Contemporary Use of Imaging Modalities in Neck Mass Evaluation

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KEYWORDS

• Neck mass • Neck ultrasonography • Neck computer tomogram • Neck magnetic resonance imaging • Diagnosis

KEY POINTS

- The incidence of new cases of head and neck cancer in the United Kingdom is approximately 8100.
- In most patients presenting with neck masses, the diagnosis is benign.
- The clinical effectiveness and efficiency of separating malignant from benign not only has a significant impact for the patient but also economic benefit to health care providers.

Introduction

A patient presenting to clinic with a neck lump is a common scenario for oral and maxillofacial/head and neck surgeons. In this article, the diagnosis and management of common and important neck masses are discussed, with particular focus on the various roles of imaging. The focus is on adult neck lumps. Thyroid lumps and pediatric cervical swellings are excluded from this discussion. More emphasis is placed on the practicalities of imaging and management rather than the provision of an exhaustive list of differential diagnoses.

In our department, 900 new patients present to a designated 1-stop neck lump clinic annually. The service allows regional general medical and dental practitioners the opportunity for rapid referral of patients with neck lumps of concerning origin. Most patients attending the 1-stop clinic receive senior clinician assessment, coupled with immediate ultrasonography (US) and cytologic investigations, where indicated. By the end of the patient's visit to the clinic, the patient receives a preliminary diagnosis and a scheduled investigative time scale. After a contemporary departmental audit, approximately 12% of these new referrals are diagnosed as malignant.

Approximately 8100 new cases of head and neck cancer are registered in England annually.[1] Seventy-three percent of patients in the United Kingdom with head and neck cancer are referred from primary care under the urgent or 2-week referral system.[2] In the United Kingdom, the incidence of cancer with unknown primary is 10,000, many of these present as cervical malignancy with undiagnosed primary origin.[3]

In our clinic, most presenting neck lumps are benign, with reactive or suppurative lymphadenopathy, lipomata, and superficial and deep cervical cysts. Benign disease of the parotid tail and submandibular and sublingual glands are also common presentations. Less frequent referrals relate to variations of normal anatomy: a prominent carotid bulb or a spinous process of cervical vertebra or a cervical rib.

The radiology team has an important role in the assessment and diagnosis of neck lumps. In particular, the ability of the radiologist to identify cancer spread and accurately stage malignancy is a key and often pivotal role in influencing treatment at the multidisciplinary team meeting. This situation has reflected the advances across the field of imaging in recent times. In this article, the imaging modalities available are reviewed, highlighting their merits and hurdles of use, and, second, the common and significant neck lumps presenting to our head and neck clinic are reviewed.

Anatomic classification of the neck

Cervical Lymphatic Classification

The extensive lymphatic system in the head and neck provides a physiologic mechanism for channeling fluid, cells, and protein from the interstitium into the systemic circulation. There are approximately 300 lymph nodes within this region, which account for 40% of the total body lymph nodes. An understanding of the head and neck lymphatic system is needed in the management of patients with head and neck cancer with regional metastasis. Lymphatics in the neck have been classified into superficial and deep systems (Fig. 1). The superficial system arising in the reticular dermis and superficial cervical fascia and the deep lymphatic circulation functions beneath the investing layer of the deep cervical fascia (Table 1). The American Head and Neck Society and American

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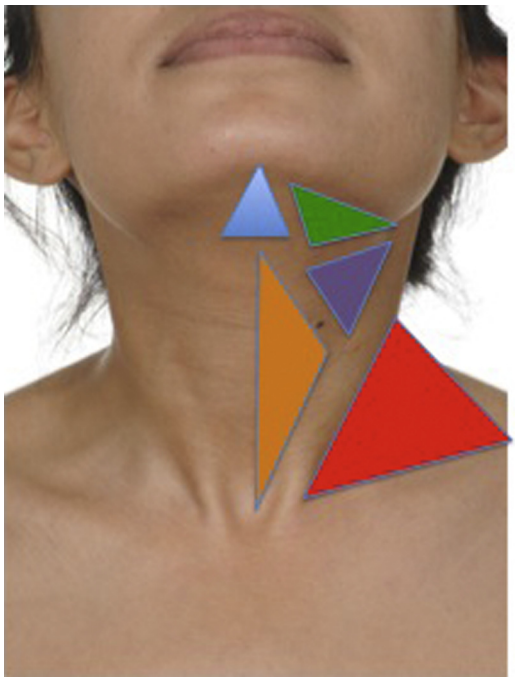

Fig. 1 Anterior and posterior triangles of the neck. Anterior: submental (*blue*), submandibular (*green*), muscular (*orange*), carotid (*purple*); posterior (*red*).

Academy of Otolaryngology—Head and Neck Surgery organized the cervical lymphatic system into separate levels, reflecting patterns of drainage (Fig. 2, Table 2). This division provides reproducible anatomic localization for both surgeon and radiologist.

Consultation appointment

With the space constraints of this article, the full history taking and examination process are not considered. However, the importance of targeted questions relevant to diagnosis must be highlighted. The fundamental aim of the clinic is to identify the malignant conditions from most referrals that prove benign. Patients presenting with an undiagnosed malignancy may have been suffering local, regional, and systematic symptoms associated with local tumor behavior and metastatic and paraneoplastic effects. In addition, questions about B symptoms in suspected lymphoma are recommended. A careful social history analyzing tobacco and alcohol habits and details of past sexual practice assigns a level of risk to the patient.

Specific questions on renal function and allergy are required before referring for radiologic investigations requiring intravenous contrast. Inherited and acquired coagulopathies need to be identified before invasive sampling. We have found that increasingly more patients attending clinic report taking new-generation antiplatelets (eg, prasugrel, ticagrelor, clopidogrel). These antiplatelets can be easily overlooked but require appropriate discussion with hematology colleagues before investigative procedures and treatment.

A routine head and neck examination should be performed, which should include an oral examination and flexible nasal endoscopy. Clues from the history may encourage the clinician to examine the chest, axillae, abdomen, and nervous system.

Findings and recommendations from the Eighth Annual Review of Data Analysis of Head and Neck Oncology[2] showed that only 80% of patients had TNM cancer staging and 66% performance status recorded at the time of multidisciplinary team discussion. The initial consultation is an ideal time to start collecting this information.

Imaging modalities in the assessment of neck lumps

Radiology is continually and rapidly advancing and forms a critical component of the diagnostic pathway for investigating neck lumps. Faster image acquisition, improved resolution, and expanding software capabilities all contribute to more detailed and more informative imaging.

The main imaging modalities used in the assessment of lumps presenting in the head and neck are US, computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography (PET). An overview of their strengths and weaknesses is provided in Table 3, with guidance related to image acquisition.

Ultrasonography

US is commonly the first-line imaging modality for assessing neck lumps. It is a quick, well-tolerated examination, which is widely available and offers a high spatial resolution without the use of ionizing radiation. Furthermore, US allows real-time guidance for fine-needle aspiration (FNA) cytology (FNAC) and core biopsy when a tissue sample is required. The main disadvantages of US are that it is limited to relatively superficial structures and is user dependent, with a high level of expertise required for the assessment of neck disease. Image quality is improved if good neck extension can be achieved (Fig. 3).

US evaluation of a neck lump is often sufficient to reassure the patient and referring clinician of a benign cause. Common benign skin and subcutaneous lesions encountered in the neck include reactive lymph nodes, sebaceous cysts, and lipomas (Fig. 4), many of which can be confidently diagnosed on US, negating the need for more expensive cross-sectional imaging or unnecessary surgery.

A focused US examination can also be a useful problem-solving tool. In the setting of head and neck cancer, cross-sectional imaging may show a borderline enlarged lymph node. Deciding whether it is pathologic or reactive can have implications for treatment options. Because of its high spatial resolution, US is able to assess the internal architecture of a lymph node in conjunction with its size measurements. Real-time use of power Doppler sonography provides additional information, with normal or reactive nodes tending to show hilar flow (Fig. 5) whereas metastatic nodes show peripheral or mixed vascularity.[4]

A meta-analysis published in 2007[5] comparing US, US-guided FNAC (USgFNAC), CT, and MRI for the detection of cervical lymph node metastases found that USgFNAC had the greatest accuracy, followed by US, with CT and MRI performing less well.

A relatively recent adjunct to a standard US examination is the use of sonoelastography. Sonoelastography measures the elasticity of a tissue, using either internal or external forces, and works on the principle that malignant lesions are stiffer than benign tissue.[6] Although some promising results have been seen in the evaluation of thyroid lumps, the role of sonoelastography in the investigation of salivary gland tumors and cervical lymphadenopathy is less convincing.