Tumors of the Ribs*

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The object of this paper on tumors of the rib is three-fold. First, to point out that many of them are not metastatic, secondly, that primary malignant tumors are not more frequent than benign tumors, and thirdly, to present some exemplary conditions one should consider in the differential diagnosis of rib tumors. The present review covers the contributions on primary rib tumors through 1953 and comprises a study of 212 cases, seven being added to the 205 cases reported last year.

Much can be learned about these cases from a detailed history, a comprehensive physical and laboratory examination, and the broader utilization of roentgenography in the study of the local area. It is of the utmost

<table>
<thead>
<tr>
<th>TABLE I—Pathology of 212 Collected Cases of Primary Tumor of the Rib.</th>
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<tbody>
<tr>
<td><strong>BENIGN TUMORS</strong></td>
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<tr>
<td>---------------------</td>
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<tr>
<td>Chondroma</td>
</tr>
<tr>
<td>Osteochondroma</td>
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<tr>
<td>Myxochondroma</td>
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<tr>
<td>Osteoma</td>
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<tr>
<td>Osteoid osteoma</td>
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<tr>
<td>Osteofibroma</td>
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<tr>
<td>Fibrous dysplasia</td>
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<tr>
<td>Hemangioma</td>
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<tr>
<td>Xanthomatous giant cell</td>
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</tbody>
</table>

*Miscellaneous—myxoma, solitary myeloma, xanthoma, lipoma, fibroma, chondromyxoid fibroma |

<table>
<thead>
<tr>
<th><strong>MALIGNANT TUMORS</strong></th>
<th>Number of Cases</th>
<th>Per cent of Malignant Tumors</th>
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</thead>
<tbody>
<tr>
<td>Chondrosarcoma</td>
<td>36</td>
<td>17.0</td>
</tr>
<tr>
<td>Osteogenic sarcoma</td>
<td>6</td>
<td>2.8</td>
</tr>
<tr>
<td>Fibrosarcoma</td>
<td>12</td>
<td>5.6</td>
</tr>
<tr>
<td>Mixed sarcomas</td>
<td>8</td>
<td>3.8</td>
</tr>
<tr>
<td>Endothelioma (Ewing's tumor)</td>
<td>25</td>
<td>11.8</td>
</tr>
<tr>
<td>Giant cell</td>
<td>1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

*Miscellaneous—myeloma, lymphosarcoma, reticulum cell, hemangioendothelioblastoma, hemangiosarcoma, liposarcoma |

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importance to the patient to decide clinically whether the tumor is an expression of a local disease or a secondary deposit, whether the growth is simply one in juxtaposition to the rib or whether the lesion is a local manifestation of a systemic disease. To this end, three illustrative cases are presented.

**Case 1:** Concerns C. S., a 58 year old man who was well until about two months before he was admitted to a hospital. At that time he complained of pain in the upper part of the left side of the chest and shoulder. Sedatives were given for the pain. Roentgenographic studies of the chest and left shoulder were taken and he was discharged several days later with a diagnosis of "neuritis." About a week later, he was admitted to another hospital where a history was obtained of loss of weight and appetite antedating the onset of pain about the left shoulder region. The physical examination at this time was non-revealing except for some tenderness in the upper part of the left side of the chest laterally and in the splenic area. A roentgenographic examination of the chest, Fig. 1A, revealed a tumor opposite the fourth intercostal space posteriorly with involvement of the fourth rib locally. In a detailed examination, a roentgenographic study of the gastrointestinal tract was performed. This disclosed a malignant lesion in the colon. Because of the pain in the chest, a palliative resection of the local area was done. At the same time, the fourth and fifth intercostal nerves were removed. The pathologist reported the tumor, Fig. 1B, as a metastatic papillary adenocarcinoma.

**Case 2:** J. M., a 49 year old man, entered the hospital complaining of pain on the right anterior part of the chest of about six months' duration. The physical examination was essentially negative. A roentgenographic study of the chest, Fig. 2A, revealed a density in the right hemithorax opposite the eighth intercostal space. The eighth rib posteriorly, proximal to the lesion, showed some narrowing. Lateral roentgenograms located the tumor in the posterior part of the thorax. Roentgenographic restudy of the chest after the induction of pneumothorax showed the tumor to be within the chest wall, Fig. 2B. At the time of surgical removal of the lesion, it was noted that the tumor, Fig. 2C, arose from the eighth intercostal nerve. The pathologist reported the tumor as a neurofibroma.

**Case 3:** A. S., a 57 year old man, entered the hospital because of pain in the right infrascapular area of about three weeks' duration; weakness, loss of appetite, and loss of weight had been present for about six weeks. On physical examination, there was noted a marked pallor, signs of recent loss of weight, and tenderness in the right infrascapular area. The admission blood count showed a hemoglobin of 40 per cent with 1,850,000 red blood cells per cubic millimeter, 5,400 white blood cells, and a relatively normal differential count. An x-ray study of the chest, Fig. 3A, showed a defect and opacity in the posterolateral part of the sixth rib on the right side. There was also noted rarefaction of the medial and lateral parts of the clavicle on the same side. The urine was positive for Bence-Jones protein. Roentgenographic examination

![Figure 1A](image1a.jpg)

![Figure 1B](image1b.jpg)

*Figure 1A:* Tumor in the left fourth intercostal space posteriorly with partial destruction of the fourth rib.—*Figure 1B:* Resected fourth and fifth ribs with intervening neoplastic tissue. Diagnosis: metastatic tumor.
of other bones showed infiltrative changes characteristic of multiple myeloma. At necropsy a rib was removed, Fig. 3B. This showed the changes associated with multiple myeloma.

In these three cases, had the history, physical examination, and x-ray studies been incomplete, at least two of the three would have been treated as primary rib disease until proved otherwise. Granting that in some instances it is not possible to make a definitive diagnosis before the tissue is examined, it does not relieve us of responsibilities to the patient. Having decided that the tumor is primary in the rib, one should leave it to the pathologist to decide whether the growth is benign or malignant, although one can make a reasonably correct diagnosis of the nature of the tumor from the history, physical examination, and roentgenographic studies. What is more important clinically is to decide whether the patient would benefit from the surgical removal of the tumor.

In discussing the pathology of primary tumors of the rib, it is well to remember that the ribs are mesodermal in origin and contain practically all the elements known to be derived from that tissue. In a study of 212 cases collected from various sources,
FIGURE 3A: Tumor on the right side of the chest wall with partial destruction of the posterior lateral part of the fifth rib. Figure 3B: A rib removed at the time of necropsy. The gross changes are characteristic of multiple myeloma.
there were 111 (52.36 per cent) benign and 101 (47.65 per cent) malignant tumors, Table I. The most frequently reported benign tumor was the fibrous dysplasia occurring in 31.5 per cent of the cases, the chondroma was encountered in 22.5 per cent of the cases, and the osteochondroma in 13.5 per cent. Of the malignant tumors, 35.6 per cent were chondrosarcomas, 24.8 per cent Ewing's tumors, and 11.9 per cent fibrosarcomas.

The clinical manifestations of a primary tumor of the rib depend upon (1) location, (2) manner of growth, (3) rate of growth, and (4) secondary effects on surrounding and distant tissues. Not infrequently, these tumors are completely asymptomatic and are discovered on "routine" physical or roentgenographic examination of the chest.

Case 4: J. G., a 19 year old girl, had a pre-employment x-ray film of the chest. A tumor was noted on the fourth rib anteriorly on the left side, Fig. 4A. The physical examination was negative. Even when her attention was called to the tumor, she maintained that it was devoid of symptoms. The tumor was removed, Fig. 4B, and reported by the pathologist as an osteochondroma.

In other instances, the patient's first symptom, and often the only symptom, is an awareness of a growing mass on the chest. The rate of growth varies from patient to patient. Benign tumors often grow slowly, while malignant ones generally tend to grow more rapidly. Case 5 concerns M. P., an 18 year old man. Although he was aware of the presence of the tumor for about three years, he did not observe any

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**Figure 4A**: An expanded lesion within the anterior part of the left fourth rib. There is some ossification in the growth. **Figure 4B**: The opened specimen of the tumor (osteochondroma) and part of the rib.

**Figure 5A**: Tumor of the fifth anterior rib on the right side of the chest. **Figure 5B**: Neoplasm (osteochondroma).
appreciable increase in its size until a few months before entering the hospital. Concomitantly with the increase in size of the tumor, he also observed some sensitivity of the region surrounding the tumor mass. Except for the presence of a mass on the right anterior chest wall which was fixed to the underlying rib, and some tenderness to pressure locally, the physical examination was essentially negative. An x-ray study of the chest, Fig. 5A, revealed a tumefaction on the anterior part of the fifth rib on the right side. The tumor was removed, Fig. 6B, and was reported by the pathologist as an osteochondroma.

The third group of patients who seek the attentions of the physician are those who have pain, either locally or referred to neighboring or distant structures. Case 6 is that of A. L., a 31 year old woman, who sought medical advice because of increasing pains in the upper posterior part of the left side of the chest for about two years. Except for some tenderness in the upper left paravertebral area, the physical examination was non-revealing. A roentgenographic examination of the chest, Fig. 6A, disclosed a multicycstic area in the expanded medial portion of the third rib posteriorly. This was removed, Fig. 6B, and the pathologist reported an hemangioma of the rib.

Thus, here are three patients with benign tumors of rib with different manifestations of the presence of the neoplasm. As in these cases, so, too, in the malignant tumors the symptomatology is variegated. Neither is the duration of symptoms any index of the histopathologic nature of these tumors. In the 212 cases, the duration of symptoms in the 111 benign tumor cases varied from absence of symptoms to 30 years, while in the 101 malignant cases, it ranged from three days to 20 years. Pain and/or tumefaction are the commonest symptoms encountered in patients with primary tumors of the rib, regardless of whether they are benign or malignant. Therefore, one cannot draw any conclusion as to the nature of the tumor from the duration of symptoms, or symptoms alone. However, the tendency is for the patient with a malignant tumor to seek medical care earlier than one who has a benign tumor because of the more rapid expansion and more persistent and/or severe pain in the area of the tumor. The age of the patient is no criterion upon which to base a diagnosis of benignity or malignancy, although endothelioma, round-cell sarcoma, plasma-cell sarcoma, and lymphosarcoma are commoner in patients below 30 years of age.

Roentgenographic studies of the tumor site do not reveal conclusive evidences as to the nature of the tumor. However, in a general way it may be said that a tumor confined to a single rib is more likely to be benign than malignant. At the same time, it must be remembered that at its inception a malignant tumor is confined to a single rib before it extends to others. Thus, the presence of a tumor in one rib does not necessarily imply that it is benign. That benign tumors of the rib may involve more than a single rib is well illustrated in the case reported by Poppe and Berg. Consequently, a definitive diagnosis cannot be made from x-ray studies of the ribs alone.

A condition which simulates a primary rib tumor and must be considered in the differential diagnosis is the eosinophilic granuloma. It is the concensus of opinion of pathologists that this lesion is inflammatory rather than neoplastic. Since Lichtenstein and Jaffe (1940) described this condition as a clinical entity, several eosinophilic granulomas of the rib have been reported. These investigators pointed out that this condi-

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**FIGURE 6A**

Figure 6A: Tumor of the third rib posteriorly on the left side.

**FIGURE 6B**

Figure 6B: Tumor (hemangioma) removed.
tion is an acute manifestation and variant of the basic bone conditions known as Letterer-Siwe disease (nonlipid histiocytosis) and Hand-Schiller-Christian disease (lipogranulomatosis). Although about 50 patients with eosinophilic granuloma of bone have been reported to date, only 10 involving ribs have been reported thus far. In one of these cases the disease also involved the teeth and lungs (Kruger, Prickman and Pugh). The writer has encountered two patients with eosinophilic granuloma of the rib.

Case 7 is that of G. S., a 14 year old girl, who was well until about two weeks before entering the hospital. At that time she noticed a painful and growing mass on the lower part of the left side of the chest. Physical examination was negative except for a tender mass in the lower lateral part of the chest wall. An x-ray film of the area, Fig. 7A, disclosed an expanded lesion within the 10th rib laterally, thickening of the periosteum with subperiosteal new bone formation. The blood count and sedimentation rate were not contributory to the diagnosis. The rib was removed, Fig. 7B, and was reported as an eosinophilic granuloma.

Case 8 concerns M. G., a 51 year old man, who complained of pain in the lower left thoracic area for many weeks. His initial symptoms were pains after meals and on deep breathing. About six weeks before entering the hospital he began to notice a sensitivity in the posterolateral part of the left lower thorax which was more or less constant and unrelated to meals or breathing. At the time of admission to the hospital, the physical examination was negative except for tenderness to pressure in the

![FIGURE 7A](image) ![FIGURE 7B](image)

*Figure 7A*: Tumor of the tenth rib on the lateral portion of the left hemithorax.—
*Figure 7B*: Tumor (eosinophilic granuloma) removed.
lower posterolateral part of the left hemithorax. An x-ray film of the chest, Fig. 8A, showed a tumefaction in the posterolateral part of the eighth rib on the left side. In addition, there was an opacity along the left border of the heart. Roentgenographic restudy of the lower part of the chest in the partially rotated position, Fig. 8B, revealed an opacity above the left diaphragm and the rib findings as noted. The blood studies were non-revealing except for a moderate leukocytosis (11,500) with an essentially normal differential count. He was explored and the involved part of the rib was removed, Fig. 8C. The cause of the supradiaphragmatic opacity was found to be a herniation of omentum through the diaphragm. The report of the pathologist on the rib was an eosinophilic granuloma.

Although a low-grade fever, an increase in sedimentation rate, and multiple sites of involvement suggest an eosinophilic granuloma, a definitive diagnosis cannot be made without biopsy of the tumor. Being an inflammatory lesion, it is supposed to subside in due time. However, there is the question of how long one should neglect the tumor, for in watchful waiting one may be delaying the care of a patient who has a neoplasm of the rib, rather than an eosinophilic granuloma.

In a review of the literature on the subject of noninflammatory primary tumors of the rib one gains the impression that many writers believe most of them to be malignant. This view is not corroborated by statistics. However, it does corroborate the view of other investigators that these tumors are potentially malignant and should be removed as soon as possible. At the time of surgical intervention, one may encounter a well delimited and even encapsulated tumor which has all the appearances of a benign tumor, but which upon histologic examination is found to be malignant. Local invasion of the tissues, or extension outside of the periosteal bed, at the time of the operation, should be considered as a sign of malignancy until proved otherwise.

In a number of cases of primary rib tumors, there is reason to believe that a pre-existing benign lesion antedated the malignant lesion. Condon and Harper reported a case in which a tumor of the rib was present for 13 years before it was removed and proved to be malignant. Just as one is often unable to determine the nature of the tumor by simple gross inspection, so, too, may one be unable to determine the degree of maturity from simple microscopic examination of a single section of the tissue. After the removal of a tumor from a rib, Johnson submitted sections to pathologists for diagnosis. The reports are worthy of note: Fifty-four called it an osteogenic sarcoma, six described it as a chondrosarcoma, 27 believed it to be an osteoid osteoma, three thought it was a fibrous dysplasia, four called it healing bone with foreign body reaction, one described it as osteoid tissue forming a tumor, and another thought it was an aneurysmal bone cyst. If the pathologists were at such variance, it is readily understandable why the surgeon is unable to make a definitive diagnosis at the operating table as to whether the tumor is benign or malignant. It may also account for the number of instances in which “benign” tumors have been described as having undergone “malignant” transformation soon after the original extirpation.

CONCLUSIONS

1. Primary rib tumors are as frequently benign as they are malignant.
2. Whether the tumor is benign or malignant is often a difficult decision unless careful and detailed studies are made grossly and microscopically.
3. All primary tumors of the ribs should be removed regardless of whether they are thought to be benign or malignant, unless contraindications exist to surgery.

CONCLUSIONES

1. Los tumores primarios de las costillas son tan frecuentemente benignos como malignos.
2. Es a menudo difícil determinar si un tumor es maligno, o benigno a menos que se hagan estudios minuciosos macro y microscópicamente.
3. Todos los tumores primarios de las costillas deben extirparse sin tener en cuenta que se piense que sean benignos o malignos.

Some of the material contained in this article was previously published in Archives of Surgery (1953). Case 2 was previously published in Annals of Surgery (1953). The foregoing is presented here with the permission of the editors of these journals.
1. Les tumeurs primitives des côtes sont aussi fréquemment bénignes que malignes.
2. Il est nécessaire que des études macroscopiques et microscopiques attentives et détaillées soient faites pour classer la tumeur, ce qui est parfois difficile.
3. Toutes les tumeurs primitives des côtes devraient être extirpées, sans tenir compte de leur caractère bénin ou malin.

BIBLIOGRAPHIES