ORIGINAL RESEARCH

RECIST 1.1 Adds Value to the Performance of NI-RADS on CECT Alone to Predict Recurrent Head and Neck Squamous Cell Carcinoma after Chemoradiotherapy

[1]Dr. Praradbh Saxena, [2]Dr. Jyoti Valecha, [3]Dr. Nitin Khantal

[1]Junior Resident**,** [2]Professor, [3]HOD & Professor, Department of Radiodiagnosis**,** Chirayu medical college & Hospital, Bhopal, Madhya Pradesh, India

Corresponding Author
Dr. Praradbh Saxena
Junior Resident, Department of Radiodiagnosis**,** Chirayu medical college & Hospital, Bhopal, Madhya Pradesh, India
Email: drprarabdhsaxena@yahoo.co.in

Received: 16 February, 2023 Accepted: 19 March, 2023

ABSTRACT

Background On computed tomography, the Head and Neck Imaging Reporting and Data System (NI-RADS) is a standardized reporting structure for categorization the degree of suspicion for recurrent head and neck malignancies. **Purpose:** The purpose of our study was to analyze the efficacy of the NI-RADS rating scale and criteria for contrast-enhanced computed tomography (CECT) alone inpredicting the local and regional recurrence of malignancies after chemoradiotherapy. **Material and Methods**: CECT of the patients with head and neck cancers receiving radiotherapy and concurrent chemotherapy as a primary treatment was obtained3 months after the completion of radiotherapy and NI-RADS scoring was done using components of Response Evaluation Criteria in Solid Tumors (RECIST 1.1) criteria. Their management was directed according to the recommendations based on their NI-RADS score. **Results**: This research included 30 patients with squamous cell carcinoma of the neck. The outcome of the biopsy or the follow-up plan, as advised by the NI-RADS rating scale, determined whether the recurrent illness was positive or negative. Pathology confirmed recurrence at the original tumor site in 15 patients. Disease persistence rates for the primary tumor location were 4% for NI-RADS 1, 24% for NI-RADS 2, and 80% for NI-RADS 3. There was recurrent lymph nodal disease in five individuals. According to NI-RADS categories 1, 2, and 3 for lymph nodal assessment, the recurrence rates of nodal disease were 5.3, 25, and 66.7%, respectively. **Conclusion**: For patients with neck malignancies, CECT alone may be used to give the NI-RADS rating scale using RECIST 1.1 criteria to determine whether recurrent tumors will develop or not.

Keywords: head/neck, CT,larynx,adultsneoplasms-primary

INTRODUCTION

Head and neck cancers are among the most common cancers indeveloping countries, especially in Southeast Asia. Overall,57.5% of global head and neck cancers occur in Asian countries and India[1].Radiation therapy alone or combined with chemotherapy, surgery, or both is a mainstay for the treatment of head and neck cancers. Advances in three-dimensional(3D) radiation planning and computer-controlled
delivery have resulted in 3D conformal radiation therapy and intensity-modulated radiation therapy (IMRT)[2].These therapies allow delivery of a therapeutic dose to the tumor while reducing the dose to the surrounding tissues and thus minimizing unwanted side effects.[3] Radiation-induced tissue damage and death occur from the destruction of endothelial
cells lining small blood vessels[4]This results inischemia, edema, and inflammation and then delayed fibrosis of adjacent tissues. Radiation-induced changes may decrease the conspicuity of residual tumors or may be mistaken for residual or recurrent disease.[5]

Radiology plays an important role in the identification of treatment failure and recurrent disease after radiotherapy. Computed tomography (CT) scan is the most commonly used modality used to assess post radiotherapy changes in neck malignancies and response is assessed using a quantitative tool called Response Evaluation Criteria in Solid Tumors(RECIST 1.1). In the past two decades, positron emission
Tomography (PET) scan has been increasingly used in combination
with CT to harness the metabolic capability of PET along with the anatomical information of CT. Response assessment using PET scan is done using Hopkins criteria or the PET Response Criteria in Solid Tumors (PERCIST).[6] Neck Imaging-Reporting and Data System (NI-RADS) is a standardized report format with a linked follow-up recommendation for patient management describing a template for both
contrast-enhanced CT (CECT) scan and for CECT combined with PET scan.[7,8] Utilization of fluorodeoxyglucose-positronemission tomography (FDG-PET) with CT allows the assessment of metabolic activity along with the anatomical characteristic of the tumor site. It also helps to reduce ambiguity and variability of narrative interpretation by the use of
numerical categories to convey levels of suspicion of diseaserecurrence. FDG-PET CT scan as a modality is not commonlyavailable and is an expensive investigation, especially indeveloping countries where the burden of head and neckmalignancies is high; our focus is to study the sensitivity ofthemore common and easily available CECT in predicting thelocal and regional residualmalignancies in routine follow-upscans. It is important to develop a cost-effective approach toprovide adequate care and management for malignancieswith a high burden in developing countries. The purpose ofour study was to analyze the efficacy of the NI-RADS ratingscale and criteria for CECT alone in predicting the local and
regional disease recurrence. We hypothesized that postcontrastenhancement characteristics and use of RECIST 1.1criteria to refine theassignment of NI-RADS rating can yielda satisfactory diagnosticaccuracy in the prediction of recurrenttumor after radiotherapy.

MATERIALS AND METHODS

SUBJECTS

This was a prospective observational study and was performed in a university-based tertiary-care Hospital. At the outset, approval from the institutional ethical committee was obtained and patients were enrolled in this study after obtaining informed consent. In this study, we included patients with primary head and neck squamous cell carcinoma treated with radiotherapy. Allthe patients had undergone apretreatment baseline CT scanand completed radiotherapy at the hospital. Concurrent chemotherapy was administered with cisplatin 40 mg/m^2
Once a week. At the time of recruitment, all the data regarding the clinical details, investigation reports, histopathological reports, and treatment details were gathered. A repeat CECT of the involved area was obtained 3 months aftercompletion of radiotherapy and NI-RADS scoring was done and their management was guided according to there commendations based on their NI-RADS score. The patients with
recommendations for follow-up were subsequently followed up for 3 to 6 months. Tumor recurrence was considered if the patients had a biopsy positive for squamous cell carcinoma, or there was evidence of disease progression on sub sequentimaging, or if there was an obvious tumor on physical examination. For declaring lack of tumor recurrence, we assessed the following: (1) follow-up imaging at least90 days after the index scan, (2) clinical follow-up for atleast 6 months without evidence of recurrent disease, or (3)biopsy of an abnormality detected on the index scan with pathology results negative for tumor. Patients were excluded
from this study if they were lost to follow-up or if they underwent surgical treatment. Further, patients with NIRADScategory X (primary image not available) or category 4(known recurrence) were excluded.

IMAGE ACQUISITION

CT was performed using 16 slice multi-detector CT scanner(General Electric Medical Systems). Scans were obtained after injection of 80 to 100mL nonionic iodinated contrast mediaiohexol 300mg I/mL (Omnipaque 300) using a double head automated pressure injector followed by 30 to 50mL salinechaser at 2 to 3mL/s.
Following volume acquisition (at 120kv, 320mAs, pitch1.375:1, rotation 55, detector coverage 40mm, slice thickness during acquisition 5mm) during one breath-hold, 0.625mmsliceswere reconstructed fromthe level of frontal sinus toT4vertebra.

IMAGE ANALYSIS

The images were analyzed on an offline work station (General Electric Medical Systems), postprocessingto generate thin/thick, multiplanar reformation images. All the post treatment scans were analyzed with pretreatment scans by two radiologists together, with 8 and 17 years of experience, respectively, and the final report was based on consensus between the two. First, the scans were analyzed for expected postradiation changes such as thickening of skin and platysma, reticulation of subcutaneous fat, edema and/or minimal fluid in the retropharyngeal space, diffuse thickening and increased enhancement of the pharyngeal walls, laryngeal structures, increased density of fat in preepiglottic space, and paralaryngeal spaces (►Fig. 1). Next, the primary tumor site was

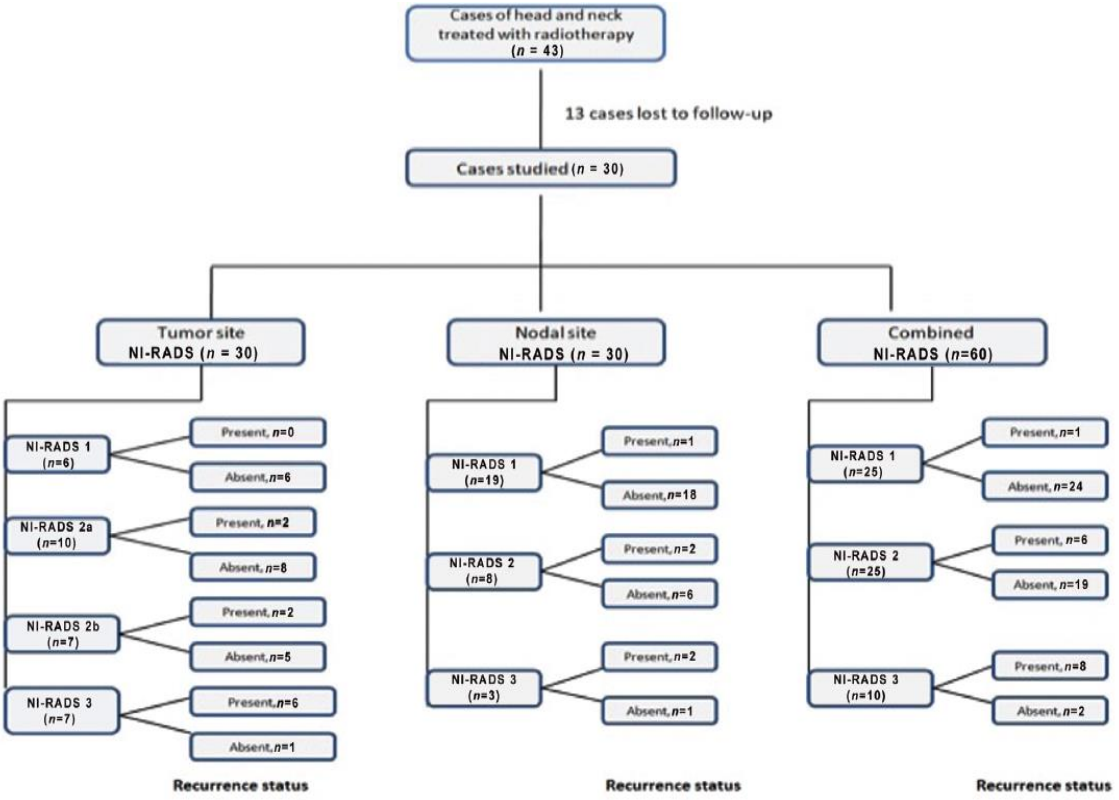
analyzed for the presence of focal mucosal enhancement, presence of soft tissue, or enhancing nodular tissue. A note was made of the degree of enhancement (comparing the HU difference from baseline scan), size of enhancing lesion, and definition of margin of
the lesion. Categorization of the lesions into NI-RADS rating was assigned as described in ►Table 1. The nodal sites were analyzed in tandem with the pretreatment images. The definition of the NI-RADS score was assigned similar to RECIST 1.1 criteria[9] as described in ►Table 1. For more than one lymph node, NI-RADS categorization of all the malignant lymph nodes was done and the one with the highest score was finally taken as the lymph nodal NIRADS score of the patient.

The template-driven surveillance protocol and linked management options laid by NI-RADS criteria were followed in all of the patients. NI-RADS 1 lesions were subjected to routine 6 months follow-up. NI-RADS 2a lesions required direct clinical or laryngoscopic inspection. If the inspection did not reveal malignancy, the patients were subjected to
3 months follow-up. NI-RADS 2b lesions underwent short term follow-up by CT scan. NI-RADS 3 lesions were biopsied. The rate of recurrent disease in each NI-RADS category and sensitivity of NI-RADS low-suspicion and high-suspicioncategories in predicting theabsence/presence of diseaserecurrence was analyzed.

Table 1 NI-RADS descriptors based on CECT for primary tumoral site and lymph nodal assessment. For lymph nodal assessment, RECIST 1.1 criteria were used for NI-RADS categorization

Primary tumor site	
NI-RADS 1	➢ Nonmass-like distortion of soft tissues ➢ Low-density nonenhancing submucosal or mucosal edema ➢ Diffuse mucosal enhancement without deep extension ➢ Expected postradiation changes such as thickening of skin and platysma, reticulation of subcutaneous fat, retropharyngeal space edema, thickening of the pharyngeal walls, increased density of fat in preepiglottic space, and paralaryngeal space
NI-RADS 2a	➢ Focal mucosal enhancement ➢ Enhancement deep to ulceration
NI-RADS 2b	➢ Ill-defined nonmass-like deep tissue with only mild contrast enhancement
NI-RADS 3	➢ Discrete enhancing nodules/ lesions with a mass-like appearance with intense or moderate enhancement
Lymph nodal assessment	
NI-RADS 1	➢ Lymph nodes that shrunk to size <1 cm in the short axis ➢ Lymph nodes showing at least a 30% decrease in short axis diameter ➢ Lymph nodes showing significant hypo-enhancement compared with previous image
NI-RADS 2	➢ Lymph nodes showing neither adequate shrinkage nor progression to qualify for NI-RADS 1 or NI-RADS 3
NI-RADS 3	➢ Presence of new enlarged malignant appearing lymph nodes ➢ For nodes >15 mm in pretreatment scan • If the diameter showed an increase in 20% short-axis diameter • Attained new morphologically abnormal features such as necrosis or extranodal extension ➢ For lymph nodes measuring 10–15 mm in pretreatment scan, unequivocal progression was decided based on the judgment of the two radiologists and was not based on a modest increase in size

Abbreviations: CECT, contrast-enhanced computed tomography; NI-RADS, Neck Imaging-Reporting and Data System; RECIST 1.1, Response Evaluation Criteria in Solid Tumors.



RESULTS

Initially, 43 patients were present in our study, out of which 13 were lost to follow-up (►Fig. 2). The rest 30 patients completely matched our inclusion criteria with adequate follow-up and were included in our study. The mean age of the patients was 49 years with a male to female ratio of 14:1. Out of 30 patients, we included carcinoma of the pyriform fossa (n¼5), base of tongue (n¼7), supraglottic region (n¼8), and glottis (n¼10). In our study, the highest number of patients were of glottic carcinoma (33.3%). Recurrent disease was detected in 10 of the patients who were all males. All 10 of these patients showed recurrent disease at primary tumor that included, 6 lesions of the laryngeal region (3 glottic carcinoma and 3 supraglottic carcinoma), 2 lesions of pyriform fossa, and the rest of the 2 lesions were of carcinoma of the base of tongue. Five of these patients also showed lymph nodal recurrence where primary sites of tumors were base of tongue (n¼2), supraglottic larynx (n¼1), glottis carcinoma (n¼1), and pyriform fossa (n¼1). The summary of NI-RADS scores in our patients and final outcome has been presented in ►Fig. 1.

SITE-SPECIFIC ANALYSIS

►Table 2 summarizes the site-specific categorization of postradiotherapy scans into NI-RADS scores along with their corresponding numbers of recurrent disease. Seven patients in our study had the base of tongue as the primary site (►Fig. 3) of which two showed recurrent disease at the
tumor site and nodal site. In one of the patients, a lymphnode was labeled as NI-RADS III owing to the mildly increased size (20% increase in short axis diameter) and increased necrosis that showed no subsequent disease recurrence. In another case, a submandibular lymph node was designated as NI-RADS I because of reduction in size less than 1 cm, while the follow-up showed nodal recurrent disease and subsequent increase in nodal size. Five patients had pyriform fossa as the primary site of the tumor of which recurrent disease was noted in two patients (►Fig. 4) rated as NI-RADS 3 and 2b categories, respectively. Eight patients had
supraglottic laryngeal carcinoma as the primary site (►Fig. 5). Tumor site recurrent malignancy was present in three of the eight supraglottic carcinoma patients (37.5%). Two of these patients were assigned into category NI-RADS 3 for tumor site and one was assigned NI-RADS 2b for tumor site. One of the patients in NI-RADS 3 category for the nodal
site showed evidence of nodal disease recurrence. Ten patients in our study had glottis as the primary tumor site, of which three showed recurrent disease (►Fig. 6). Two of these patients were assigned NI-RADS 3 category for tumor site, while one patient was assigned 2a category. One of the patients in the NI-RADS 2 category for the nodal site also showed nodal disease recurrence.

Table 2 Site-specific categorization of postradiotherapy scans into NI-RADS scores along with their corresponding numbers of recurrent diseases

NI-RADS	Base of tongue carcinoma ($n=7$)		Pyriform fossa carcinoma ($n=5$)		Supraglottic larynx carcinoma ($n=8$)		Glottic carcinoma ($n=10$)	
	No of patients	Recurrent disease present	No of patients	Recurrent disease present	No of patients	Recurrent disease present	No of patients	Recurrent disease present
Primary tumor site								
1	2	0	1	0	0	0	3	0
2a	2	1	2	0	2	0	4	1
2b	1	0	1	1	4	1	1	0
3	2	1	1	1	2	2	2	2
Lymph nodes								
1	3	1	3	0	4	0	9	0
2	2	0	2	1	3	0	1	1
3	2	1	0	0	1	1	0	0

Abbreviation: NI-RADS, Neck Imaging-Reporting and Data System.

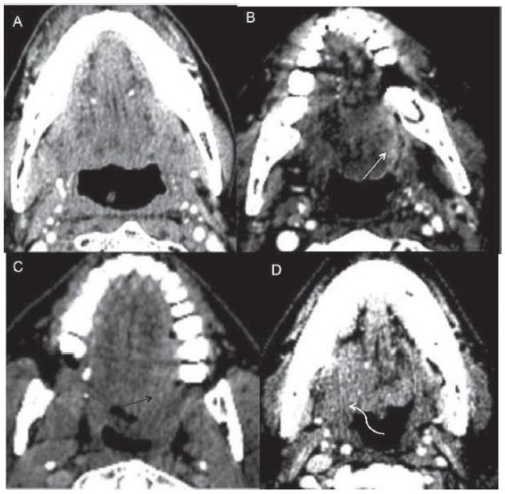


Fig. 3 Follow-up computed tomographic scans of postradiotherapy carcinoma of base of tongue. (A) Neck Imaging-Reporting and Data System (NI-RADS) 1. (B) NI-RADS 2a—Asymmetrical mucosal enhancement on left side (*white arrow*). (C) NI-RADS 2b—nonenhancing soft tissue lesion on left side (*black arrow*). (D) NI-RADS 3—moderately enhancing mass lesion on right side (*curved white arrow*).

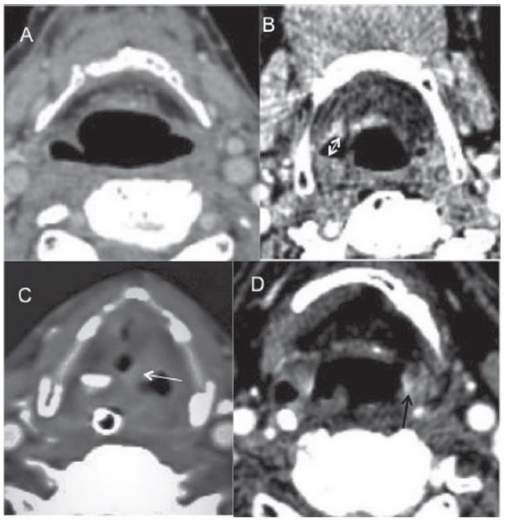


Fig. 4 Follow-up computed tomographic scans of postradiotherapy carcinoma of pyriform sinus. (A) Neck Imaging-Reporting and Data System (NI-RADS 1). (B). NI-RADS 2a—asymmetrical mucosal enhancement on right side (*white double arrow*). (C) NI-RADS 2b—minimally enhancing soft tissue lesion on left side (*white arrow*), subsequently positive for recurrent disease. (D) NI-RADS 3—frankly enhancing soft tissue lesion on left side (*black arrow*).

TUMOR SITE NI-RADS

►Table 3 summarizes the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of individual NIRADS scores at primary tumor site in our study. Six of the patients were assigned NI-RADS 1 for primary site, of which none showed signs of recurrence on follow-up for 6months. A NI-RADS score of 2 or higher had a high sensitivity (100%) and low specificity (30%) in prediction of recurrent disease. NI-RADS score of 2b or higher had a high specificity (70% respectively) compared with score of 2a that had a low specificity (30%). Ten of the patients were assigned NI-RADS 2a category and were referred for direct visual inspection based on the American College of Radiology recommendations of which two patients revealed recurrent

disease. Two of the seven category 2b patients showed recurrent malignancy. In both these patients, the largest dimension of enhancing component measured more than 1cm (11mm and 15mm respectively), while in the other patients with NI-RADS 2b lesions and absent recurrent

malignancy, the largest dimension was 9mm or lower. A NI-RADS score of 3 had a high specificity (95%) but a lower sensitivity (60%) in prediction of recurrent malignancy.

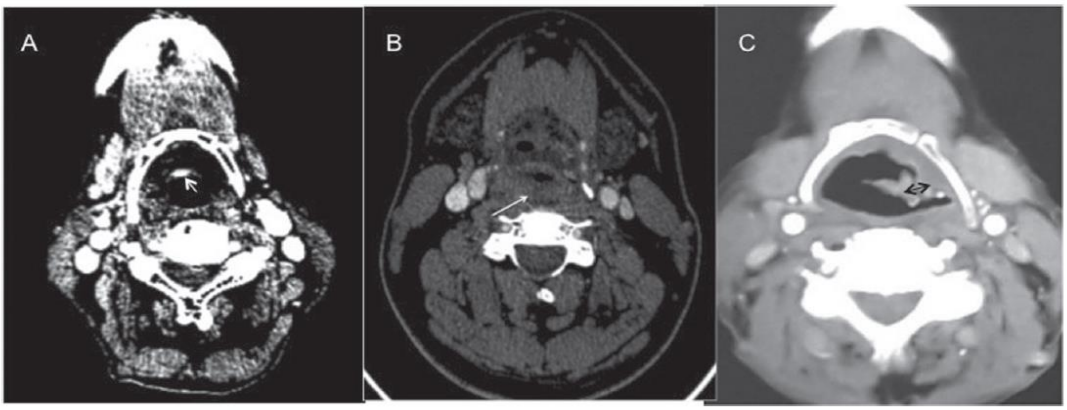


Fig. 5 Follow-up computed tomographic scans of postradiotherapy supraglottic carcinoma. (A) Neck Imaging-Reporting and Data System (NI-RADS) 2a—anterior focal mucosal enhancement (*short arrow*), negative for recurrent disease. (B) NI-RADS 2b—nonenhancing increased soft tissue bulk (*white arrow*). (C) NI-RADS 3—irregularly thickened epiglottis and supraglottic mucosa on the left side (*double black arrow*).

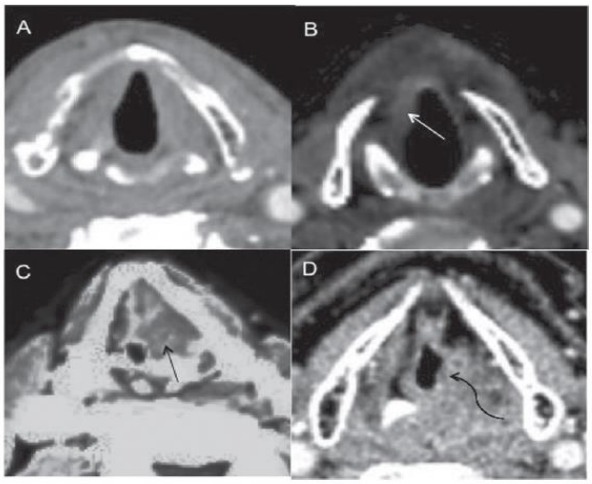


Fig. 6 Follow-up computed tomographic scans of postradiotherapy glottic carcinoma. (A) Neck Imaging-Reporting and Data System (NI-RADS 1). (B) NI-RADS 2a—asymmetrical mucosal enhancement on right side anteriorly (*white arrow*). (C) NI-RADS 2b—nonenhancing left-sided soft tissue (*black arrow*). (D) NI-RADS 3—enhancing lesion on left side posteriorly (*curved black arrow*).

Table 3 Sensitivity, specificity, PPV, and NPV of individual NI-RADS score at primary site of malignancy

NI-RADS score	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)	Accuracy (%)
≥1	100	0	33	-	33.33
≥2a	100	30	42	100	53.33
≥2b	80	70	57	87	73.33
≥2	100	30	42	100	53.33
≥3	60	95	86	83	83.33

Abbreviation: NI-RADS, Neck Imaging-Reporting and Data System.

Table 4 Tumor recurrence rate in different NI-RADS categories

Tumor site NI-RADS	Percentage of patients with recurrent disease	Nodal site NI-RADS	Percentage of patients with recurrent disease	Combined NI-RADS	Tumor recurrence rate
NI-RADS 1	0%	NI-RADS 1	5.3%	NI-RADS 1	4%
NI-RADS 2a	20%	NI-RADS 2	25%	NI-RADS 2	24%
NI-RADS 2b	28.5%				
NI-RADS 3	85.7%	NI-RADS 3	66.7%	NI-RADS 3	80%

Abbreviations: NI-RADS, Neck Imaging-Reporting and Data System; NPV, negative predictive value; PPV, positive predictive value.

NECK NI-RADS ANALYSIS

The majority of the patients (19 out of 30) were assigned NIRADS1category (►Fig. 7A) for the nodal site due to thepresence of residual nodal tissue less than 1 cm in the shortaxis or disappearance of the nodes leaving some strand ofresidual tissue. One of these patients showed recurrentdisease at the nodal site. Eight of the patients were assigned NI-RADS 2 (►Fig. 7B) due to the presence ofmildly enlargingsize (<20% increase in short axis diameter) or less than 30% reduction in short axis diameter. Two of these patients showed nodal recurrence. Three of the patients were assigned NI-RADS 3 (►Fig. 7C) category due to the presence of new or enlarging lymph node (more than 20% increase in short axis diameter) with abnormal morphologic features

(necrosis or extranodal extension). Two of these patients were positive for nodal recurrence on biopsy (66.7%). However, one of the three patients, which showed mildly increased size as well as increased necrotic component, was negative for disease recurrence on lymph nodal biopsy and subsequent follow-up. A NI-RADS score of 3 had a high specificity (96%) and NPV (86%) but a low sensitivity (40%) and PPV (66.7%). NI-RADS score of 2 or higher had a high sensitivity (80%) and NPV (94.7%) and a low specificity (72%) and PPV (36%).

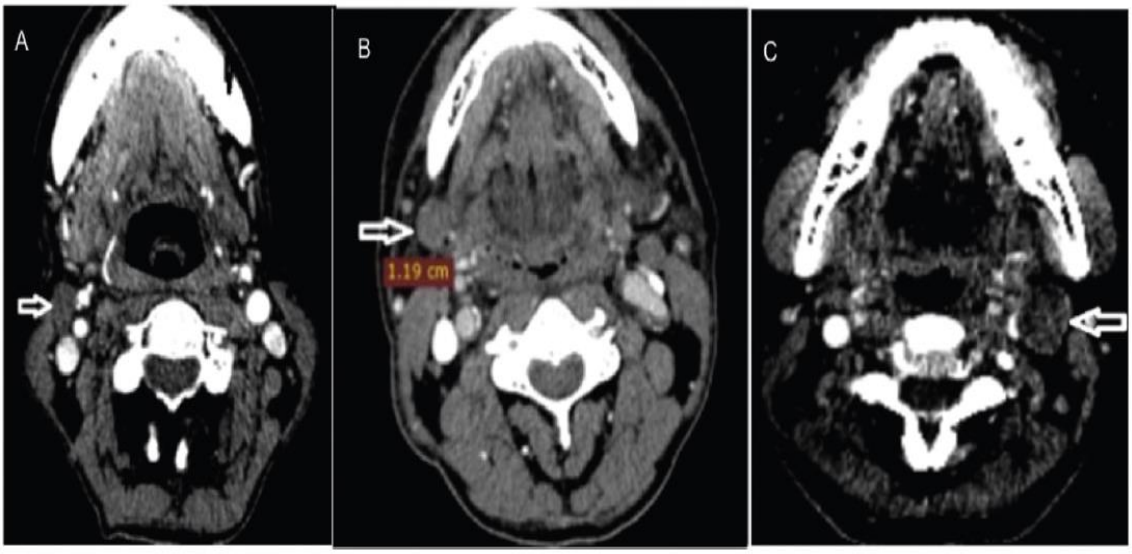


Fig. 7 Neck Imaging-Reporting and Data System (NI-RADS). Follow-up computed tomographic scans of patients at 3 months after completion of radiotherapy showing (A) small less than 1 cm lymph node (NI-RADS 1) (*arrow*), negative for nodal recurrent disease; (B) marginally enlarging lymph node (*arrow*) without significant postcontrast enhancement (NI-RADS 2), negative for nodal recurrent disease; and (C) significantly enlarging lymph node (*arrow*) with central necrosis (NI-RADS 3), positive for nodal recurrent disease.

DISCUSSION

The NI-RADS was created for surveillence of CECT in patients with previously treated head and neck tumors, either with or without positron-emission tomography. According to the degree of suspicion, the original tumor site and neck are both evaluated for recurrence/residual disease and given a category of 1 to 4 with associated management suggestions.[10]Imaging with combined use of PET and CT at 3 months afterthe completion of treatment is currently considered as thebest approach for posttreatment imaging.[11,12]FDG-PET adds to the information by conducting a functional examination of the radiation-damaged tissue, whereas CT provides a fairly accurate anatomical survey of the post-radiation neck. The combined use of PET and CT has emerged as the preferred method for NI-RADS scoring due to PET's ability to increase or decrease the level of suspicion given by CECT. However, PET is an expensive test and is not offered in every facility that offers oncological treatment. Occasionally PET scans can result in false-positive results due to post surgical changes, tongue fasciculations, radiation-induced injury to bones, and soft tissue. CT can offer rapid imaging solutions for the follow-up of these patients and our study shows that CT alone can be adequately utilized for NI-RADS categorization with comparable accuracy to the combined usage of PET and CT. The performance of NI-RADS in follow-up CECT scans to predict disease recurrence demonstrated significant discrimination between groups in our study, with disease recurrence rates of 4% for NI-RADS 1, 24% for NI-RADS 2, and 80% for NIRADS 3. NI-RADS 1 category for the primary site is used for expected post treatment changes. Diffuse mucosal enhancement without deep extension is more likely mucositis and should fall under NI-RADS 1. Our study showed a 0% residual disease on routine follow-up at 6months in these patients. In a previous study by Krieger et al, NI-RADS 1 lesions showed a tumor recurrence rate of 3.5%.10 Our results and the existing literature show that lesions scored as NI-RADS 1 can be safely subjected to routine 6 months follow-up without the need for PET scan.[8] NI-RADS 2 category is used for mildly suspicious lesions on imaging. Low-suspicion superficial mucosal lesions fall under the 2a group, and direct visual inspection is advised as a result. In post-treatment imaging, focal asymmetric enhancement could either signify benign mucositis or an early tumor return. Out of these 10 individuals with 2a lesions, two (20%) had recurrent illness. The 2b category is used for deep, ill-defined, non-discrete, low-suspicion lesions at the primary location. In actual fact, biopsy is rarely used to treat category 2 lesions; instead, short-term follow-up is used. These lesions make poor candidates for biopsies

because they are poorly defined and lack a mass-like appearance. Two of the seven patients in our research who were assigned to the NI-RADS 2b category (28.5%) had recurrent disease. Patients with NI-RADS 2b sizes less than 1 centimeter did not exhibit recurrent disease, whereas those with sizes greater than 1 cm did. In total, 23.5% of the patients had an NI-RADS 2 score, which was slightly higher than the 18.4% recurrence rate described in a prior study using PET/CT by Krieger et al.For high-suspicion lesions, such as discrete, nodular, highly enhancing lesions where biopsy is advised, 10 NI-RADS 3 is used. In our research, the NI-RADS 3 score was given to six out of seven patients (85.7%), which is higher than the 54.6% reported by a prior study using PET and CECT. High FDG avidity is a significant indicator of recurrent disease for lymph nodal assessment and should be given an NIRADS 3 grade. According to the available literature, new or "definitely enlarging" lymph nodes should be given NI-RADS 3, while "mildly enlarging" lymph nodes should be given NI-RADS 2. This is to be done in the absence of a PET scan. When the lymph nodes should be regarded as unquestionably enlarging, however, there are no precise objective standards. Our research backs up the use of RECIST 1.1 criteria, which states that progressive disease should be defined as a 20% increase in the short-axis diameter of target lymph nodes (>15mm). (NI-RADS 3). In instances of "unequivocal progression" for non-target lymph nodes (10–15mm), NI-RADS 3 was given based on the opinions of two radiologists. It should be mentioned that the current version of NIRADS does not include the application of RECIST 1.1 to lymph nodes. NIRADS 1 score was given to subcentimetric lymph nodes (less than 1 centimeter in short axis), which were regarded as nonpathological. Due to its tiny size, only one lymph node in our research demonstrated tumor recurrence after being given NI-RADS 1. A score of NI-RADS 1 was given to target lymph nodes when short axis diameter decreased by more than 30%, which was regarded as an indication of overall response.

Lymph nodes that did not exhibit sufficient shrinkage or development to meet the criteria for NI-RADS 1 or NI-RADS 3 were classified as NI-RADS 2. In our experience, using RECIST 1.1 measurements to determine the lymph node's NI-RADS score can add a fair amount of objectivity to the post-treatment imaging evaluation. NIRADS categories 1, 2, and 3 for lymph nodal assessment showed nodal recurrent disease rates of 5.3, 25, and 66.7%, respectively. Similar results were found in the earlier research by Krieger et al., which used both CT and PET scans to show recurrence rates of 4, 15, and 70% for NI-RADS 1, 2, and 3 lesions, respectively.10 We are aware that our research had a lot of flaws. First, there weren't enough patients in our study to support statistical significance. Second, because the two radiologists did not separately interpret the scans, we did not measure interobserver variation in determining NI-RADS scores. Third, because PET scans were not available in our university, we were unable to directly compare the use of CT alone with that of PET/CT. The study's strengths were its prospective design and sufficient patient follow-up. We believe that this is the first prospective research to assess the usefulness of the NIRADS template solely using CECT. In conclusion, this research demonstrates that CECT alone may be used, particularly in the absence of PET/CT, to give the NI-RADS rating scale and predict whether or not tumor recurrence will occur in patients with neck malignancies. Additionally, using the measurements encouraged by the RECIST 1.1 standards can help the NI-RADS system classify malignant neck lymph nodes.This initial research made the case that, in the absence of PET, CECT might be sufficient for NI-RADS categorization, particularly when combined with the RECIST 1.1 criteria. In order to evaluate the precision of CECT alone with that of PET CT in predicting tumor recurrence in neck malignancies based on the NI-RADS rating scale, further substantial multicentric studies are advised.

CONFLICT OF INTEREST

None.

ACKNOWLEDGMENT

None.

REFERENCES

1. Kulkarni MR. Head and neck cancer burden in India. Int J Head Neck Surg 2013;4:29–35
2. Garden AS, Morrison WH, Rosenthal DI, Chao KS, Ang KK. Target coverage for head and neck cancers treated with IMRT: review of clinical experiences. Semin Radiat Oncol 2004;14(02):103–109
3. Zackrisson B, Mercke C, Strander H, Wennerberg J, Cavallin-Ståhl
4. E. A systematic overview of radiation therapy effects in head and neck cancer. Acta Oncol 2003;42(5-6):443–461
5. Paris F, Fuks Z, Kang A, et al. Endothelial apoptosis as the primary lesion initiating intestinal radiation damage in mice. Science 2001;293(5528):293–297
6. Glastonbury CM1. Parker EE, Hoang JK. The postradiation neck: evaluating response to treatment and recognizing complications. AJR Am J Roentgenol 2010;195:164–171
7. Peacock JG, Christensen CT, Banks KP. RESISTing the need to
8. quantify: putting qualitative FDG-PET/CT tumor response assessment criteria into daily practice. AJNR Am J Neuroradiol 2019;40 (12):1978 1986
9. Aiken AH, Hudgins PA. Neck imaging reporting and data system.
10. Magn Reson Imaging Clin N Am 2018;26(01):51–62
11. Aiken AH, Farley A, Baugnon KL, et al. Implementation of a novel surveillance template for head and neck cancer: neck imaging reporting and data system (NI-RADS). J Am Coll Radiol 2016;13 (06):743–746.e1

12. Eisenhauer EA, Therasse P, Bogaerts J, et al. New response evaluation criteria in solid tumours: revised RECIST guideline (version 1.1). Eur J Cancer 2009;45(02):228–247
13. Krieger DA, Hudgins PA, Nayak GK, et al. Initial performance of NIRADS to predict residual or recurrent head and neck squamous
14. cell carcinoma. AJNR Am J Neuroradiol 2017;38(06):1193–1199
15. Leung AS, Rath TJ, Hughes MA, Kim S, Branstetter BF IV. Optimal timing of first posttreatment FDG PET/CT in head and neck squamous cell carcinoma. Head Neck 2016;38(Suppl 1): E853–E858
16. Manikantan K, Khode S, Dwivedi RC, et al. Making sense of post treatment surveillance in head and neck cancer: when and what of follow-up. Cancer Treat Rev 2009;35(08):744–753
17. Nishino M, Jagannathan JP, Ramaiya NH, Van den Abbeele AD. Revised RECIST guideline version 1.1: what oncologists want to know and what radiologists need to know. AJR Am J Roentgenol 2010;195(02):281–289