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Neck Imaging Reporting and Data System: More Than Just a Template

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ABSTRACT

SUMMARY: The Neck Imaging Reporting and Data System (NI-RADS) is a guide developed and introduced in 2017 by head and neck radiologists who worked in an academic radiology department. Based on the Breast Imaging Reporting and Data System, the initial goals of NI-RADS were to make posttreatment head and neck cancer imaging dictations more succinct and efficient, guide treating physicians in the next appropriate steps when recurrence was suspected, and encourage institutional and national research. NI-RADS is more than a dictation template, and it is best instituted after a head and neck imaging practice is established. We support the use of NI-RADS once a radiologist understands the nuances of head and neck cancer, including the biology, common subsites involved, essentials of tumor staging, common posttreatment benign imaging appearances, and subtleties of recurrent disease.

ABBREVIATIONS: CECT = contrast-enhanced CT; HN = head and neck; HNC = head and neck cancer; NI-RADS = Neck Imaging Reporting and Data System; TB = tumor board

The Neck Imaging Reporting and Data System (NI-RADS) is a guide developed and introduced in 2017 by head and neck radiologists who worked in an academic radiology department. Based on the widely successful Breast Imaging Reporting and Data System, the initial goals of NI-RADS were to make dictations of posttreatment head and neck cancer (HNC) imaging more succinct and efficient, guide treating physicians in the next appropriate steps when recurrence was suspected, and encourage research both within the institution and nationally.[1]

The clinical setting that allowed NI-RADS to develop and be successful is important. There were 4 neuroradiologists with extensive head and neck (HN) expertise, and all understood the HNC biology of the disease, clinical presentations, variations in imaging based on different pathology, treatment modalities including indications for each, and the nuances of recurrent disease and treatment complications. We were part of a large HNC practice with standardized imaging protocols, surveillance schedules and regimens, and weekly tumor boards (TBs). With time, we knew the accuracy of our interpretations, including results of our recommended biopsies for suspected recurrence at the primary site and pathologic adenopathy.

Formal TB presentations were succinct and direct because we knew exactly the clinical setting or issue, based on our knowledge of the disease. TB discussions and decisions were made with multidisciplinary input. When there was controversy regarding staging or treatment decisions, the conversations were spirited, and this scenario is when we learned the most, even as experienced HNC imagers. In our academic practice, neuroradiology fellows and radiology residents routinely reported that the TB experience added to their HNC knowledge base, but it also impacted their understanding of how critical it is to generate accurate imaging interpretations. As members of the HNC team, we were trusted by nonradiology team members. With this historical background, one can understand how our use of NI-RADS was readily accepted by the HNC team.[2]

As the volume increased, the need for efficiency in our reports was obvious. Surveillance imaging was a prime example. Does every incidental finding on each follow-up study in the patient with HNC need to be described again? Surveillance imaging goals are the following: 1) primary site treatment response, 2) status of lymph nodes in ipsilateral neck, 3) status of lymph nodes in the contralateral neck, 4) second primary disease, and 5) treatment complications, especially radiation-related soft-tissue or bone necrosis or carotid artery disease. Recommendations based on surveillance posttreatment imaging are limited and are the following:

1) Continue with established surveillance regimens if the study is negative for recurrence
2) Use shorter interval follow-up if recurrence is possible but not definite

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NI-RADS history example

Tumor site	Right tonsil
Initial stage	T3 (tumor >4 cm), N2 (bilateral pathologic adenopathy)
Treatment	Definitive chemoradiation
Final treatment	12 Months ago
Initial posttreatment PET/CECT	No residual disease

3) Direct endoscopic assessment if a mucosal abnormality is present on imaging
4) Perform additional diagnostic imaging with another modality (usually MR imaging, as surveillance imaging was usually CECT)
5) Perform PET/CT or image-guided biopsy if a deep recurrence is suspected.

Except for endoscopy, the recommendations are based on imaging or biopsy with image guidance. Therefore, the responsibility for the posttreatment imaging recommendations is the purview of the radiologist.

NI-RADS is more than a simple template to improve dictating efficiency. When a radiologist uses such a specialized reporting system, especially when next-step treatment recommendations are part of the system, the user should be familiar with the disease process and all the variations. The bulk of the template is to assess the primary site and nodal drainage basins.[3] A brief bulleted history of the disease before the findings section of the report is helpful (Table). The date of presentation, initial tumor stage including primary and nodal disease, and the initial treatment technique and date can be listed. For radiation treatment, knowing the time since the final treatment is necessary because posttreatment imaging before 10–12 weeks after treatment is not recommended. Knowing the patient's status, whether the patient is asymptomatic, has a new palpable mass, has pain and what the specialist sees during the most recent outpatient visit is very important.

It is obvious, then, that adopting and using NI-RADS in daily practice is more than simply inputting a template into a speech-recognition program. Using NI-RADS is a final step, not an initial step, in radiology practice. Without an infrastructure of knowledge, experience, and trust between HN radiologists and a referral clinical practice, NI-RADS should not be used. It requires much more than finding soft-tissue "fullness" or unusual, vague contrast enhancement on imaging.

If a radiology practice does not have dedicated HN neuroradiologists, a subspecialized dictation template can be still be used, but it is best instituted after appropriate preparation and infrastructure development. The following recommendations can serve as a guide to developing an efficient HN service:

1) Standardize imaging protocols at all sites. CECT, MRI, and PET/CT techniques should be established for accurate comparisons among initial, posttreatment, and surveillance scans. This process includes scan acquisition parameters, scanner angulation, slice thickness, and even which series are sent to the PACS. Standardized intravenous contrast protocols are critical: dose, bolus technique, and timing of acquisition during or after the contrast bolus. In-service educational conferences for CT and MRI technologists help establish and maintain standardization and reinforce the team-based approach to the care of patients with HNC.
2) Establish imaging algorithms with referrers. Surgeons and oncologists must understand that the availability of both pretreatment and baseline posttreatment imaging results in the best patient care. This involves uploading imaging examinations from an outside institution and formal re-interpretation by an internal radiologist. It is important to have a pretreatment examination before biopsy because postbiopsy change can sometimes hinder accurate staging on imaging. Recognizing recurrent disease is facilitated by knowing what the tumor initially looked like and where it was located prior to treatment. In our experience, the concept of baseline posttreatment imaging was new to some providers. When we likened baseline imaging to the baseline posttreatment physical examination, referring clinicians better understood the need for a predictable time and modality for posttreatment imaging. In our practice, the modality was usually PET coupled with CECT at 12 weeks after the end of treatment. Universal surveillance imaging algorithms, with respect to timing and modality, have not been determined, but an individual HNC group can establish their own algorithm.
3) Establish a core group of radiologists to interpret HNC imaging. One goal of NI-RADS is consistency across imaging techniques, timing of surveillance, and interpretation. A small group of radiologists can more easily agree to standardized interpretations than a large group, with expected differences in interpretation styles, experience, and confidence levels. A smaller group, maybe 2–4 HN radiologists, can better agree on what constitutes worrisome or definite findings of recurrence. Even 1 outlier who routinely overcalls indeterminate findings can impact the practice. Routine meetings among the core group of radiologists helps standardize the imaging approach to a patient with HNC.
4) HN imagers must recognize the appearance of recurrent HN cancer. Recurrent HNC is rarely an easily appreciated "new necrotic peripherally enhancing mass." Recurrent tumor in the HN is often subtle: loss of fat planes, gradual changes in reconstructive flap morphology, perineural tumor, muscle denervation, or increasing size of small non-necrotic nodes that are in the expected draining nodal basin. Nodal size criteria are not a reliable predictor of nodal metastasis. Squamous cell carcinoma, the most common tumor, behaves in a different manner depending on the subsite. A true vocal cord tumor and a tonsil carcinoma have different imaging appearances, treatment, and recurrence patterns that are unique to each subsite. Therefore, it is critical that the radiologist know the HN subsites, normal and variant appearances, first- and second-order nodal drainage, common treatment modalities, and the specific imaging appearance of recurrent tumor. This knowledge requires a broad and detailed base because there is no universal and predictable recurrent-tumor appearance. Case sharing and discussion helped our group improve the knowledge base.
5) Attend TBs and routinely get clinical follow-up, including for operative and image-guided biopsies. Discussion at TBs helps the radiologist understand the nuances of HNC and what specific knowledge various treating clinicians need from imaging.

For example, radiation oncologists must know the proximity of the tumor to critical structures, such as the optic nerve or spinal cord. The presence of extranodal extension of tumor is important for medical oncologists to plan chemotherapeutic regimens. Routine follow-up after CT or MRI interpretations and next-step recommendations add to an individual HN radiologist's expertise.

In summary, our goals were to improve efficiency, standardize imaging and interpretations, clarify the HN radiologists' responsibilities, and improve patient care. Obviously, we enthusiastically support the use of NI-RADS. Introducing NI-RADS is best when all disciplines involved in caring for a patient with HNC trust that the HN radiologist is familiar with complex HN imaging, has a broad knowledge infrastructure for the disease, and understands the implications of further diagnostic recommendations. Implementing the NI-RADS template is the last step in developing a mature HNC imaging practice.

Disclosure forms provided by the authors are available with the full text and PDF of this article at www.ajnr.org.

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