Implementing virtual endoscopy technology for head and neck cancer patients with anticipated difficult airways onto PACS radiology systems.

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Background

Our institution is one of the largest in the UK that treats patients with head & neck cancer. It is the regional specialist centre for head & neck cancer and identified as excellent by the NICE peer review team.

The Fourth National Audit Project (NAP4), (1) a review of all major complications of airway management in the United Kingdom, was published 2011. One of the key findings of the NAP4 report was the poor assessment and subsequent planning of cases that ultimately led to significant airway morbidity(1).

Additionally, patients with head, neck, and tracheal disease were far more likely to experience difficulties in the management of their airway. Clinical examination has been shown to be both inaccurate and insufficient, particularly in patients with head, neck, and tracheal disease.

Multi-plane computerized tomography (CT) scanning is performed for a large proportion of patients with head and neck disease. (2) These static CT images are presented in a two-dimensional format and not allow dynamic intraluminal assessment and informed airway planning.

Virtual endoscopy (VE) is a valuable tool that bridges the gap in airway assessment by providing a noninvasive, anatomically accurate representation of intraluminal geography of the airway, including supraglottic, glottic, and subglottic structures.

By reconstructing diagnostic CT images, a three-dimensional (3D) ‘‘fly-through’’ video of endoscopic anatomy is created, allowing tailored comprehensive airway management strategies in advance of any direct patient intervention.

This makes it patient specific and allows the anaesthetist the advantage of forward planning the airway management for that surgery. It therefore has the power to reduce complications.

El-Bogdadly et al’s (3) study showed a change in the airway management plan in half of the cases when virtual endoscopy videos were reviewed by anaesthetists, with the vast majority changing to a more cautious plan (90.6%).

Aims

Our aim is for head and neck cancer patients patients to receive a virtual endoscopy run through video made by the radiologists so that these images are available to view on the PACS system by anaesthetists. This would enable the anaesthetists to have information from, CT scans and virtual endoscopy hence having a more informed and rounded approach to planning the airway management plan.

This quality improvement project will improve airway management, airway safety, and reduce unexpected critical incidents for patients receiving anaesthetics with head and neck pathology. The objectives are to establish a successful virtual endoscopy project in our trust. This will advance airway assessment for anaesthetists.

Method

The consultant surgeon reviews the patient referrals in the outpatient clinic. The patients deemed to have difficult airways from history, examination and from the CT scan images are identified by the surgeon. The list of patients are given to the anaesthetist. The anaesthetist gives this list of patients to the Consultant radiologist who would be constructing the virtual endoscopy videos.

The virtual endoscopy videos are created from the helical CT imaging of the airway pathology in axial, coronal and sagittal views. The radiologist creates the ‘fly through’ virtual endoscopy video. The radiologist uses Osirix MD to create the virtual endoscopy videos.

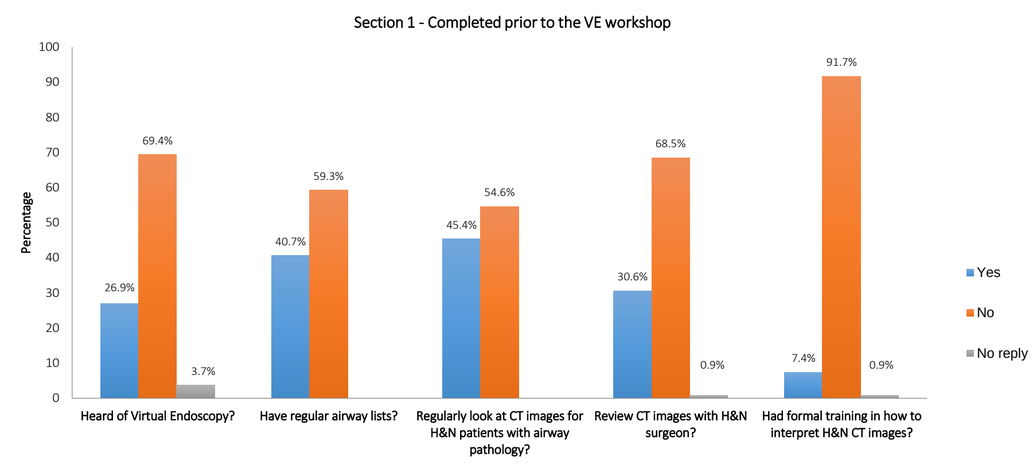
Once the virtual endoscopy videos are created they are uploaded to PACS (Patient Archive and Communication system by the radiologists. The PACS system is viewable on all trust wide hospital computers.

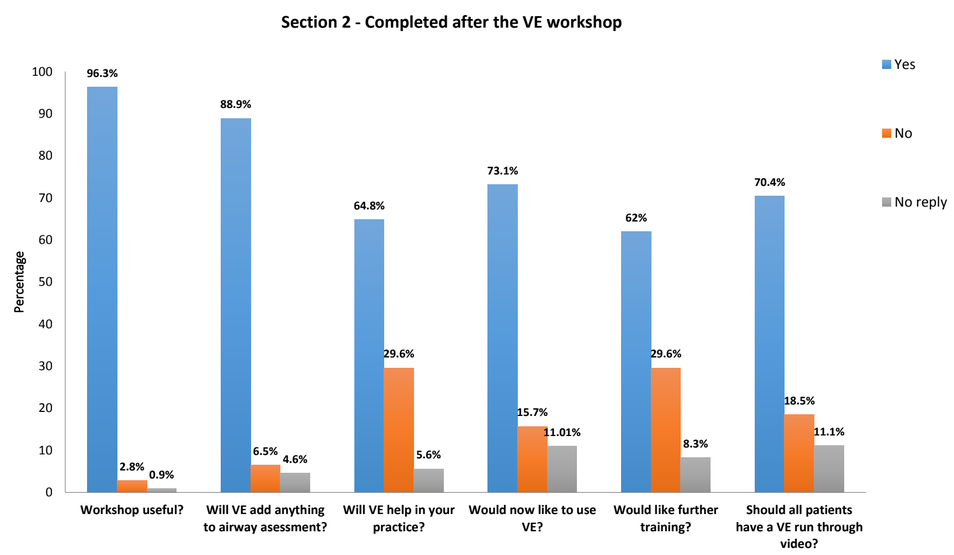
The anaesthetist can review the virtual endoscopy video comprising axial, coronal, and sagittal views of the airway. The structures can be circumnavigated in a 3D perspective Figure1 including supraglottic, glottis and subglottic structures. The other multidisciplinary team members who could also access the fly through videos are the surgeons. The videos are stored as part of the PACS system.

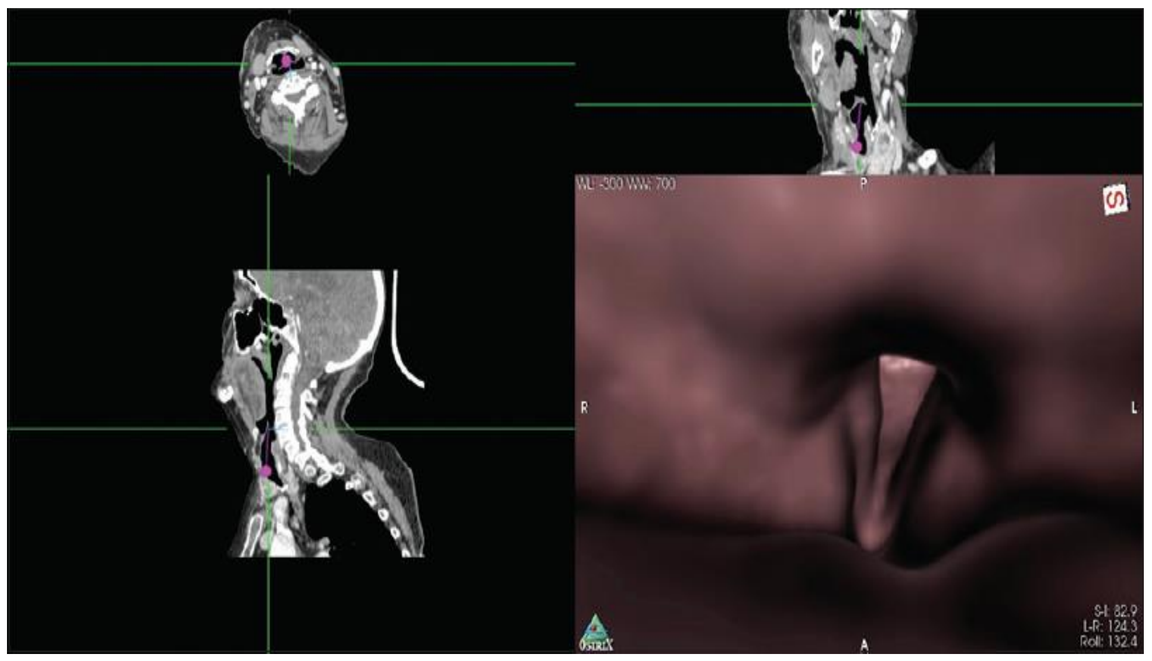
Results

A survey was performed at a national conference prior to the QI being implemented. The survey was completed by anaesthetists who perform airway and non airway lists.

The survey showed that 88.9% of anaesthetists who attended the national difficult airway conference felt virtual endoscopy will add to airway assessment. 70% the anaesthetists who attended the national conference felt that all patients with difficult airways should have the virtual endoscopy videos.







Outcomes

- The grant will fund the performance of the research project. Once the software is installed the videos will be created. A randomised controlled study looking at the airway outcomes for head and neck cancer patients who had virtual endoscopy videos created against those patients that did not will be performed.

References

- 1. Cook TM, Woodall N, Frerk C, Fourth National Audit Project. Major complications of airway management in the UK: results of the Fourth National Audit Project of the Royal College of Anaesthetists and The Difficult Airway Society. Part 1: Anaesthesia. Br J Anaesth 2011; 106: 617-31.
- 2.Norskov AK, Rosenstock CV, Wetterslev J, Astrup G, Afshari A, Lundstrom LH. Diagnostic accuracy of anaesthesiologists’ prediction of difficult airway management in daily clinical practice: a cohort study of 188 064 patients registered in the Danish Anaesthesia Database. Anaesthesia 2015; 70: 272-81.
- 3.El-Bogdadly K, Onwochei D, Milhoff B, Ahmad I The effect of virtual endoscopy on diagnostic accuracy and airway management strategies in patients with head and neck pathology: a prospective cohort study Can J Anesth 2017; 64(11):1101-1110