

**EXTRAOSSEOUS NONCALCIFIED SOFT-TISSUE UPTAKE OF <sup>99m</sup>Tc-POLYPHOSPHATE**

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***Two cases of breast tumor, one of cerebral tumor, and one of soft-tissue abscess have been found to accumulate <sup>99m</sup>Tc-polyphosphate. In neither of these cases was there radiographic evidence of calcification.***

Technetium-99m-labeled phosphate compounds are now widely used radiopharmaceuticals for bone scintigraphy. Diphosphonate compound has been reported to concentrate in two cases of breast tumor (1) and there are reports of Hodgkin's lesions and soft-tissue melanoma concentrating polyphosphate (2). A case of cerebral infarct has been found to take up polyphosphate also (3). The purpose of this paper is to present four cases illustrating extraosseous noncalcified tumor or abscess uptake of <sup>99m</sup>Tc-polyphosphate (<sup>99m</sup>Tc-PP). To our knowledge, no cases of cerebral tumor, soft-tissue pyogenic abscess, or breast tumor have previously been demonstrated to concentrate <sup>99m</sup>Tc-PP.

**CASE REPORTS**

**Case 1.** A 58-year-old white woman was admitted to the University Hospital for a large fungating mass in right breast (Fig. 1A). She was initially treated with a course of radiation therapy and combined chemotherapy. Three weeks later she had a right total mastectomy with axillary lymph node dissection. A preoperative and pretherapy <sup>99m</sup>Tc-PP whole-body scan (Fig. 1B) revealed a metastatic lesion in the left hip area and an area of increased uptake over the right midchest corresponding to the tumor area. A postmastectomy repeat whole-body scan (Fig. 1C) revealed the same lesion in the left hip area but no uptake in the right breast area suggesting that initial uptake was indeed in the breast tumor and not in the ribs. A lesser degree of uptake seen in the right lower chest area (shown by open arrow) in both scans is due to liver uptake of <sup>99m</sup>Tc-PP. There

was no radiographic evidence of calcification in the tumor or any rib involvement.

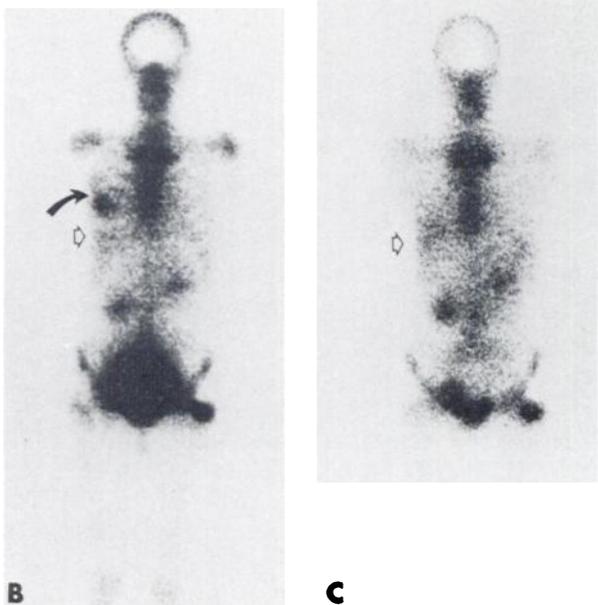
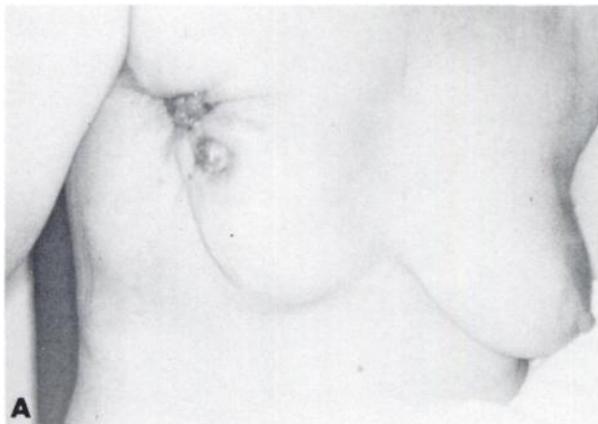
**Case 2.** A 54-year-old black woman had a 6-month history of left breast mass progressively increasing in size. Physical examination revealed normal right breast and rock-hard left breast with induration and erythema of the skin overlying the left breast. A biopsy revealed infiltrative adenocarcinoma of the left breast with skin involvement. She was first treated with radiotherapy followed by left mastectomy. A preoperative and pretherapy whole-body scan obtained with <sup>99m</sup>Tc-PP revealed no bony metastases but there was increased uptake of the isotope in the area of left breast mass (Fig. 2). A lateral projection revealed the activity to be outside the rib cage and in the area of breast lesion. Radiography failed to demonstrate soft-tissue calcification or rib lesions.

**Case 3.** An 11-year-old girl was diagnosed as having osteomyelitis of the left ilium with a large subfascial abscess along the lateral aspect of the left thigh. She underwent sequestrectomy with incision and drainage of the abscess. A preoperative whole-body scan (Fig. 3A) with <sup>99m</sup>Tc-PP revealed no significant asymmetry in the uptake between two iliac bones. However, there was a longitudinal area of increased uptake along the lateral aspect of the left thigh (arrow). One can visualize the activity in the femur proper along the medial aspect of the abscess. A <sup>67</sup>Ga scan (Fig. 3B) was also performed and as expected showed excessive uptake in the abscess actually delineating the extent of the lesion. A plain film of the thigh disclosed no calcification.

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**FIG. 1.** (A) Adenocarcinoma of right breast (Case 1). (B-C)  $^{99m}\text{Tc}$ -PP whole-body scans (anterior views, 3 hr postinjection). (B) Preoperative scan shows increased concentration in right midchest area (solid arrow). Activity (open arrow) seen in right lower chest area is most likely in liver. In addition, there is metastatic lesion in left hip area. (C) Postmastectomy scan shows disappearance of previously seen abnormal activity in right breast area. Activity (open arrow) seen in liver area is still present.

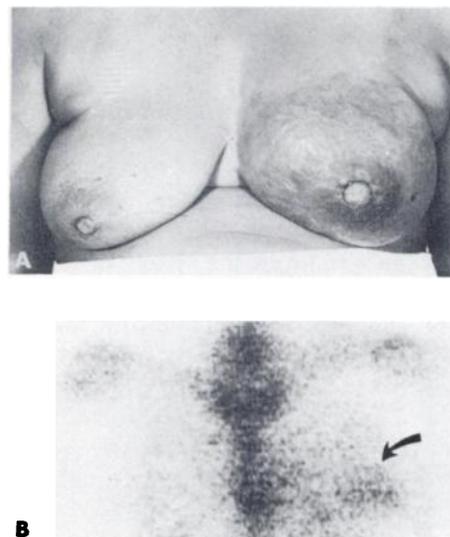
The culture of the abscess fluid failed to show growth of bacteria or fungi.

**Case 4.** A 71-year-old woman who had adenocarcinoma of the bowel resected 15 years ago presented with primary squamous cell carcinoma of lung proven by x-ray, cytology, and brush biopsy. Because of neurologic symptoms,  $^{99m}\text{Tc}$ -pertechnetate brain scintigrams (Fig. 4A) were performed to evaluate possible brain metastasis and indeed revealed a focal lesion in the left frontal area. Because the lung cancer is of most recent origin and the colon cancer was resected 15 years ago, it is highly suspected that the brain metastasis is from the primary cancer of the lung. A  $^{99m}\text{Tc}$ -PP scintigram (Fig. 4B) also showed increased uptake in the left

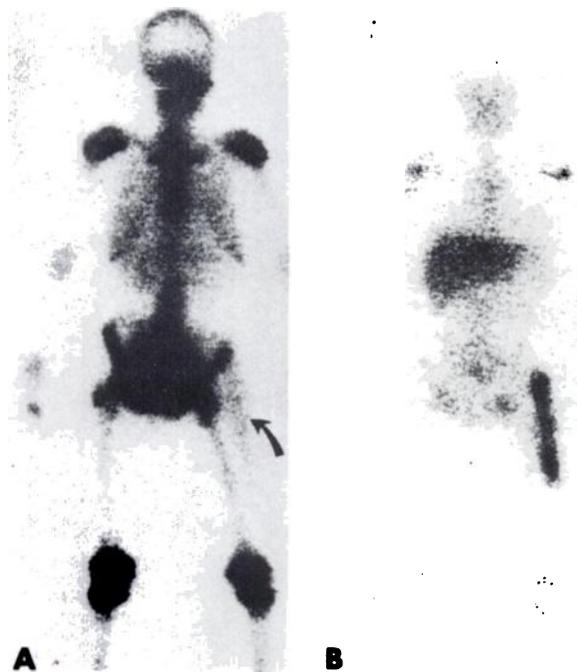
frontal area corresponding to the site of increased uptake with pertechnetate. An x-ray film of the skull demonstrated neither calcification in the frontal area of the brain nor involvement from the intracerebral tumor.

#### DISCUSSION

While  $^{87m}\text{Sr}$  was in use, there were several reports of extraosseous soft-tissue tumor uptake of this bone-seeking radionuclide (4-6). Since the introduction of  $^{99m}\text{Tc}$ -PP in 1971, reports of extraosseous soft-tissue tumor uptake of this agent are scant. Thrall, et al (2) mentioned uptake of  $^{99m}\text{Tc}$ -PP in two cases of Hodgkin's disease and six cases of soft-tissue melanoma. As far as breast tumor is concerned, Cancroft and Goldsmith (7) reported  $^{99m}\text{Tc}$ -pertechnetate uptake and Berg, et al (1) demonstrated  $^{99m}\text{Tc}$ -diphosphonate concentration in breast tumors. To our knowledge, there has been no illustration of  $^{99m}\text{Tc}$ -PP uptake in breast tumor. In contrast, Grames and Jansen (3) reported scans of cerebral infarct being positive with  $^{99m}\text{Tc}$ -PP. No documented case of cerebral tumor (primary or secondary) or of soft-tissue abscess has yet been reported to concentrate  $^{99m}\text{Tc}$ -PP. While obtaining bone scans with  $^{99m}\text{Tc}$ -PP, two cases of adenocarcinoma of breast demonstrated increased uptake of  $^{99m}\text{Tc}$ -PP. One case of brain tumor (metastasis from lung cancer) had showed uptake of  $^{99m}\text{Tc}$ -PP. In this instance, the tumor was positive also with a  $^{99m}\text{Tc}$ -pertechnetate brain scan. One case of soft-tissue abscess (extension from osteomyelitis of local bone) in the left lateral thigh had increased uptake of  $^{99m}\text{Tc}$ -PP. This case was also positive with  $^{67}\text{Ga}$ . Because of the widespread use of  $^{99m}\text{Tc}$ -PP in the evaluation of bone



**FIG. 2.** (A) Adenocarcinoma of left breast (Case 2). (B) Preoperative  $^{99m}\text{Tc}$ -PP scan (anterior view) shows excessive uptake in left breast area.



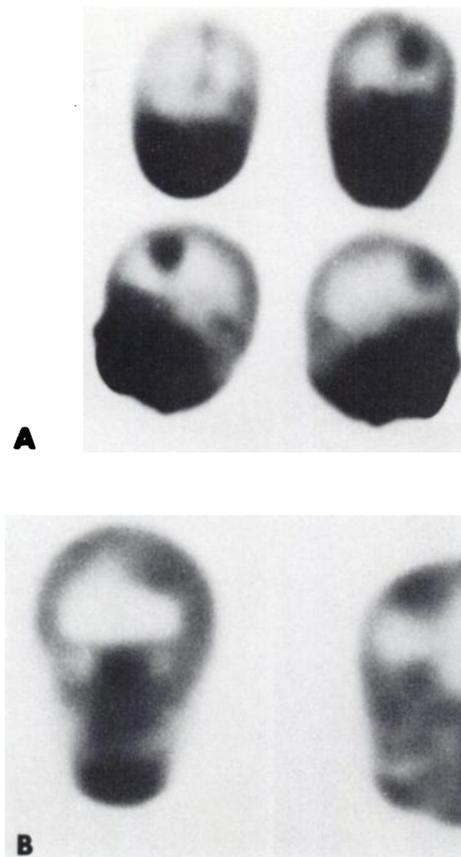
**FIG. 3.** (A)  $^{99m}\text{Tc}$ -PP whole-body scan (anterior view) of Case 3 demonstrates normal epiphyseal distribution of activity and longitudinal area of abnormal uptake along lateral aspect of left thigh (arrow). (B)  $^{67}\text{Ga}$  whole-body scan of Case 3 reveals excessive accumulation of isotope along abscess.

diseases, we believe it worthwhile to report extra-osseous tumor and abscess uptake of this agent to aid in the interpretation of scintigrams performed with it.

Although there have been some speculations on the mechanism of radiostrontium uptake in extra-osseous tumor (8), we are unable at present to explain the exact mechanism of noncalcified tissue uptake of  $^{99m}\text{Tc}$ -PP. That the tumor uptake of  $^{99m}\text{Tc}$ -PP in these instances is not due to increased vascularity is evidenced by the absence of comparable activity in the liver and heart blood pool area. Neither was the tumor uptake due to free pertechnetate as evidenced by lack of concentration in the stomach. The possibility of phosphatase enzyme systems present in high concentration in certain tumors playing a role in binding  $^{99m}\text{Tc}$ -PP should be considered. Whatever may be the underlying mechanism, if many or all breast tumors pick up  $^{99m}\text{Tc}$ -PP, it may be of value as a screening test for the diagnosis of occult breast tumor.

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**FIG. 4.** (A)  $^{99m}\text{Tc}$ -pertechnetate brain scans (2 hr postinjection) show abnormal uptake in left frontal area consistent with mass lesion. (B)  $^{99m}\text{Tc}$ -PP scan of skull is also abnormal showing abnormal uptake in left frontal area.

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