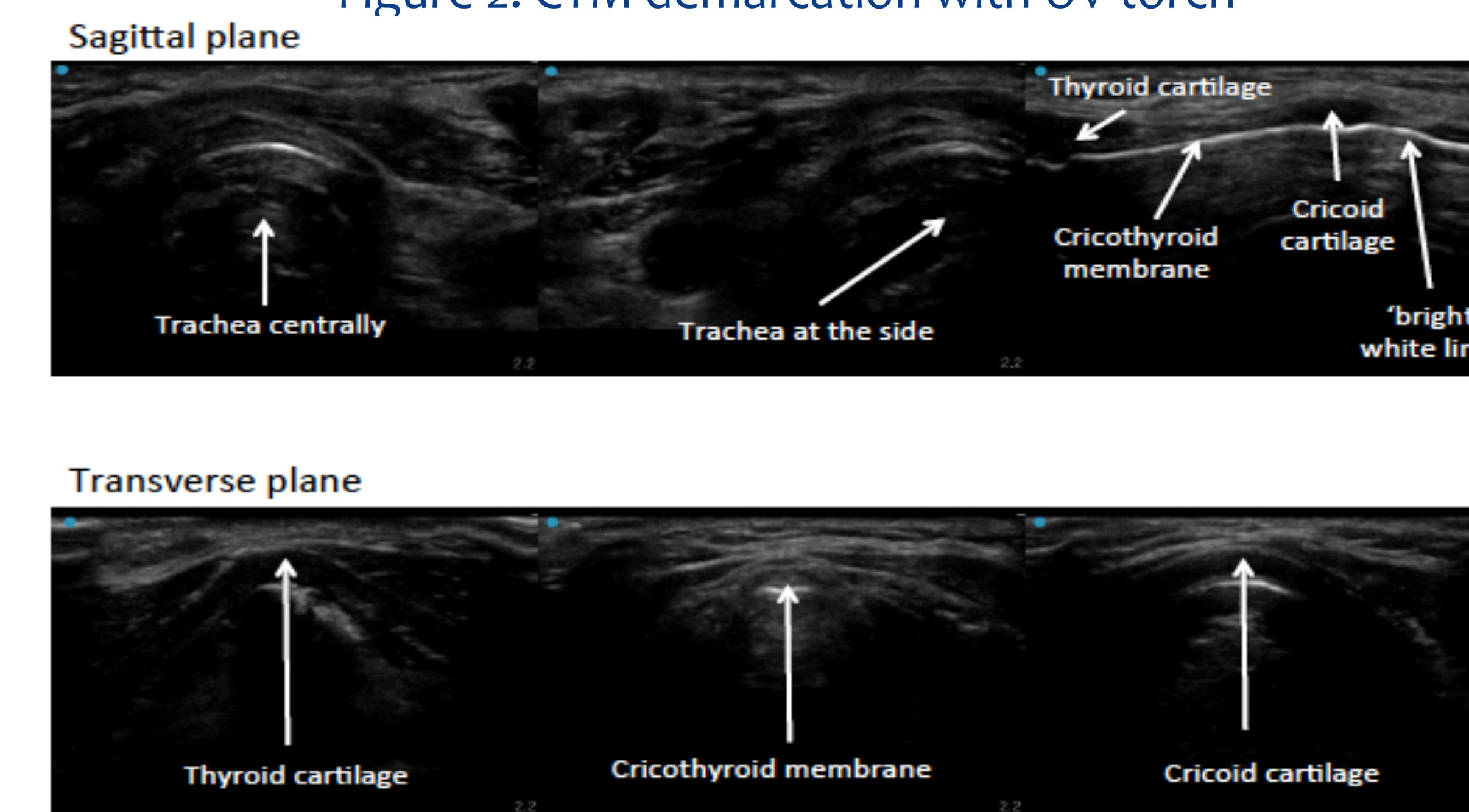


Figure 3: Ultrasound images of Subject A

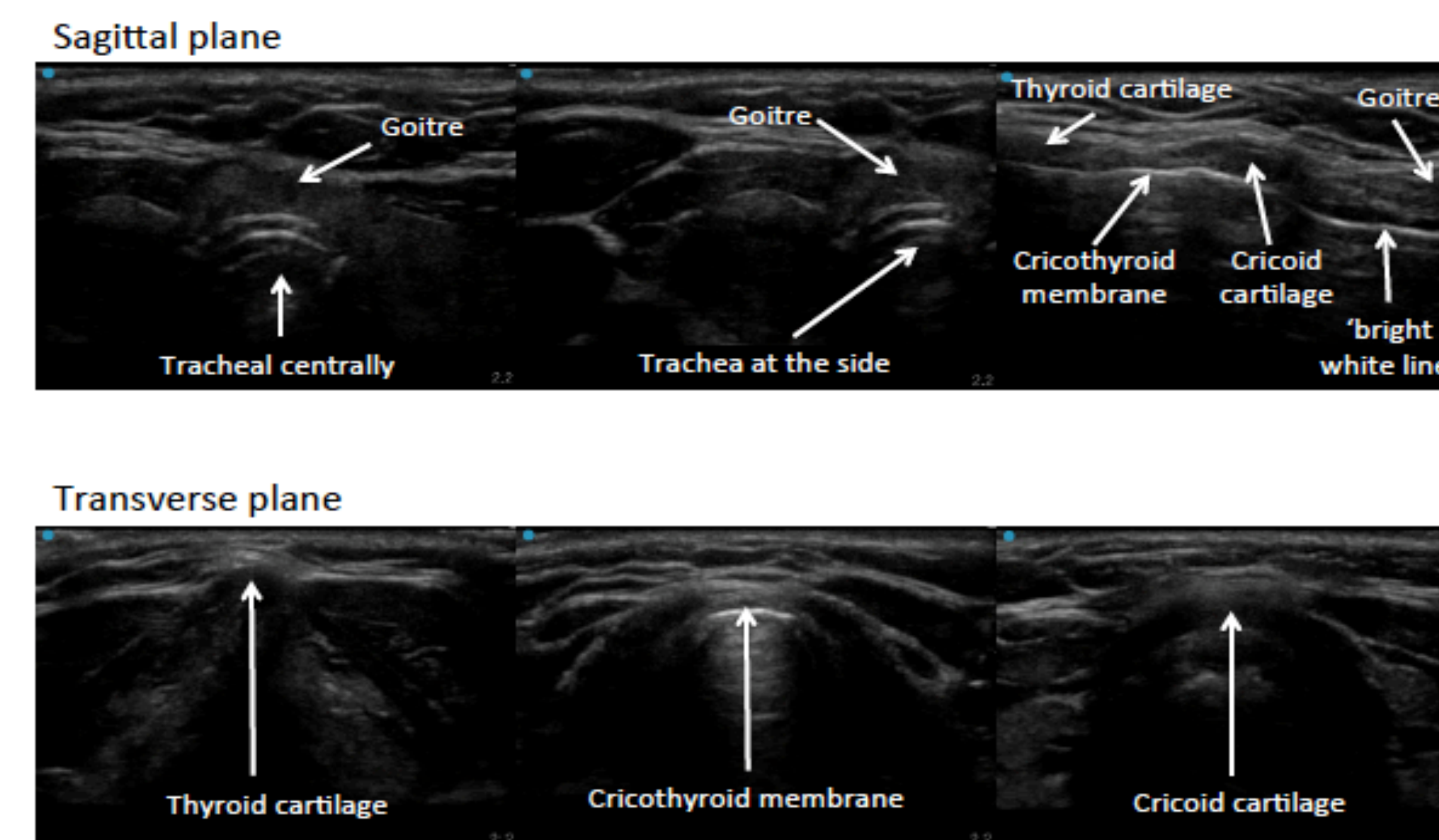


Figure 4: Ultrasound images of Subject B

Results

Forty anaesthetists were involved in the study, with all (100%) proficient in utilising ultrasound in clinical practice. In subject A (previous neck surgery), the mean (SD) times to identify the CTM with the sagittal and transverse techniques were 69.0 (44.9) s and 41.3 (28.6) s, whereas in subject B (enlarged thyroid gland), they were 55.8 (32.6) s and 29.7 (15.6) s. Transverse ultrasound technique was significantly faster than the sagittal ultrasound technique ($p < 0.001$). In comparing accuracy, the CTM of subject A was accurately identified by 18 (45%) anaesthetists with the sagittal technique and 20 (50%) with the transverse technique, whereas in subject B, it was accurately identified by 31 (78%) anaesthetists with the sagittal technique and 27 (68%) with the transverse technique.

Discussion

In both subjects, the transverse technique was significantly faster than the sagittal technique. In Subject A, the transverse technique was more accurate in identifying the CTM compared to the sagittal technique. However in Subject B, the sagittal technique was more accurate in identifying the CTM compared to the transverse technique.

The key to identify the CTM accurately on ultrasound is identifying the 'bright white line' between the thyroid cartilage and cricoid cartilage. The 'bright white line' is the strong reflection as the ultrasound beam reaches the tissue/air border and everything beyond that point are reverberation artefacts².

There are more steps and ultrasound transducer handling with the sagittal technique compared to the transverse technique, explaining the longer time required for the sagittal technique.

Conclusion

Our study concluded that the most predictive factor in accurately identifying the CTM is the subject itself. Patients with neck pathology will present with a variance of surface landmark of neck anatomy. Further studies on ultrasound identification of CTM in patients with neck pathology should be explored.

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References:

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2. Kristensen MS. *Acta Anaesthesiologica Scandinavica* 2011; **55**: 1155-1173.