

Primary osteogenic sarcoma of the mediastinum

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Ikeda, T., Ishihara, T., Yoshimatsu, H., Kikuchi, K., Murakami, M., Kobayashi, K., Inoue, H., and Kasahara, M. (1974). *Thorax*, 582–588. **Primary osteogenic sarcoma of the mediastinum.** A 22-year-old man with primary osteogenic sarcoma of the superior mediastinum is reported. This case is the second instance of primary osteogenic sarcoma of the mediastinum and the first case of superior mediastinal origin to be reported. The patient had local recurrence one year after the first operation. After resection of the recurrent tumour with left upper lobectomy and partial pericardectomy followed by radiation, he has been well for more than five years without recurrence.

Extrasosseous osteogenic sarcoma of soft tissue is very rare and has been reported in 103 patients. The five-year survival of patients with extrasosseous osteogenic sarcoma is 22.4%. The distribution and prognosis of this tumour are similar to those of rhabdomyosarcoma in soft tissue. Primary amputation or wide excision is the treatment of choice.

Extrasosseous osteogenic sarcoma arising from soft tissues (Allan and Soule, 1971; Wurlitzer, Ayala, and Romsdahl, 1972) and organs such as the breast (Jernstrom, Lindberg, and Meland, 1963), kidney (Johnson, Ancona, Johnson, and Pineda, 1970), thyroid (Livingstone and Sandison, 1962), urinary bladder (Crane and Tremblay, 1943), uterus (Carleton and Williamson, 1961; Amromin and Gildenhorn, 1962), and lung (Nosanchuk and Weatherbee, 1969; Reingold and Amromin, 1971) is sporadically reported but there has been no report of spontaneous occurrence of osteogenic sarcoma in the superior mediastinum (Benjamin, McCormack, Effler, and Groves, 1972; Conkle and Adkins, 1972).

We have encountered a case of osteogenic sarcoma of mediastinal origin, and we report it as a primary osteogenic sarcoma of the mediastinum.

CASE REPORT

A 22-year-old well-developed male student was admitted to the Keio University Hospital on 23 August 1968 with a principal complaint of chest pain and mild dyspnoea. The symptoms had developed suddenly one week previously after three days' pyrexia. Until then he had been in good health.

No evidence of anaemia or jaundice was detected. He was 180 cm tall and weighed 63 kg. The blood pressure was 106/52 mmHg and the pulse was regular with a rate of 80 beats/minute. There were no palpable lymph nodes in the supraclavicular region or elsewhere. Dullness to percussion and reduced breath sounds were noted over the left chest anteriorly. No other physical signs were detected.

Examination of the blood revealed the following: haemoglobin 13.5 g/100ml, haematocrit 41.0%, red blood cells 4.2×10^6 , white blood cells 7,700, total protein 6.8 g/100ml, serum sodium 142 mEq/l, serum chloride 108 mEq/l, serum potassium 4.0 mEq/l, and serum calcium 5.0 mEq/l. Urine examination revealed a specific gravity of 1.034, protein and sugar negative. Urinary sediment showed no abnormality. Urinary excretion of 17-hydroxycorticoids was 6.67 mg per day and that of 17-ketosteroids 1.31 mg per day. The former was slightly over the normal range, the latter decreased.

Pulmonary function test results were: vital capacity 2,580 ml (55%), maximum voluntary ventilation 47.0 l/min (36%), and forced expiratory volume in one second 1,870 ml/sec (62%).

The postero-anterior chest radiograph showed a sharply defined, round mass protruding from the left mediastinal border (Fig. 1). In the lateral view an elliptical mass was seen in the anterior mid portion of the chest (Fig. 2). The bronchogram revealed posterior

displacement of the left upper lobe and anterior basal bronchi due to the mass (Fig. 3). With the diagnosis of mediastinal tumour, a left thoracotomy was performed on 4 September 1968. The tumour was located in the superior mediastinum anteriorly adhering to the lingula and the superior parietal pericardium. During dissection of the tumour from the lung, rupture of a part of the tumour occurred and a quantity of yellow serous liquid flowed out. The tumour, attached to the thymus, was removed.

The specimen measured 13×9×7 cm and was surrounded by a fine fibrous capsule, which appeared fleshy, nodular, and red-brown in colour. The cut surface was nodular, yellowish-grey in colour, elastic-firm in consistency, and contained cysts (Fig. 4). Microscopically the tumour cells were predominantly pleomorphic, and fusiform or polygonal in shape, resembling osteogenic sarcoma or fibrosarcoma. There were irregular areas of osseous and osteoid differentiation surrounded by bizarre multinucleate giant cells and spindle cells containing abundant intranuclear chromatin (Figs 5 and 6). A few mitotic figures were seen. Other areas consisted of well-differentiated eosinophilic cytoplasm. The tumour cells infiltrated the surrounding fibrous capsule. The histological diagnosis established on the basis of these findings was osteogenic sarcoma. A skeletal radiological survey carried out after the operation was negative.

In October 1969 the patient had a chest radiograph and an abnormal shadow was found in the left hilum (Fig. 7), though he had no bronchopulmonary symptoms. He was admitted to hospital for the second time on 20 October 1969.

Physical examination was non-contributory. The chest radiograph showed a round, homogenous density extending from the left hilum, smaller than the primary tumour. Results of blood examinations were: red blood cells 4.2×10^6 , haemoglobin 13.6 mg/100 ml, haematocrit 44.0%, white blood cells 6,200, total protein 6.8 mg/100 ml, serum sodium 140.5 mEq/l, serum chloride 108 mEq/l, serum potassium 4.1 mEq/l, serum calcium 4.7 mEq/l, serum inorganic phosphorus 2.2 mEq/l, icterus index 6, SGOT 13, SGPT 9, LDH 110, total cholesterol 174 mg/100 ml, and alkaline phosphatase 5.6 units.

A second thoracotomy was performed on 24 October 1969, with a provisional diagnosis of local recurrence of the tumour. The tumour was about the size of a hen's egg, invading the lingular segment of the upper lobe and the pericardium. Almost complete

resection of the tumour could be carried out by removing the left upper lobe and invaded pericardium. The histological findings were identical with those of the original lesion. A lymph node metastasis close to the left main bronchus was resected. The patient developed a haemothorax postoperatively but recovered well without re-operation. Radiation therapy was administered to the superior mediastinum with a dose of 7,000 rad. by linear accelerator.

He returned to hospital on 17 June 1970 with symptoms of bloodstained sputum and productive cough. A bronchopleural fistula or local recurrence of the tumour was suspected, and a third thoracotomy was performed on 29 June 1970. The operative diagnosis was pyothorax due to bronchopleural fistula from the superior segment of lower lobe. There was no evidence of recurrence of the tumour grossly or microscopically. He made an uneventful recovery and was discharged on 1 September 1970.

He was readmitted on 21 November 1971 because of sudden haemoptysis. The chest radiograph revealed no change compared with the previous film, though the left lung field was opacified after the operation for pyothorax. Cytological examination of the sputum and bronchoscopic biopsy were negative. Since 1971 he has had occasional bloodstained sputum. He has now survived for more than five years after the first operation without any further evidence of recurrent tumour.

DISCUSSION

The occurrence of ossification or calcification in degenerative, reactive or neoplastic tissues of the somatic soft parts is not so rare. Osteogenic sarcomata arising in soft tissues are very uncommon. We reviewed 103 extraosseous osteogenic sarcomas reported in the literature. Tables I and II show age, sex, and anatomical distribution.

In 1951 Stauss reported an extraosseous osteogenic sarcoma in the right pleura. Thereafter three cases of osteogenic sarcoma originating in the pleura were reported in the literature (Cohn and Hall, 1968; Pearson, Rubin, Szemes, and Preger, 1969). Hoffmann, Fine, Ponka, and Welborn (1966), Das Gupta, Hadju, and Foote (1968) and Alpert, Abaci, and Werthamer (1973) separately described three cases of osteogenic sarcoma found in the chest wall (Table III). As far as primary

TABLE I
AGE AND SEX DISTRIBUTION OF 104 PATIENTS WITH EXTRAOSSEOUS OSTEOGENIC SARCOMA

	Total	Age (years)							
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-
Males	59		5	12	7	10	13	11	1
Females	45	1		7	6	6	10	10	5
Total	104	1	5	19	13	16	23	21	6

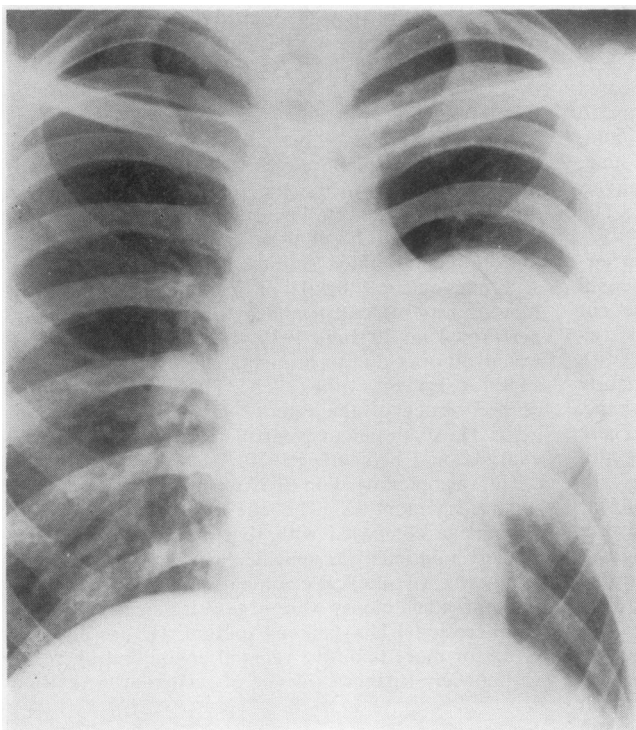


FIG. 1.

FIG. 1. Chest radiograph at first admission showing a round, homogenous, and sharply defined mass protruding from the left mediastinal border.

FIG. 2. Left lateral view showing an elliptical mass.

FIG. 3. Bronchogram showing posterior displacement of the upper lobe bronchus and anterior basal bronchus by the mass.

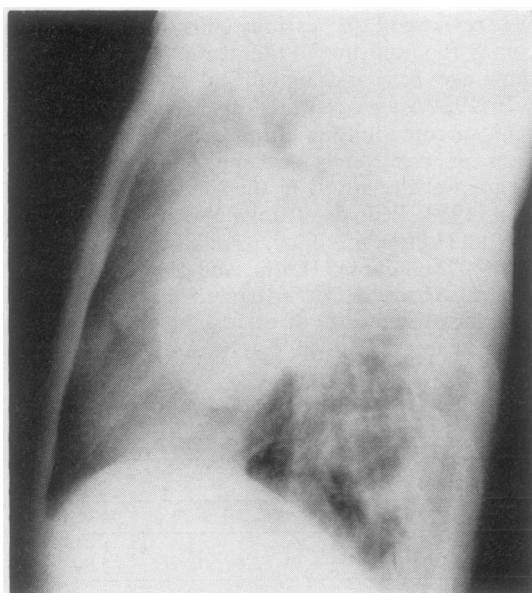


FIG. 2.

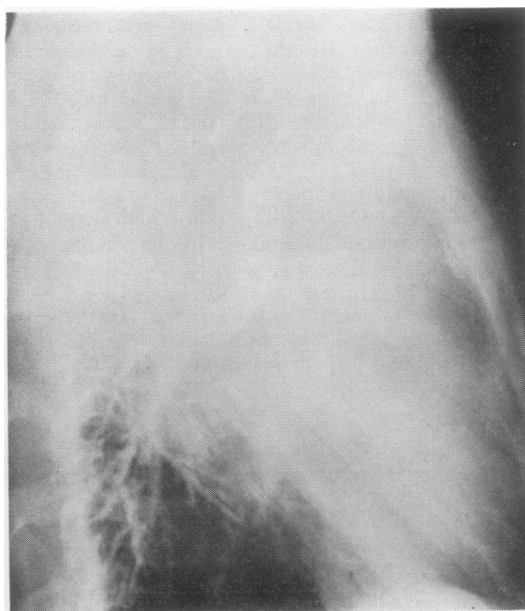


FIG. 3.

Primary osteogenic sarcoma of the mediastinum

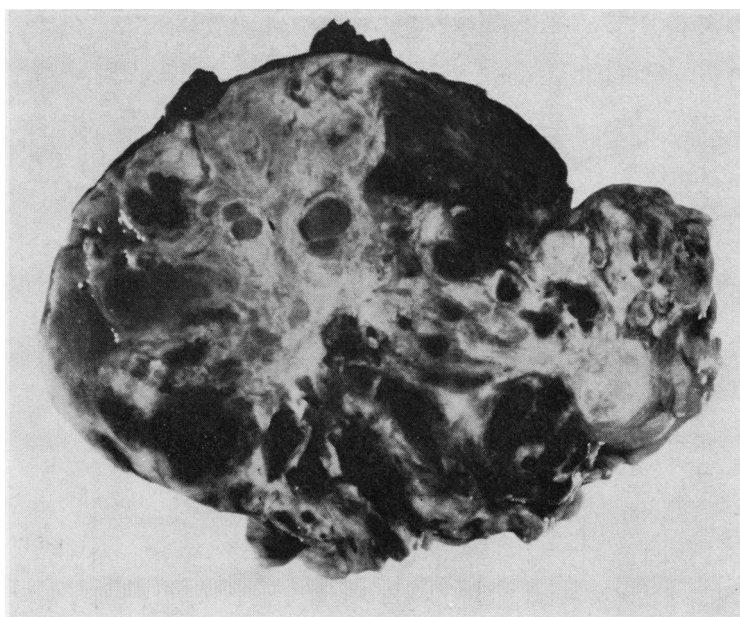


FIG. 4. *Cut surface of the resected specimen. Fibrous elements and cystic lesions are seen.*

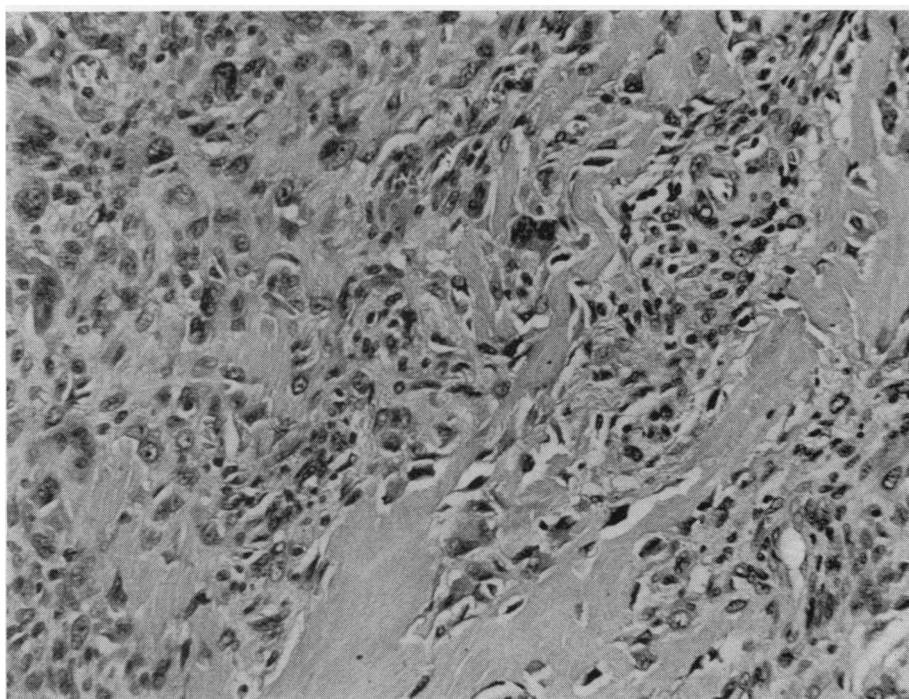


FIG. 5. *Microscopical appearance of the tumour showing areas of osseous and osteoid differentiation and fibrosarcomatous elements (H and E \times 346).*

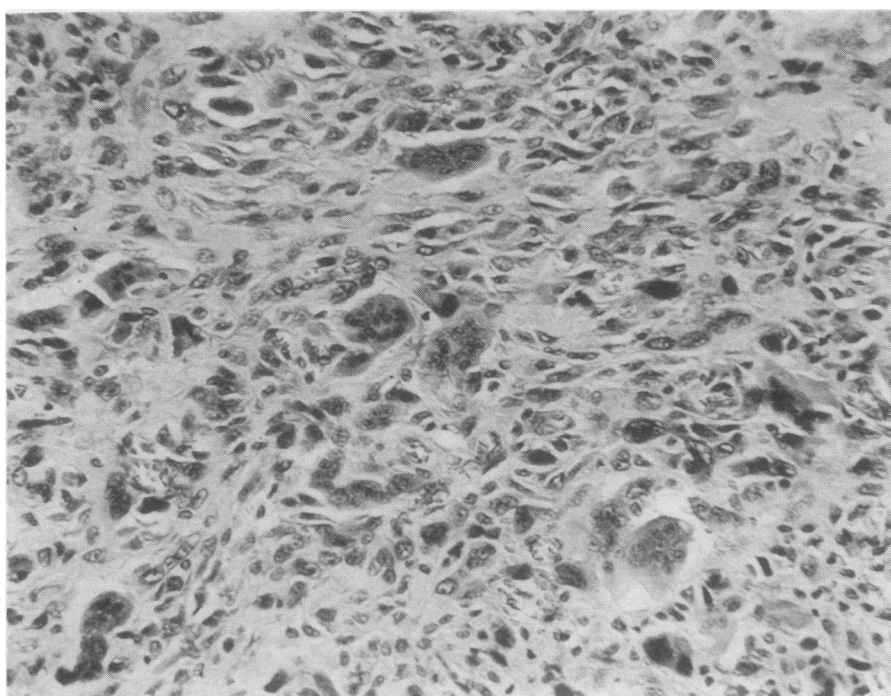


FIG. 6. Areas of bizarre multinuclear giant cells and spindle cells containing abundant intranuclear chromatin (H and E $\times 346$).

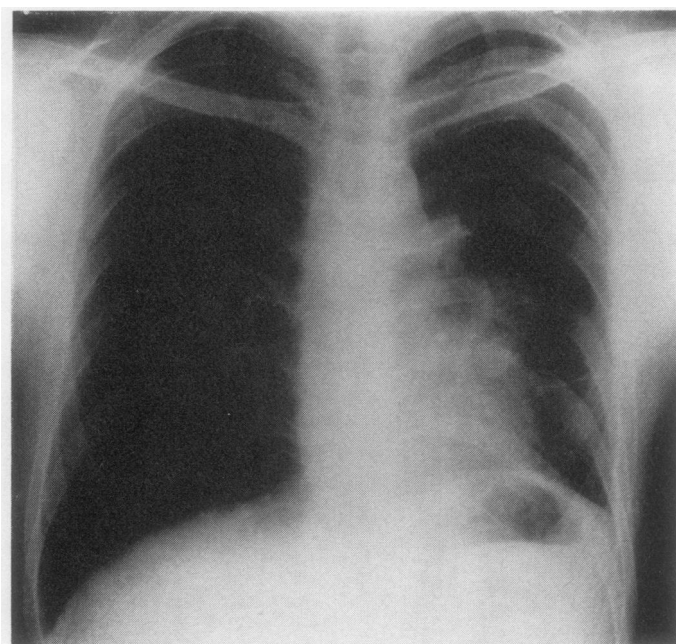


FIG. 7. Chest radiograph at second admission showing a round and homogenous density projecting from the left hilum.

TABLE II
ANATOMICAL SITE OF 104 EXTRAOSSEOUS OSTEOGENIC SARCOMATA

Site	No. of Patients
Limbs and limb girdles	75
Upper extremity	14
Shoulder girdle	6 (1) ¹
Arm	7
Hand	1
Lower extremity	61
Pelvic girdle	11 (1)
Thigh	39
Knee	4
Leg	4
Foot	3
Trunk	21
Retroperitoneal	8 (1)
Abdominal wall	4 (3)
Chest wall	3 (1)
Pleura	4
Mediastinum	2 ²
Miscellaneous	8
Neck	2
Mesentery	1
Lip	1
Meninges	1
Right orbit	1 (1)
Right zygoma	1
Temporal area	1

¹Cases of radiation-induced osteogenic sarcoma are indicated in parentheses.

²Authors' case included.

osteogenic sarcoma of the mediastinum is concerned, Wilson (1941) reported a patient with a mediastinal tumour which was proved to be an osteogenic sarcoma at necropsy. This case was later described by Binkley and Stewart (1940) as a primary in the pericardium with metastases to the brain, pancreas, kidney, lungs, and soft tissue of the left iliac fossa and left thigh. Our case is the second instance of primary osteogenic sarcoma of the mediastinum.

Extraosseous osteogenic sarcoma of other organs is also reported, including breast, kidney, thyroid, urinary bladder, and uterus. However, the occurrence of osteogenic sarcoma in thoracic organs is rare. Five cases of primary osteogenic sarcoma of the lung (Reingold and Amromin, 1971) and five cases of osteogenic sarcoma of the heart (Lowry and McKee, 1972) have been reported. In our case the tumour was found at the second operation to invade the lung, but a primary origin from the lung can be denied from the findings at the first operation.

The aetiology of extraosseous osteogenic sarcoma has been discussed as metaplasia of con-

TABLE III
EXTRAOSSEOUS OSTEOGENIC SARCOMA OF THE UPPER TRUNK

Reference	Sex/Age	Site	Treatment	Course
Stauss (1951)	F 14	Right pleura	None	Died 7 mth. Tumour involving right pleura, diaphragm, left pleura, retroperitoneal tissues, vertebrae, and rib
Cohn and Hall (1968)	M 61	Left upper pleura	Thoracotomy only	Died shortly after operation. Metastases to left lung, pleura, pericardium, and right kidney
Pearson <i>et al.</i> (1969)	M 66	Left lateral pleura	Thoracotomy only	Died 5 mth after onset of symptoms. Metastases to kidneys and lungs
	F 73	Left pleura	Thoracotomy only	Died 6 mth postop. Metastases to right lung and single subcutaneous nodule in thoracotomy scar
Hoffmann <i>et al.</i> (1966)	M 59	Left lateral chest wall	Excision (2) ¹ Lung metastasis removed	No further follow-up
Das Gupta <i>et al.</i> (1968)	F 53	Right posterior chest wall	Excision (5) ¹ Chest wall resection, axillary dissection	Died 3 yr 10 mth after first excision. Metastases to lungs and liver
Alpert <i>et al.</i> (1973)	F 41	Upper anterior chest wall	Excisional biopsy	Alive 1 yr without evidence of tumour recurrence
Wilson (1941)	M 19	Mediastinum (pericardium)	None	Died 2 mth after admission. Tumour in base of heart. Metastases to brain, pancreas, kidney, and lungs
Present case	M 22	Superior mediastinum	Thoracotomy and excision (3) ¹ Irradiation	Alive 5 yr after first operation with no further evidence of tumour

¹Number of operations in parentheses.

nective tissue or embryonal remnant (Amromin and Gildenhorn, 1962; Livingstone and Sandison, 1962; Jussawalla and Desai, 1964; Cohn and Hall, 1968; Lowry and McKee, 1972), while some cases are thought to have been induced by trauma (Fine and Stout, 1956; Järvi, Kvist, and Vainio, 1968) or radiation (Boyer and Navin, 1956; Alpert *et al.*, 1973). In our case the tumour was attached to the thymus but there was no histological relation between the tumour and the thymus. Although teratoma may arise in the anterior superior mediastinum no tissue remnant characteristic of teratoma other than osseous, osteoid, and fibrosarcomatous elements was found in our case. Therefore we conclude that the tumour was primary osteogenic sarcoma of the mediastinum developing from connective tissue metaplasia. The tumour recurred after primary excision; however, the patient has now survived for more than five years without evidence of disease after resection of the recurrent tumour and the left upper lobe followed by irradiation.

These tumours have a very poor prognosis because of their tendency to early metastasis and rapid and widespread local growth. Almost all cases of osteogenic sarcoma in the trunk died of recurrence or metastases. Extraosseous osteogenic sarcoma should be considered in the differential diagnosis of mediastinal, pleural or lung tumours.

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