

Difficult airways: A 3D printing study with augmented virtual reality for fiberoptic intubation

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Introduction

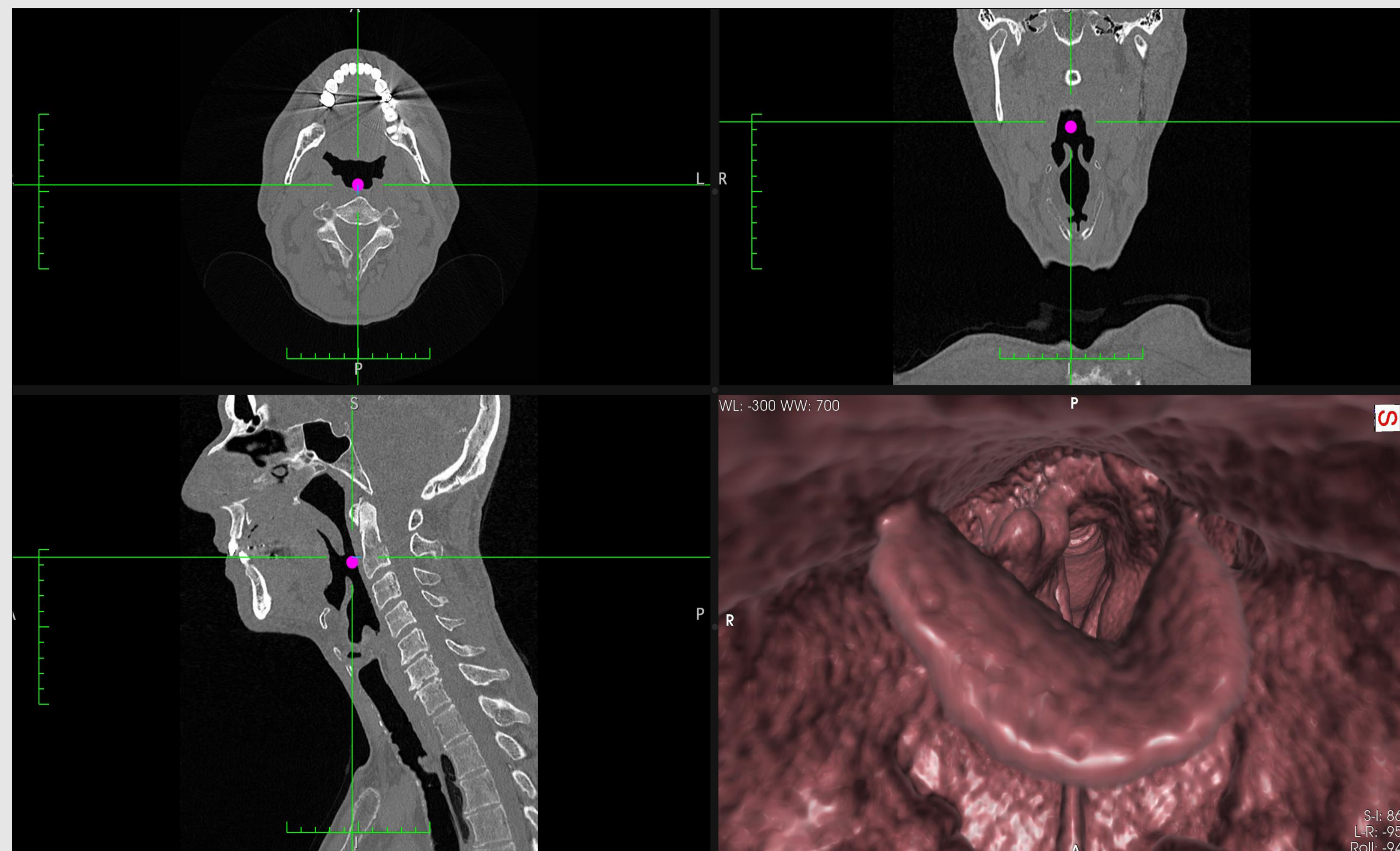
Head and neck cancer patients present unique airway challenges to the anaesthetist. Oropharyngeal, laryngeal and hypopharyngeal tumours significantly distort and narrow the anatomy of the airway.

We report the use of a 3D augmented reality software combined with 3D printed models to assess the anatomy of difficult airways and to assist the formulation of the most optimum airway management strategy in difficult head and neck cancer patients.

Method

DICOM files of the patients CT scans have been imported to a 3D rendering software Osirix (Pixmeo SARL, Switzerland).

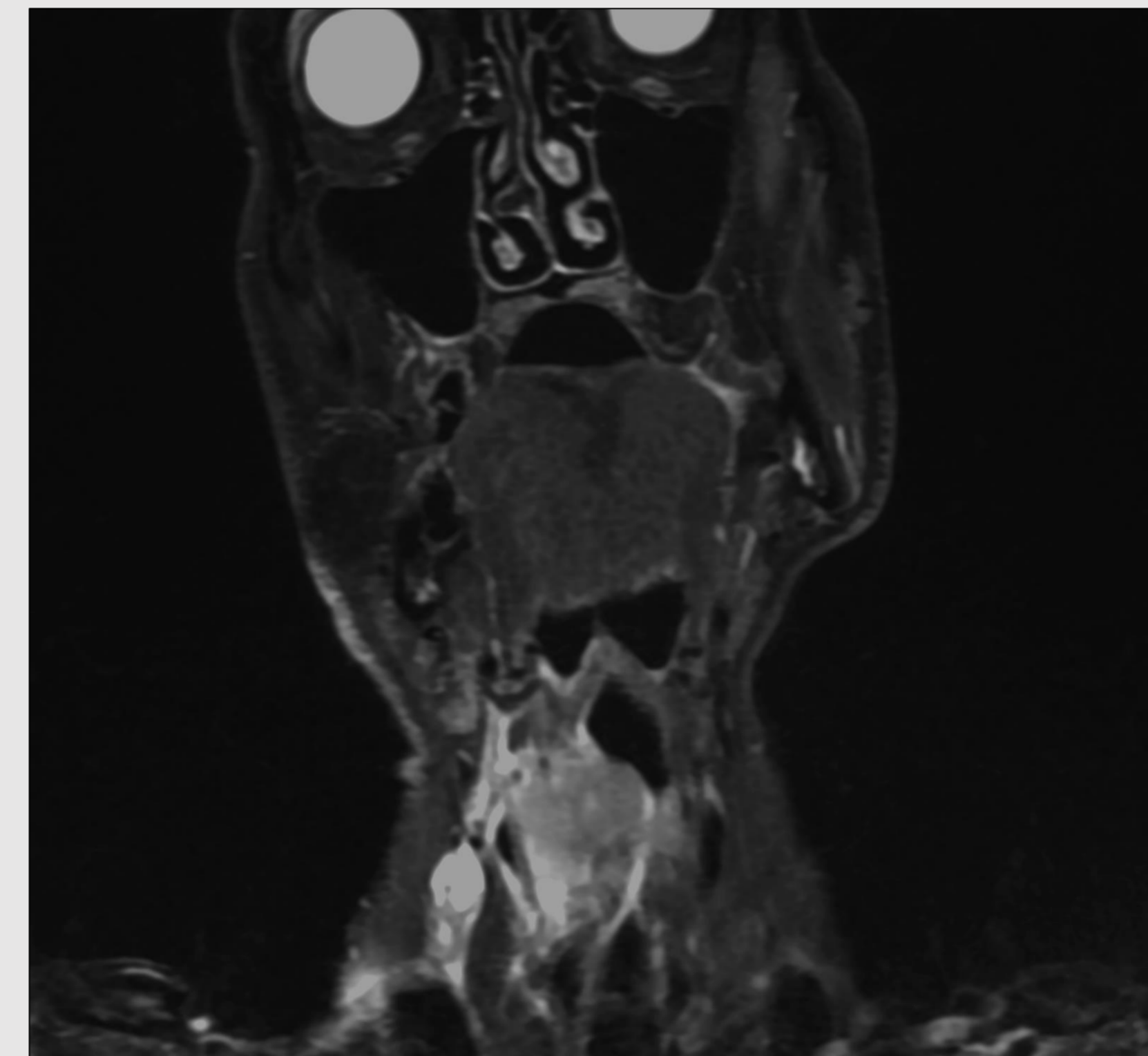
Volume rendered models have been constructed for initial airway assessment. Subsequently, serial surface rendered models have been generated to create a virtual endoscopic path of the airway in order to simulate the fiberoptic approach (see video link).



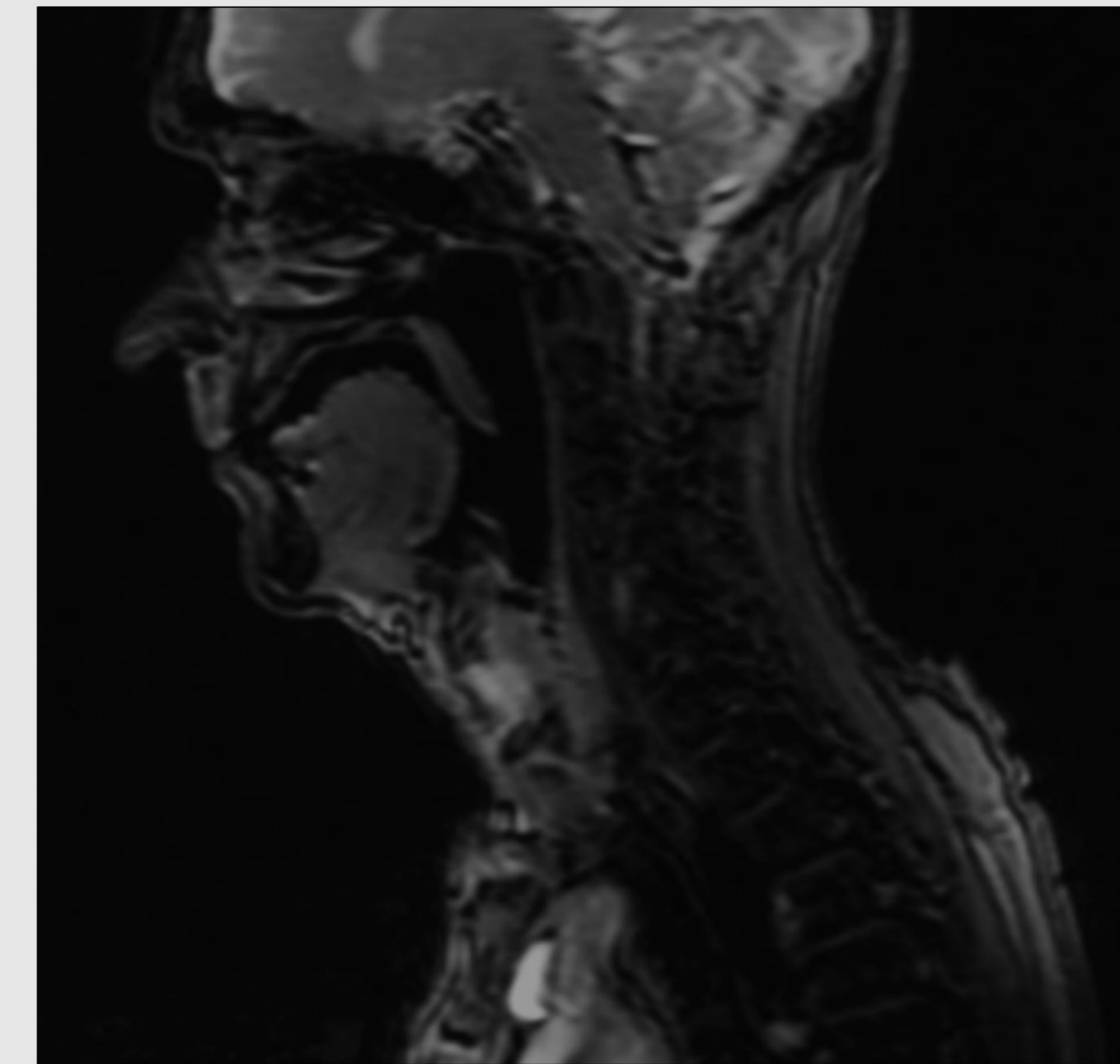
Normal virtual laryngoscopy view

Application

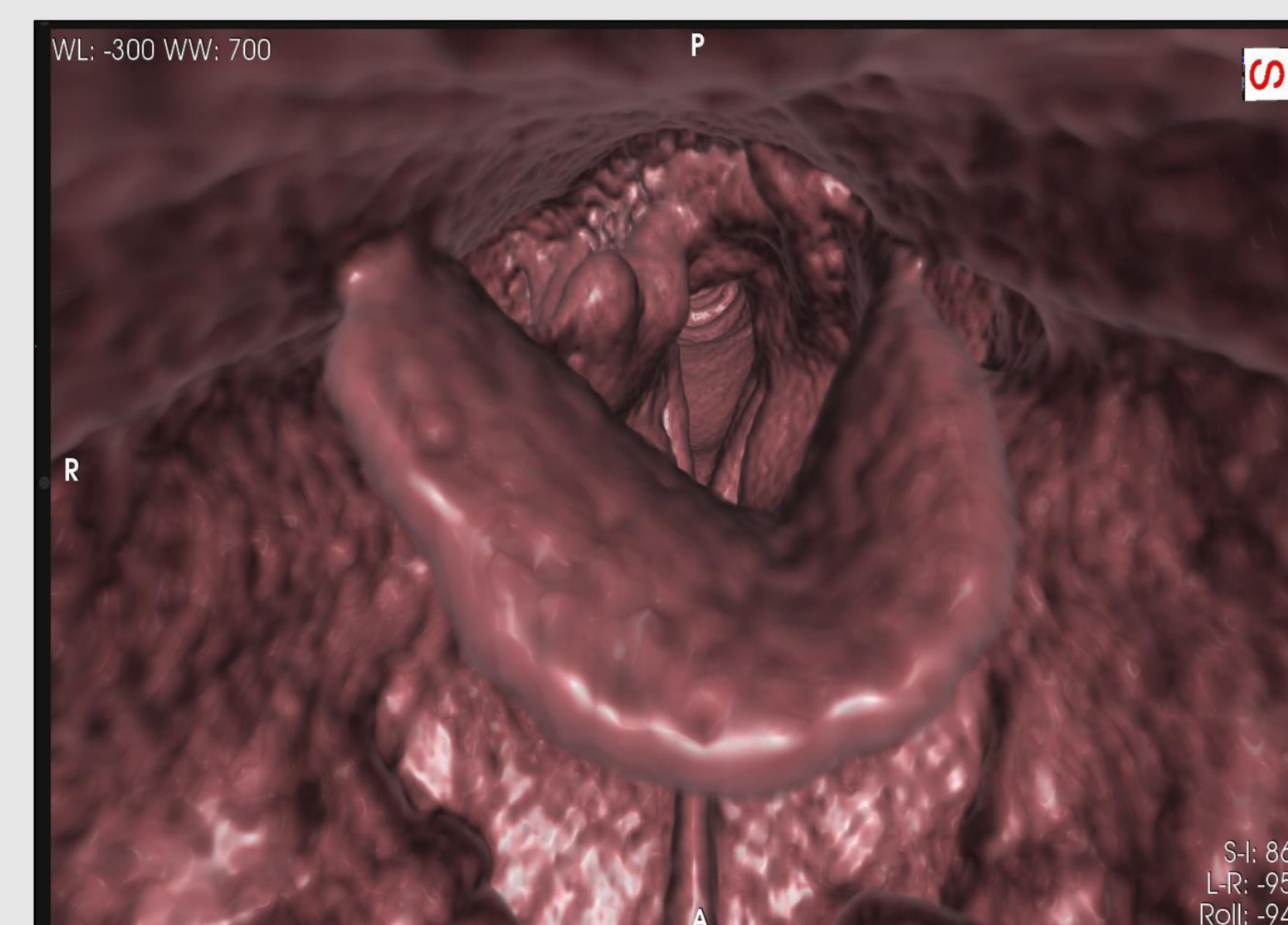
73 years old gentlemen who presented with biphasic stridor and impending airway obstruction. Imaging showed extensive hypopharyngeal malignancy. The patient required intubation for a surgical tracheostomy and biopsies. Augmented virtual reality was utilized, allowing virtual fiberoptic intubation to aid airway planning.



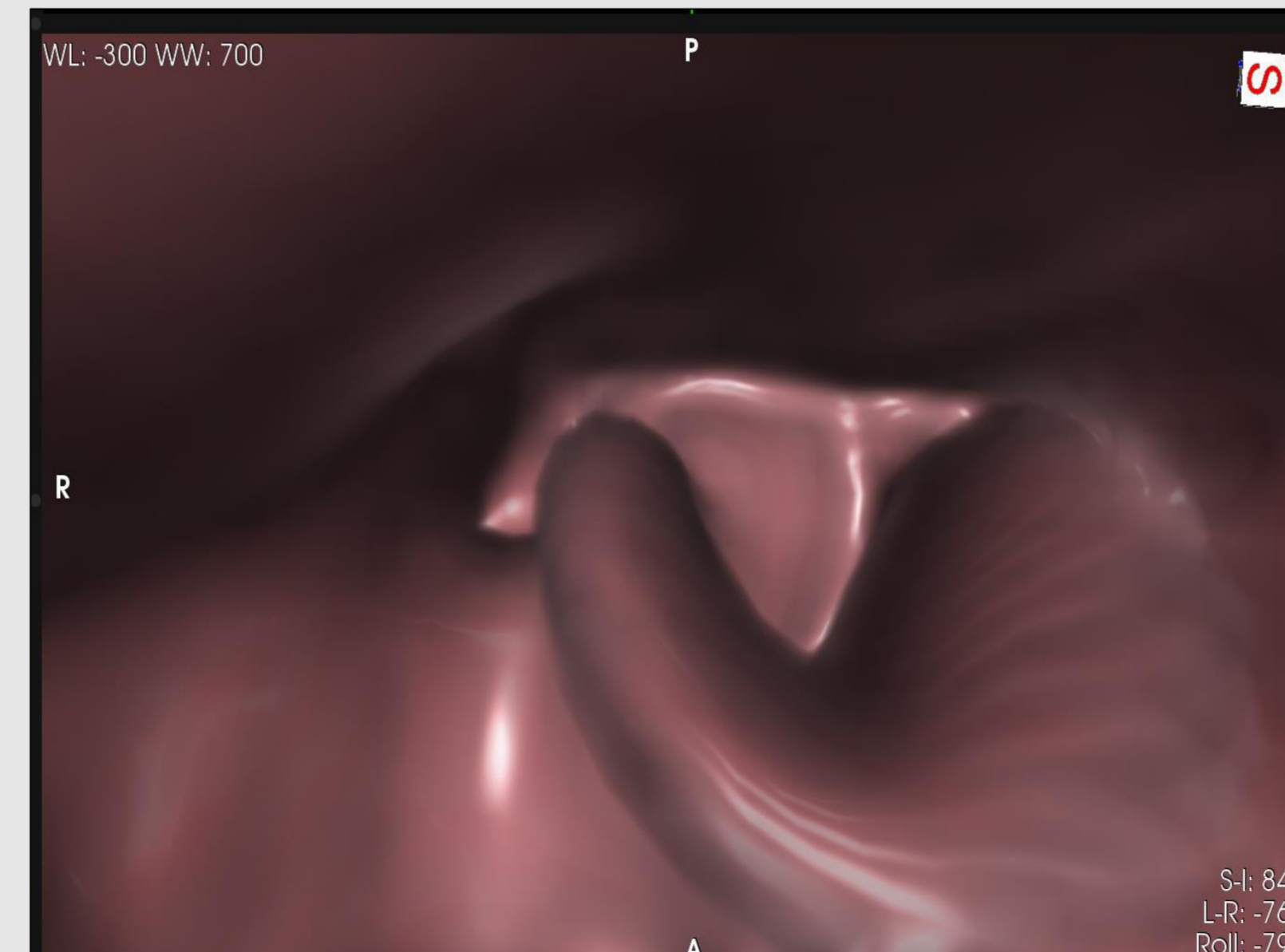
MRI coronal view



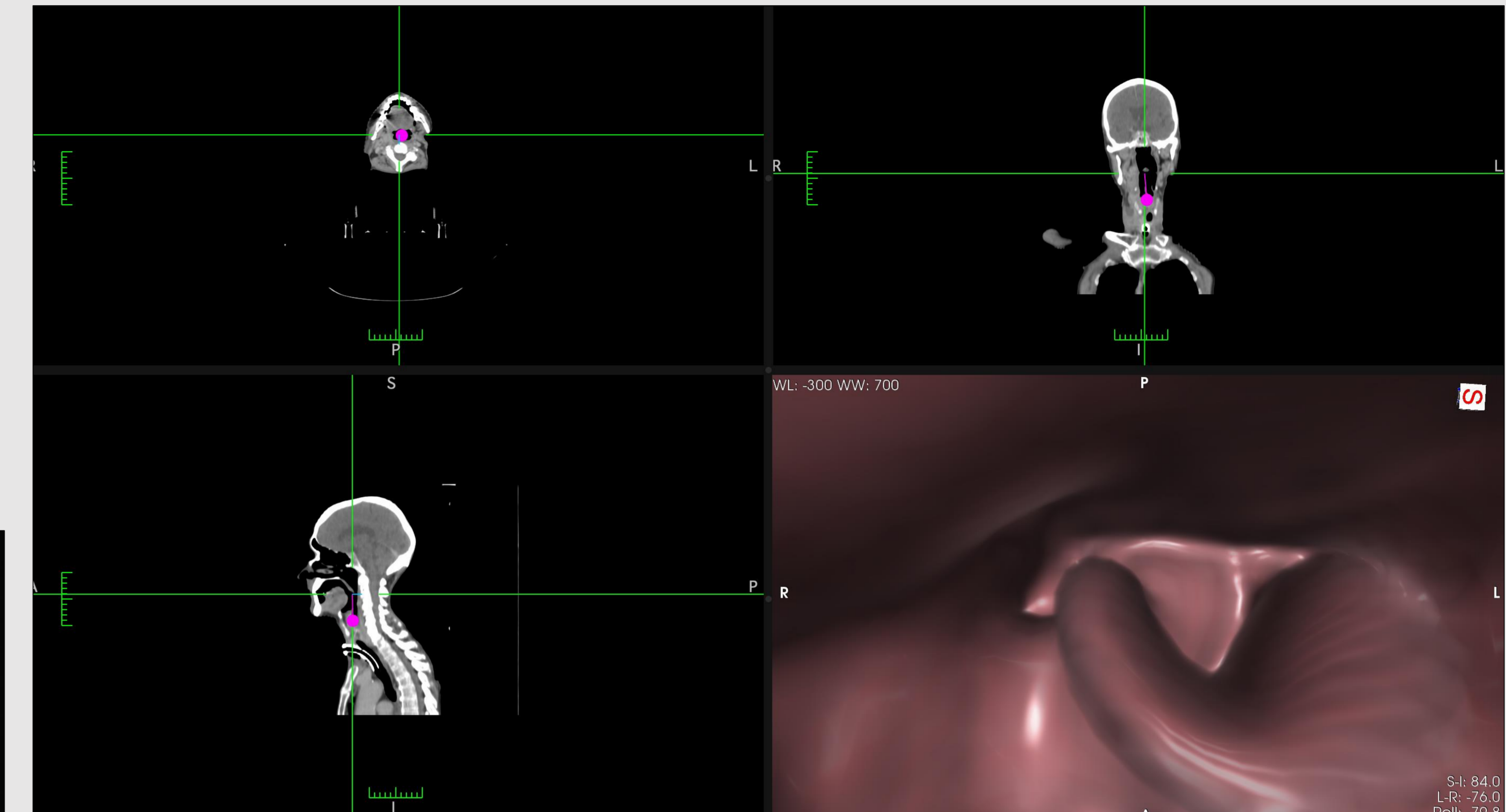
MRI sagittal view



Normal laryngoscopy view



Abnormal laryngoscopy view



Abnormal virtual laryngoscopy view

Virtual Reality Video Link

PASSWORD: NWAM
<https://vimeo.com/369965402>



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Conclusion

Head and neck tumours significantly distort the airway. Thorough studying of the relevant anatomy, prior to undertaking airway management in such cases, aids in selection of the most appropriate approach.

We describe a useful and novel pre-assessment strategy that allows virtual visual three dimensional assessment of the airway anatomy, allowing identification of potentially difficult anatomical features. This allows the anaesthetist to anticipate any critical steps, adjust the plan accordingly, and improves first attempt success rate of tracheal intubation.