

Extrasosseous Accumulation of Tc-99m Pyrophosphate in Soft Tissue after Radiation Therapy

Extrasosseous accumulation of Tc-99m phosphates and other bone-seeking compounds has been reported in patients with myocardial and cerebral infarction (2,5,13), soft-tissue calcification (4,9), tumors of the breast, lung, and liver (1,3,6,7,10), soft-tissue abscess (4), healing surgical wounds and other conditions (8,9,11-13). In our department we have observed one patient with diffuse concentration of Tc-99m pyrophosphate in soft tissue after radiation therapy.

A 12-year-old boy had a 4-mo history of progressively increasing left thigh swelling. A radiograph of the left thigh raised suspicion of Ewing's sarcoma with typical alterations of the bone (Fig. 1). The diagnosis was confirmed on 11/11/76 by surgical biopsy. On 12/1/76 the boy was admitted to the nuclear medicine department for a bone scan. The examination, 4 hr after i.v. administration of 4 mCi Tc-99m pyrophosphate, was performed with a scintillation camera, using the "single picture" technique.

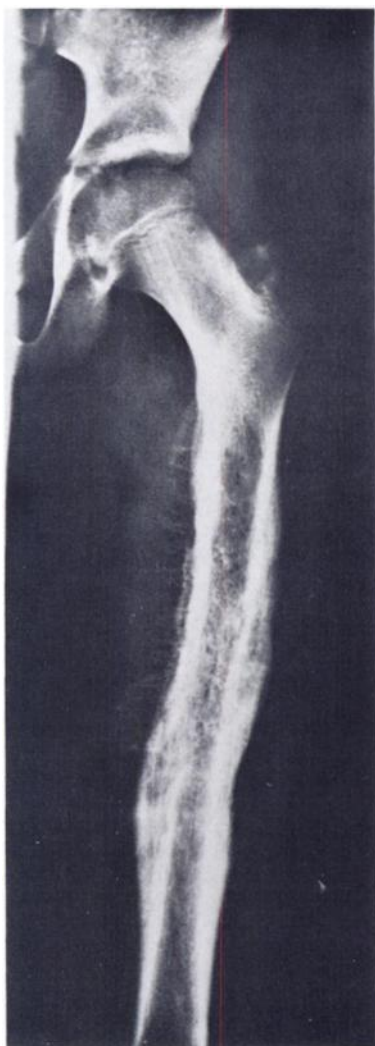


FIG. 1. Radiographic examination of left femur shows structural changes of bone typical of Ewing's sarcoma.



FIG. 2. Bone scan performed before radiation therapy shows increased uptake in proximal part of left femur caused by bone tumor. No extrasosseous activity can be observed in soft tissue surrounding tumor.



FIG. 3. Whole-body scan performed 10 wk after completion of radiation therapy. Irradiated area is marked. Note tracer accumulation in soft tissue of left thigh strictly corresponding to irradiated area.

The scan (Fig. 2) revealed increased activity in the proximal part of the left femur. Extrasosseous uptake was not observed.

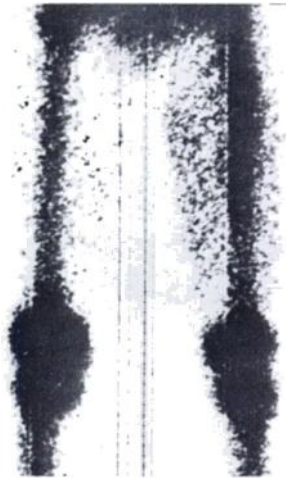


FIG. 4. Enlargement of Fig. 3. Abnormal soft-tissue activity in left thigh is clearly visible.

The patient was treated by chemotherapy and irradiation. Cobalt-60 radiation, with a tumor dose of 6,500 rads, was applied to the thigh between 12/6/76 and 1/28/77.

At followup on 4/10/77, physical examination revealed swelling and induration of the left thigh corresponding to the irradiated area.

On 4/13/77 a second whole-body scan, performed 4 hr after i.v. administration of 4 mCi Tc-99m pyrophosphate, showed increased uptake in the bone tumor and diffuse tracer accumulation in the soft tissue of the left thigh, strictly corresponding to the treated area (Figs. 3 and 4).

We are not able to explain the observed phenomena or to decide whether the added chemotherapy had influenced the result of the bone scan. We believe that the uptake is not specific to radiation injury alone because we have observed similar abnormalities in bacterial, nonpyogenic inflammation of soft tissue. We suspect that the mechanism of the extraosseous pyrophosphate accumulation is quite similar to that seen in myocardial infarction and other conditions involving cell damage.

We hope our observation can contribute to the discussion about the possible mechanism of extraosseous accumulation of bone-seeking agents.

On the other hand, this observation stimulated us to investigate whether Tc-99m bone-seeking compounds can be used as potential radiopharmaceuticals for the detection of irradiation-damaged tissue in the human body.

A. BEKIER
Kantonsspital
St. Gallen, Switzerland

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BOOKS RECEIVED

The receipt of the following is acknowledged:

Handbook of Clinical Nuclear Medicine, Philip Matin. 344 pp, illustrated. Flushing, NY, Medical Examination Publishing Company, Inc., July 1977. \$12.00.

Clinical Oncology, First Edition, John Horton, M.B., Ch. B., and George J. Hill, II, M.D., Editors. 819 pp, illustrated. Philadelphia-London-Toronto, W.B. Saunders Company, April 6, 1977. \$30.00 (U.S.) and \$30.90 (Canada).

Isotope Effects on Enzyme-Catalyzed Reactions, W. Wallace Cleland, Marion H. O'Leary, Dexter B. Northrop, editors. 303 pp, illustrated. Baltimore, University Park Press, 1977. \$39.50.

Noncoherent Optical Processing, G. L. Rogers. 176 pp, illustrated. New York/London/Sydney/Toronto, John Wiley & Sons, Inc., 1977.