# The role of imaging in the management of patients with nonmelanoma skin cancer

## Diagnostic modalities and applications

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**Learning objectives**

After completing this learning activity, the learner should be able to describe commonly used imaging modalities, such as CT, PET/CT, MRI, ultrasound, and lymphoscintigraphy, and discuss their appropriate utilization for management of nonmelanoma skin cancer on the head and neck and identify and select the imaging technique best suited for visualization of different body tissue compartments that may be affected by nonmelanoma skin cancer.

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While uncomplicated cases of nonmelanoma skin cancer can be treated with surgery, destruction, or topical therapy alone, advanced or neglected cases require more complex management decisions. Dermatologists and dermatologic surgeons should be familiar with the imaging techniques relevant to cutaneous oncology and their value in different clinical scenarios. Herein we review imaging modalities used in management of nonmelanoma skin cancer. (J Am Acad Dermatol 2017;76:579-88.)

***Key words:*** basal cell carcinoma; computed tomography; dermatofibrosarcoma protuberans; imaging; magnetic resonance imaging; Merkel cell carcinoma; positron emission tomography; radiology; squamous cell carcinoma; skin cancer; ultrasound.

## INTRODUCTION

As the incidence of skin cancer continues to rise, dermatologists and dermatologic surgeons in particular will encounter more aggressive tumors that may require imaging to optimize patient work-up and management. However, radiologic imaging of skin cancer is not a familiar topic to most dermatologists. There are but a few sources of information found in radiology texts[1] and the dermatologic literature,[2,3] and it remains a knowledge gap in dermatology. In addition to streamlining patient care, an understanding of different imaging modalities will facilitate the use of cost effective imaging resources.[4,5] The objective of this article is to provide a current overview of imaging modalities pertinent to nonmelanoma

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*Abbreviations used:*

| | |
|---|---|
| 18-FDG: | 18-fluoro-deoxyglucose |
| CDU: | color Doppler ultrasonography |
| CT: | computed tomography |
| FNAB: | fine-needle aspiration biopsy |
| MRI: | magnetic resonance imaging |
| NMSC: | nonmelanoma skin cancer |
| NSF: | nephrogenic systemic fibrosis |
| PET CT: | positron emission tomography—computed tomography |
| SUV: | standard uptake value |
| US: | ultrasonography |

skin cancer (NMSC) and to discuss clinical scenarios where imaging is indicated. For reasons of brevity and relevance to this audience, the discussion will exclude melanoma.

## OVERVIEW OF COMMONLY USED IMAGING MODALITIES

### Anatomic planes of imaging

Cross-sectional imaging requires standard nomenclature to refer to the visualized plane. A correct understanding of the terminology used by radiologists is essential in the interpretation of imaging reports and communication. The commonly used anatomic planes in imaging studies (ie, axial or transverse, sagittal, and coronal) are shown in Fig 1.

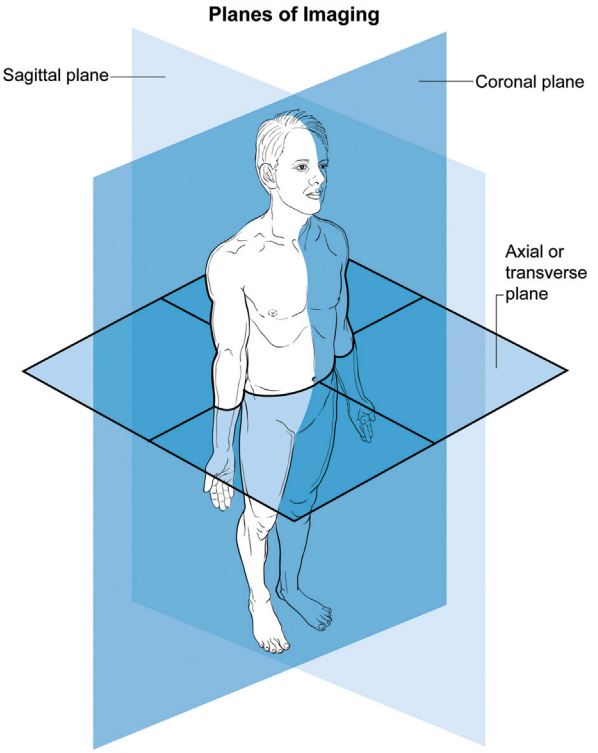


**Fig 1.** Anatomic planes used in radiologic imaging. Reproduced with kind permission of Springer Nature from Shah K, Onufer J, MacFarlane DF. Imaging of head and neck skin cancer. In: MacFarlane DF, editor. Skin cancer management. New York: Springer Nature; 2010. Illustration by Alice Chen.

## COMPUTED TOMOGRAPHY BASICS

### Key points

- **Computed tomography is typically the initial imaging study in the preoperative evaluation of head and neck tumors**
- **Computed tomography scans offer superior spatial resolution compared to magnetic resonance imaging scans and excellent visualization of bony structures and lymph nodes**
- **Computed tomography scans can be quickly performed and are widely available**
- **Computed tomography scans involve exposure to ionizing radiation**
- **Computed tomography scans should be ordered with contrast for tumor imaging**

Computed tomography (CT) scans are the mainstay in the evaluation of advanced cutaneous tumors at most institutions. CT scans are used for showing the soft tissue extent of tumor, bone invasion, and nodal metastases.[1] CT scans use ionizing radiation (radiography) to generate axial images. As the x-ray beam travels through the tissue being imaged, the beam is attenuated and the detector registers the resulting changed radiation level. The degree of beam attenuation reflects tissue density, which is expressed in Hounsfield units (HUs).[6,7] By definition, the CT value of air is -1000 HUs and the value of water is 0 HU. Fat has negative values, soft tissue values range from 10 to 50 HUs, and bone is >1000 HUs (Table I).[8] Intravenous injection of an iodinated contrast agent increases the physical density of blood, enhancing the tissue contrast of vascular structures, organs, and neoplasms.[1] Tumor imaging is significantly improved by contrast administration, in the context of both CT and magnetic resonance imaging (MRI) scans.

CT imaging of specific tissues, such as bone, can be improved by limiting the monitor display to a specific spectrum of the gray scale (ie, bone windows) and by using tailored reconstruction algorithms such that bone invasion can be better identified. For this reason, CT is frequently used to evaluate tumor invasion of cortical bone (Fig 2). A CT scan is usually the first imaging modality used in the evaluation of lymph nodes for tumor staging. Abnormal lymph nodes in the head and neck can be precisely localized and classified.[9] In our experience, lymph nodes <1.0 cm can be identified as metastatic if they show necrosis or abnormal enhancement. A sub-centimeter, abnormal parotid