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Lesions of the Head and Neck in Patients with AIDS: CT and MR Findings

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The CT and/or MR findings were reviewed in 43 patients with head and neck disease; 27 had AIDS, 14 had AIDS-related complex, and two had positive human immunodeficiency virus serologies. Fourteen patients had infections, 15 had tumors, and 15 had benign lymphoid hyperplasia. Deep cervical infections were caused by bacterial and mycobacterial organisms, including *Mycobacterium avium-intracellulare*. Bacterial infections were clinically more virulent than they would be in immunocompetent patients. Neoplasms included Kaposi sarcoma, lymphoma, and squamous cell carcinoma. Benign lymphoid hyperplasia demonstrated enlargement of the cervical lymph nodes, adenoids, and tonsils. Although there was considerable overlap in the imaging characteristics of the various diseases seen, several distinguishing features were noted. Cellulitis, with infiltration and thickening of the subcutaneous fat, was typical of bacterial infections, but was uncommon with tumors or mycobacterial infections. Lymph nodes with necrotic centers were seen with Kaposi sarcoma, squamous cell carcinoma, and mycobacterial infection, but not with lymphoma or benign lymphoid hyperplasia. Benign adenoidal enlargement is usually symmetric with a flat anterior border, but bulky lesions indistinguishable from tumor were seen in two patients.

It is important for radiologists to be aware of the spectrum of head and neck disease in patients with human immunodeficiency virus. The CT and MR assessment can guide biopsy and assist in planning therapy.

Opportunistic infections, malignancies, and diffuse reactive adenopathy in the head and neck are present in 40–50% of all AIDS patients [1, 2]. Most of these patients can be adequately evaluated by clinical examination, laryngoscopy, or barium pharyngography. However, in some patients the nature or extent of the lesion cannot be determined with conventional techniques, and further imaging with CT or MR is indicated. This report analyzes the CT and MR findings in 43 patients infected with the human immunodeficiency virus (HIV). We encountered a variety of infections, tumors, and benign enlargement of lymphoid tissue (benign lymphoid hyperplasia). Although there was considerable overlap in the imaging characteristics of these diseases, some distinguishing features were found.

Materials and Methods

Of 43 patients studied, 27 had opportunistic infections or neoplasms that fulfilled the Centers for Disease Control criteria for AIDS [3]. Fourteen patients had the AIDS-related complex (ARC), also known as the lymphadenopathy syndrome, with persistent lymphadenopathy; fatigue; weight loss; and often lymphopenia, diarrhea, and oral candidiasis [4]. Two patients were serologically positive for HIV but did not fall into the AIDS or ARC categories. All the patients were homosexual males. Thirty-one patients had CT examination with a GE 8800 or 9800 scanner. Five-mm-thick contiguous sections and continuous IV infusion of 150 ml of 60% iohalamate sodium contrast material were used. Sixteen patients had MR examination with a 1.5-T or 0.35-T superconducting MR imager. T1-weighted sagittal, $\leq 600/\leq 30/2-4$ (TR/TE/excitations), and T2-weighted axial, $2000/\geq 60/2$, images were obtained. T1-weighted axial and T1- or T2-weighted coronal images were also obtained in some

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patients. These studies were evaluated retrospectively with full knowledge of the diagnosis. No effort was made to compare CT and MR since only four patients were studied with both techniques. In an effort to characterize the various lesions, the scans were evaluated for the size and appearance of mass lesions, the size and appearance of lymph nodes, and the presence or absence of subcutaneous cellulitis.

TABLE 1: Head and Neck Infections and Tumors in Patients with AIDS

| Pathology | No. of Patients |
|--|-----------------|
| Infection: | |
| Bacterial neck (<i>Pasteurella</i> , <i>Bacteriodes</i> , <i>Pseudomonas</i> , <i>Streptococcus</i> , <i>Staphylococcus</i>) | 5 |
| Probable bacterial neck | 2 |
| Mycobacterial neck: | |
| Tuberculosis | 3 |
| <i>Mycobacterium avium-intracellulare</i> | 1 |
| Subtotal | 4 |
| <i>Pneumocystis</i> of external auditory canal | 1 |
| <i>Rhinosporidium</i> of nasal cavity | 1 |
| Total | 15 ^a |
| Tumor: | |
| Kaposi sarcoma: | |
| Pharyngeal | 4 |
| External auditory canal | 1 |
| Subtotal | 5 |
| Lymphoma: | |
| Nasopharynx | 2 |
| Neck | 2 |
| Parotid | 1 |
| Subtotal | 5 |
| Squamous cell carcinoma: | |
| Nasopharynx | 1 |
| Tongue | 2 |
| Subtotal | 3 |
| Sarcoma | 1 |
| Metastatic rectal carcinoma | 1 |
| Total | 15 |

^a Fourteen patients had 15 infections.

Results

Fourteen patients had infections, 15 had tumors, and 15 had benign lymphoid hyperplasia. One patient had both a tumor and an infection. All the infections and tumors were verified pathologically. Eight of the 15 cases of benign lymphoid hyperplasia were verified pathologically.

In the patients with infection, bacterial and mycobacterial infections predominated (Table 1). The five definite bacterial infections were all deep cervical infections that usually involved multiple tissue spaces (Fig. 1). Two other deep neck infections were probably of bacterial origin; however, cultures were negative because the patients were placed on antibiotics before surgery (Fig. 2). Clinically, the bacterial neck infections were unusually virulent compared with those in nonimmunosuppressed patients. Two patients required reoperation for adequate drainage, and prolonged IV antibiotic therapy was required in three patients.

Mycobacterial neck infections occurred in four patients. Three of these patients had tuberculous lymphadenitis. The fourth patient was infected with *Mycobacterium avium-intracellulare* (Fig. 3). One patient had both tuberculous lymphadenitis and *Pseudomonas* epiglottitis. Of the seven patients with bacterial or probable bacterial neck infections, two had AIDS, four had ARC, and one was HIV-positive. All the patients with mycobacterial neck infections had AIDS.

The most common tumors were Kaposi sarcoma (five patients) and non-Hodgkin lymphoma (five patients) (Table 1). Kaposi sarcoma involved the pharynx in four patients (Figs. 4 and 5) and the external auditory canal in one patient. Non-Hodgkin lymphoma was seen in the nasopharynx in two patients, in the neck in two patients (Figs. 6 and 7), and in the parotid gland in one patient. Four of the five patients with lymphoma had AIDS and one patient had ARC. Oral and nasopharyngeal squamous cell carcinomas were seen in three patients. An undifferentiated sarcoma and a metastatic rectal carcinoma were also seen.

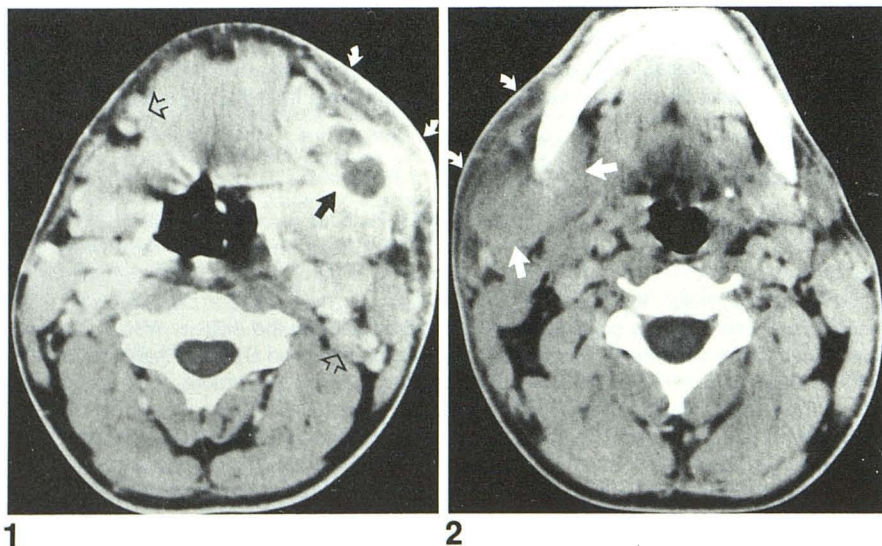


Fig. 1.—Submandibular staphylococcal abscess in 22-year-old human immunodeficiency-positive patient with painful swelling under his left mandible. Contrast-enhanced CT scan shows left submandibular mass with multilocular low-density center (solid black arrow). Marked increased density and thickening of adjacent subcutaneous tissue (curved arrows); multiple lymph nodes (open arrows).

Lesion was surgically drained but required prolonged antibiotic therapy for complete resolution.

Fig. 2.—Probable bacterial deep neck infection in 22-year-old patient with AIDS-related complex and painful swelling near right mandible. Contrast-enhanced CT scan shows soft-tissue swelling in submandibular space (straight arrows). Thickening and increased density of adjacent subcutaneous tissue (curved arrows). Thin-needle aspiration biopsy after several days of antibiotic therapy revealed inflammation only.

Because CT showed no drainable abscess, the patient was treated with antibiotics with a good clinical response.

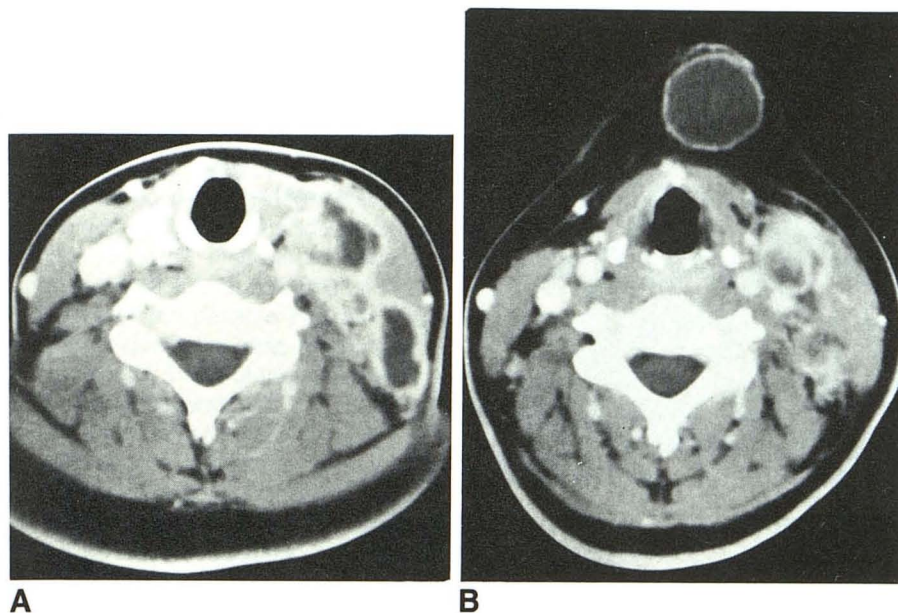


Fig. 3.—*Mycobacterium avium-intracellulare* lymphadenitis in 20-year-old AIDS patient with painless left neck mass. Contrast-enhanced CT scans show multiple enlarged lymph nodes in anterior and posterior triangles (A) and submental area (B). Nodes have enhancing rims and very-low-density centers. Note absence of thickening and increased density in adjacent subcutaneous tissues.



Fig. 4.—Kaposi sarcoma in 31-year-old AIDS patient with dysphagia and painless right neck mass. Abnormal soft-tissue is seen in hypopharynx, obliterating left vallecula and encroaching on right vallecula (straight arrows). Some of the multiple enlarged lymph nodes, seen on the right, contain low-density centers (curved arrow). Laryngoscopy revealed a large mass involving right aryepiglottic fold and both valleculae.

Biopsy of mass and lymph nodes revealed Kaposi sarcoma.

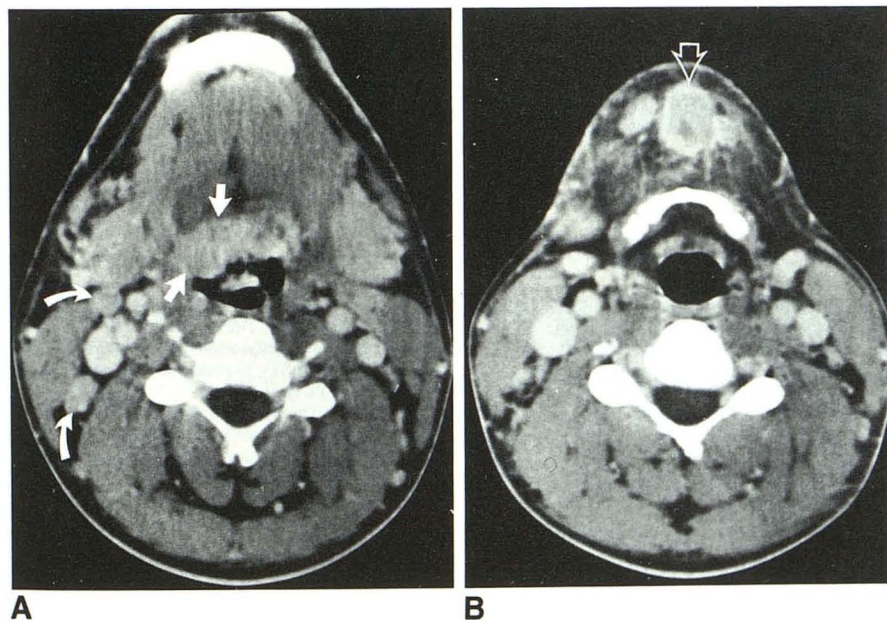


Fig. 5.—Kaposi sarcoma and tuberculous lymphadenitis in 21-year-old AIDS patient with widespread cutaneous Kaposi sarcoma and neck swelling.

A, Contrast-enhanced CT scan shows mass in right hypopharynx involving tongue base partially obliterating vallecula (straight arrows). Multiple lymph nodes are seen (curved arrows).

B, Large submental lymph node (arrow) was biopsied, and both Kaposi sarcoma and acid-fast bacilli were seen. Streaky densities in subcutaneous fat are consistent with enlarged lymphatics. However, there is no significant thickening in subcutaneous tissues.



Fig. 6.—Non-Hodgkin lymphoma in 41-year-old AIDS patient with neck and abdominal masses. CT scan shows two right neck masses of homogeneous density and thin, enhancing rims. There is no adjacent subcutaneous cellulitis.

Biopsy revealed Burkitt lymphoma.

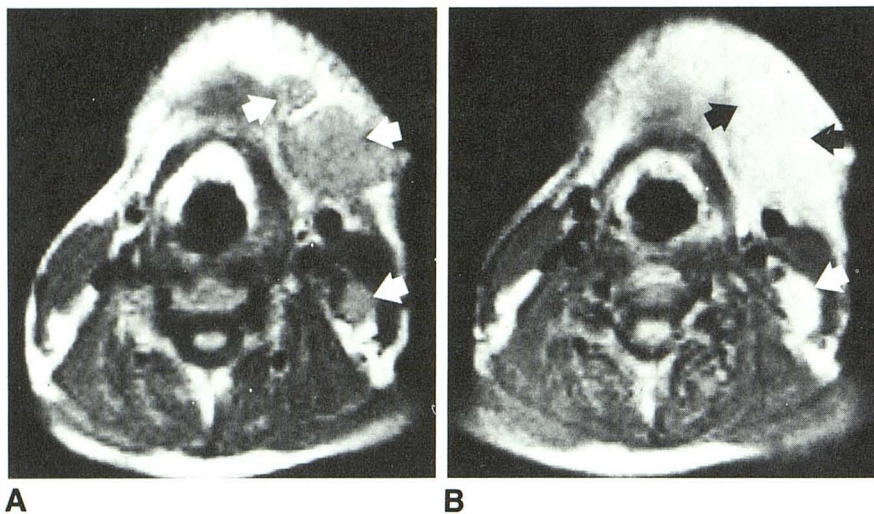


Fig. 7.—Non-Hodgkin lymphoma in 42-year-old man with painless neck swelling.

A, T1-weighted MR image, 500/30 (0.35 T), shows anterior and posterior nodal masses (arrows) of homogeneous medium signal intensity.

B, T2-weighted MR image, 2000/60, shows homogeneous increased signal intensity within lesion (arrows).

Biopsy revealed lymphoma.

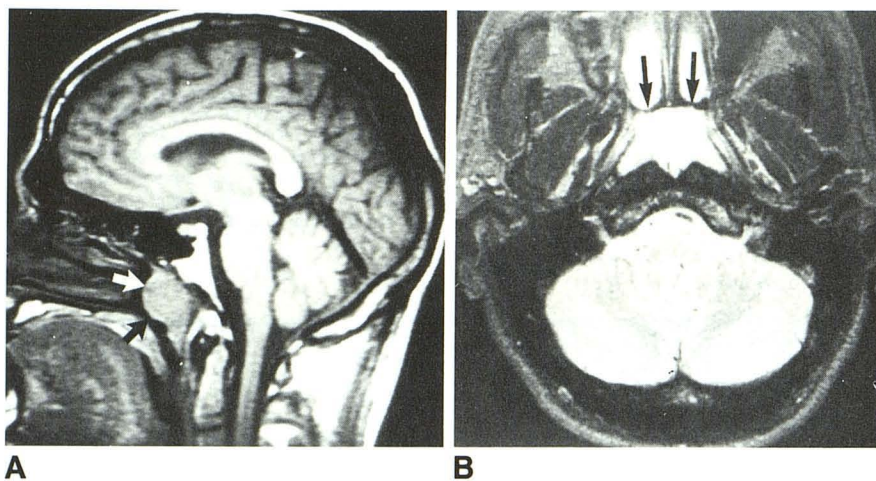


Fig. 8.—Benign lymphoid hyperplasia in 38-year-old homosexual man with enlarged adenoids on physical examination.

A, T1-weighted MR image, 600/20 (1.5T), reveals smooth enlargement of adenoids (arrows).

B, T2-weighted MR image, 2000/60, shows increased signal intensity within adenoids and flat anterior margin.

Because of clinical concern for tumor, a biopsy was performed, which revealed benign follicular hyperplasia.

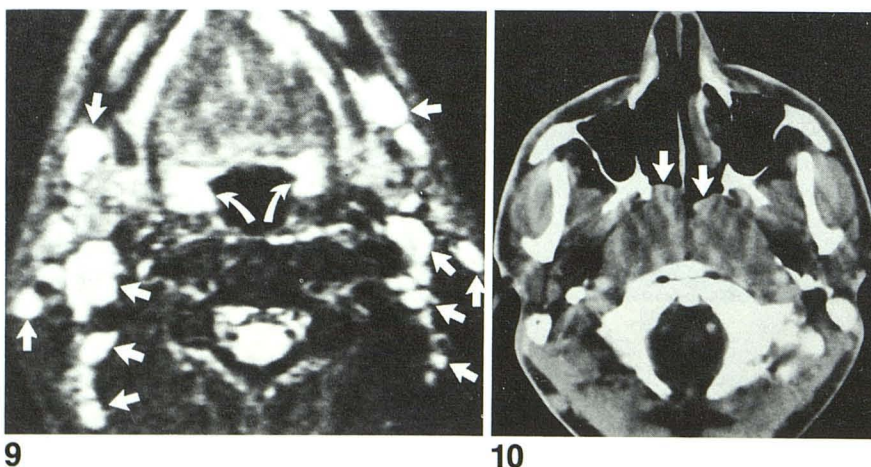


Fig. 9.—Benign lymphoid hyperplasia in 33-year-old patient with AIDS-related complex and generalized lymphadenopathy. T2-weighted MR image, 2000/60 (1.5T), shows multiple anterior and posterior triangle lymph nodes of high signal intensity (straight arrows). Enlarged tonsillar tissue is also of high signal intensity (curved arrows).

Biopsy revealed benign lymphoid hyperplasia.

Fig. 10.—Benign adenoid hypertrophy in 30-year-old man with AIDS-related complex and nasal obstruction. CT scan shows bulky enlargement of adenoids extending into nasal cavities (arrows). A tumor was suspected, but biopsy revealed benign lymphoid hyperplasia.

Benign enlargement of the adenoids, tonsils, or lymph nodes was present in 15 patients (Figs. 8–10). Pathologic verification was obtained in eight of these patients, four with AIDS and four with ARC. Pathologically, there was acute and chronic inflammation with reactive hyperplasia of lymphocytes (benign follicular hyperplasia). In the seven patients in whom there was no pathologic verification, the lymphoid enlargement was benign on physical examination. In all seven the lymph nodes on physical examination were nondominant, smaller than 2 cm, mobile, nontender, and not rapidly enlarging. Five of the patients had adenoid enlargement that on physical examination was symmetrical, of normal color, and nonulcerated. Three of these patients had AIDS and four had ARC. All 15 patients had lymphadenopathy, 12 had adenoid enlargement, and five had tonsillar enlargement.

Table 2 summarizes the comparative findings of the three categories of head and neck disease.

Of the four patients studied with both CT and MR, two had pathologically proved adenoid hypertrophy, one had nasopharyngeal carcinoma, and one had an undifferentiated sarcoma. In both patients with adenoid hypertrophy, homogeneous soft-tissue density was seen with CT, homogeneous medium signal intensity with T1-weighted MR, and homogeneous high signal intensity with T2-weighted MR. In the patient with nasopharyngeal carcinoma, the primary tumor had signal characteristics similar to those of adenoid hypertrophy, but was bulky and asymmetric. Necrotic nodes were seen on CT but not on MR since the nodes were of homogeneous high signal on T2-weighted MR. In the patient with sarcoma, heterogeneous density was seen on contrast-enhanced CT, and heterogeneous signal was seen on T1- and T2-weighted MR. Necrosis was not evident within the mass or nodes on either CT or MR.

Discussion

Clinical evidence of head and neck disease is present in 40–50% of all AIDS patients [1, 2]. Oral or pharyngeal Kaposi sarcoma and candidal infections are the most common lesions [1, 2, 5, 6]. Bacterial infections, lymphoma, and oral squamous cell carcinomas have also been reported to be of increased frequency [6, 8]. Diffuse lymphadenopathy, which often involves the cervical area, is also very common in patients with AIDS or ARC [7, 8]. Nineteen percent of otherwise healthy homosexual males have lymphadenopathy, as do 32% of AIDS patients and 95% of patients with ARC [7]. We similarly have found a variety of head and neck diseases in these patients. There were equal numbers of infections, tumors, and benign lymph node enlargement. We found that CT and MR were useful in helping to distinguish between the various origins and often assisted in clinical management.

Bacterial infections were common and had the most characteristic CT appearance, with mass lesions involving multiple deep neck spaces and adjacent subcutaneous cellulitis in all seven cases. CT helped direct therapy in these patients by demonstrating low density within the central portion of the mass in five of seven patients, leading to surgical drainage.

The ability of CT to guide treatment in nonimmunosuppressed patients with neck infections has been previously reported [9].

Mycobacterial and often unusual infections (*Rhinosporidium* and *Pneumocystis*) were seen in six patients. *Pneumocystis* of the external auditory canal has been previously reported in patients with AIDS [10, 11]. Nodal masses with low-density centers and ring enhancement without significant overlying subcutaneous cellulitis has been described as typical for tuberculous lymphadenitis [12]. This appearance was seen in only one of our four patients with mycobacterial infection. However, in the other three patients, only mildly increased density in the subcutaneous tissue was seen. Only one patient had significant thickening of the subcutaneous tissues, and this patient had both *Pseudomonas* and mycobacterial infections. Although the lack of significant cellulitis helps distinguish mycobacterial from bacterial infections, it was difficult to distinguish mycobacterial from malignant lymphadenopathy. Although in the latter there is usually evidence of a primary tumor, in one of our patients with oral Kaposi sarcoma, lymph-node biopsy revealed both Kaposi sarcoma and tuberculous adenitis (Fig. 5). Biopsy, therefore, often is necessary to make the diagnosis in AIDS patients with atypical CT findings.

In the patients with tumors, most of the neoplastic masses were of homogeneous CT density and MR signal intensity. The only distinguishing feature in this category was the appearance of the lymph nodes. With CT, all the lymphomatous nodes were of homogeneous density, while most of the Kaposi sarcoma and squamous cell carcinoma nodal lesions had low-density centers. Typically, Kaposi sarcoma involved the oral cavity or hypopharynx and frequently was associated with low-density lymph nodes. On the other hand, lymphoma usually involved either the nasopharynx or cervical nodal groups and had homogeneous lymph nodes.

As mentioned, lymphadenopathy is extremely common in patients with AIDS and ARC. We have found that enlargement of tonsils and adenoids also is common. The enlarged adenoids can cause nasal obstruction and, therefore, clinically mimic nasopharyngeal malignancy. Benign adenoidal enlargement usually had a symmetric, smooth ventral margin with a flat anterior border on axial imaging. However, in two cases, asymmetric bulky adenoidal enlargement indistinguishable from tumor was found. Benign lymphadenopathy was always homogeneous in CT density and MR signal intensity. This is in distinction to lymphadenopathy of Kaposi sarcoma and squamous cell carcinoma, in which low-density nodes were predominant. Benign lymph nodes may reach 2 cm in size but usually are smaller than 1.5 cm.

In summary, although significant overlap exists in the imaging appearance of many of the lesions we encountered, it is often possible to distinguish bacterial infections from tumors and benign lymphoid hyperplasia. Mycobacterial infections are a problem because they may simulate malignant lymphadenopathy. CT and MR are useful in guiding biopsy and following therapeutic maneuvers in AIDS patients with head and neck disease. It is important for radiologists to be aware

TABLE 2: CT and MR Findings of Head and Neck Lesions in Patients with AIDS

| Finding | Infection | | Tumor | | | Lymphoid Hyperplasia |
|----------------------------|-----------|------------------|----------|------------------|-------|-----------------------|
| | Bacterial | AFB | Lymphoma | KS | Other | |
| Subcutaneous changes: | 7/7 | 3/4 ^a | 3/5 | 2/5 | 0/5 | 0/15 |
| Infiltration | 7/7 | 3/4 | 3/5 | 2/5 | 0/5 | 0/15 |
| Thickening | 7/7 | 1/4 ^a | 1/5 | 1/5 | 0/5 | 0/15 |
| Degree | 2-3+ | 1+ | 1+ | 1+ | - | - |
| Low-density center (CT): | | | | | | |
| Mass | 5/7 | 0/4 | 1/4 | 0/4 | 1/3 | 0/7 |
| Nodes | 1/7 | 2/4 ^b | 0/4 | 3/4 ^b | 2/3 | 0/7 |
| Homogeneous nodes (MR) | - | - | 1/1 | 1/1 | 4/4 | 10/10 |
| Size of largest node (cm): | | | | | | |
| <1 | 0/7 | 0/4 | 2/5 | 2/5 | 2/5 | 3/8, 4/7 ^c |
| 1-1.4 | 0/7 | 0/4 | 1/5 | 1/5 | 1/5 | 4/8, 2/7 ^c |
| 1.5-2 | 6/7 | 1/4 | 0/5 | 0/5 | 0/5 | 1/8, 1/7 ^c |
| >2 | 1/7 | 3/4 | 2/5 | 2/5 | 2/5 | 0/8, 0/7 ^c |

Note.—AFB = acid-fast bacillus; KS = Kaposi sarcoma.

^a One patient had both tuberculous and *Pseudomonas* infections.

^b One patient had both Kaposi sarcoma and tuberculosis in lymph nodes.

^c The 15 patients comprise eight with pathologic verification and seven without.

of the increased frequency and spectrum of head and neck disease in patients with or at-risk for AIDS.

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