The Bone Mineral Content of the Phalanx of
Chronic Hemodialysis Patients

MASTER

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All patients undergoing chronic hemodialysis for the treatment of chronic renal failure have bone complications of varying severity. Two types of bone disease have been described (1), osteomalacia and osteitis fibrosa. Both conditions can result in changes in the bone mineral content of the phalanges. To estimate the magnitude of these changes, the bone mineral content of the phalanx of 5 patients undergoing chronic hemodialysis has been measured over periods of up to a year.

A dichromatic x-ray attenuation method was used to determine the bone mineral content (2). This precise non-destructive method allows the repeated evaluation of the bone mineral mass of a volume of bone defined by the photon beam. Since each photon beam is 1.5 mm in diameter, the sample volume is a rod of bone 1.5 mm in diameter through the entire phalanx. Bone biopsies, while providing histological information, do not allow repeated evaluation of the exact same site, and many biopsies cause discomfort to the patient.

The site chosen for the measurement was the center of the 2nd or 3rd proximal phalanx of the right hand. Because four patients had shunts in their left arms, the right hand was chosen for the measurement so that the local effects of the shunt on the bone mineral content would be eliminated. The 2nd or 3rd proximal phalanx was chosen because it was felt that the error of repositioning the bone for each measurement would be smaller than for any other bone of the hand.

PRELIMINARY RESULTS AND PLANS

The preliminary results of this study are summarized in Table I. No significant bone mineral changes were observed in any of the 5 patients. A statistical analysis indicated that a 3% change in the bone mineral content could have been observed with a 95% confidence, if the measurements were performed over a year. For shorter lengths of measurement the 95% confidence levels are proportionately larger. Subject A had a kidney transplant 21 weeks after the beginning of the study.

The bone mineral content measurements will continue for all 5 patients. We would like to follow these patients through the entire course of their disease. Other parameters that will be evaluated are:

1. Serum alkaline phosphatase levels
2. Serum calcium levels
3. Serum phosphorous levels
4. Metastatic calcification

These factors will be used to determine the severity of the bone disease and to relate the bone mineral content changes to the severity of the bone disease.

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TABLE I

<u>Patient</u>	<u>Bone Mineral Content (gm/cm²)</u>	<u>Change in Bone Mineral Content (% per year)*</u>	<u>Length of Measure- ment (weeks)</u>	<u>Number of Measurements</u>
A	0.392 $\pm$.005	0.007 $\pm$ 4.0	20	8
B	0.286 $\pm$.008	0.27 $\pm$ 2.4	46	21
C	0.506 $\pm$.006	0.24 $\pm$ 1.1	48	22
D	0.602 $\pm$.005	0.55 $\pm$ 0.2	20	9
E	0.602 $\pm$.013	6.2 $\pm$ 3.8	24	10
Control	0.556 $\pm$.008	0.97 $\pm$.88	48	25

* Estimate of slope from a least squares analysis of data