9 Lymphoma

Aarti Kaushik and Robert W. Henderson

Case 9.1: Transformation of Follicular Lymphoma Grade

History

A 63-year-old female with recurrent lymphoma. Patient had low-grade (grade 1A) follicular B-cell lymphoma initially in the left inguinal region. The current disease is follicular B cell (grade 3). Scan is requested for restaging.

Findings

There are at least two subcentimeter left cervical level 2 lymph nodes with the most active with maximum SUV of 8.6 (Fig. 9.1). There is a subcentimeter left level 5 lymph node with maximum SUV of 7.9. These are consistent with lymphomatous involvement. There are multiple splenic lesions noted with the largest and most active measuring 2.4 cm × 1.8 cm, with maximum SUV of 13.9 correlating to hypodense region on CT.

Pearls and Pitfalls

Recurrent disease with histopathological transformation from grade 1–3 (Fig. 9.1).

P.S. Conti, A. Kaushik (eds.), *PET-CT*, DOI 10.1007/978-1-4419-5811-2_9

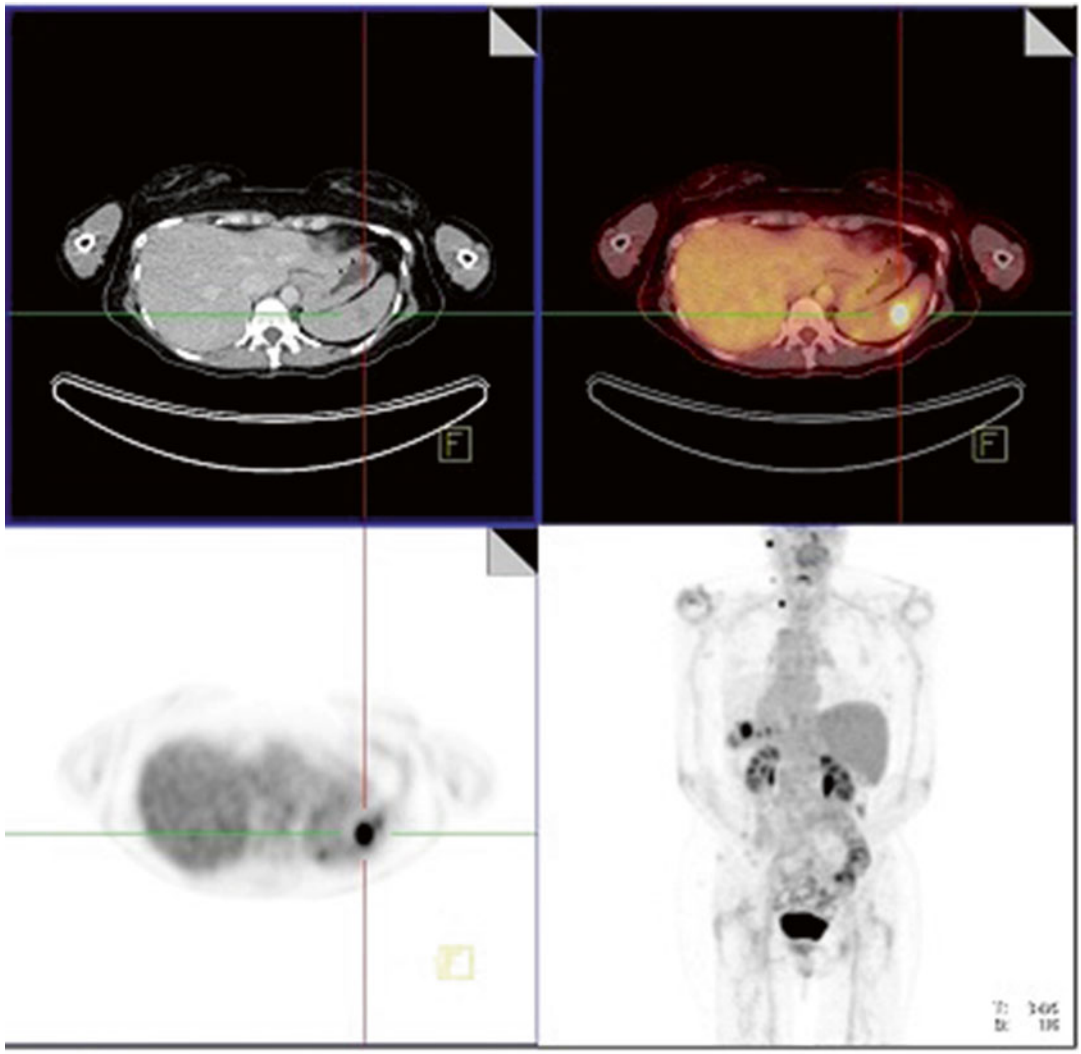

Fig. 9.1

Case 9.2: Multiple Recurrences with High-Grade Transformation of Lymphoma

History

A patient with low-grade follicular lymphoma initially diagnosed in the sacrum in 1998, treated with chemotherapy and radiation. A patient had recurrence in 2004 involving the right groin, bilateral iliac region, and right base of the tongue, treated with chemotherapy and radiation therapy. No interval treatment since then. Current study in 2011.

Findings

Interval increase in size and metabolic activity of a left level 4 node now measuring 1.2 cm in short axis with SUVmax 4.5 (normal size and inactive in prior) (Fig. 9.2). New intensely active and enlarged left porta hepatis nodes, SUVmax up to 12. There is interval increase in metabolic activity but unchanged size of a left retroaortic node, now with SUVmax 4.3 (SUVmax 3.8 in prior).

Pearls and Pitfalls

1. Multiple recurrences with progressive more biologic activity as noted with SUVmax in the current study.
2. Zevalin (90Yt Rituxan) with higher response rate than Rituxan alone.

Discussion

Follicular lymphoma is the second most common type of lymphoma in high-income countries, representing nearly 20 % of all non-Hodgkin's lymphomas. The pathogenesis of follicular lymphoma remains elusive, and evidence exists that t(14;18)(q32;q21), the most common genetic alteration in follicular lymphoma cells, which results in an overproduction of the antiapoptotic BCL-2 protein, is not sufficient to cause the disease [26]. By contrast, the role of infiltrating cells in the tumor microenvironment has gained attention in the past few years [1]. The clinical course of follicular lymphoma is quite variable, with some patients having an indolent, waxing, and waning disease for years, without the need for therapy, and others presenting with a more disseminated and rapidly growing disease. Most patients with follicular lymphoma have incurable disease, with a generally indolent course, frequent relapses, and a progressive decrease in duration of responses with every subsequent relapse. A major advance in the treatment of follicular lymphoma was the introduction of monoclonal antibodies to therapeutic regimens, mainly antibodies against CD20. These antibodies have contributed to the improvements in survival of patients with follicular lymphoma recorded in the past decade [2]. But, even in the immunotherapy era, relapses will occur (Fig. 9.2).

Case 9.3: Diffuse Large B-Cell Lymphoma Scapula

History

A patient with diffuse large B-cell lymphoma, stage 4, involving the right scapula (biopsy dated 12/13/2010). No treatment yet.

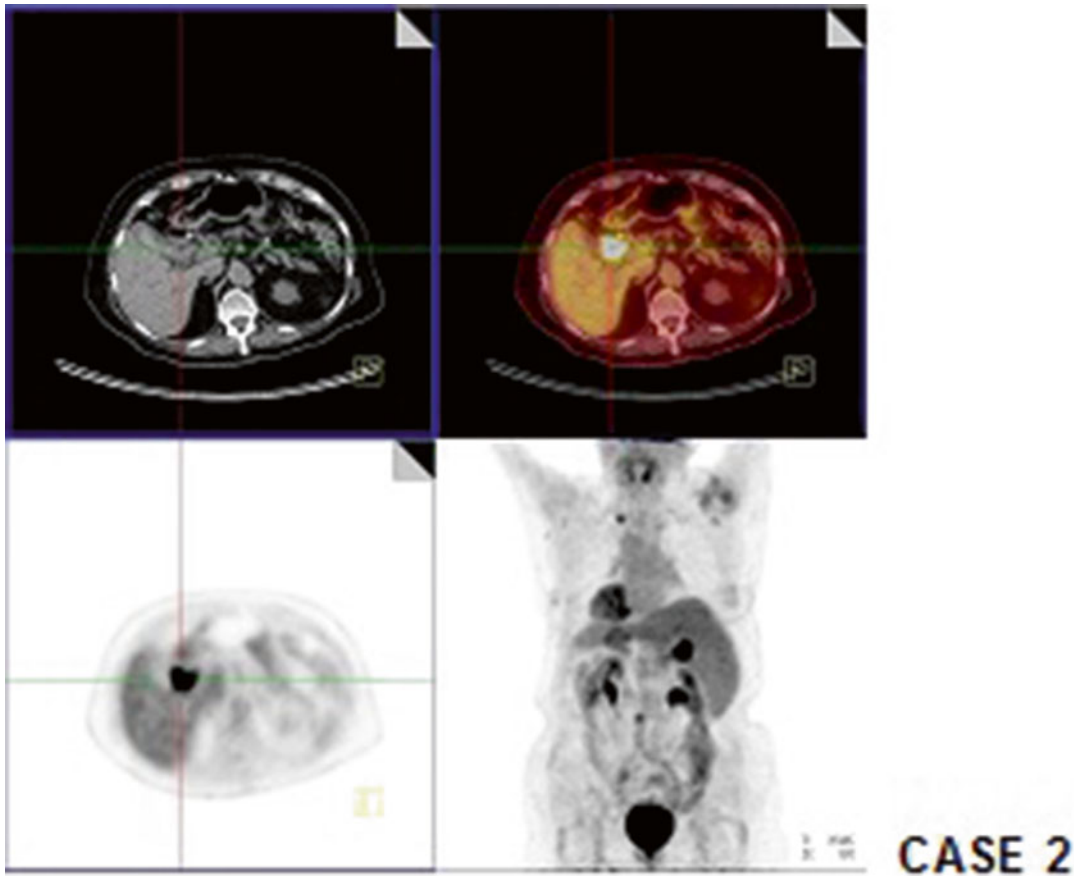

Fig. 9.2

Findings

A hypermetabolic, osteolytic right scapular body mass involving the wing and extending into the glenoid, with SUVmax 10.3 consistent with biopsy-proven lymphoma (Fig. 9.3). Hypermetabolic, right supraclavicular and right axillary nodes (faintly visible) with SUVmax up to 6.5 and hypermetabolic right inguinal node (1.3 cm, with SUVmax 13.2) are consistent with lymphomatous involvement (Fig. 9.3).

Case 9.4: Hodgkin's Lymphoma Involving Spine

History

A 47-year-old female presenting with neurologic symptoms, undergoing workup with PET-CT for T5 lesion, status post bone biopsy which was

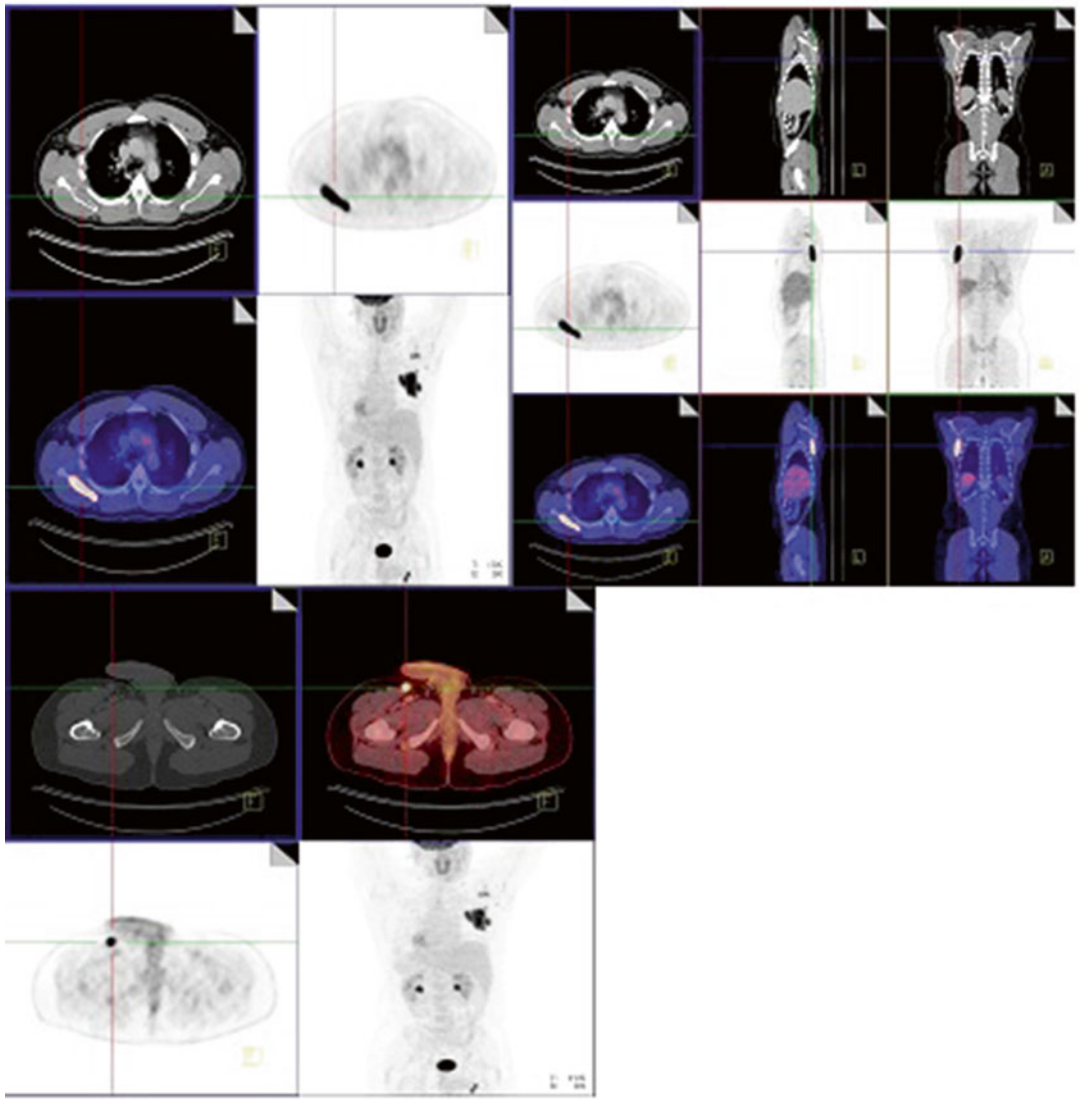

Fig. 9.3

nondiagnostic. However, post scan biopsy reported classic Hodgkin's lymphoma.

Findings

There is a large hypermetabolic mass involving T5 with its soft tissue component causing bony destruction and extending posteriorly abutting and possibly causing mass effect on the spinal cord, SUVmax 13.3 (Fig. 9.4). This lesion extends anteriorly to abut the posterior aspect of the trachea and extends laterally involving adjacent paravertebral space (Fig. 9.4).

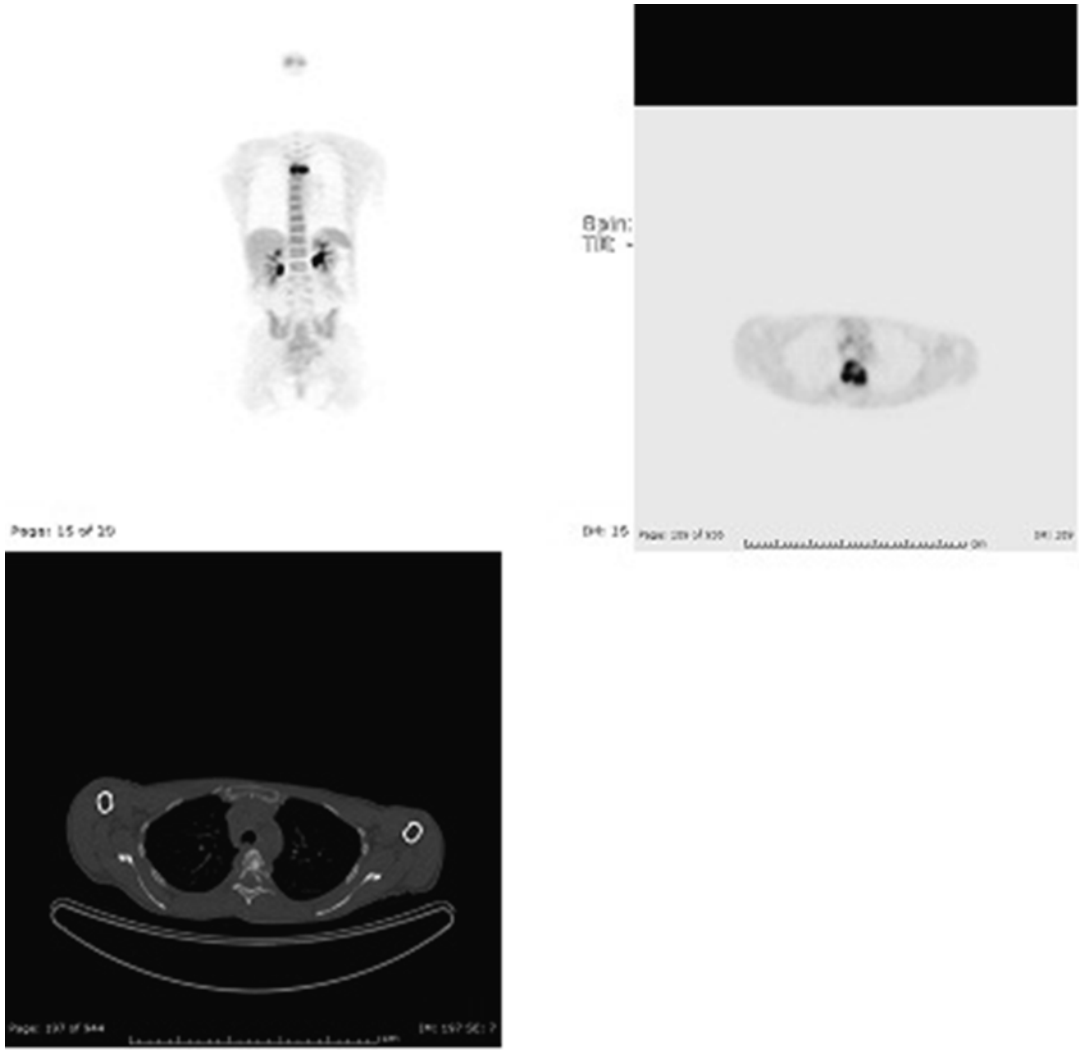

Fig. 9.4

Case 9.5: Sacral Lymphoma

History

A 59-year-old male with B-cell lymphoma of the right sacrum.

Findings

Intensely active destructive lytic mass involving the right sacral wing and body with presacral extension of the soft tissue, with maximum SUV of 12.5 (Fig. 9.5). In addition, there is extension of this lesion into the adjacent

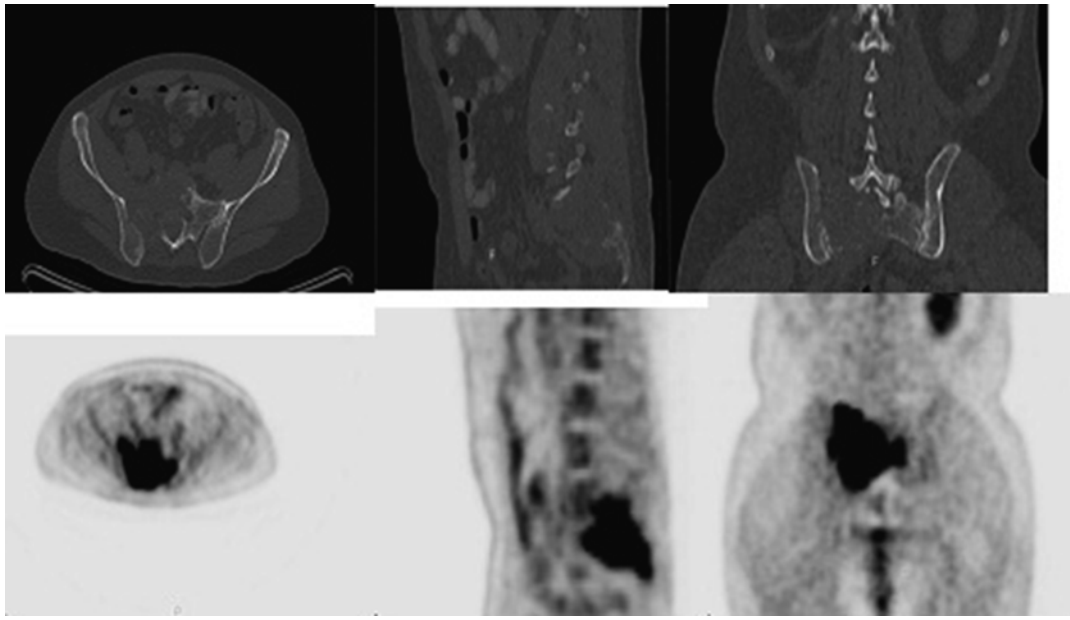

Fig. 9.5

iliacus musculature. There is extension into the lower bony spinal canal with involvement of the first and second sacral foramina (Fig. 9.5).

Case 9.6: Right Maxillary Lymphoma

History

A 71-year-old male with history of diffuse large B-cell lymphoma involving the right maxilla and right neck nodes for initial staging.

Findings

There is a large right maxillary sinus mass with SUVmax 15 (Fig. 9.6). There is osseous destruction involving the anterior and medial walls of the right maxillary sinus as well as the maxilla.

Discussion

Primary lymphoma of the bone is a rare malignant condition that accounts for less than 5 % of all primary bone tumors [3]. It has also been called reticulum cell sarcoma [4], malignant lymphoma of the bone [5], and more

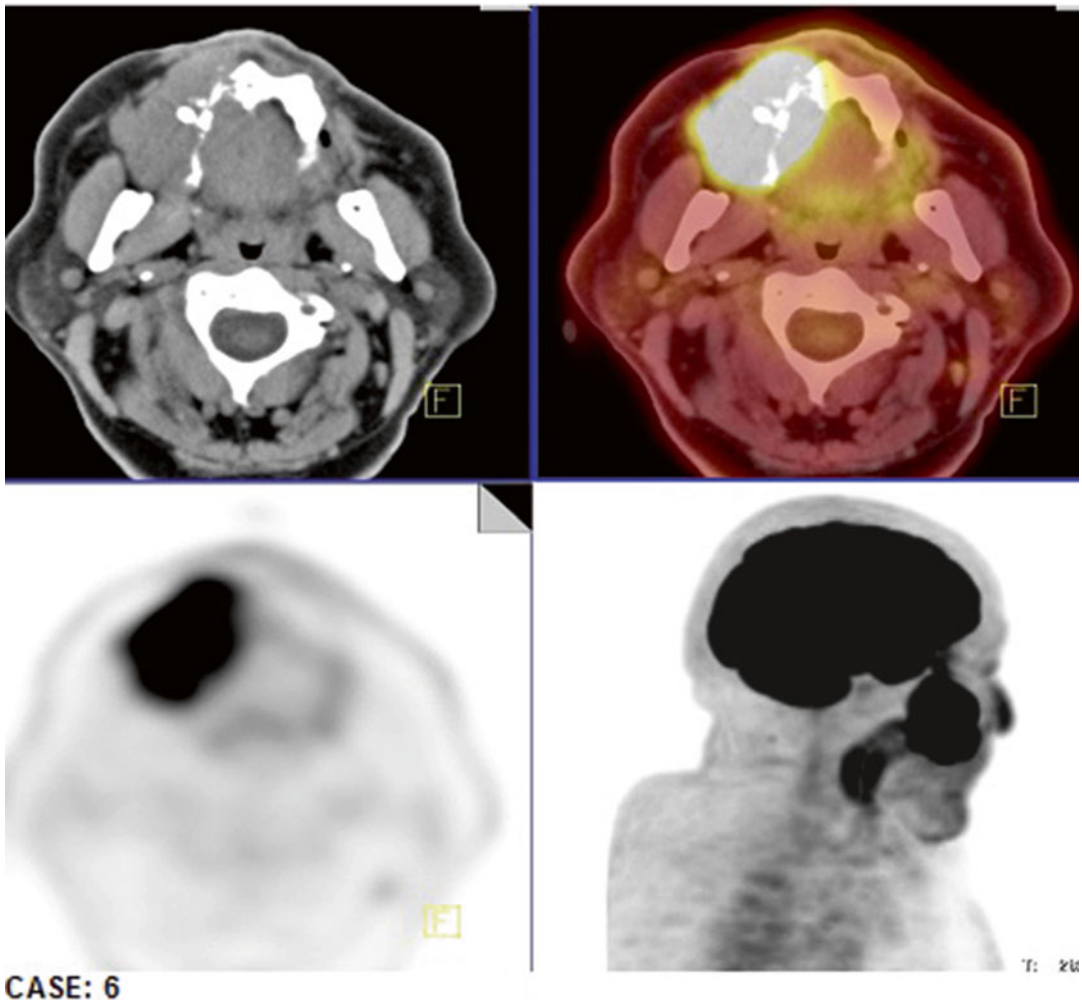

Fig. 9.6

recently osteolymphoma [6]. The vast majority of cases are of the non-Hodgkin type, with Hodgkin's disease accounting for 6 % of cases in one series [3]. Lymphomas of the bone are uncommon, comprising only 8 % of primary malignant bone tumors [3]. Most malignant lymphomas of the bone are diffuse non-Hodgkin's lymphomas of B-cell type [4] (Fig. 9.6).

Case 9.7: NHL Bladder

History

Primary urinary bladder non-Hodgkin's lymphoma in an 80-year-old female. She presented with difficulty urinating and urinary frequency and

urgency along with weak stream of urine. On physical examination, she was found to have bladder neck mass for which she underwent transurethral resection of the mass. The pathology was consistent with diffuse large B-cell lymphoma.

Findings

Staging PET-CT study demonstrated a hypermetabolic, soft tissue mass at the base of the urinary bladder, measuring $6.3 \times 3.8 \times 3.4$ cm and maximum SUV of 21.8 (Fig. 9.7). She had received chemotherapy and demonstrated excellent response on the follow-up PET-CT study.

Pearls and Pitfalls

Lymphomas of the bladder are rare lesions, representing approximately 0.2 % of the primary neoplastic lesions and approximately 1.8 % of the secondary lesions in this organ [7, 8, 27].

Discussion

Primary lymphoma of the bladder represents 0.2 % of all bladder malignancies. Secondary involvement of the bladder by malignant lymphoma occurs in 10–50 % of cases. Most lymphomas of the bladder are non-Hodgkin's lymphomas of the B-cell type, with preponderance among women. Patients with bladder lymphomas can be divided into three

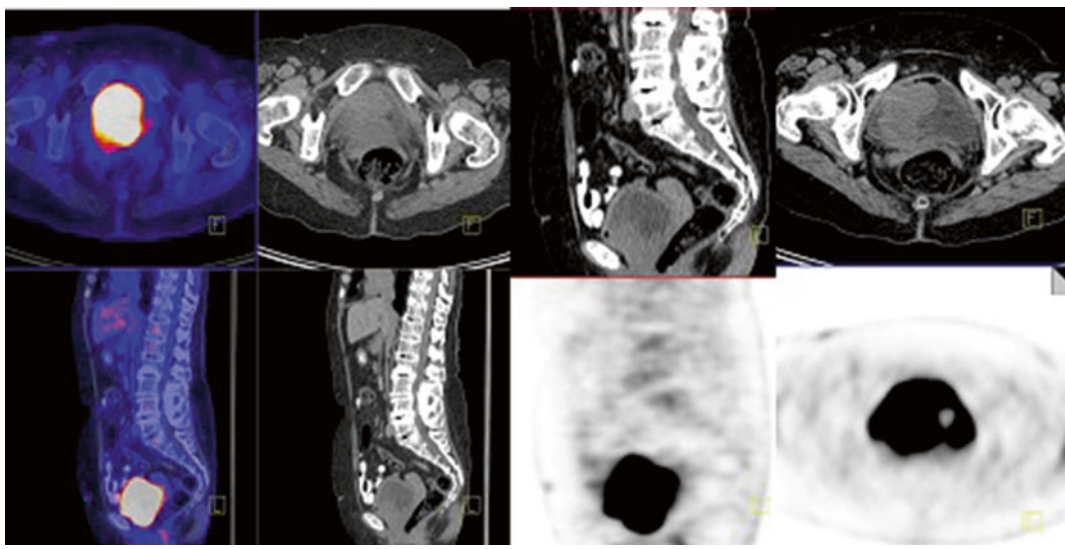

Fig. 9.7

groups, according to their clinical presentation: (1) primary cases in the bladder, (2) cases occurring in the bladder as a manifestation of systemic disease, and (3) secondary cases, with clinical history of malignant lymphoma recurring in the bladder. In the latter case, the main sites of involvement are peripheral lymph nodes, the bone marrow, and the spleen [8] (Fig. 9.7).

Case 9.8: Parotid Lymphoma

History

A 48-year-old female with non-Hodgkin's lymphoma in the left parotid diagnosed in 2012, for initial staging.

Findings

There is intensely hypermetabolic soft tissue density noted in the left parotid with the maximum SUV of 10.4 with photopenic hypoattenuating center which may be related to necrosis or seroma, consistent with the known left parotid tumor (Fig. 9.8). There is brown fat activity noted in the bilateral posterior cervical region in the images.

Pearls and Pitfalls

The following clinical features might suggest the diagnosis: development of a parotid mass in a patient with a known history of malignant lymphoma; occurrence of a parotid mass in a patient with an immune disorder, such as Sjogren's syndrome, rheumatoid arthritis, or acquired immunodeficiency syndrome; occurrence of a parotid mass in a patient with a previous diagnosis of "benign lymphoepithelial lesion"; multiple masses in a unilateral parotid gland or bilateral parotid masses; or parotid mass associated with multiple, enlarged unilateral or bilateral cervical lymph nodes.

Discussion

Sjogren's disease is the commonest collagen vascular disorder involving the parotid gland causing enlargement. The parotid node maybe involved in lymphoma. Parotid glands are the only salivary glands with lymph nodes. Primary malignant lymphomas of the salivary glands are uncommon, comprising only 1.7–3.1 % of all salivary neoplasms [9–11] and 0.6–5 % of all tumors and/or tumor like lesions of the parotid gland [9, 12]. The lymphoma may arise in intraglandular lymph nodes normally found

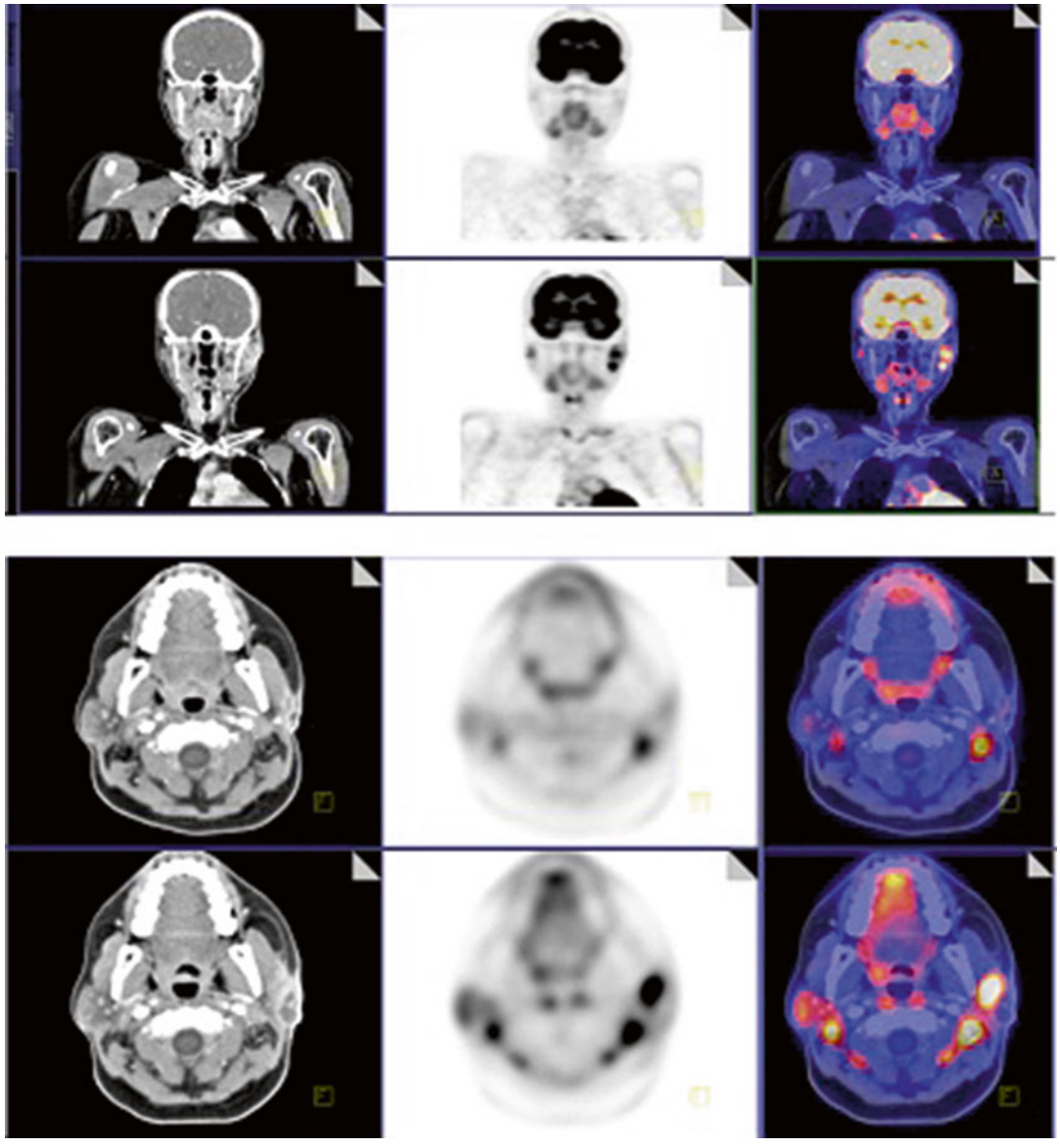

Fig. 9.8

in the parotid gland or from the parenchyma (mucosa-associated lymphoid tissue [MALT]) or both. The distinction of nodal vs parenchymal (MALT) origin of a salivary lymphoma has some clinical significance, since many of the parenchymal (MALT) lymphomas tend to be low grade, are localized at the time of diagnosis and often remain so for extended periods, frequently are associated with a "benign lymphoepithelial lesion," and are often curable. 18–25 A few, however, may disseminate to lymph nodes or other MALT sites or even transform to a higher-grade lymphoma (Fig. 9.8).

Case 9.9: Renal Non-Hodgkin's Lymphoma

History

A patient is a 70-year-old male with history of non-Hodgkin's lymphoma. The study is requested for staging.

Findings

Bilateral kidneys are markedly enlarged and demonstrate intense activity on PET, consistent with lymphomatous infiltration (Fig. 9.9). The right kidney measures approximately 14.5 cm AP × 13.7 cm transverse × 19.5 cm craniocaudal and has a maximum SUV up to 11.5. The left kidney measures approximately 16.9 cm AP × 16 cm transverse × 18.2 cm craniocaudal and has a maximum SUV of 9.8. There is a right ureteral stent, with the distal pigtail terminating in the urinary bladder.

Numerous enlarged lymph nodes in are seen multiple nodal basins in the neck, chest, abdomen, and pelvis, consistent with the documented lymphoma abdomen, and pelvis. For reference, the largest right axillary adenopathy measures 2.0 × 4.6 cm and has a maximum SUV of 7.0.

Pearls and Pitfalls

1. Primary renal lymphoma should be suspected if there is bilateral enlargement of the kidneys.
2. Imaging techniques and renal histology have a central role in establishing the diagnosis.

Discussion

Primary renal lymphoma is an uncommon variant of extranodal non-Hodgkin's lymphoma. Manifestations are usually nonspecific hematuria, fever, flank pain, and renal insufficiency [13, 14]. Renal lymphoma, however, is important to include in the differential diagnosis of renal masses, because generally it is a systemic disease and treatment is nonsurgical. Primary renal NHL is a rare disease [15, 16]. It is defined as an NHL arising primarily in the renal parenchyma, not resulting from invasion of an adjacent lymphomatous mass [16]. It affects middle-aged people and is usually of B-cell lineage. Clinical presentation includes symptoms of flank pain and renal insufficiency [15, 16]. Compressive alteration of the tubules and vascular impairment are the main structural events. The pathogenesis of primary renal lymphoma is poorly understood, as the renal parenchyma is not a lymphoid organ. It is believed by some investigators that lymphomas in nonlymphoid organs arise in the setting of an inflammatory disease with a lymphoplasmacytic infiltrate [17]. However,

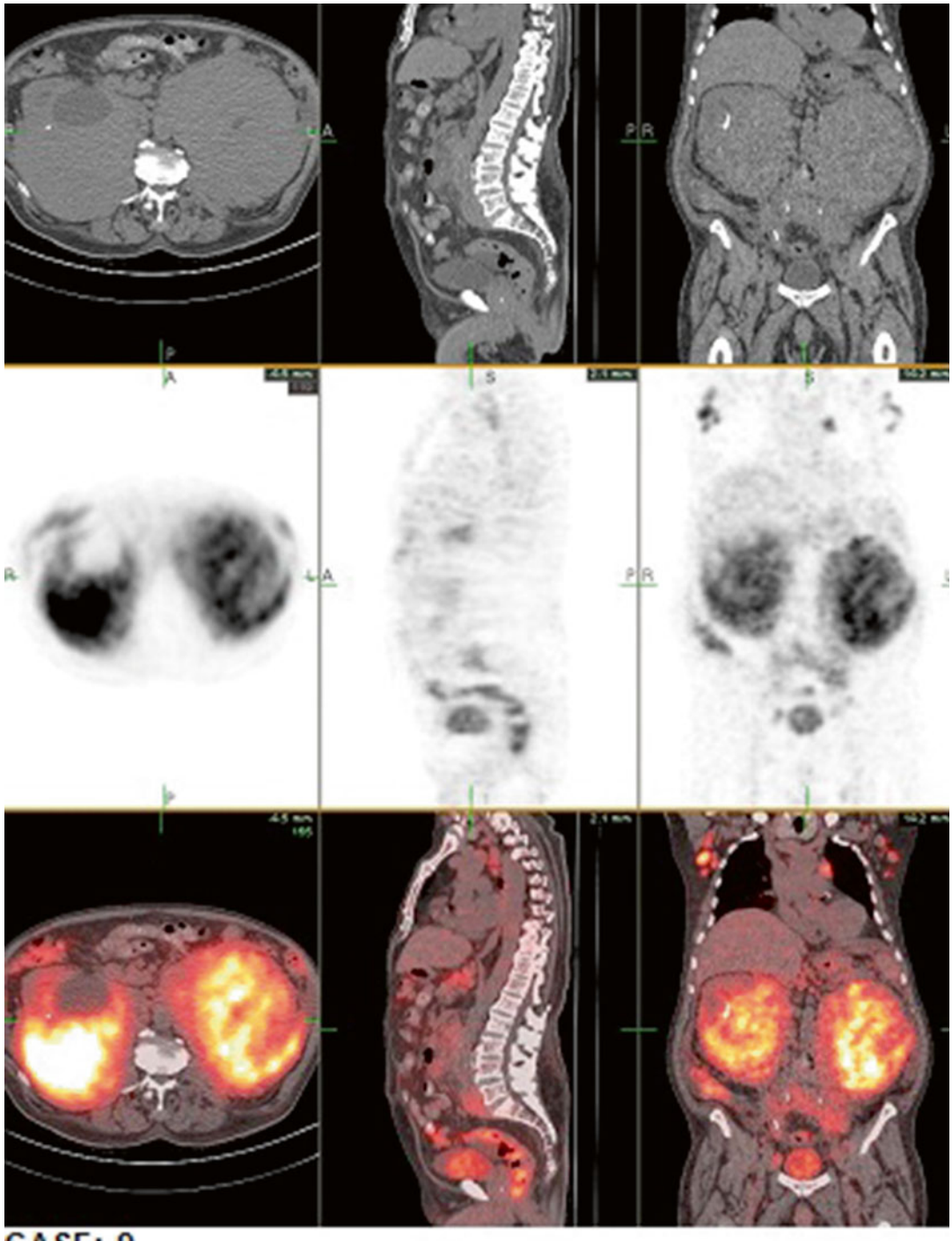

Fig. 9.9

such a pathogenetic mechanism has not been applied to the kidney. Most primary renal lymphomas disseminate rapidly from their renal origin, and mean survival is reportedly less than a year after the diagnosis [18]. Differentiating renal lymphoma from carcinoma, especially in the case of a unilateral lesion, is a diagnostic challenge (Fig. 9.9).

Case 9.10: NK Lymphoma

History

A patient with NK-type nasal lymphoma for initial staging.

Findings

Hypermetabolic right nasopharyngeal mass with destruction of the lower mid bony nasal septum with SUVmax 7.3 (Fig. 9.10). The mass begins in the cavity and extends along the medial wall of the right maxillary sinus to the posterior nasal cavity and superiorly up to the level of the hard palate.

Pearls and Pitfalls

NK-cell lymphoma is the commonest histologic subtype in nasal lymphomas in Asian patients.

Discussion

Natural killer (NK) cells are cytotoxic cells, which are capable of lysing tumor cells, and cells infected by bacteria and virus [19–21]. Nasal NK-cell lymphomas refer generally to tumors arising in the nose and the upper airway [22]. The male to female ratio is approximately 3:1, with disease peaking in the fifth decade of life. NK-cell lymphoma is the commonest histologic subtype in nasal lymphomas in Asian patients [22]. Nasal NK-cell lymphomas present as destructive mass lesions involving the nasal cavity, nasopharynx, paranasal sinuses, tonsils, hypopharynx, and larynx. Destruction of the hard palate leads to a characteristic midline perforation, from which the term “lethal midline granuloma” was originally derived (Fig. 9.10).

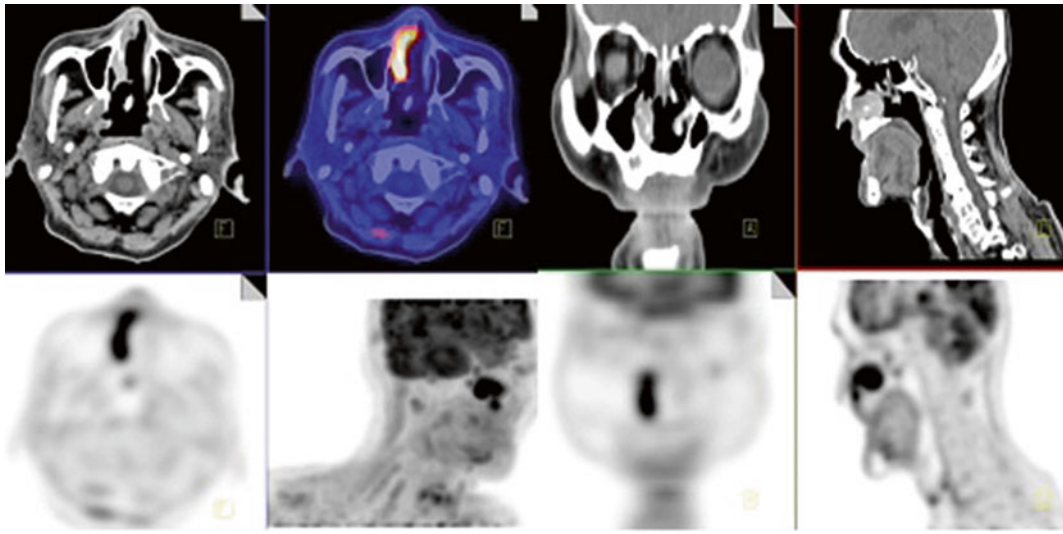

Fig. 9.10

Case 9.11: Orbital Lymphoma

History

A patient with history of orbital lymphoma (MALT), with follow-up showing complete remission.

Findings

There is a right retro-orbital mass, with SUVmax 7.2 consistent with history of lymphoma (top row) (Fig. 9.11). On follow-up there is activity in the bilateral ocular muscles with inactive residua on the right (bottom images).

Pearls and Pitfalls

Orbital lymphoma is almost always non-Hodgkin's lymphoma (NHL) with the most common subtype being low-grade small B-cell lymphoma.

Discussion

Lymphoproliferative lesions of the orbit account for 5–10 % of orbital masses and exist along a spectrum from benign hyperplasia (10–40 %) to lymphoma (60–90 %). Orbital lymphoma is almost always non-Hodgkin's

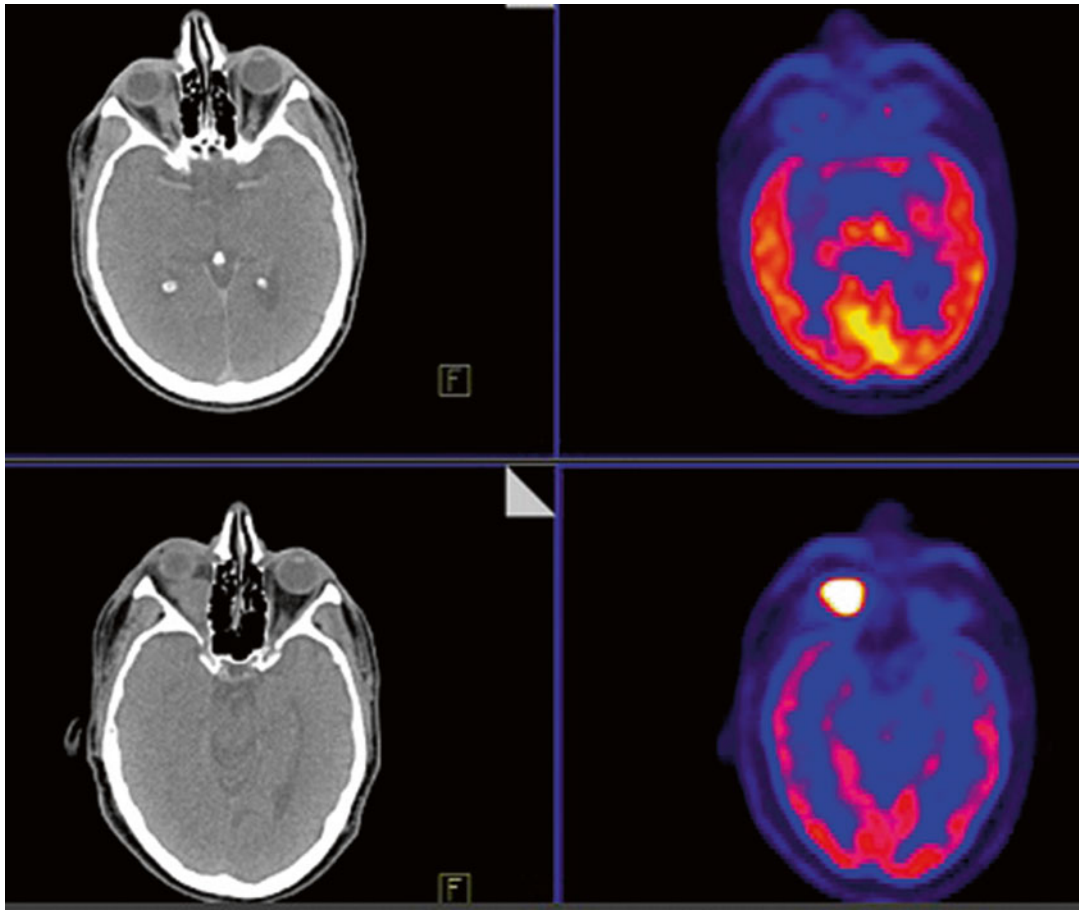

Fig. 9.11

lymphoma (NHL) with the most common subtype being low-grade small B-cell lymphoma. The most common presentation is a painless slow-growing mass. It is commonly extraconal, anterior, superolateral and has a predilection for the lacrimal glands. It is bilateral in 25 % of cases, and 50 % will have globe displacement. Orbital lymphoma is also known to infiltrate the conal or rectus musculature as well as the globe. Fluorine-18 deoxyglucose PET (FDG-PET) can sometimes find systemic extranodal lymphomatous sites that are not detected with conventional imaging studies. This ability yields valuable information in patients with ocular lymphoma, which may result in important changes in staging and also in patient management [23, 24]. PET has been found to have a higher sensitivity than CT scan (86 % vs. 72 %) in detecting distant disease [25] (Fig. 9.11).

References

1. Dave SS, Wright G, Tan B, et al. Prediction of survival in follicular lymphoma based on molecular features of tumor-infiltrating immune cells. N Engl J Med. 2004;351:2159–69.
2. Liu Q, Fayad L, Cabanillas F, et al. Improvement of overall and failure-free survival in stage IV follicular lymphoma: 25 years of treatment experience at The University of Texas M.D. Anderson Cancer Center. J Clin Oncol. 2006;24:1582–9.
3. Mulligan ME, McRae GA, Murphey MD. Imaging features of primary lymphoma of bone. Am J Roentgenol. 1999;173:1691–7.
4. Coley BL, Higinbotham NL, Groesbeck HP. Primary reticulum-cell sarcoma of bone. Radiology. 1950;55:641–58.
5. Boston Jr HC, Dahlin DC, Irvins JC, Cupps RE. Malignant lymphoma (so-called reticulum cell sarcoma) of bone. Cancer. 1974;34:1131–7.
6. Christie DR, Cahill SP, Barton MB. Primary bone lymphoma (osteolymphoma). Australas Radiol. 1996;40:319–23.
7. Díaz-Peromingo JA, Tato-Rodríguez J, Pesqueira-Fontán PM, Molinos-Castro S, Gayol-Fernández MC, Struzik JP. Non-Hodgkin's lymphoma presenting as a primary bladder tumor: a case report. J Med Case Reports. 2010;4:114.
8. Bates AW, Norton AJ, Baithun SI. Malignant lymphoma of the urinary bladder: a clinicopathological study of 11 cases. J Clin Pathol. 2000;53:458–61.
9. Sharkey FE. Systemic evaluation of the World Health Organization classification of salivary gland tumors: a clinicopathologic study of 366 cases. Am J Clin Pathol. 1977;67:272–8.
10. Gleeson MJ, Bennett MH, Cawson RA. Lymphomas of salivary glands. Cancer. 1986;58:699–704.
11. Schusterman MA, Granick MS, Erickson ER, Newton D, Hanna DC, Brighten R. Lymphomas presenting as a salivary gland mass. Head Neck Surg. 1988;10:411–5.
12. Bears OH, Woolner LB, Carveth SW, Devine KD. Surgical management of parotid lesions: a review of 760 cases. Arch Surg. 1960;80:890–904.
13. Freeman C, Berg JW, Cutter SJ. Occurrence and prognosis of extranodal lymphomas. Cancer. 1972;29:252–60.
14. Pervez H, Shaikh M, Potti A, Mehdi SA. Uncommon presentations of non-Hodgkin's lymphoma: case 3-primary renal lymphoma. J Clin Oncol. 2003; 21:567–9.
15. Stallone G, Infante B, Manno C, et al. Primary renal lymphoma does exist. J Nephrol. 2000;13:367–72.
16. Okuno SH, Hoyler JD, Ristow K, et al. Primary renal non-Hodgkin's lymphoma: an unusual extra nodal site. Cancer. 1995;75:2258–61.
17. Brouland JP, Meeus F, Rossert J, et al. Primary bilateral B-cell renal lymphoma. Am J Kidney Dis. 1994;24:586–9.
18. Saito S. Primary renal lymphoma: case report and review of the literature. Urol Int. 1996;56:192–5.
19. Spits H, Lanier LL, Phillips JH. Development of human T and natural killer cells. Blood. 1995;85:2654–70.
20. Kwong YL. Natural killer-cell malignancies: diagnosis and treatment. Leukemia. 2005;19:2186–94.
21. Oshimi K. Progress in understanding and managing natural killer cell malignancies. Br J Haematol. 2007;139:532–44.

22. Cheung MM, Chan JK, Lau WH, Foo W, Chan PT, et al. Primary non-Hodgkin' s lymphoma of the nose and nasopharynx: clinical features, tumor immunophenotype, and treatment outcome in 113 patients. J Clin Oncol. 1998;16:70–7.
23. Valenzuela AA, Allen C, Grimes D, Wong D, Sullivan TJ. Positron emission tomography in the detection and staging of ocular adnexal lymphoproliferative disease. Ophthalmology. 2006;113(12):2331–7.
24. Roe RH, Finger PT, Kurli M, Tena LB, Lacob CE. Whole-body positron emission tomography/computed tomography imaging and staging of orbital lymphoma. Ophthalmology. 2006;113(10):1854–8.
25. Sullivan TJ, Valenzuela AA. Imaging features of ocular adnexal lymphoproliferative disease. Eye. 2006;20(10):1189–95.
26. Tomás JF. The challenge of recurrent follicular lymphoma. Lancet Oncol. 2011;12(8):714–6.
27. Kempton CL, Kurtin PJ, Inwards DJ, Wollan P, Bostwick DG. Malignant lymphoma of the bladder: evidence from 36 cases that low-grade lymphoma of the MALT-type is the most common primary bladder lymphoma. Am J Surg Pathol. 1997;21:1324–33.