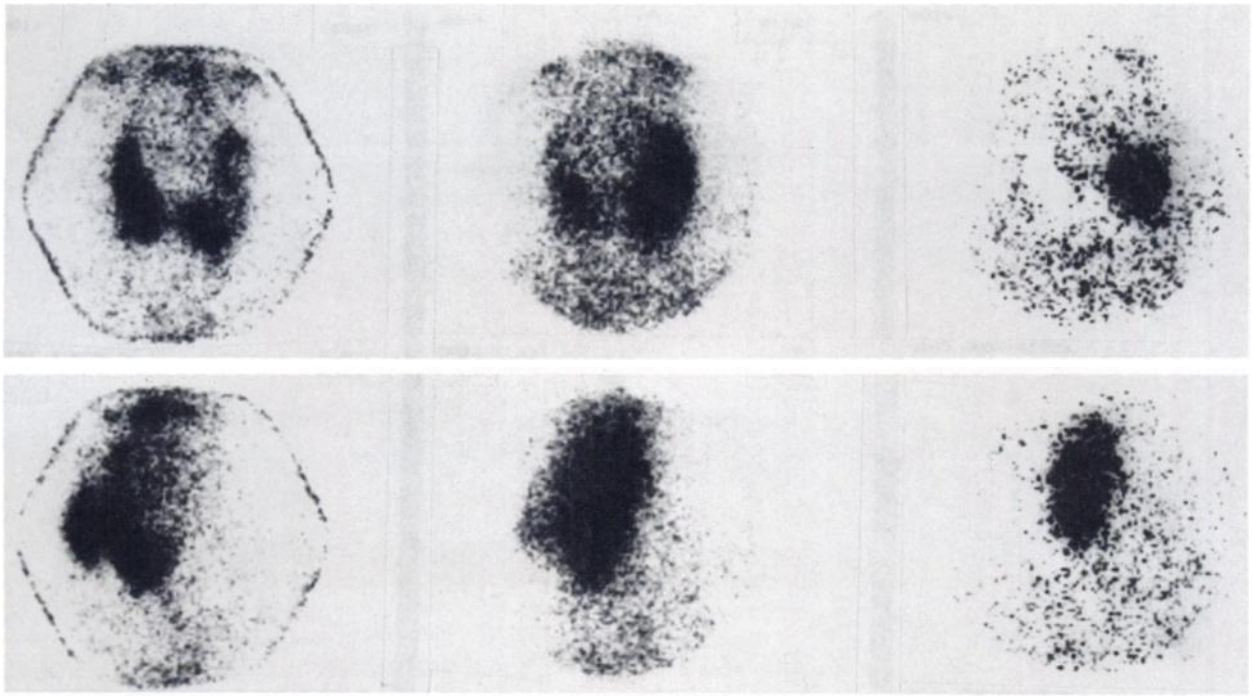

**FIGURE 1**
**Top row: The technetium scan (left) is subtracted from the thallium scan (center) and a round hot area is seen in the subtracted image (right). Bottom row: In the left anterior oblique view, the technetium scan (left) which revealed a large cold area in the left thyroid lobe is subtracted from the thallium image (center) and an ovoid hot area, larger than that obtained in the anterior position, is seen in the subtracted image (right).**

We believe that oblique views will increase the imaging quality of this method.

### Reference


1. Ferlin G, Borsato N, Camerani M, et al: New perspectives in localizing enlarged parathyroids by technetium-thallium subtraction scan. *J Nucl Med* 24:438-441, 1983



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## Use of Oral Phosphate to Enhance Visualization of Enlarged Parathyroids on Scanning

**TO THE EDITOR:** During the past two years, several reports have appeared in the nuclear medicine literature from across the world, about parathyroid imaging using thallium-201 (Tl), and technetium $99^m$ pertechnetate (Tc), subtraction scanning (*1-3*). This has led to a resurgence of interest in parathyroid imaging which had been abandoned in the past because of poor detectability. In the earlier studies with Se-75 selenomethionine, only tumors weighing more than 2 g could be consistently visualized (*4*), whereas, with Tl-Tc subtraction, tumors as small as 0.25 g can be detected (*2*).

Oral phosphate therapy is sometimes used in the treatment of patients with primary hyperparathyroidism. It reduces circulating 1, 25 dihydroxy Vitamin D and serum calcium leading to elevation of serum PTH by feed back mechanism (*5*). It was reasoned that phosphate therapy by increasing PTH secretion might increase the thallium uptake in the parathyroid glands, thus improving the detectability of adenomas on scanning. Three patients with primary hyperparathyroidism, scheduled for surgical exploration were scanned before and after oral phosphate therapy to assess its effectiveness.

The first patient was a 74-year-old woman with serum calcium of 12.2 mg/dl (normal range 8.5-10.5). Serum PTH was 140 nl Eq/ml (normal less than 25). A subtraction scan was performed using 3 mCi Tc, and 2 mCi Tl, and showed a slight uptake on both sides of the lower right thyroid lobe. She received oral phosphate* 1 g/day in divided doses for 3 wk. A repeat serum calcium dropped to 11.2 and PTH rose to 205. A repeat dual isotope scan with 3 mCi Tc and 2 mCi Tl clearly demonstrated enhancement of the uptake laterally as well as medially (Fig. 1). At surgery a 450 mg. parathyroid adenoma located lateral to the right thyroid lobe was removed. The uptake medially was associated with a co-existing thyroid adenoma. In a second patient (a 72-yr-old male), there was slight reduction of serum calcium from 11.1 to 10.8 with an increase of serum PTH from 78 to 135, 3 wk after 1 g/day therapy with oral phosphate. A repeat subtraction scan demonstrated enhancement of left inferior parathyroid adenoma as compared to pre-phosphate stimulation scan. On surgery an adenoma weighing 620 mg was excised. The third patient, a 62-yr-old female, received oral phosphate 1 g/day for only 10 days. There was no drop in serum calcium level of 11 md/dl and no increase in PTH level which was 98 and 68 units pre and post therapy,


**FIGURE 1**
**Thallium-Tc subtraction scan demonstrates a parathyroid adenoma emerging on the lateral side of lower pole of right thyroid lobe. The uptake on the medial side was related to a thyroid adenoma. Note enhancement of both lesions post oral phosphate therapy (left).**

respectively. Subtraction scan before and after demonstrated left superior parathyroid adenoma with no significant change or enhancement in the pre and post therapy scans. On surgery a 325 mg left superior parathyroid adenoma was removed.

The mechanism of thallium concentration by enlarged parathyroid glands is not clear. Thallium is known to concentrate in thyroid adenomas and well differentiated thyroid carcinomas (*6*). Thallium is a potassium analogue and yet a recent study showed an inverse relation between serum potassium level and thyroid uptake of thallium and also that thallium uptake is TSH dependent (*7*). It appears, in addition, that thallium uptake might be affected by the level of circulating PTH. The demonstration of enhancement of images following oral phosphate stimulation with documented reduction in serum calcium and elevation of PTH would support this contention. However, as the figure demonstrates this enhancement may not be specific for parathyroid adenoma as it was also present in a coexisting thyroid adenoma.

Though thallium uptake by parathyroid was not quantified before and after therapy in these cases, the subjective visualization of pre and post therapy scans in otherwise identical technical settings and dose of radionuclide supports its effectiveness in two of three patients studied. It also appears from this experience that at least 3 wk of therapy with the present dose of 1 g/day, would be required to effectively elevate PTH levels as was seen in the first two cases. Finally, there were no side effects observed in the patients requiring cessation or reduction in dosage of phosphate. We conclude that PTH stimulation test by oral phosphate has potential for increasing the sensitivity of thallium parathyroid scanning, though nonspecificity may be a problem with coexisting thyroid adenomata. Further studies are needed in a large number of patients before firm guidelines and a definitive protocol can be established. We are currently evaluating a higher dose of phosphate (1.5 g/day) with detailed biochemical analysis and quantitation of thallium uptake.

**Footnote**

* Neutra-Phos.

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