Chest Wall Tumors: Radiologic Findings and Pathologic Correlation

Part 1. Benign Tumors

Benign chest wall tumors are uncommon lesions that originate from blood vessels, nerves, bone, cartilage, or fat. Chest radiography is an important technique for evaluation of such tumors, especially those that originate from bone, because it can depict mineralization and thus indicate the diagnosis. Computed tomography (CT) and magnetic resonance (MR) imaging are helpful in further delineating the location and extent of the tumor and in identifying tumor tissues and types. Although the radiologic manifestations of benign and malignant chest wall tumors frequently overlap, differences in characteristic location and appearance occasionally allow a differential diagnosis to be made with confidence. Such features include the presence of mature fat tissue with little or no septation (lipoma), the presence of phleboliths and characteristic vascular enhancement (cavernous hemangioma), evidence of neural origin combined with a targetlike appearance on MR images (neurofibroma), well-defined continuity of cortical and medullary bone with the site of origin (osteochondroma), or fusiform expansion and ground-glass matrix (fibrous dysplasia). Both aneurysmal bone cysts and giant cell tumors typically manifest as expansile osteolytic lesions and occasionally show fluid-fluid levels suggestive of diagnosis.

©RSNA, 2003

Index terms: Ribs, neoplasms, 471.30 • Thorax, CT, 470.1211 • Thorax, MR, 470.12141, 470.12143 • Thorax, neoplasms, 470.31, 470.36, 470.85
Thorax, radiography, 470.11

RadioGraphics 2003; 23:1477–1490 • Published online 10.1148/rg.236015526

1From the Divisions of Diagnostic Radiology (U.T., M.K., N.M.), Pathology (T.H.), Orthopedics (R.Y.), and Thoracic Surgery (R.T.), National Cancer Center Hospital and Institute, S-1-1, Tsukiji, Chuo-Ku, 104-0045, Tokyo, Japan; Division of Diagnostic Imaging, M. D. Anderson Cancer Center, Houston, Tex (G.W.G.); and Division of Orthopedics, National Kyushu Cancer Center, Fukuoka, Japan (R.Y.). Recipient of a Cum Laude award for an education exhibit at the 2001 RSNA scientific assembly. Received December 20, 2001; revision requested February 22, 2002; final revision received April 22, 2003, and accepted April 25. Supported in part by grant for Scientific Research Expenses for Health and Welfare Programs, the Foundation for the Promotion of Cancer Research, and 2nd-term Comprehensive 10-year Strategy for Cancer Control. Address correspondence to U.T. (e-mail: utateishi@ncc.go.jp).

©RSNA, 2003
Benign chest wall tumors, which may be of vascular, peripheral nerve, osseous, cartilaginous, or adipose tissue origin, are relatively uncommon, and few research studies of this group of tumors have been reported. Radiologic imaging is important in the assessment of these tumors, particularly for determining anatomic origin and extent, response to therapy, and recurrence (1). Although the imaging features of many of these lesions are nonspecific, the combination of imaging appearance, location, and clinical information also may suggest a diagnosis (Tables 1, 2). In this article, we survey the clinical manifestations and imaging appearances of the most frequently occurring tumor types, including cavernous hemangioma, glomus tumor, schwannoma, neurofibroma, ganglioneuroma, paraganglioma, osteochondroma, aneurysmal bone cyst, fibrous dysplasia, ossifying fibromyxoid tumor, chondromyxoid fibroma, lipoma, and spindle cell lipoma. We describe the imaging techniques that are most widely used for evaluating and localizing these tumors and detail the imaging findings common to tumors of each type, giving particular attention to findings that may contribute to differential diagnosis.

### Introduction

Benign chest wall tumors typically manifest as slow-growing, palpable masses in asymptomatic patients. The slow growth rate that typifies most benign chest wall tumors is evidenced on radiologic images by well-defined tissue planes and sometimes by pressure erosions on adjacent bone. Chest radiography can be used to determine the location, size, and growth rate of the mass, as well as to detect calcification, ossification, or bone involvement (2). However, the high-kilovoltage radiographic technique used at chest imaging is not optimal for assessing soft-tissue calcification, bone, or tumor matrix. The low-kilovoltage technique used for bone radiography can more accurately define soft-tissue planes, particularly in fat-containing tumors such as lipomas. Low-kilovoltage radiographs also more accurately delineate calcifications.

Computed tomography (CT) enables more accurate assessment of tumor morphology, composition, location, and extent (1, 3). When used with contrast material, CT also can provide an indication of the vascularity of a tumor. When the relevant anatomy is poorly depicted on axial images—as occurs, for example, in lesions that are located parallel to the ribs or in the supraclavicular region—the CT scan may be acquired with an angled gantry or a thin-section breath-hold technique and multiplanar reformations to clarify anatomic relationships.

### Overview of Imaging Techniques and Findings

Benign chest wall tumors typically manifest as slow-growing, palpable masses in asymptomatic patients. The slow growth rate that typifies most benign chest wall tumors is evidenced on radiologic images by well-defined tissue planes and sometimes by pressure erosions on adjacent bone. Chest radiography can be used to determine the location, size, and growth rate of the mass, as well as to detect calcification, ossification, or bone involvement (2). However, the high-kilovoltage radiographic technique used at chest imaging is not optimal for assessing soft-tissue calcification, bone, or tumor matrix. The low-kilovoltage technique used for bone radiography can more accurately define soft-tissue planes, particularly in fat-containing tumors such as lipomas. Low-kilovoltage radiographs also more accurately delineate calcifications.

Computed tomography (CT) enables more accurate assessment of tumor morphology, composition, location, and extent (1, 3). When used with contrast material, CT also can provide an indication of the vascularity of a tumor. When the relevant anatomy is poorly depicted on axial images—as occurs, for example, in lesions that are located parallel to the ribs or in the supraclavicular region—the CT scan may be acquired with an angled gantry or a thin-section breath-hold technique and multiplanar reformations to clarify anatomic relationships.
## Table 2
Clinical and Imaging Findings in Benign Chest Wall Tumors

<table>
<thead>
<tr>
<th>Tumor Tissue and Type</th>
<th>Clinical Findings</th>
<th>Imaging Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vascular</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cavernous hemangioma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infancy or early adulthood</td>
<td>Uncommon</td>
<td>Typically cutaneous mass of dilated, tortuous, thin-walled vessels</td>
</tr>
<tr>
<td>Glomus tumor</td>
<td>Adulthood</td>
<td>Rare</td>
</tr>
<tr>
<td><strong>Peripheral nerve</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schwannoma</td>
<td>Adulthood</td>
<td>Common</td>
</tr>
<tr>
<td><strong>Neurofibroma</strong></td>
<td>Early adulthood</td>
<td>Common</td>
</tr>
<tr>
<td>Ganglioneuroma</td>
<td>Early adulthood</td>
<td>Uncommon</td>
</tr>
<tr>
<td>Paraganglioma</td>
<td>Adolescence to early adulthood</td>
<td>Rare</td>
</tr>
</tbody>
</table>
Table 2
Clinical and Imaging Findings in Benign Chest Wall Tumors

<table>
<thead>
<tr>
<th>Tumor Tissue and Type</th>
<th>Patient Age*</th>
<th>Frequency of Occurrence</th>
<th>General</th>
<th>Clinical Findings</th>
<th>Imaging Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osseous and cartilaginous Osteochondroma</td>
<td>Adulthood</td>
<td>Common</td>
<td>Bone fracture or deformity</td>
<td>Cartilaginous cap</td>
<td>Cap; T2-weighted images: high signal intensity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Eccentric growth pattern; location at costochondral junction</td>
</tr>
<tr>
<td>Aneurysmal bone cyst</td>
<td>Early adulthood</td>
<td>Uncommon</td>
<td>...</td>
<td>Cortical thinning</td>
<td>Heterogeneous signal intensity on both T1- and T2-weighted images; fluid-fluid levels</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Expansile blood-filled cyst</td>
</tr>
<tr>
<td>Fibrous dysplasia</td>
<td>Adolescence to early adulthood</td>
<td>Uncommon</td>
<td>Bone fracture or deformity</td>
<td>Amorphous calcification</td>
<td>Heterogeneous signal intensity on both T1- and T2-weighted images</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fusiform; monostotic or polyostotic involvement</td>
</tr>
<tr>
<td>Ossifying fibromyxoid tumor</td>
<td>Adulthood</td>
<td>Rare</td>
<td>...</td>
<td>Sclerotic band, osteolytic change</td>
<td>T2-weighted images: high signal intensity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Confluent contours; vascularity; heterogeneous enhancement</td>
</tr>
<tr>
<td>Giant cell tumor</td>
<td>Early to middle adulthood</td>
<td>Common</td>
<td>Location in subchondral region of flat or tubular bones</td>
<td>Cortical thinning</td>
<td>T1-weighted images: low signal intensity; T2-weighted images: high signal intensity; fluid-fluid levels (less common than in aneurysmal bone cyst)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Eccentric growth; usually solitary but may occur in multiples</td>
</tr>
<tr>
<td>Chondromyxoid fibroma</td>
<td>Early adulthood</td>
<td>Rare</td>
<td>Location in rib, spine, or scapula</td>
<td>Sclerotic band</td>
<td>T2-weighted images: high signal intensity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Expansile; diffuse or heterogeneous enhancement</td>
</tr>
<tr>
<td>Adipose Lipoma</td>
<td>Adulthood</td>
<td>Common</td>
<td>Deep soft-tissue lesion; most frequent in the obese</td>
<td>Attenuation of fat; slightly enhancing septa</td>
<td>T1-weighted images: high signal intensity (low-signal-intensity septa); T2-weighted images: high signal intensity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Well-defined contours; internal homogeneity and no enhancement unless septa are present</td>
</tr>
<tr>
<td>Spindle cell lipoma</td>
<td>Adulthood</td>
<td>Uncommon</td>
<td>Subcutaneous location in neck or shoulder region; slow growth; most frequent in men</td>
<td>NA</td>
<td>T1-weighted images: low signal intensity; T2-weighted images: high signal intensity</td>
</tr>
</tbody>
</table>

Note.—NA = not applicable.
*Typical patient age at diagnosis.
Magnetic resonance (MR) imaging is the preferred modality for the evaluation of chest wall tumors. The superior spatial resolution afforded by MR imaging with the administration of contrast material often enables accurate characterization of the tumor tissue and extent, including differentiation from adjacent areas of inflammation. Meticulous attention to technique is necessary for optimal MR imaging. Standard spin-echo and fast spin-echo sequences are satisfactory for most evaluations, but the use of peripheral cardiac gating and respiratory compensation can reduce motion artifacts that often degrade MR images of the thorax. Prone positioning of the patient can lessen the occurrence of respiratory artifacts on images of anterior chest wall tumors. Surface coils are useful for obtaining detailed images of superficial chest wall lesions, whereas a dedicated torso coil should be used to optimize image quality for tumors with greater intrathoracic extent.

**Vascular Tumors**

**Cavernous Hemangioma**

Cavernous hemangiomas, which are among the least common benign chest wall masses, consist of dilated, tortuous, thin-walled vessels. They are typically cutaneous in location, large, and poorly circumscribed, and they can be locally destructive. Noncutaneous location is uncommon, with a reported frequency of 0.8% among all benign vascular lesions (4) (Fig 1).

Cavernous hemangiomas typically manifest at birth or before the age of 30 years. Plain chest radiographs may show a soft-tissue mass, which occasionally is associated with pressure erosion on adjacent bone. CT is more sensitive than plain radiography in detecting phleboliths, which are present in approximately 30% of cavernous hemangiomas (5). CT scans show a soft-tissue mass with heterogeneous low levels of attenuation due to the fatty, fibrous, and vascular tissue elements of the mass. T1- and T2-weighted MR images typically reveal areas of high signal intensity in the mass. On T1-weighted images, intramuscular cavernous hemangiomas manifest as poorly margined masses with signal intensity similar to that of skeletal muscle. Wispy or coarse linear areas of high signal intensity are common and thought to be caused in part by the presence of stagnant

---

**Figure 1.** Cavernous hemangioma in a 46-year-old man. (a) Axial T1-weighted (repetition time msec/echo time msec = 600/12) magnetic resonance (MR) image obtained with a surface coil at the level of the liver (L) shows an ill-defined soft-tissue mass in the right chest wall. The tumor appears as an area of heterogeneous hyperintense signal relative to the signal intensity of adjacent muscle (arrows). (b) Axial gadolinium-enhanced T1-weighted (600/12) fat-suppressed MR image shows heterogeneous enhancement and distended vessels (arrow) in the tumor.
blood in cavernous or cystic spaces. On T2-weighted images, these tumors are well marginated and have high signal intensity compared with that of subcutaneous fat. Signal intensity voids caused by rapidly flowing blood also can be seen (6,7).

**Glomus Tumor**

Glomus tumors consist of neoplastic cells that closely resemble the smooth muscle cells of the normal glomus body. They typically occur in adulthood, with equal frequency in men and women, and manifest clinically as solitary, painful masses (8). Multiple tumors are uncommon and are more likely to be asymptomatic. An intramuscular location is common (Fig 2). Benign glomus tumors outnumber malignant ones by a sizable margin. Chest radiographs and CT scans may show a soft-tissue mass with erosion of adjacent bone. In typical cases, MR images reveal a tumor that displaces major vessels and is encircled by tortuous vessels arborizing from a vascular pedicle (9,10). The mass is usually heterogeneous in signal intensity and sharply delineated from adjacent soft tissue after intravenous administration of gadolinium-based contrast material (9).

**Peripheral Nerve Tumors**

**Schwannoma**

Schwannomas, also known as neurilemomas or neurinomas, are encapsulated neoplasms that originate in nerve sheaths and are usually slow growing. Chest wall schwannomas arise from spinal nerve roots and intercostal nerves and typically occur in patients between 20 and 50 years of age. Small tumors tend to be spheroid, firm, and well circumscribed (Fig 3), whereas larger tumors are ovoid or irregularly lobulated. Schwannomas occasionally manifest as fibrous-walled cysts containing smaller solid nodules. Radiographs do not usually depict small schwannomas, but bone erosion or scalloping can occasionally be seen. Nonenhanced CT scans of schwannoma typically show a well-circumscribed homogeneous mass with attenuation slightly less than or equal to that of muscle. On CT scans acquired after contrast material administration, the attenuation of the mass is equal to or slightly greater than that of muscle, and any cystic or necrotic areas in the mass appear nonenhanced. The signal intensity of schwannoma on T1-weighted MR images is equal to or slightly greater than that of muscle and on T2-weighted images is markedly greater, with increased contrast between the high-signal-intensity nerve sheath tumor, intermediate-signal-intensity fat, and low-signal-intensity muscle (11). The nerve from which the tumor originated can often be seen along one side of the mass. Small tumors tend to enhance brightly and uniformly after intravenous administration of contrast material, whereas the enhancement pattern of larger lesions may be more heterogeneous because of
central cystic change. The presence of bone erosion without destruction indicates the benign nature and slow growth rate of this lesion. The extreme pain that often accompanies percutaneous biopsy is further evidence of the neural origins of the tumor.

**Neurofibroma**

Neurofibromas are slow-growing neoplasms that originate from a nerve, may or may not be encapsulated, and may include components of cystic degeneration and calcification. Neurofibromas develop most commonly in patients between the ages of 20 and 30 years, in men and women equally. In 60%–90% of affected patients, the diagnosis is either type 1 neurofibromatosis or multiple plexiform neurofibromas. Malignant degeneration occasionally occurs in these lesions, but the risk is low.

Radiographs of the spine may show a widening of neural foramina because of tumor extension along spinal nerve roots. Most neurofibromas are hypodense on nonenhanced CT scans and show heterogeneous enhancement after intravenous administration of contrast material. Many neurofibromas have a histologic pattern of zonal distinction, with a central zone composed of a highly cellular component and a peripheral zone composed of abundant stromal material, which results in a targetlike appearance on T2-weighted MR images. On these images, the mass is characterized by a rim of increased signal intensity that surrounds the central part of the tumor, which has a lower signal intensity (Fig 4). This sign is also evident on gadolinium-enhanced MR images, on which the central part of the tumor appears markedly enhanced (12).

**Ganglioneuroma**

Ganglioneuromas originate from the sympathetic ganglia in the chest wall. Although this tumor most often arises de novo in young adults, it also may occur as a maturation of neuroblastoma. The mass is composed of mature ganglion cells, Schwann cells, and nerve fibers, and it is often large and encapsulated, with delicate trabeculation. Ganglioneuromas usually manifest radiologically as ovoid, sharply marginated paravertebral masses. Calcification occurs in 25% of cases. The tumor has either homogeneous or heterogeneous attenuation on CT images and homogeneous intermediate signal intensity on both T1- and T2-weighted MR images. Curvilinear bands of low signal intensity are seen on both T1- and T2-weighted images, giving the lesion a whorled appearance (13) (Fig 5).
Paraganglioma
Paragangliomas arise either in the aorticopulmonary paraganglia or in the aorticosympathetic paraganglia in the paravertebral region. They are typically located in the middle thorax, adjacent to the fifth, sixth, or seventh rib, with a right-sided predominance. Most paragangliomas occur in adolescents and young adults (Fig 6). On MR images, the tumors show homogeneous signal intensity and marked enhancement after intravenous injection of contrast material (14). Many patients with paragangliomas also have adrenal or extrathoracic paraganglionic tumors that manifest either synchronously or metachronously.

Osseous and Cartilaginous Tumors
Osteochondroma
Osteochondromas are relatively common skeletal lesions that originate from the aberrant growth of normal tissue. In the ribs, these tumors occur with particular frequency at the costochondral junction. The tumors are characteristically pedunculated osseous protuberances arising from

![Figure 6](image)

Figure 6. Paraganglioma in a 23-year-old man. Coronal reformatted image from a contrast-enhanced multidetector CT study of the thoracic spine shows an extrapleural spindle-shaped mass (M) with relatively homogeneous attenuation in the left paravertebral region. The apparently noninvasive well-demarcated mass was discovered at resection to be attached to the sympathetic nerve (arrow).

![Figure 7](image)

Figure 7. Osteochondroma in a 39-year-old woman. (a) Axial contrast-enhanced CT scan at the level of the left atrium (A) shows a dense calcification (arrowhead) that projects medially from a right rib. (b) Axial T2-weighted (6,000/112) MR image of the right side of the chest wall obtained with a surface coil shows a cartilaginous apical cap (arrow), which has a slightly higher signal intensity than does muscle.
calc or medullary bone in the extremities can be detected with CT or MR imaging (15,16) but is not often apparent on images of the ribs. Complications associated with this tumor include fractures, osseous deformity, vascular injury, neural compression, bursa formation, and malignant transformation. Pain at the lesion site, as well as bone erosion, irregular calcification, or thickening of the cartilage cap depicted on radiologic images, indicate malignant transformation.

Aneurysmal Bone Cyst
Aneurysmal bone cysts are unusual benign masses that have the potential for rapid growth, bone destruction, and extension into adjacent soft tissue. The masses contain a network of multiple blood-filled cysts lined by fibroblasts and multinucleated giant cells of the osteoclast type. Although a sclerotic margin around the lesion may indicate that it is benign, soft-tissue extension can make it difficult to differentiate aneurysmal bone cyst from sarcoma. Most aneurysmal bone cysts occur in patients under the age of 30 years. In the chest wall, the most common sites of involvement are the posterior elements of the spine (eg, articular process, lamina, and spinous process).

Radiographs show an expansile lesion with a well-defined inner margin. CT is useful in delineating the size and location of the intraosseous and extraosseous components of the tumor. MR images typically show a lobulated or septated mass with a thin, well-defined rim of low signal intensity (Fig 8) (17,18). The detection of a fluid-fluid level within the tumor indicates the hemorrhagic nature of the cyst contents; however, fluid-fluid levels also may be found in other osseous lesions, including giant cell tumor, simple bone cyst, and chondroblastoma (19,20).
Fibrous Dysplasia of Bone

Fibrous dysplasia is a skeletal developmental anomaly in which mesenchymal osteoblasts fail to undergo normal morphologic differentiation and maturation. Approximately 70%–80% of cases are monostotic and 20%–30% are polyostotic. The age range of patients with monostotic disease is 10–70 years, but recognition is most frequent at 20–30 years of age. Patients are usually asymptomatic, although pathologic fracture resulting from fibrous dysplasia can cause pain. The ribs are commonly affected, and the clavicle is occasionally involved. Radiographs characteristically show unilateral fusiform enlargement and deformity with cortical thickening and increased trabeculation of one or more ribs. Amorphous or irregular calcification is often seen in the lesion on CT scans. MR imaging is useful in accurately defining the full extent of the lesion. The signal intensity varies from low to high on T2-weighted images but typically is low in areas of lesion involvement on T1-weighted images (21–23) (Fig 9). Monostotic disease does not usually progress to polyostotic disease, and the size and number of lesions generally remain the same over time as they were at initial radiologic evaluation. Although malignant transformation also is rare, osteosarcoma or fibrosarcoma may develop after irradiation of the involved bones.

Ossifying Fibromyxoid Tumor

Ossifying fibromyxoid tumor is a rare neoplasm of uncertain origin that most often occurs in the ribs. Tumors consist of well-vascularized fibrous
stromata containing trabeculae of new bone and multinucleated giant cells (24) and may occur singly or in multiples. Tumors appear on plain radiographs as elongated, bubble-shaped areas of intracortical osteolysis surrounded by a band of sclerotic tissue. Although they are usually stable in size, spontaneous regression and progression have been reported. On T2-weighted MR images, tumors manifest as focal areas of high signal intensity corresponding to that of myxoid material (25) (Fig 10). The vascularity of these tumors is apparent from their characteristic enhancement after the administration of contrast material.

**Figure 10.** Ossifying fibromyxoid tumor in a 32-year-old man. (a) Axial T2-weighted (4,500/160) MR image at the level of the stomach (S) shows a well-defined mass with multiple septa and an overall signal intensity higher than that of muscle, as well as a focal nodule of relatively low signal intensity (arrow). (b) Photograph of a resected specimen reveals myxoid components (white areas) separated by bands of fibrous tissue (arrowheads), as well as a soft-tissue nodule (arrow) that corresponds to the low-signal-intensity area seen on MR images. (c) Photomicrograph (original magnification, ×100; hematoxylin-eosin stain) shows the trabecular or lacy arrangement of tumor cells in the myxoid matrix, with areas of marked ossification (arrow) that exhibited low signal intensity on MR images.

**Giant Cell Tumor**

Giant cell tumors are relatively common benign skeletal lesions of uncertain origin. These tumors consist of vascular sinuses that are lined or filled with abundant giant cells and spindle cells. Giant cell tumors are typically solitary but also may occur simultaneously or metachronously in multiples. The tumors typically manifest at age 21–40 years, after closure of the epiphyses, and are more common in women than in men. Thoracic giant cell tumors often arise in subchondral regions of the flat and tubular bones of the chest wall, including the sternum, clavicle, and ribs. Plain radiographs of these tumors show eccentric osteolytic lesions accompanied by cortical thinning and expansion. CT allows evaluation of the extent of the tumor and its relationship to surrounding structures. Tumors typically have a long relaxation time at T1- and T2-weighted MR imaging and appear as areas of low signal intensity on T1-weighted images and high signal intensity on T2-weighted images (Fig 11). Fluid-fluid levels are less commonly seen in these tumors than in aneurysmal bone cysts (26–29).
Chondromyxoid Fibroma

Chondromyxoid fibromas, the least common benign cartilaginous neoplasms, consist of varying proportions of chondroid, myxomatous, and fibrous components arranged in lobules that are separated by vascular sclerotic bands. Chondromyxoid fibromas typically occur in patients who are less than 30 years of age. They are relatively rare in the chest wall and occasionally occur in the ribs, spine, or scapulae. On plain radiographs, chondromyxoid fibromas usually appear as well-margined masses with scalloped sclerotic borders and no internal calcification. Cortical expansion, exuberant endosteal sclerosis, and overlapping areas of cortical scalloping also may be present, giving the impression of coarse trabeculation. Chondromyxoid fibromas have heterogeneous signal intensity on T2-weighted MR images and diffuse enhancement on T1-weighted images acquired after intravenous administration of contrast material (30,31) (Fig 12).

Adipose Tissue Tumors

Lipoma

Lipomas are well-circumscribed encapsulated masses composed of adipocytes that differ very little from normal fatty tissue. They typically occur in patients who are 50–70 years of age, and they are most frequent in the obese. Most lipomas that originate in the chest wall are deep lipomas, which tend to be larger and less well circumscribed than superficial lesions (32). On CT and MR images, lipomas generally appear to be internally homogeneous and do not enhance after intravenous contrast material administration (Fig 13). However, multiple thin septa often are present that appear slightly enhanced on CT scans and have low signal intensity on fat-suppressed T1-weighted MR images.

Spindle Cell Lipoma

Spindle cell lipoma is a rare, painless, and slow-growing neoplasm in which mature fat cells are replaced by collagen-forming spindle cells. The tumor usually manifests as a solitary well-demarcated 3–5-cm mass confined to the subcutaneous tissues of the neck or shoulder region in men older than 45 years of age (32,33). On both T1- and T2-weighted MR images, it appears as a heterogeneous mass with lipomatous and nonlipomatous components of various quantities (Fig 14).

Conclusions

Benign chest wall tumors are a diverse group of lesions with vascular, neural, osseous, cartilaginous, or lipomatous origins. Radiologic assessment is an essential component of the management of these tumors and usually includes the use of chest radiography to detect and localize the lesion and of cross-sectional CT and MR imaging to further characterize the lesion and define its extent. Radiologic findings indicative of a benign tumor (eg, presence of a well-defined mass without infiltration of adjacent structures, or presence of bone erosion without destruction) and clinical features such as slow growth and lack of pain support a relatively conservative management strategy. Occasionally, benign tumors may have imaging features that are specific enough to enable
immediate diagnosis and initiation of appropriate management. Such features include the presence of mature fatty tissue with little or no septation (lipoma), the presence of phleboliths and characteristic vascular enhancement (cavernous hemangioma), and evidence of neural origin combined with a targetlike appearance on MR images (neurofibroma). Several primary bone tumors also may have characteristic features that allow confident identification, such as well-defined cortical and medullary continuity with the bone of origin (osteochondroma) or fusiform expansion and ground-glass matrix (fibrous dysplasia). Both aneurysmal bone cysts and giant cell tumors typically manifest as expansile osteolytic lesions and occasionally show fluid-fluid levels suggestive of diagnosis. However, many chest wall tumors have

Figure 12. Chondromyxoid fibroma in a 56-year-old woman. (a) Axial T2-weighted (6,000/112) MR image at the level of the liver (L) shows a mass in the lateral part of the chest wall. The mass has an overall signal intensity higher than that of fat, but multiple septa (arrow) with lower signal intensity also are visible in the tumor. (b) Photomicrograph (original magnification, ×100; hematoxylin-eosin stain) reveals fibroblasts intermingled with interstitial myxoid material that accounts for the high signal intensity on T2-weighted MR images.

Figure 13. Lipoma in a 42-year-old woman. Axial contrast-enhanced CT scan at the level of the pulmonary artery (P) shows a well-defined mass with the same attenuation as fat in the left part of the chest wall. Soft-tissue septa (arrows) are clearly visible at the periphery of the mass. Septa not only occur in benign lipomas but also are common in atypical lipomatous tumors and liposarcomas.

Figure 14. Spindle cell lipoma in a 72-year-old man. Axial gadolinium-enhanced T1-weighted (500/15) MR image at the level of the spleen (SP) and stomach (ST) reveals a nodule (arrow) with heterogeneous enhancement in the subcutaneous tissues of the back. The fat component in this tumor is hard to identify on MR images.
nonspecific imaging features, and histologic analysis of tissue specimens is frequently required for diagnosis. Even after the decision has been made to perform a biopsy, imaging continues to play an important role in tumor management and is frequently used to facilitate biopsy, assess postprocedural complications, and perform follow-up evaluation of tumors that are not excised.

References