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Overview

Modern Radiology in the Management of Head and Neck Cancer

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Abstract

The accurate staging of head and neck cancer is vital to direct appropriate management strategies and to deliver the best radiation therapy and surgery. Initial challenges in head and neck cancer imaging include determination of T- and N-stage, stage migration with detection of metastatic disease and identification of primary disease in the patient presenting with nodal metastases. In follow-up, imaging has an important role in assessing patients who may require salvage surgery after radiotherapy and assessing clinical change that may represent either residual/recurrent disease or radiation effects. This overview gathers recent evidence on the optimal use of currently readily available imaging modalities (ultrasound, computed tomography, magnetic resonance imaging and positron emission tomography-computed tomography) in the context of head and neck squamous cell cancers.

Key words: Computed tomography; radiotherapy planning; squamous cell carcinoma; staging

Statement of Search Strategies Used and Sources of Information

This overview reflects the opinion and experience of the authors and evidence has been presented accordingly. It is based upon our own research findings and clinical trial experience. It is not a systematic review.

Introduction

This overview represents the opinion and experience of the authors. No formal search strategy was undertaken in the presentation of these materials. This overview restricts itself to squamous cell cancers in the head and neck and other diseases, such as salivary gland disease or paranasal sinus adenocarcinomas, are not discussed.

Computed Tomography

Computed tomography (CT) continues to evolve. Tube rotation times are down to 0.3 s. These speeds, needed for cardiac imaging, easily surpass requirements for CT imaging of the neck. Mid-range, 64-detector systems provide consistently high-quality images, even during dynamic manoeuvres such as 'eee' phonation CT for laryngeal tumours and 'puffed cheek' CT for oral cavity tumours. These breath-hold manoeuvres can be comfortably achieved by all but the most dyspnoeic patients [1,2].

The decision to use CT or magnetic resonance imaging (MRI) in staging head and neck cancer remains an institutional preference, which is reflected in the latitude offered in various guidelines [3,4]. However, MRI is our preference. MRI has superior contrast resolution compared with CT, so improving tumour detection and margin definition. This holds particular importance in difficult to see areas for fibre optic nasendoscopy, such as the tongue base. Another diagnostic situation where MRI has unequivocal advantage over CT is the investigation of nerve or referred pain. MRI is more likely to show perineural invasion than contrast-

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enhanced CT and due to the complex network of neural relays in the head and neck the disease may be distant from the site of symptoms so a good working knowledge of cranial nerve anatomy is of importance in image interpretation. The pre-eminence of MRI as the anatomical imaging test of choice continues to gain ground as hardware improvements are made and supplemented by an ever growing choice of sequences including functional acquisitions (see below). These developments mean shortened scan times and superior tumour detection. Staging CT in my institution is used only when MRI is contraindicated or where patient intolerance has rendered the MRI non-diagnostic (Figure 1).

Patients with a head and neck carcinoma are at increased risk of developing a second malignancy at an annual rate of 4–7%, the lung being the most frequent other site [5,6]. The risk of harbouring a synchronous lung primary at first diagnosis is around 1% [7]. A chest radiograph is insufficiently sensitive for effective screen detection of lung tumours [8,9]. The incidence of distant metastases in head and neck cancer at presentation remains low compared with many other tumours and is dependent upon the characteristics of the primary, i.e. location, stage and biology, as well as the extent of nodal involvement. Once again the lung is the most common distant site. These factors together with the wide availability of CT has led to chest CT being part of many standard staging protocols.

Lung cancer screening with low dose CT is now underway in the USA. It has been muted that such patients may also benefit from screening for head and neck cancer given the conflated risk in this patient population (Figure 2) [10].

CT continues to be used alongside other modalities when assessing the treated patient, be it response assessment, complications or suspected recurrence. This author's preference is a 3 month post-treatment scan of the neck as a helpful reference for future detection of suspected local recurrence because anatomical distortions from both disease and treatment make *de novo* detection a challenge. The 3 month scan should ideally be MRI with CT chest added-in on clinical grounds, e.g. incidental lung nodule found at staging. This current practice is changing for those treated with chemoradiotherapy (CRT), as evidence favouring post-treatment positron emission tomography-computed tomography (PET-CT) becomes embedded into clinical practice (see below).

The radiotherapy planning CT currently remains indispensable. This is why CT is the imaging modality by which most radiation oncologists gain an understanding of the complex anatomy of the head and neck region, aided by the pioneering CT atlases of neck clinical target volumes [11]. Scan acquisition in planning should be of diagnostic quality to optimise accurate tumour delineation, but with reference made to concurrent MRI and PET-CT where available. International MRI-Linac collaborations are being forged and although less complex anatomical sites will be the test bed for the new technology, head and neck will be expected to follow. Hence, CT may also become a fall back rather than first choice modality in this setting.

It is worth mentioning the perennial debate around how best to delineate bone and cartilaginous invasion in head and neck cancer. This is a key issue because osseous or cartilaginous disease has pivotal staging implications that influence treatment choices and prognosis in a number of head and neck sites, from skull base to trachea. CT used to be considered the test of choice, but now MRI, provided a high-quality study can be achieved, holds primacy when it comes to understanding the subtleties of shade in what has been coined the 'evil grey' [12–14].

CT protocols are less varied than MRI, but the technique still requires optimisation and patient co-operation. Most head and neck cancers will be satisfied by a standard technique from skull base to thoracic inlet at 1–1.5 mm

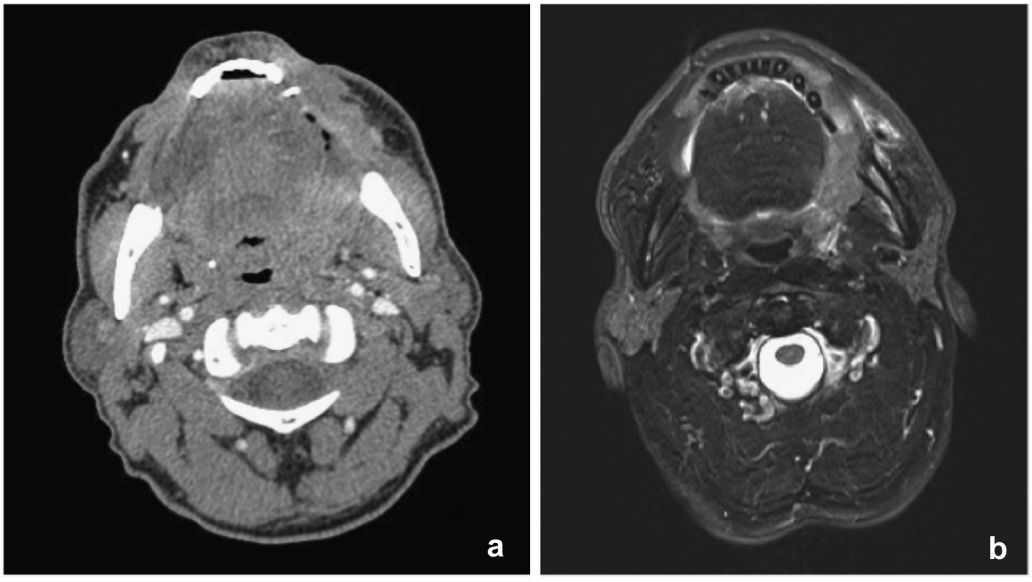

Fig 1. Left oropharyngeal/buccal squamous cell carcinoma on (a) contrast-enhanced computed tomography and (b) T2 axial DIXON-FS magnetic resonance imaging (MRI), showing the benefits of superior contrast resolution in MRI.

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