BRAIN SCAN IN HYPERPARATHYROIDISM

Fred Mishkin and Klaus Weber

Indiana University Medical Center, Indianapolis, Indiana

Increased concentration of a variety of ionic radionuclides occurs in association with areas of increased bone turnover (*1*). This is apparent on the ^{99m}Tc-pertechnetate brain scan in areas at the edges of surgical defects, fractures, osteomyelitis, Paget's disease, fibrous dysplasia and osseous neoplasm, primary or metastatic. Hyperparathyroidism can also present a picture of diffuse increase of skull activity on the ^{99m}Tc-pertechnetate brain scan. The following case provides a striking example of this phenomenon.

CASE REPORT

A 19-year-old youth had chronic pyelonephritis related to bilateral ureteropelvic junction strictures. This led to a total right nephrectomy and a partial left nephrectomy with a cutaneous ureterostomy. He had previous episodes of acidosis, hyponatremia, and dehydration as well as anemia requiring numerous hospitalizations. At the time the brain scan was done he came to the hospital comatose following grand mal seizures. His blood pressure was 170 mmHg systolic, 100 mmHg diastolic. His pulse was 140, his temperature 104°F. He was unresponsive to painful stimulation and demonstrated bilateral Babinski reflexes. The disc edges of the optic nerves were blurred. Lumbar puncture revealed the opening pressure to be 250 mm water but was otherwise normal. The hemoglobin was 5.6 gm/100 ml, the hematocrit 17%. The serum sodium measured 130, the potassium 3.9, the chloride 87 mEq/liter, and the arterial pCO_2 was 57 mmHg with a pH of 7.4. Also reflecting severe renal insufficiency was a blood urea nitrogen level of 135 mg/100 ml and a creatinine clearance ranging between 2 and 3 ml/min.

Received April 26, 1971; original accepted May 27, 1971.

For reprints contact: Fred S. Mishkin, Dept. of Radiology, Section of Nuclear Medicine, Martin Luther King, Jr. General Hospital, 12021 Wilmington Ave., Los Angeles, Calif. 90059.

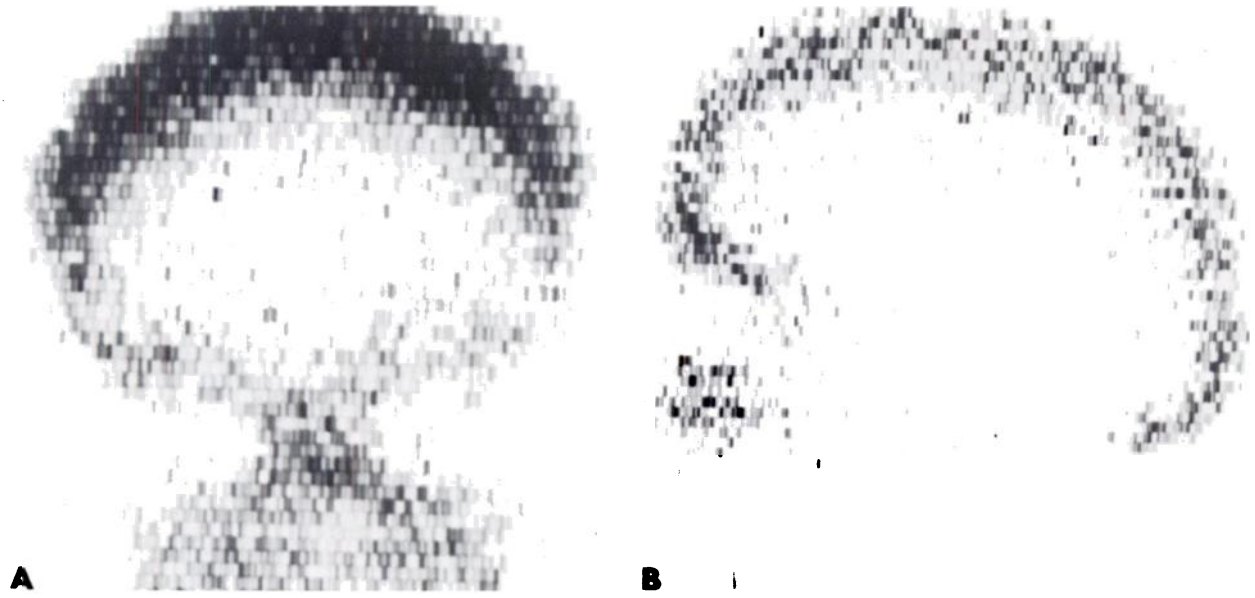

FIG. 1. Rectilinear scan image (A) 3 hr after injection of ^{99m}Tc-pertechnetate shows marked accumulation of activity over cranial vault and in maxillary area on anterior view. Lateral view (B) confirms that activity lies in diploic bone since no soft tissue structures or vascular structures can be seen on scan in head, face, or neck.

Indices of secondary hyperparathyrodism included a serum calcium measuring 7.5 mg and a serum inorganic phosphate of 8.6 mg with a serum albumin of 1.3 gm/100 ml and a previous serum alkaline phosphatase measurement of 43 Bessey-Lowry units.

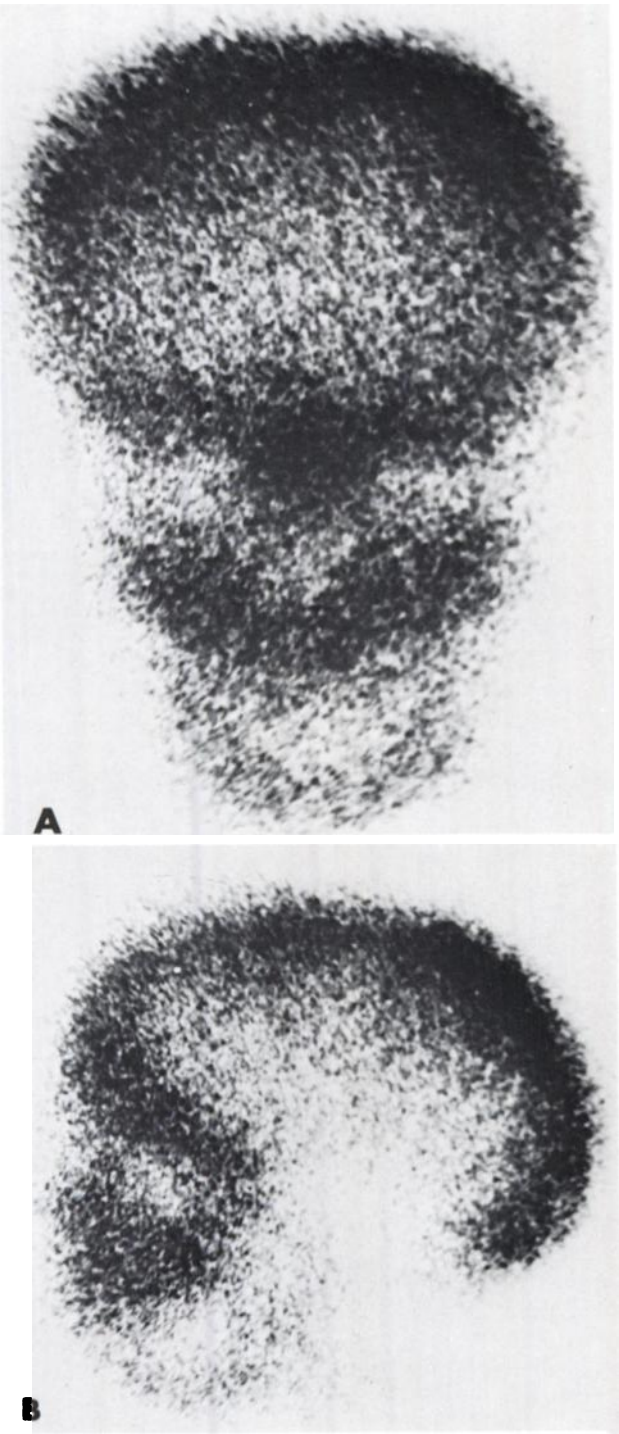

FIG. 2. Anger camera image 24 hr after injection of ^{99m}Tc-pertechnetate shows even more striking appearance of skull on anterior view (A) and right view (B).

Skeletal film revealed resorption of the bone in the distal clavicles and proximal humeri, marked thinning of the inner table of the skull, and no demonstrable lamina dura about the teeth. Following oral perchlorate a brain scan was done 3 hr after intravenous administration of 20 mCi ^{99m}Tc-pertechnetate. High concentration of activity outlining the skeletal structures of the head was apparent (Fig. 1). Twenty-four hours later another image made without further injection of pertechnetate continued to show accumulation of activity in the bone (Fig. 2). The patient responded to appropriate intravenous fluid therapy and Dilantin with cessation of his seizures and return to normal responsiveness. Released from the hospital, he died from his renal disease 2 months later.

DISCUSSION

This case represents the most striking example of increased skull activity encountered in a review of all five patients with clinically-proven hyperparathyroidism who had brain scans performed since June 1967. One of two patients with primary hyperparathyroidism and three patients with hyperparathyroidism secondary to renal disease showed this phenomenon. In each case, the appearance was most striking on the anterior view which showed increased activity over the crown of the head.

Cases which showed the most striking scan changes had the highest levels of serum alkaline phosphatase but could not be separated from those which had minimal or no scan changes by measurement of serum calcium or inorganic phosphate. All patients demonstrating this abnormal uptake had abnormal skull films showing diploic expansion and reduction of the thickness of the skull tables, while the patient with a normal scan had no roentgenographic changes. These findings suggest that the abnormal brain scan reflects the effect of elevated levels of parathormone on bone. In this particular situation in which one attempts to detect increased peripheral activity in the presence of normal activity in the brain, changes from the normal ratio may be more readily perceived when no contrast enhancement is employed to obtain the data (compare Fig. 1 with Fig. 2).

REFERENCE

1. Tow DE, Wagner HN: Scanning for tumors of brain and bone: Comparison of sodium pertechnetate Tc99m and ionic strontium 87m. *JAMA* 199: 610–614, 1967