Lymphomas of the Head and Neck: CT Findings at Initial Presentation

Ya-Yen Lee, Pamela Van Tassel, Craig Nauert, Luceil B. North and Bao-Shan Jing

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Lymphomas of the Head and Neck: CT Findings at Initial Presentation

Ya-Yen Lee[1]
Pamela Van Tassel
Craig Nauert
Luceil B. North
Bao-Shan Jing

CT findings were reviewed in 68 patients with untreated head and neck lymphoma. More than half of the patients with either Hodgkin's disease or non-Hodgkin's lymphoma were detected in the earlier stages (stage I or II). Four types of abnormalities were identified with CT: nodal involvement alone (type 1), extranodal involvement alone (type 2), a combination of extranodal and nodal disease (type 3), and multifocal extranodal disease with or without nodal involvement (type 4). In the 18 patients with Hodgkin's disease, a subgroup of mixed cellularity was most common; type 1 was the prevailing CT presentation, and no type 2 or 4 lesions were observed. In the 50 patients with non-Hodgkin's lymphoma, diffuse large-cell lymphoma was the most common histologic subtype, and the most common CT presentation was type 2, followed by type 3. Lymphomatous nodes may be extensive and confluent, but often they are smaller than 2 cm and rarely are necrotized. The most frequent extranodal sites of head and neck lymphomas are Waldeyer's ring, paranasal sinuses, and nasal cavity. Extranodal lymphoma cannot be differentiated reliably from the more commonly occurring carcinoma, although it is less often associated with invasion and destruction of adjacent bony structures. Multiple sites of extranodal involvement, with or without neck lymphadenopathy, may suggest a diagnosis of non-Hodgkin's lymphoma.

Hodgkin's disease and non-Hodgkin's lymphoma often involve the head and neck region, and many clinical articles have been published on head and neck lymphomas [1–14]. However, to our knowledge there are no thorough radiologic evaluations of head and neck lymphomas, particularly ones that emphasize CT findings. In this paper, we report our analysis of the CT findings of untreated head and neck lymphomas in 68 patients to establish CT patterns and to correlate them with histopathologic and staging classifications.

Materials and Methods

Between October 1981 and July 1986, 68 untreated patients with a diagnosis of lymphoma involving the head and neck region were referred to the Department of Diagnostic Radiology at the University of Texas M. D. Anderson Hospital and Tumor Institute at Houston for CT evaluation of tumor extent in the head and neck. The CT studies were performed with a GE 8800, GE 9800, Siemens Somatom 2, or Siemens DR-3 scanner after an IV bolus injection of contrast medium (either 300 ml of 30% iodine or 150 ml of 60% iodine). Consecutive 4- or 5-mm-thick axial images were obtained routinely from the sphenoid sinus to the angle of the mandible, and sections 8 or 10 mm thick from there to the sternal notch. For those patients with lesions suspected in the orbit or paranasal sinuses, both direct coronal and axial 4- or 5-mm-thick images were obtained.

Nodal and extranodal lesions were confirmed by pathologic studies. The histopathologic classification of these 68 patients was made according to the Rye classification [15] for Hodgkin's disease and the working formulation classification [16] for non-Hodgkin's lymphoma. The Ann Arbor staging classification [17] was used for both Hodgkin's and non-Hodgkin's lymphomas after a complete staging workup, which included chest radiography, chest CT in selected cases, lymphangiography and/or CT of the abdomen, and bone-marrow

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[1] All authors: Division of Diagnostic Imaging, Department of Diagnostic Radiology, M. D. Anderson Hospital and Tumor Institute, University of Texas System Cancer Center, 1515 Holcombe Blvd., Houston, TX 77030. Address reprint requests to Y-Y Lee.

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TABLE 1: Classification of Head and Neck Lymphomas

Type of Lymphoma: Category	No. by Stage									
	IA	IEA	IIA	IIEA	IIIA	IIIEA	IIIB	IVA	IVB	Total
Hodgkin's disease:										
Nodular sclerosis	0	0	2	1	1	0	2	0	0	6
Mixed cellularity	1	0	2	2	0	0	0	3	1	9
Lymphocytic predominance	2	0	1	0	0	0	0	0	0	3
Subtotal	3	0	5	3	1	0	2	3	1	18
Non-Hodgkin's lymphoma:										
Diffuse, small lymphocytic	0	1	0	2	0	0	0	0	0	3
Follicular, small cleaved	1	1	0	0	1	0	0	2	0	5
Follicular, mixed	0	0	1	0	0	0	0	0	0	1
Follicular and diffuse, large	0	0	0	0	0	1	0	1	0	2
Diffuse, mixed	0	2	0	0	0	0	0	1	2	5
Diffuse, large	2	11	1	10	0	0	0	3	0	27
Diffuse, small noncleaved	0	4	0	0	0	0	0	0	0	4
Lymphoblastic	0	0	0	0	0	1	0	0	0	1
Unclassified	0	2	0	0	0	0	0	0	0	2
Subtotal	3	21	2	12	1	2	0	7	2	50
Total	6	21	7	15	2	2	2	10	3	68

biopsy. Eighteen patients had Hodgkin's disease and 50 had non-Hodgkin's lymphoma (Table 1).

Results

CT Patterns

Four CT patterns of head and neck lymphomas were identified (Table 2).

In Hodgkin's disease, six were type 1A, nine were 1B, and three were 3A. In non-Hodgkin's lymphoma, five were type 1A, two were 1B, five were 2A, 20 were 2B, eight were 3A, seven were 3B, two were 4A, and one was 4B (Table 3).

Histopathologic correlation.—In Hodgkin's disease, the mixed-cellularity subgroup was observed most often (nine of 18 patients), followed by the nodular sclerosis subtype. Nodal involvement occurred in all 18 cases. Among these, three patients presented with additional extranodal lesions in Waldeyer's ring (type 3A): one in the nasopharynx, one in the tonsil, and one at multiple sites). No cases were observed of isolated extranodal presentation (type 2).

Twenty-seven (54%) of 50 non-Hodgkin's patients had diffuse large-cell lymphomas. The predominant feature was extranodal presentation, 25 (50%) without (type 2) and 15 (30%) with (type 3) nodal involvement. Isolated nodal involvement (type 1) was observed in only seven (14%) of 50 cases. The most common single CT pattern was type 2B, occurring in 20 patients (40%). The most common sites of extranodal involvement were Waldeyer's ring, the paranasal sinuses, and the nasal cavity (Table 4). Waldeyer's ring involvement in non-Hodgkin's lymphoma was found at more than one site in eight of 13 patients and was associated with nodal disease in eight of 13. Conversely, 12 of 13 patients whose disease involved the paranasal sinuses and nasal cavity were free of nodal involvement.

TABLE 2: CT Patterns of Head and Neck Lymphomas

Type, Description
1, Nodal lymphomas:
1A, Unilateral
1B, Bilateral
2, Extranodal lymphomas:
2A, Extranodal lesion(s) confined within Waldeyer's ring
2B, Extranodal lesion outside Waldeyer's ring (extralymphatic)
3, Nodal and extranodal lymphomas (combined types 1 and 2):
3A, Waldeyer's ring lesion(s), with nodal involvement
3B, Extralymphatic lesion, with nodal involvement
4, Multifocal extranodal lymphomas:
4A, Without nodal involvement
4B, With nodal involvement

Staging correlation.—In Hodgkin's disease, more than half (11 of 18) the patients had earlier staging (stage I or II) at presentation. The same observation was made in non-Hodgkin's lymphoma (38 of 50). Most of the patients in both groups were free of constitutional symptoms (for example, fever, sweats, pruritis, and unexplained weight loss of more than 4.5 kg).

Anatomic Considerations

Nodal involvement.—In 13 (72%) of 18 patients the involved lymph nodes in Hodgkin's disease measured less than 2 cm in greatest diameter on CT (Fig. 1). All cases had involvement of the deep lymphatic chains, particularly the internal jugular chains, either unilaterally (10 of 18) or bilaterally (eight of 18). Additional superficial nodes were involved in only one case. One case showed evidence of extracapsular spread and nodal necrosis.

TABLE 3: Distribution of Head and Neck Lymphomas by CT Pattern

Type of Lymphoma: Category	No. by CT Pattern								
	1A	1B	2A	2B	3A	3B	4A	4B	Total
Hodgkin's disease:									
Nodular sclerosis	2	3	0	0	1	0	0	0	6
Mixed cellularity	2	5	0	0	2	0	0	0	9
Lymphocytic predominance	2	1	0	0	0	0	0	0	3
Subtotal	6	9	0	0	3	0	0	0	18
Non-Hodgkin's lymphoma:									
Diffuse, small lymphocytic	0	0	0	1	2	0	0	0	3
Follicular, small cleaved cell	2	0	2	1	0	0	0	0	5
Follicular, mixed cell	1	0	0	0	0	0	0	0	1
Follicular and diffuse, large cell	0	0	0	2	0	0	0	0	2
Diffuse, mixed cell	0	1	0	2	2	0	0	0	5
Diffuse, large cell	2	1	3	8	3	7	2	1	27
Diffuse, small noncleaved	0	0	0	4	0	0	0	0	4
Lymphoblastic	0	0	0	0	1	0	0	0	1
Unclassified	0	0	0	2	0	0	0	0	2
Subtotal	5	2	5	20	8	7	2	1	50
Total	11	11	5	20	11	7	2	1	68

Note.—CT patterns are defined in Table 2.

TABLE 4: Extranodal Sites of Head and Neck Lymphomas

Type of Lymphoma: Site	No.
Hodgkin's disease:	
Waldeyer's ring:	
Nasopharynx	1
Tonsil	1
Multiple sites	1
Subtotal	3
Total	3
Non-Hodgkin's lymphoma:	
Waldeyer's ring:	
Nasopharynx	3
Tonsil	2
Multiple sites	8
Subtotal	13
Paranasal sinuses and nasal cavity	13
Cheek:	
Skin	4
Buccal mucosa	3
Subtotal	7
Thyroid gland	4
Nose	1
Orbit	1
Parotid gland	1
Multifocal:	
Nasopharynx plus submandibular gland	1
Nasopharynx plus paranasal sinus	1
Waldeyer's ring plus cheek	1
Subtotal	3
Total	43

In non-Hodgkin's lymphoma, most (15) of the 23 involved nodes also measured less than 2 cm. However, in seven (30%) of 23 cases the largest node was more than 5 cm; of these, six had extracapsular and three had nodal necrosis (Fig. 2). Of interest, in three cases very large nodes were present (greater than 10 cm in the largest), but none showed evidence of central necrosis (Fig. 3). As in Hodgkin's disease the deep lymphatic chain was always involved in cases in which non-Hodgkin's lymphoma appeared in the neck lymph nodes unilaterally (13 of 23) or bilaterally (10 of 23). However, the superficial lymphatic chains were involved in nine (39%) of 23 patients because associated disease was common at extralymphatic sites such as the cheek or thyroid gland.

Extranodal involvement (Table 4).—Waldeyer's ring was the site at which extranodal disease occurred most often in head and neck lymphomas (Fig. 4). In our series there were three in Hodgkin's disease and 16 in non-Hodgkin's lymphoma, and the disease often infiltrated more than one site within the ring. However, in several cases isolated lesions were found in the nasopharynx or tonsil. None of the Waldeyer's-ring lesions had associated destruction of the base of the skull.

All the extranodal lymphomas outside the Waldeyer's ring (extralymphatic) were in non-Hodgkin's lymphoma, predominantly the diffuse large-cell subgroup (Table 3). The paranasal sinuses and nasal cavity were the sites at which extralymphatic disease was found most often (Fig. 5). Minimal adjacent bone destruction was seen in nine of 13 cases. Tumor calcification occurred in only one case, appearing in the ethmoid sinus with extensive bone destruction and intracranial extension (Fig. 6).

All four cases of thyroid lymphoma in our series had a preceding history of goiter with a histologic background of chronic lymphocytic thyroiditis detected microscopically. All of these lymphomas were aggressively infiltrating the adjacent aerodigestive tract and had extensive nodal involvement (Fig. 7). The cheek lesions, either originating in skin or buccal submucosa, extended into the maxillary sinus or nasal cavity,

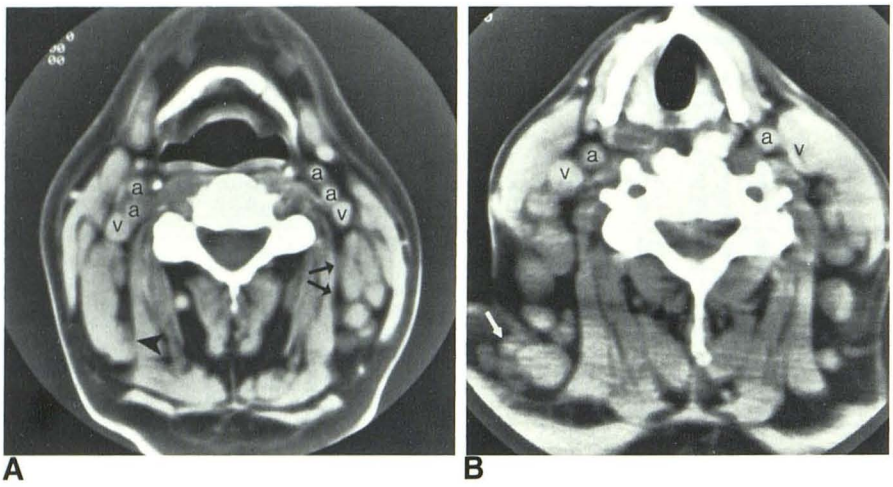

Fig. 1.—*A* and *B*, Bilateral nodal disease in 20-year-old man with nodular sclerosing Hodgkin's disease involving deep lymphatic chains. Large, right, nonnecrotic spinal accessory node (*arrowhead*) is confluent with jugular nodes. Clusters of left jugular nodes (*black arrows*) and right transverse cervical nodes (*white arrow*) all measured less than 1 cm in diameter. a = common internal and external carotid arteries; v = internal jugular veins.

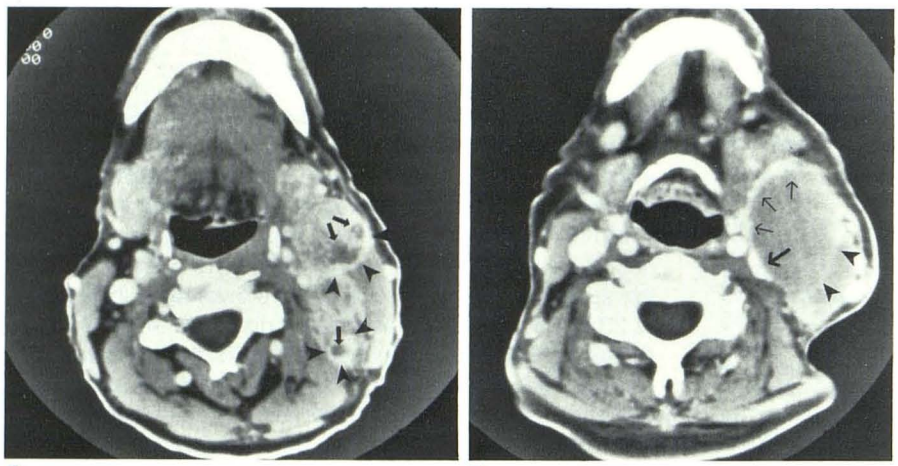

Fig. 2.—Confluent nodal involvement along with left deep jugular and spinal accessory chains in 62-year-old woman with diffuse large-cell lymphoma. Nodal necrosis is manifested as central hypodensity within lymph nodes (*arrows*); in addition, extracapsular spread is shown as thick pericapsular enhancement obliterating normal fasciae (*arrowheads*).

Fig. 3.—Left nodal involvement along deep jugular chain in 63-year-old woman with follicular small-cleaved-cell lymphoma. Internal jugular vein (*large arrow*) and facial vein (*small arrows*) are displaced by large confluent node that shows extracapsular spread into overlying sternomastoid muscle (*arrowheads*). However, no nodal necrosis is evident.

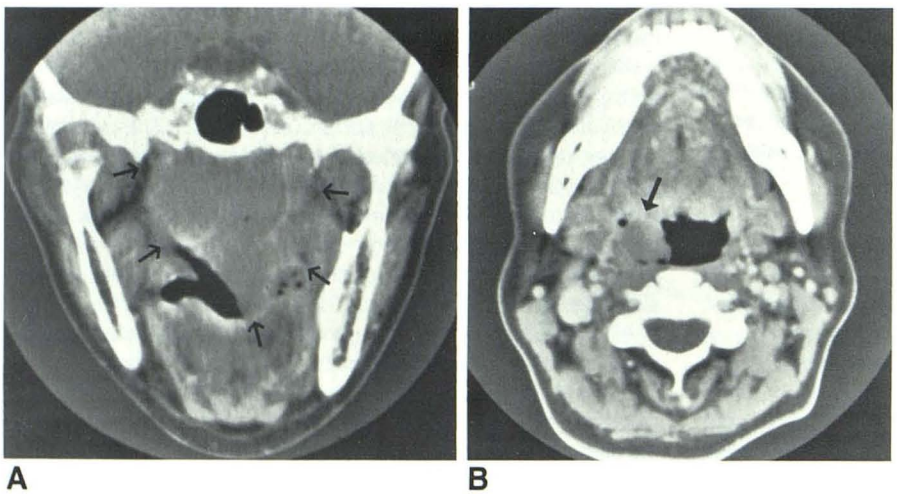

Fig. 4.—*A*, Multiple-site involvement of Waldeyer's ring (*arrows*) of diffuse large-cell lymphoma without nodal disease in 68-year-old woman. There is no destruction of base of skull or extension into sphenoid sinus despite extensive disease in nasopharynx.

B, Isolated, diffuse large-cell lymphoma in right tonsillar fossa (*arrow*) projects into oropharynx in 48-year-old woman.

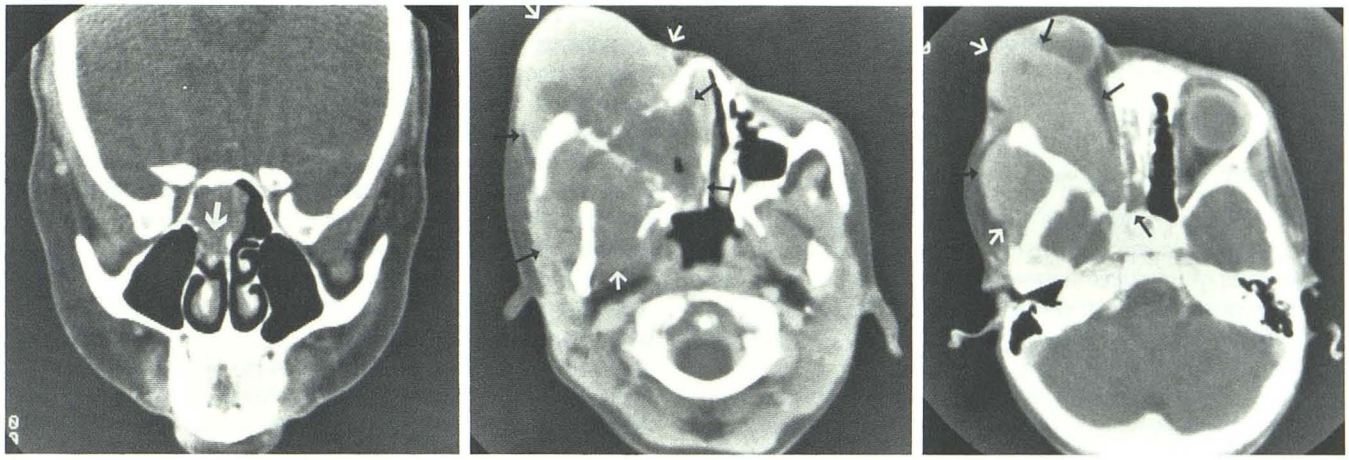

Fig. 5—*A*, Diffuse large-cell lymphoma involving sphenoid sinus in 43-year-old woman. Minimal bone destruction (*arrow*) but no intracranial extension. *B* and *C*, Extensive infiltrative lymphoma (*arrows*) of diffuse, small, noncleaved subtype (non-Burkitt's) in 4-year-old boy originates from right maxillary sinus and has extensive bone destruction. There is direct extension into right orbit, temporal fossa, infratemporal fossa, and right nasal cavity.

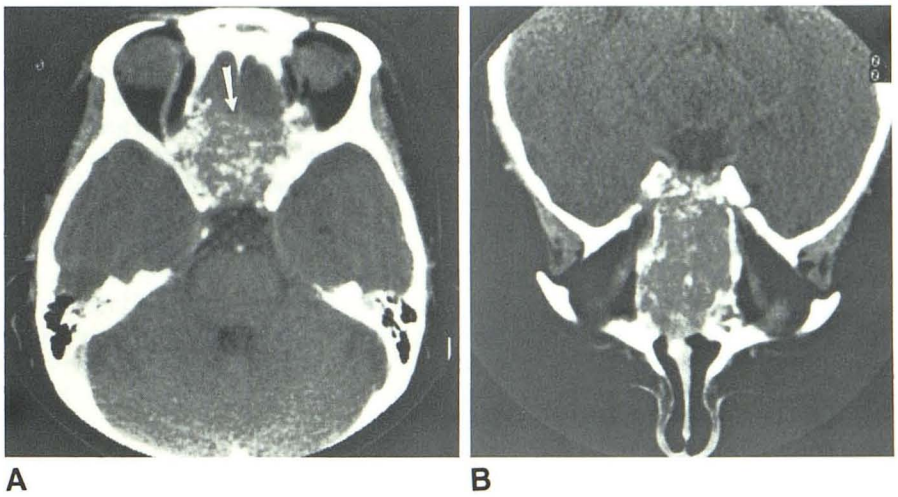

Fig. 6.—Axial (*A*) and coronal (*B*) views. Diffuse involvement of nasal cavity and ethnoid sinuses with bone destruction and intracranial extension (*arrow*) in 49-year-old woman with diffuse large-cell lymphoma. Note scattered tumoral calcifications.

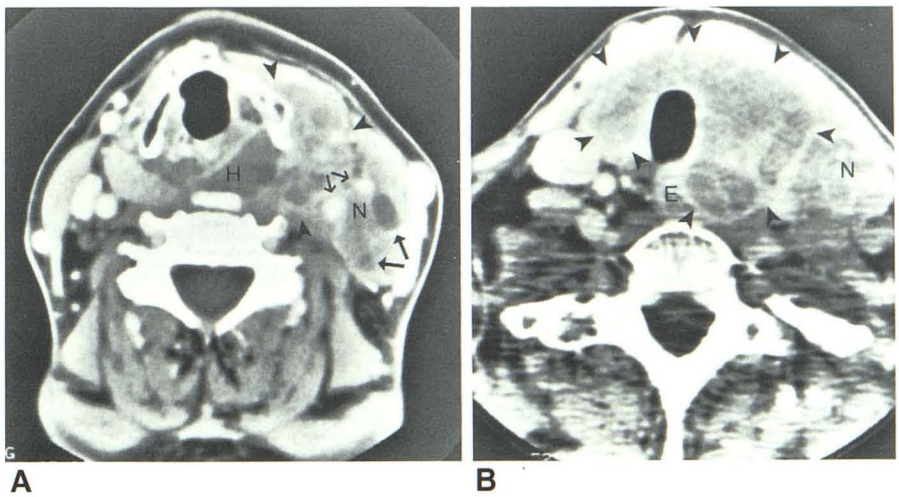

Fig. 7.—*A* and *B*, Diffuse thyroid lymphoma (*arrowheads*) of diffuse large-cell subtype with extensive regional extension and nodal disease (N) in 60-year-old woman. Note extension into hypopharynx (H) and esophagus (E). Nodal necrosis (*large arrows*) is seen in confluent nodal involvement. Common carotid artery and internal jugular vein (*small arrows*) are encased by tumor infiltration.

with bone destruction in three of seven patients. Three patients had multifocal extranodal disease, all from diffuse, large-cell lymphomas (Fig. 8).

Discussion

The malignant lymphomas are a heterogeneous group of solid lymphoreticular neoplasms. Hodgkin's disease is a subgroup of lymphomas that originate from cells of the monocyte-histiocyte series, and it accounts for 25% of all malignant lymphomas [18]. The other lymphomas are grouped together as non-Hodgkin's lymphomas.

One of the most common initial presentations of Hodgkin's disease is painless lymph-node enlargement in the head and neck region. Hodgkin's disease spreads in a predictable fashion from one lymph-node group to the next contiguous group by lymphatic channels [19]. Extranodal presentation of Hodgkin's disease is rare, even with nodal involvement. Conversely, non-Hodgkin's lymphoma frequently involves extranodal structures in the head and neck region, which is the second most common site of extranodal lymphoma after the gastroenterologic tract [7, 11–13]. More than half of the patients with extranodal head and neck lymphomas present with disease localized to the site of origin, and less often associated with nodal involvement [1]. The extranodal sites most frequently involved are Waldeyer's ring, the paranasal sinuses, and the nasal cavity. The histologic subtypes are usually intermediate or high-grade, particularly diffuse, large-cell lymphomas [1, 3, 10, 14].

When neck nodes are involved in either Hodgkin's or non-Hodgkin's lymphoma, the disease spreads into multiple nodes. Whether the nodal involvement is unilateral or bilateral, the deep lymphatic chains are almost always involved, particularly the internal jugular chain. The middle and lower jugular nodes are often diseased when lymphomas present in the nodal pattern (type 1). Isolated lymphomatous involvement of the superior internal jugular chain or superficial nodes is unusual; this is in contrast to the carcinomatous nodal involvement of unknown primary site. The size of the involved lymph node can be quite variable, with larger ones more than 10 cm in diameter and smaller ones less than 5 mm. Frequently, multiple nodes of varying sizes are involved. Sometimes they are elliptical in shape, although a rounded appearance is most common. It is of interest to note that nodal necrosis was found in only one (5%) of our 18 patients with Hodgkin's disease and three (13%) with non-Hodgkin's lymphoma, even when the disease was extensive. Since necrosis is prevalent in carcinomatous nodes, its absence may warrant a prebiopsy diagnosis.

The extranodal lesions in Waldeyer's ring can be isolated by their appearance, which resembles squamous carcinoma; however, more often there are multiple sites of involvement within the ring. Rarely does nasopharyngeal lymphoma present with skull-base destruction, even with extensive involvement. This is in contrast to the frequent bone destruction seen with squamous carcinoma. The extralymphatic lesions in the paranasal sinus and oral cavity can be small or extensive and often are associated with sinus obstruction. This observation is nonspecific, and these lesions are indistinguishable from other slow-growing neoplasms. Tumor calcification, previously unreported, was observed in one of our cases, and its cause is undetermined.

Thyroid lymphoma tends to diffusely infiltrate the adjacent soft tissue, including the aerodigestive tract, and is often accompanied by extensive nodal involvement. As mentioned [20, 21], all four cases in our series had associated chronic lymphocytic thyroiditis histologically, suggesting a strong relationship between the two. Lymphoma originating from the cheek, either in the skin or buccal submucosa, tends to extend regionally into the nasal cavity, maxillary sinus, and orbit, and is often associated with bone destruction. Again, this finding mimics that of other slow-growing neoplasms.

In summary, the extranodal presentation of head and neck lymphoma is nonspecific and indistinguishable from the more commonly occurring carcinoma. However, multiple sites of involvement within or outside Waldeyer's ring, without or with nodal disease, should alert radiologists to the possible diagnosis of a lymphoreticular neoplasm.

Treatment of both Hodgkin's and non-Hodgkin's lymphoma

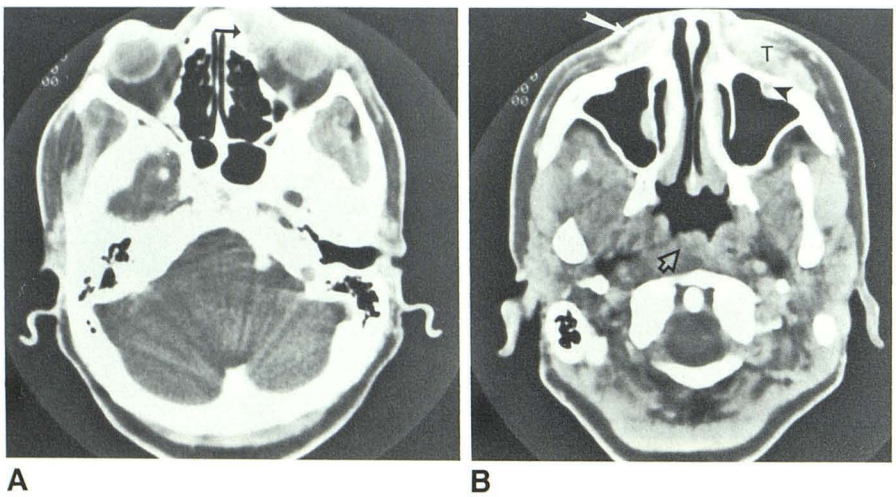

Fig. 8.—*A* and *B*, Multicentric involvement of diffuse large-cell lymphoma in 36-year-old woman. Note extensive regional infiltration of left cheek lesion (T) into left medial orbital canthus (*solid black arrow*), left infraorbital canal (*arrowhead*), and right cheek (*white arrow*). Second lesion is identified in nasopharynx (*open arrow*).

is based on the histologic classification and anatomic staging of disease, the latter of which has been influenced by modern diagnostic imaging. The diagnosis and management of head and neck lymphoma, in particular non-Hodgkin's, often varies with the site of extranodal disease. The precise definition of the anatomic extent of disease is critical to effective treatment when radiotherapy is used alone. Therefore, the decision to obtain a CT scan should be made according to the histologic classification and clinical involvement of disease [22]. It is the practice in our institute not to obtain a CT scan of the head and neck routinely unless the findings will dictate the treatment planning of the lymphoma. Generally, nodal lymphoma does not require a CT evaluation. A CT scan of the head and neck is needed for identifying a possible extranodal primary site when there are isolated superficial nodes positive for lymphoma. Waldeyer's-ring lymphoma may require a CT scan for evaluation of exact tumor extent for radiotherapeutic portal definition. A CT evaluation is definitely desired in extranodal extralymphatic lymphomas for diagnosis and staging purposes as well as for determining radiation portals.

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