UPTAKE OF ^{85}Sr BY AN OSTEOSARCOMA METASTATIC TO LUNG

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Although the ability of metastatic osteosarcomas to calcify and be visualized by radiologic means has been recognized for many years (*1*), the use of radiostrontium scintiscanning for this detection has been largely overlooked. Nilsson and Ullberg (*2*) have shown this to be possible theoretically by obtaining whole-body autoradiographs of mice who were injected with ^{90}Sr following the subcutaneous implantation of an experimental osteosarcoma. Multiple metastatic lesions within the major organs were detected in this manner, all of them having a histologic appearance similar to that of the mother tumor.

In clinical material, Rosenthall (*3*) reported the case of a woman who had undergone a hip disarticulation for an osteosarcoma of the femur and in whom a partially calcified soft tissue mass was noted in the pelvis on x-ray. A ^{85}Sr scan showed an increased concentration of radioactivity within the mass which on biopsy proved to be a metastatic focus of the primary tumor. In a somewhat different manner, Briggs and Wegner (*4*) described a case in which a carcinoma of the bladder metastatic to an iliac lymph node was diagnosed by both x-ray and ^{85}Sr scan because of the ability of the transitional cell epithelium to induce heterotopic metaplastic bone formation within the node.

The case presented here is unusual in that it describes concentration of ^{85}Sr in a distant metastasis of an osteosarcoma which was depicted by routine radiostrontium bone scanning.

REPORT OF A CASE

TS (#08-29-63), a 14-year-old boy, was well until October 1968 when he complained of pain in his right knee. An x-ray examination showed an abnormality, and a biopsy revealed an osteosarcoma. Subsequent evaluation failed to uncover any evidence of metastases, and the patient underwent a right hip disarticulation.

During the next 9 months he remained free of disease. Periodic chest x-rays appeared normal until September when he was found to have two discrete nodules in the left lung field accompanied by several small radiodensities suggestive of multiple metastases. The patient was admitted to the National Institutes of Health for further evaluation.

The admission physical examination was unremarkable. The patient was treated with an experimental antitumor agent, poly-inosinic-cytidylic acid (poly I:C) for the next 35 days. During this time a large left-sided pleural effusion developed which was controlled with intrapleural quinacrine hydrochloride (atabrine). Cytologic examination of the fluid was negative for malignant cells. Although x-ray detail of the lung fields was obscured by the effects of atabrine, full chest tomography revealed the presence of multiple, confluent metastases within the left lung. Compared with the previous chest films, these lesions had enlarged and become calcified.

Because the tumor appeared localized to the left lung, a pneumonectomy was considered, and the patient was reevaluated for evidence of any further metastases. A ^{85}Sr rectilinear scan of the pelvis was obtained along with a linear axis profile study. The pelvic scan was interpreted as normal and showed the effects of the previous surgery. However, the profile study detected an asymmetric area of heightened activity localized to the left chest. A scan of this region revealed multiple areas of inhomogeneous radionuclide accumulation which corresponded to the calcified metastases seen on the chest film (Fig. 1).

During the next week, an enlarging mass was noted on x-ray in the right lung between the minor fissures. An exploratory right thoracotomy was performed which revealed a 2-cm tumor between the upper and middle lobes that was completely removed by wedge resection and diagnosed as metastatic osteosarcoma. There was no evidence of further involvement of the

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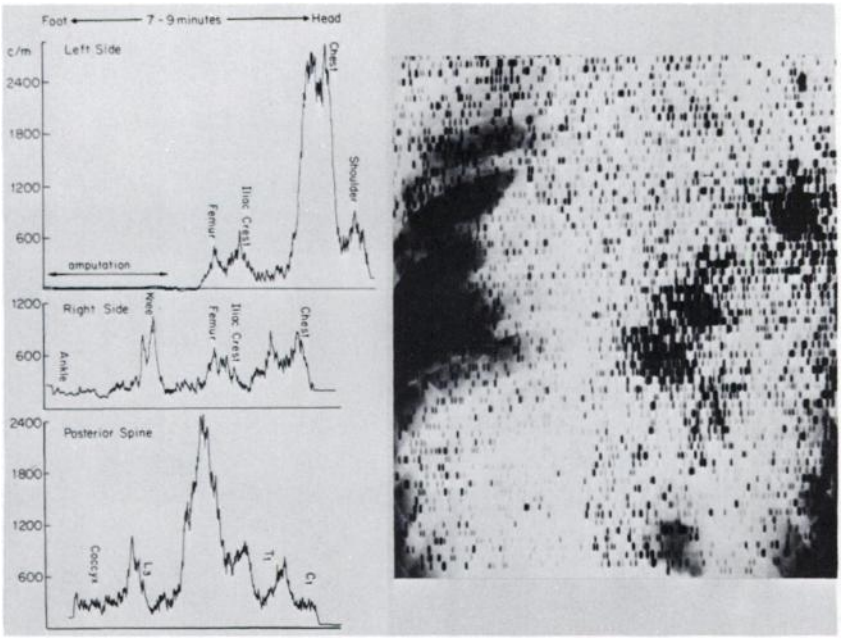

FIG. 1. Left: linear axis profile showing prominent ^{85}Sr concentration localized to left chest. Right: rectilinear scan of chest superimposed on x-ray by use of coincidence markers. There is inhomogeneous uptake of ^{85}Sr in areas corresponding to calcified lung lesions.

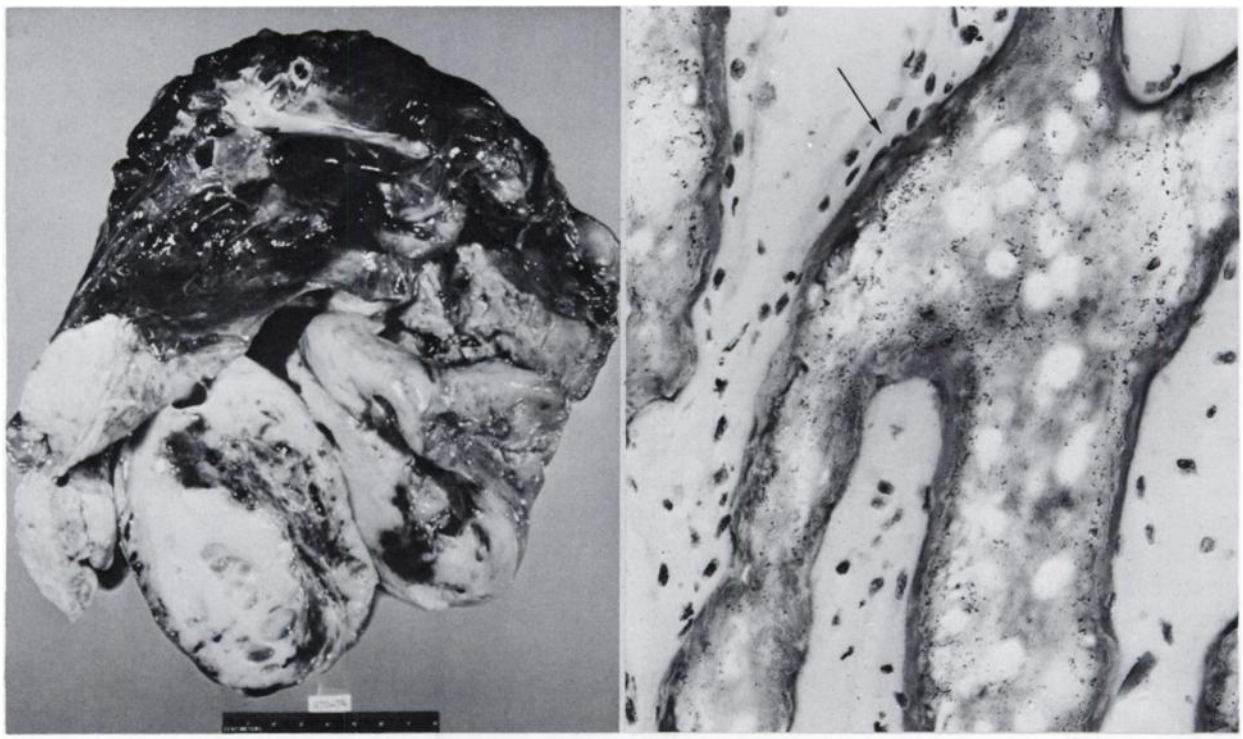

FIG. 2. Left: hilar view of left lung in which almost entire lower lobe is replaced by tumor. Right: autoradiograph of metastatic osteosarcoma showing significant ^{85}Sr depositions in highly mineralized osteoid seams surrounded by large number of osteoblasts (arrow) (× 250).

right lung. Four weeks later a left pneumonectomy was performed. The lower lobe was almost completely replaced by tumor which, histologically, was similar to the primary neoplasm and exhibited diffuse areas of necrosis. Autoradiographs of the metastatic tumor showed active osteoblastic activity around highly mineralized osteoid seams in which there was prominent ^{85}Sr deposition (Fig. 2).

The patient was discharged after 11 days in good condition to be followed in the clinic, but several months later experienced a relapse and subsequently expired.

COMMENT

McKenna and associates (*5*) have reported that the incidence of osteosarcoma to the most common

sites of spread, lung, and bone, respectively, is significantly higher at autopsy than was suspected roentgenographically during the course of the disease. Conceivably, strontium scintiscanning may ultimately prove to be a more sensitive indicator of osteoblastic activity than the x-ray as it is in the diagnosis of metastases *to* bone, and thus be a valuable procedure in the staging and therapeutic evaluation of patients with this tumor. The absence of radiostrontium uptake in an area, however, should not definitely rule out the possibility that a metastasis is present because this method failed to detect the small lesion within the right lung. In any case, its use should be a more *specific* means of confirming the presence of osteosarcoma metastases than merely assuming that any abnormal calcifications detected in a person with the primary tumor are indeed due to metastases.

In addition, this specialized application of bone scanning may be helpful in the evaluation of therapy which by necessity is limited to radiation or chemotherapeutic agents. Numerous investigators have reported, both from work with experimental osteosarcomas in animals (*6,7*) and in clinical material (*8*), that the distribution of radioisotope uptake by this neoplasm is often very irregular, with the central portions of the tumor exhibiting relatively small levels of activity due to degeneration and necrosis. This was confirmed by autoradiography in the current case and may account for the irregular pattern of the ^{85}Sr concentration noted in the scan. Thus it may be possible by serial scanning of osteosarcomas, especially with short-lived agents such as ^{87m}Sr and ^{18}F, to document response to therapy in both primary and metastatic lesions.

SUMMARY

A case is presented of a patient with an osteosarcoma of the femur in whom a ^{85}Sr bone scan confirmed the presence of functioning metastases within the lungs. The areas of concentration corresponded to the calcified lesions which were seen on the chest x-ray. Strontium-85 scintiscanning may prove to be a useful procedure for detecting soft tissue metastases in patients with primary osteosarcomas.

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