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The Future of ORL-HNS and Associated Specialties Series

The future of imaging in otolaryngology

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Computed tomography is presently the mainstay of imaging in ENT. Fine bone detail defines clearly the state of inner and middle ears. Coronal computed tomography (CT) sections of the sinuses likewise provide a necessary 'road map' of variable anatomy which needs to be studied by the surgeon before embarking on functional endoscopic sinus surgery (FESS). The new spiral CT machines provide sectional images of neck and chest in a greatly reduced time, making easier the hunt for the 'unknown primary' in a patient who presents with an enlarged lymph node in the neck, and also improving the accuracy of detection of small neoplastic nodes. Volumetric Multislice CT is an advance from spiral in that multiple slices can be obtained at the same time and will mean patients can be scanned up to eight times faster than on current spiral scanners. This combined with much thinner slices for very little increase in radiation dose will revolutionize CT for the larynx and neck. The challenge for radiologists will be the need for workstation review of hundreds of images down to 0.5 mm, enabling isotropic multiplane reformats in any direction. This combined with contrast infusion for the head and neck will delineate malignancies and enable their vascular associations to be accurately described. Direct coronal imaging for temporal bones and sinuses will be an examination of the past as with one acquisition all planes can be produced afterwards. The new multislice CT will provide literally hundreds of images – too many to photograph and send to clinics. ENT radiologists and surgeons will need to evolve new methods of viewing and discussing images together. Clinical meetings in future may be spent gathered around a PC or workstation or studied on video.

Magnetic resonance imaging (MRI) although unsatisfactory for demonstrating the middle ear is now the imaging investigation of choice for inner ear lesions and their central connections. The cranial nerves in the internal auditory meatus can be depicted reliably and the contents of the scalae of the cochlea are being shown and pathology estimated sometimes with the help of contrast enhancement. Magnetic resonance angiography is a non-invasive way of demonstrating the major vessels of the head and neck, although conventional angiography is still clearly superior in demonstration of very small vessels. Perhaps the most disappointing aspect of imaging has been the almost complete failure of tissue characterization with a few notable exceptions such as the way MRI can differentiate between cholesteatoma and cholesterol granuloma, the two commonest expansile lesions of the petrous apex shown by CT. Recent improvements in anatomical resolution have led to better discrimination of certain pathologies on the basis of their exact site and shape, as well as greater sensitivity in detection of small tumours and lesions such as arterial dissections. However, sometimes neither CT nor MRI is able to distinguish recurrent or continuent carcinoma from radiation damage although this is now being achieved by metabolic imaging such as FDG-PET or SPECT (FDG – Fluoro-deoxyglucose-PET – Positron emission tomography – SPECT – Single photon emission computed tomography). Various regimes are now being introduced to use metabolic imaging in combination with CT or MRI to overcome the problem of distinguishing recurrent tumour from fibrosis. MRI guided laser induced thermotherapy has also been described for treatment of recurrent head and neck tumours.

Ultrasound is underused in this age of CT and MRI, but is often the most efficient investigation available to the clinician with a diagnostic problem related to soft tissues of the head and neck. It should be the investigation of choice for thyroid nodules, salivary glands, and most neck lumps and in many cases it is possible to make a confident diagnosis before fine needle aspiration cytology (FNAC). Ultrasound shows greater detail within lymph nodes than either CT or MRI and often reveals

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other clinically useful information. For example the ultrasound appearance of medullary cell carcinoma is virtually pathognomonic. 3D volumetric power Doppler studies have proved valuable in differentiating benign and inflammatory lesions from malignant. Image guided biopsy is a routine procedure in head and neck oncology, in which the treatment regime is dependent upon a tissue diagnosis. Ultrasound and CT are used in most cases, but there is an increasing role for MRI guided biopsy particularly of lesions near the skull base. It is in the assessment of the clinically N_0 neck that ultrasound can make the greatest impact on clinical management where it has been shown to be superior to CT and MRI in the detection of lymph node metastases. In specialist hands lymph node ultrasound, in combination with FNAC, has a sensitivity of over 90 per cent, with a specificity of over 85 per cent.

Conclusion

The future of imaging in otolaryngology would seem to lie, perhaps fairly equally, with four modalities:

1) Computed tomography for the best display of bone detail and calcific lesions (particularly for middle ear and sinuses), and with the new ultrafast volumetric multislice CT to demonstrate normal as well as pathological vascularity.
2) Magnetic resonance imaging for lesions of the inner ear and its central connections, and increasingly for head and neck tumours.
3) Nuclear medicine in the form of metabolic imaging to distinguish continuent or recurrent tumour from radiation damage.
4) Ultrasound for assessment of lymph nodes, superficial neck lumps and salivary glands, and in combination with FNAC as the quickest and easiest way to obtain an initial and necessary pre-treatment tissue diagnosis.

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