#A11
Jmea
6584

Tumors of the Chest Wall

ALTON OCHSNER, JR., M.D.

ALTON OCHSNER, M.D.

Tumors of the chest wall can involve the soft tissues or the thoracic skeleton.[1] The two types are usually not difficult to differentiate except when a soft tissue tumor is extensive and fixed to the underlying tissues or a bone tumor is associated with extensive reaction in the overlying soft tissue. The tumors may be benign, primary malignant, or metastatic. In addition, there are a large number of non-neoplastic conditions which may simulate chest wall tumors, either clinically or roentgenologically.

TUMORS OF THE THORACIC SKELETON

Though less common than tumors of the soft tissues, tumors of the thoracic skeleton represent a more serious problem because most of them are malignant. In fact, the most common tumor of the thoracic skeleton is a metastatic lesion, and sometimes it is the first sign of the primary neoplasm. The primary tumors are most frequently in the lung, breast, or prostate. Metastatic tumors usually cause pain but some are first discovered on roentgenography of the chest.

Primary tumors of the thoracic skeleton may be benign (Table 1) or malignant (Table 2), the former being slightly more common. They can be loosely grouped according to origin as cartilaginous and osteogenic or hematopoietic and reticuloendothelial. Tumors of cartilaginous origin predominate. The most frequent benign tumors are osteochondromas, fibrous dysplasia (which is probably not a true neoplasm but deserves to be listed with them), eosinophilic granuloma, and hemangioma. The most frequent primary malignant tumors are myelomas and chondrosarcomas. Tumors are found most often in the ribs and least often in the sternum but with surprising frequency in the scapula. Benign tumors are especially rare in the sternum, primary malignant tumors are unusual in the thoracic vertebra,

From the Department of Surgery, Ochsner Clinic, New Orleans, Louisiana

(30)

Published by AsbestosClaims.Law
asbestosclaims.law/library/25449/1

Table 1. *Benign Thoracic Skeletal Tumors*

CARTILAGINOUS AND OSTEOGENIC	HEMATOPOIETIC AND RETICULOENDOTHELIAL
Osteochondroma	Fibrous dysplasia
Enchondroma	*Eosinophilic granuloma*
Chrondroblastoma	Nonosteogenic fibroma
Chondromyxoid fibroma	Hemangioma
Bone island	*Lymphangioma*
Osteoma	Aneurysmal bone cyst
Osteoid osteoma	Bone cyst
Osteoblastoma	Lipoma
Giant cell tumor	Cholesteotoma
Ganglion cyst	Myxoma
Xanthoma	

Table 2. *Malignant Thoracic Skeletal Tumors*

CARTILAGINOUS AND OSTEOGENIC	HEPATOPOIÊTIC AND RETICULOENDOTHELIAL
Chondrosarcoma	Myeloma
Osteogenic sarcoma	Hodgkin's disease
Parosteal osteogenic sarcoma	Reticulum cell sarcoma
Malignant giant cell tumor	Ewing's tumor
	Malignant giant cell tumor
	Fibrosarcoma
	Angiosarcoma
	Liposarcoma

and metastatic tumors are uncommon in the scapula. The primary tumors of the thoracic skeleton are usually symptomatic when first discovered; more than 60 per cent of benign tumors and more than 85 per cent of malignant tumors are symptomatic.[5] The initial manifestation of benign tumors of cartilaginous and osteogenic origin is five times more frequently a mass than it is pain, but when the tumors are of hematopoietic and reticuloendothelial origin pain is twice as common as the presence of a mass. In primary malignant bone tumors of cartilaginous and osteogenic origin pain and mass are seen with almost equal frequency, but primary malignant tumors of hematopoietic and reticuloendothelial origin are manifested almost exclusively by pain alone.[5]

Diagnosis

The diagnosis of thoracic skeletal tumors may be obvious from the classic roentgenographic appearance but frequently it is difficult to make. Many factors must be considered.

AGE AND SEX. Benign tumors are usually found in young adults, primary malignant tumors in middle-aged persons, and metastatic tumors in the elderly.[5] Thoracic skeletal tumors have a predilection for male pa-

tients. Osteochondromas (or osteocartilaginous exostoses) are usually seen in boys, enchondromas in women, osteoblastomas in adolescent boys, and bone island tumors in women. Chondrosarcomas are most common in men and osteogenic sarcomas in adolescent boys. Fibrous dysplasia is seen in middle-aged men and women, aneurysmal bone cysts in boys, eosinophilic granuloma in boys and girls, myeloma in men, and reticulum cell sarcoma and Hodgkin's and Ewing's sarcoma in adolescent boys and girls.

SYMPTOMS. The essential complaints of patients with thoracic skeletal tumors are pain and a mass. There is nothing typical about the pain. It is usually in the region of the tumor but a vertebral or posterior rib tumor may cause intercostal neuralgia. Discomfort is often vague and diffuse but sometimes severe, localized, and associated with point tenderness. Osteoid osteoma characteristically produces nocturnal pain. A large tumor may exist but not be clinically apparent because of its location deep beneath the thick muscles under the scapula or intrathoracically. A pulsating tumor is diagnostic of metastasis from carcinoma of the thyroid or a hypernephroma.[4]

The average duration of symptoms of primary malignant tumors is more than twice that of benign lesions, and for cartilaginous and osteogenic tumors more than eight or nine times that of hematopoietic and reticuloendothelial tumors. In our experience[5] the average duration of symptoms of benign tumors was more than one year, of primary malignant tumors a few years, and of metastatic tumors only a few months. We had one patient with a chondrosarcoma of the sternum with symptoms for fourteen years before curative resection.

MALIGNANT TUMOR ELSEWHERE. The history or discovery of a malignant tumor elsewhere may lead to recognition of the metastatic nature of the thoracic skeletal tumor. Unless, however, the patient has multiple tumors, one should not assume that the tumor in the chest wall is metastatic, and further diagnostic procedures are indicated.

ROENTGENOGRAPHY. Roentgenography can be invaluable and sometimes is diagnostic (bone island). Often, however, it is of only limited value and sometimes it is misleading.[6] Special views and techniques with attention to bone detail are essential. Oblique films and planigrams are helpful. Intraosseous phlebography may be informative.[6]

OTHER LABORATORY PROCEDURES. Studies, such as blood count, urinalysis, serum calcium and phosphorus determinations, acid and alkaline phosphatase determinations, and bone marrow examination, have limited diagnostic value. Radioactive strontium 85 is sometimes useful in localizing tumors that cannot be visualized in routine radiographs.

BIOPSY. The only definitive diagnostic procedure is biopsy, and whenever feasible, this should be excisional. Interpretation of the true histologic appearance of a cartilaginous tumor in particular can be extremely difficult, the difference between a benign cartilaginous tumor and a low grade chondrosarcoma is often slight.[7] Curettage may be necessary for vertebral

tumors which cannot be excised. Rarely, needle biopsy of an obviously metastatic tumor is justified.

PERIODIC EXAMINATIONS. The correct diagnosis may depend on careful periodic examinations, because what was originally thought to be a "benign" tumor of the thoracic skeleton can prove in time to have been malignant.[8]

Treatment

Tumors of the thoracic skeleton should be completely excised when possible. This is recommended even for metastatic tumors, when open biopsy is necessary, for it provides the quickest relief of symptoms. If a primary malignant tumor is suspected, the excision should be wide. Wide excision of tumors of the ribs means as much of the rib as possible because of propensity for intramarrow[12] and periosteal[4] spread of these tumors, the rib above and below, and the adjacent pleura and overlying muscles. For tumors in the lower portion of the sternum, all of the sternum except the manubrium must be removed, including the adjacent costal cartilages. When the manubrium is involved, the medial heads of the clavicle should also be excised. Large defects in the thoracic wall can be bridged by Marlex, fascia lata, rib struts, or when low and lateral on the chest, by elevation of the lateral attachment of the diaphragm. Wide excision of the clavicle means the entire bone and surrounding muscles; sometimes it is necessary to resect the adjacent ribs as well. For primary malignant tumors of the scapula forequarter amputation is indicated for high grade malignant disease, and for low grade malignant disease, *en bloc* excision dividing the upper humerus and clavicle, preserving a functional arm.[1-3] Resection of vertebral neoplasms is limited to those involving the spinous and transverse processes and pedicles. Tumors of the body of the vertebra must be treated by curettage followed by irradiation.

For synovial sarcoma at least regional lymph node excision is also desirable, because this tumor has a higher incidence of spread to the lymphatics than any other sarcomas of the chest wall. In any part of the chest wall local recurrent lesions should be excised when feasible, as re-excision may provide a cure.[8]

Irradiation can be an adjunct to surgical excision or it can be used in the treatment of obvious metastatic disease, but in general it should not be employed as a primary treatment for tumors of the thoracic skeleton unless consent for operation is refused or the tumor is surgically inaccessible. Some tumors are highly radiosensitive: reticulum cell sarcoma, myeloma, Ewing's tumor, hemangioma, and eosinophilic granuloma. Endocrine therapy and chemotherapy have a place in the management of metastatic tumors, particularly of the breast and prostate.

Prognosis

The prognosis of benign tumors of the thoracic skeleton is good but

cartilaginous tumors sometime
importance of periodic examina
prognosis of malignant tumors de
metastatic tumors and primary
reticuloendothelial origin but rela
cartilaginous and osteogenic orig
these patients are hopefully cu
prognosis is less favorable, how
sarcomas.

SOFT TI

As in the thoracic skeleton, t
be benign or malignant, primar
somatic soft tissues are more c
common than those in the bone

Although neoplasms in thi
undifferentiated, most of them h
from any of the tissue types in t
muscular, vascular, reticuloendot
(Table 3). Except for breast tum
common benign and fibrosarcoma
neoplasm found in the chest wall
from the breast, stomach, uteru

Pain is an unusual symptom
the result of pressure on a ner
leiomyoma or a glomus tumor
exquisitely tender, however. The
tissue tumors of the chest wall is
skin discoloration (nevi) and ha
the shoulder girdle. The tumor,
first by its intrathoracic projec
mass can be of any size. It is u
extensive and fixed to the bone or
ulcerates, becomes infected, and i

Diagnosis

As with tumors of the thor
obvious, many factors should be

AGE AND SEX. Vascular tum
children, fibrosarcomas and ne
middle aged women, but lipos

CLINICAL FEATURES. Ve
tumors are firm and adipose and

Published by AsbestosClaims.Law
asbestosclaims.law/library/25449/4

cartilaginous tumors sometimes recur,* a fact which underscores the importance of periodic examination of these patients for a long time. The prognosis of malignant tumors depends on the type. It is extremely poor for metastatic tumors and primary malignant tumors of hematopoietic and reticuloendothelial origin but relatively favorable for malignant tumors of cartilaginous and osteogenic origin, particularly chondrosarcomas. Most of these patients are hopefully cured after radical surgical excision.* The prognosis is less favorable, however, for osteogenic sarcomas and synovial sarcomas.

SOFT TISSUE TUMORS

As in the thoracic skeleton, tumors of the soft tissue of the chest may be benign or malignant, primary or metastatic. Primary tumors of the somatic soft tissues are more common and metastatic tumors are less common than those in the bones and cartilages.

Although neoplasms in this anatomic area are sometime histologically undifferentiated, most of them have definite histogenesis. They may arise from any of the tissue types in the chest wall: epithelial, fibrous, adipose, muscular, vascular, reticuloendothelial, nerve, and undifferentiated tissue (Table 3). Except for breast tumors and cutaneous nevi, lipoma is the most common benign and fibrosarcoma the most common malignant soft tissue neoplasm found in the chest wall.[9] Metastatic tumors are most commonly from the breast, stomach, uterus, and kidney.

Pain is an unusual symptom of tumors of the soft tissues. It usually is the result of pressure on a nerve. The small, subcutaneous nodule of a leiomyoma or a glomus tumor (which is rare in the chest wall) may be exquisitely tender, however. The presenting complaint of patients with soft tissue tumors of the chest wall is usually a painless mass but sometimes it is skin discoloration (nevi and hemangiomas) or discomfort on movement of the shoulder girdle. The tumor, especially neurofibromas, may be recognized first by its intrathoracic projection on roentgenography of the chest. The mass can be of any size. It is usually superficial and moveable, but may be extensive and fixed to the bone or other deep tissues. Sometimes the tumor ulcerates, becomes infected, and bleeds.

Diagnosis

As with tumors of the thoracic skeleton when the diagnosis is not obvious, many factors should be considered:

AGE AND SEX. Vascular tumors are usually seen in female infants and children, fibrosarcomas and neurofibroma in young adults, lipomas in middle-aged women, but liposarcomas in men.

CLINICAL FEATURES. Vascular tumors are soft, whereas fibrous tumors are firm and adipose and muscle tumors are of variable density. A

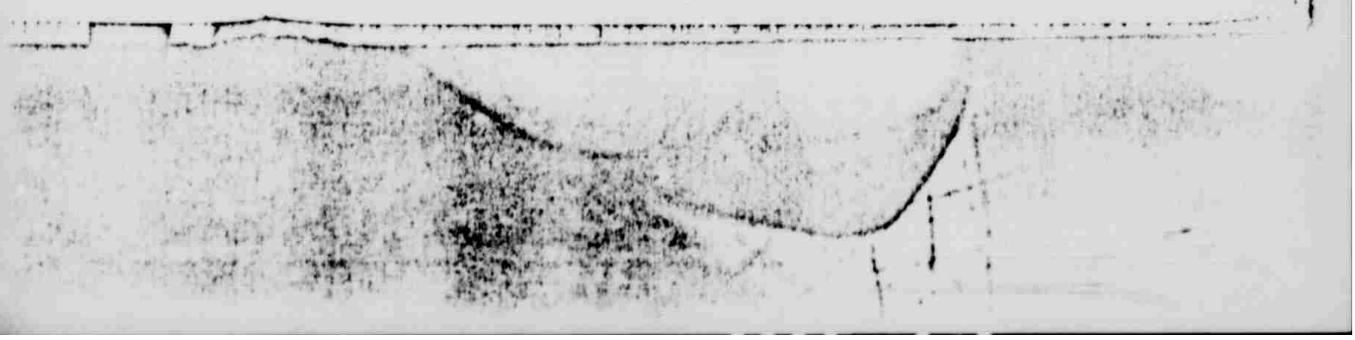


Table 3. *Soft Tissue Tumors of Thoracic Wall*

	BENIGN	MALIGNANT
Epithelial		
Epidermal	Verruca Keratosis Nevus Cyst	Squamous cell carcinoma Basal cell carcinoma Melanoma
Adnexal	Breast tumors Tumors of sebaceous, apocrine, and eccrine glands	Breast tumors Tumors of sebaceous, apocrine, and eccrine glands
Fibrous	Fibroma Desmoid Dermatofibroma	Fibrosarcoma Dermatofibrosarcoma protuberans
Adipose	Lipoma Hibernoma	Liposarcoma Malignant hibernoma
Muscle	Leiomyoma Rhabdomyoma Granular cell myoblastoma	Leiomyosarcoma Rhabdomyosarcoma Malignant granular cell myoblastoma
Vascular	Hemangioma Lymphangioma Glomus tumor	Angiosarcoma Kaposi's sarcoma Hemangiopericytoma Lymphangiosarcoma
Reticuloendothelial		Lymphoma Lymphosarcoma Reticulum cell sarcoma Hodgkin's disease Mycosis fungoides
Peripheral nerve	Neurilemmoma Neurofibroma Ganglion neuroma	Malignant neurilemmoma
Undifferentiated	Myxoma Mesenchymoma	Myxosarcoma Malignant mesenchymoma

tension cyst may even be hard. Fibrous tumors (including neurofibromas) do not transilluminate light well whereas most of the others do. If the tumor is intrathoracic or beneath the muscles, it may not be palpable. With muscle contraction, submucosal tumors become more difficult to feel and intramuscular tumors become less mobile.

ROENTGENOGRAPHY. Roentgenography is of limited usefulness in the diagnosis of soft tissue tumors compared with skeletal tumors. Intrathoracic extension, soft tissue swelling, bone erosion, or calcification may, however, be demonstrated in roentgenograms.

OTHER LABORATORY PROCEDURES. These are primarily indicated to rule out conditions other than soft tissue tumors. As with skeletal tumors, the diagnosis is best established by excisional biopsy. For extensive tumors, needle biopsy may be used.

PERIODIC EXAMINATIONS. Periodic examinations are important, especially if the patient has multiple benign lesions, for malignant transformation may occur in some (neurofibromas).

Treatment

It is wise to excise all
hemangioma in infants shou
initially this tumor enlarge
Malignant soft tissue tumor
multiple as is frequently th
Wide excision of muscle t
there may be multicentric
fascial planes. If the skin i
can be closed by split thic
The adjacent thoracic s
tissue tumor is attached
should be excised with
this is less important for
apparent solitary pulmon
from wide resection of a
should also be resected.[5]

Irradiation is not
advanced disease. It can
tively and even proper
reduce the size of the tu
The prognosis of l
guarded in malignant
propensity of some of t

CONDITIONS

A number of cond
(Table 4) may simula
only clinically, and
graphically.

The hy
frequently referred fo
tosis is most confusin
mistaken for osteogen
because it resembles
but, also because it ma
ature is not always
and infections becaus
such fever. Conversel
masked by antibiotic
painful, suppurative
joint.[5] The second co

Treatment

It is wise to excise all large or growing benign tumors. A cavernous hemangioma in infants should be observed, however, because even though initially this tumor enlarges, in time spontaneous involution usually occurs. Malignant soft tissue tumors require wide excision unless they are obviously multiple as is frequently the case with Kaposi's sarcoma and lymphoma. Wide excision of muscle tumors means the entire muscle group because there may be multicentric tumors and there is a tendency to spread along fascial planes. If the skin is involved, it should be widely excised. The defect can be closed by split thickness skin graft or rotation of skin muscle flaps. The adjacent thoracic skeleton should be resected as well when the soft tissue tumor is attached to the periosteum. The regional lymph nodes should be excised with vascular malignant lesions and fibrosarcomas but this is less important for malignant tumors of adipose or muscle origin. An apparent solitary pulmonary metastatic lesion should not deter the surgeon from wide resection of a primary fibrosarcoma but the pulmonary lesion should also be resected.[9]

Irradiation is not a substitute for surgical excision except in far-advanced disease. It can be an adjunct to surgical excision, given postoperatively and even preoperatively, especially in extensive lesions, for it may reduce the size of the tumor so that resection becomes possible.[11]

The prognosis of benign tumors of the soft tissues is good but must be guarded in malignant tumors even after radical excision because of the propensity of some of the soft tissue tumors for hematogenous spread.

CONDITIONS SIMULATING THORACIC WALL TUMORS

A number of conditions of the thoracic soft tissues and thoracic skeleton (Table 4) may simulate thoracic wall tumors. Some of these cause confusion only clinically, and others (as indicated by the asterisks) roentgenographically.

The hypertrophied costal cartilage is probably the condition most frequently referred for evaluation, but in babies, infantile cortical hyperostosis is most confusing because its roentgenographic appearance can be mistaken for osteogenic sarcoma. Myositis ossificans is important not only because it resembles sarcoma from the clinical and radiologic standpoint but, also because it may even undergo malignant change.[10] A septic temperature is not always helpful in differential diagnosis of chest wall tumors and infections because some neoplasms, notably Ewing's tumor, may cause such fever. Conversely, the temperature response of some infections is masked by antibiotics. Tietze's syndrome (questionably a real entity) is a painful, suppurative swelling of the sternoclavicular or costochondral joint.[5] The second costochondral junction is most frequently involved.



Table 4. *Conditions Simulating Thoracic Soft Tissue and Skeletal Tumors*

	SOFT TISSUE TUMORS	SKELETAL TUMORS
Normal anatomic relationships—misinterpreted	Breast,* nipple*	Center of ossification,* prominent xiphoid
Congenital abnormalities	Polythelia, polymastia, anomalous muscle	Hypertrophied costal cartilage, pigeon breast, rib anomalies,* infantile cortical hyperostosis*
Post-traumatic conditions	Foreign body, hematoma, myositis ossificans,* fat necrosis	Fracture, costochondral separation
Infections and inflammations	Granuloma, pseudo-epitheliomatous hyperplasia, specific infections, abscess, empyema necessitans, nodular non-suppurative panniculitis	Osteomyelitis,* osteochondritis,* hydatid cyst,* arthritis, gout
Circulatory disturbances	Aortic or intercostal artery aneurysm, thrombophlebitis of chest wall vein	Aseptic necrosis,* spontaneous absorption of bone,* rib notching*
Nutritional and metabolic disturbances	Amyloidosis, calcinosis, xanthoma tuberosum	Rickets, scurvy, hypervitaminosis A, sprue*
Endocrine disturbances	Gynecomastia, cystic mastitis	Hyperparathyroidism,* acromegaly
Collagen disorders	Dermatomyositis, periarteritis nodosa	
Conditions of unknown etiology		Paget's disease of bone,* melorheostosis,* Caffey's disease,* osteopoikilosis,* Tietze's syndrome

* Conditions important from the standpoint of radiographic interpretation.

CONCLUSIONS

Tumors of the chest wall may involve the soft tissue or the thoracic skeleton. The latter type is frequently malignant. Chest wall tumors can be difficult to diagnose. They can be simulated by a large number of conditions. Excisional biopsy is recommended. Wide excision of primary tumors is the treatment of choice, and in many such malignant tumors, the prognosis seems favorable. Resection is well tolerated. Because correct histologic diagnosis of cartilaginous tumors, particularly, can be difficult, careful periodic examinations are recommended even for "benign" tumors. Re-excision is recommended for locally recurrent tumors.

REFERENCES

1. Burwell, H. N.: Resection of the shoulder with humeral suspension for sarcoma involving the scapula. J. Bone & Joint Surg. *47A*: 300, 1965.

2. Crile, G. C., Jr.: Pulsating tumors of the sternum. Ann. Surg. *103*: 199, 1936.
3. Francis, K. C., and Worcester, J. N., Jr.: Radical resection for tumors of the shoulder with preservation of a functional extremity. J. Bone & Joint Surg. *44-A*: 1423, 1962.
4. Halpert, B., and Davis, J. B.: Chondrosarcoma; report of 2 cases. Am. J. Cancer *23*: 784, 1935.
5. Kayser, H. L.: Tietze's syndrome. Am. J. Med. *21*: 982, 1956.
6. Lessman, F. P., Schobinger von Schowingen, R., and Lasser, F. C.: Intravenous venography in skeletal and soft tissue abnormalities. Acta radiol. *44*: 397, 1955.
7. Lichtenstein, Louise, and Jaffe, H. L.: Chondrosarcoma of bone. Am. J. Path. *19*: 553, 1943.
8. Ochsner, Alton, Jr., Lucas, G. L., and McFarland, G. B., Jr.: Tumors of the thoracic skeleton. J. Thorac. & Cardiovasc. Surg. (in press).
9. Ochsner, A., Sr., and Ochsner, A., Jr.: Tumors of the thoracic wall. Chap. 15 in Tumors of the Chest, New York, Grune & Stratton, Inc., 1959.
10. Pack, G. T., and Braund, R. R.: Development of sarcoma in myositis ossificans. J.A.M.A. *119*: 776, 1942.
11. Pack, G. T., and Miller, T. R.: Combined radiation therapy and surgical treatment of technically inoperable cancer. Radiology *57*: 529, 1951.
12. Upshaw, J. E., McDonald, J. R., and Ghormley, R. K.: Extension of primary neoplasms of the bone to bone marrow. Surg. Gynec., & Obst. *89*: 704, 1949.