# PATTERN OF BONE DISEASE IN MAINTENANCE HAEMODIALYSIS PATIENTS IN MALAYSIA

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## SUMMARY

*Skeletal radiographs of 122 patients treated by maintenance haemodialysis were reviewed retrospectively for bone disease. Significant radiological bone changes were very low at commencement of dialysis (2–9%), as well as at six months of dialysis (6.1%). This figure rose to 19.7% when the total period of dialysis was considered. In the latter group, fractures occurred in seven patients (5.7%), erosions in 12 patients (9.8%), vascular calcification in 13 patients (10.7%) and osteosclerosis in eight patients (6.6%). Osteoporosis was noted to be very common (76.2%). Significant bone changes are hence rare in maintenance haemodialysis patients in Malaysia.*

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## INTRODUCTION

Bone disease is a frequent and potentially serious complication of chronic renal failure particularly in patients undergoing long-term haemodialysis.[1,2] There are three main components of renal osteodystrophy and these are osteitis fibrosa, osteomalacia and changes in bone "turnover". The incidence of these main components alters during the progression from early renal failure to regular dialysis and transplantation. More recently vitamin D resistant aluminium-induced osteomalacia has been described, in virtually every country that undertakes long-term dialysis.[3]

There is a marked geographical variation in the prevalence of "dialysis bone diseases". In some treatment centres, it becomes widespread and disabling after two to three years of dialysis, while in other centres it remains rare.[4,5]

There are various risk factors which predispose to the development of bone disease and these are youth, female sex, tubulo-interstitial types of nephropathy and a long duration of uraemia.[6]

We undertook a retrospective study to determine the pattern of bone disease in maintenance haemodialysis patients in Malaysia and to determine the risk factors involved.

## PATIENTS AND METHODS

One hundred and twenty-two patients who were treated by maintenance haemodialysis which commenced over an eight-year period from 1974 to 1981 at the Department of Nephrology. General Hospital, Kuala Lumpur were studied retrospectively. There were 41 Malays, 71 Chinese and 10 Indians. The male to female ratio was 3:1. Patients were of all age groups. Patients were followed up from the time of commencement of haemodialysis until they left the programme, either because of successful renal transplantation or death. At the time of analysis. 51 patients were alive on haemodialysis, 43 had functioning transplants and 28 were dead. The mean follow-up period was two to six years, with a range of half to seven years.

Patients had had.skeletal radiographs initially at commencement of dialysis, then at six-monthly intervals for one year and thereafter at yearly intervals. Skeletal radiographs included X-rays of hand, vertebrae, pelvis, chest and skull. The criteria used in the analysis were fractures, erosions, vascular calcification, osteosclerosis and osteoporosis where there were no radiological signs of osteomalacia such as fractures (including loozer's zones) and bone softening such as protrusio acetabuli or bending.

Predialysis serum calcium, phosphate and alkaline phosphatase were measured in all patients. All patients were on maintenance therapy with aluminium hydroxide and some patients were on rocalcitriol.

Isotope and histological bone studies had however not been performed.

## RESULTS

Significant radiological bone changes were very low at commencement of dialysis (2.9%) as well as at six months of dialysis (6.1%). This figure rose to 19.7% when the total period of dialysis was considered. In the latter group, fractures occurred in seven patients (5.7%), erosions in 12 patients (9.8%), vascular calcification in 13 patients (10.7%) and osteosclerosis in eight patients (6.6%). Osteoporosis was noted to be very common (76.2%). Osteoporosis alone, unassociated with the other radiological manifestations of bone disease,was noted in 57.4% of the patients (Table I).

We have excluded osteoporosis from our figures for "significant bone changes" as the evaluation for osteoporosis was done without the use of bone index and hence the figures may not be very reliable. Furthermore, many of the patients in the study had been on steroids which itself can cause osteoporosis. Hence, it may not be possible to determine the incidence of osteoporosis done on renal failure or haemodialysis *per se.*

Bone erosions were commonly detected on the radial aspect of the phalanges of the hands, especially the middle phalanges (Fig. 1). Erosions of the lateral clavicular ends and symphysis pubis were also detected, though less commonly (Table II).

Fractures were most common in the ribs (Fig. 2) and less commonly found in the humerus, tibia,

**TABLE I**

**RADIOLOGICAL CHANGES DETECTED**

| Overall period of maintenance HDx | No. | (%) |
|---|---|---|
| Fractures | 7 | ( 5.7) |
| Subperiosteal Resorption Erosion | 12 | ( 9.8) |
| Vascular Calcification | 13 | (10.7) |
| Osteosclerosis | 8 | ( 6.6) |
| Osteoporosis (Total) | 93 | (76.2) |
| (Alone) | 70 | (57.4) |

**TABLE II**

**OVERALL PERIOD OF MAINTENANCE HDx**

| Subperiosteal Resorption/Erosion | |
|---|---|
| Clavicle | 2 |
| Terminal Phalanges | 9 |
| Middle Phalanges | 1 |

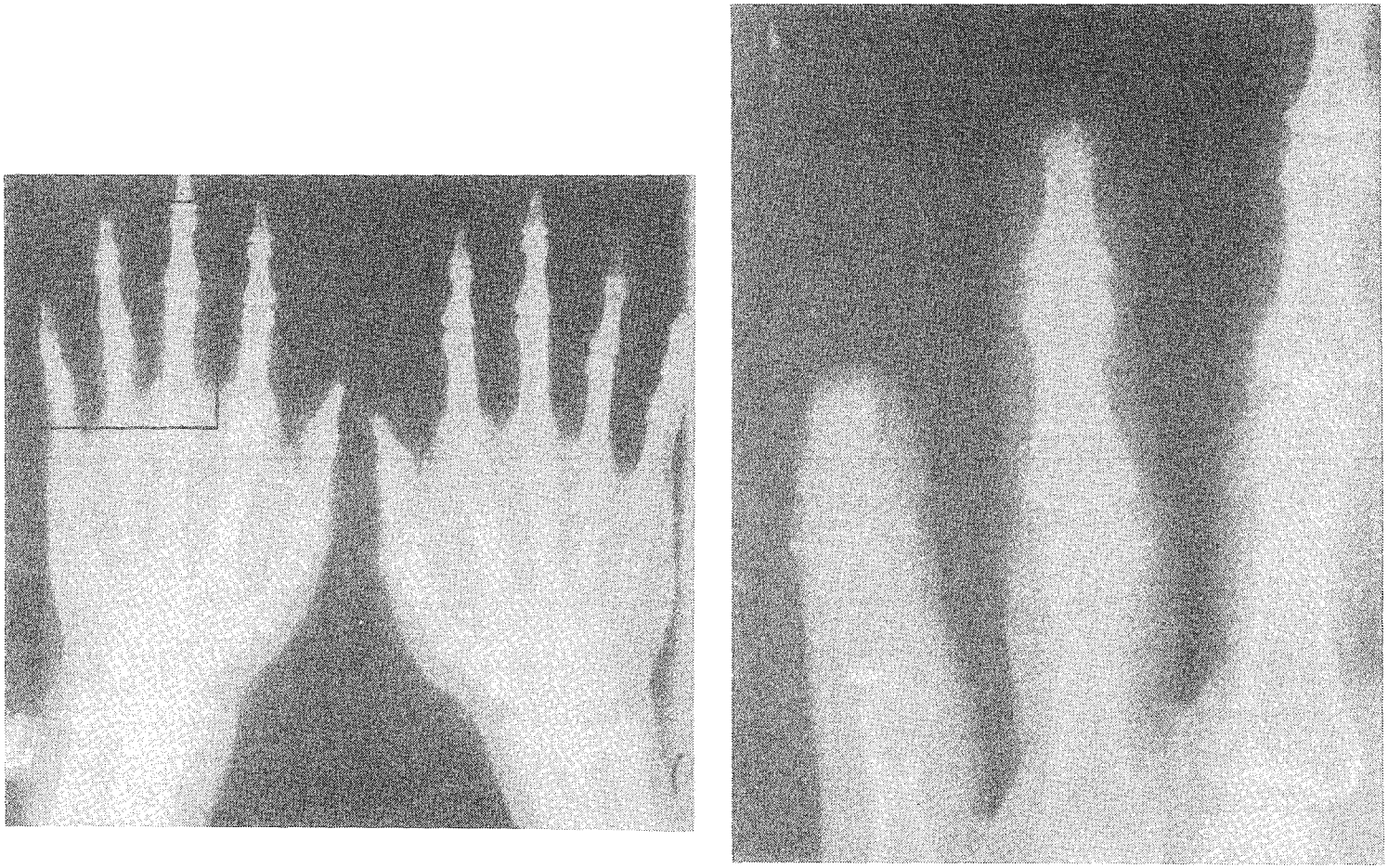

Fig. 1 Hands: erosion of the terminal phalanges and subperiosteum.

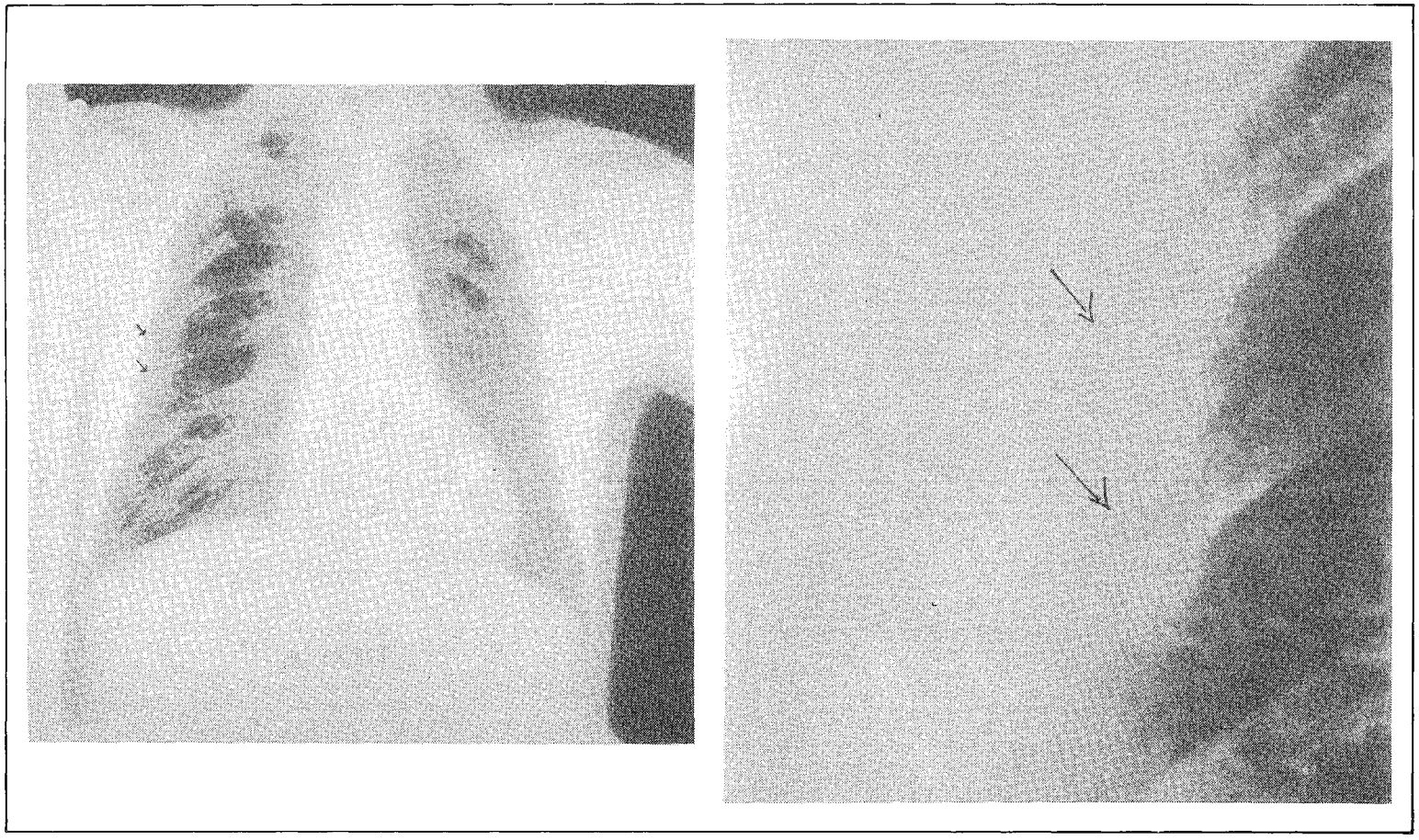

Fig. 5 Lumber vertebrae: osteosclerosis of the vertebral borders giving rise to "rugger-jersey" appearance. Note aortic wall calcification.

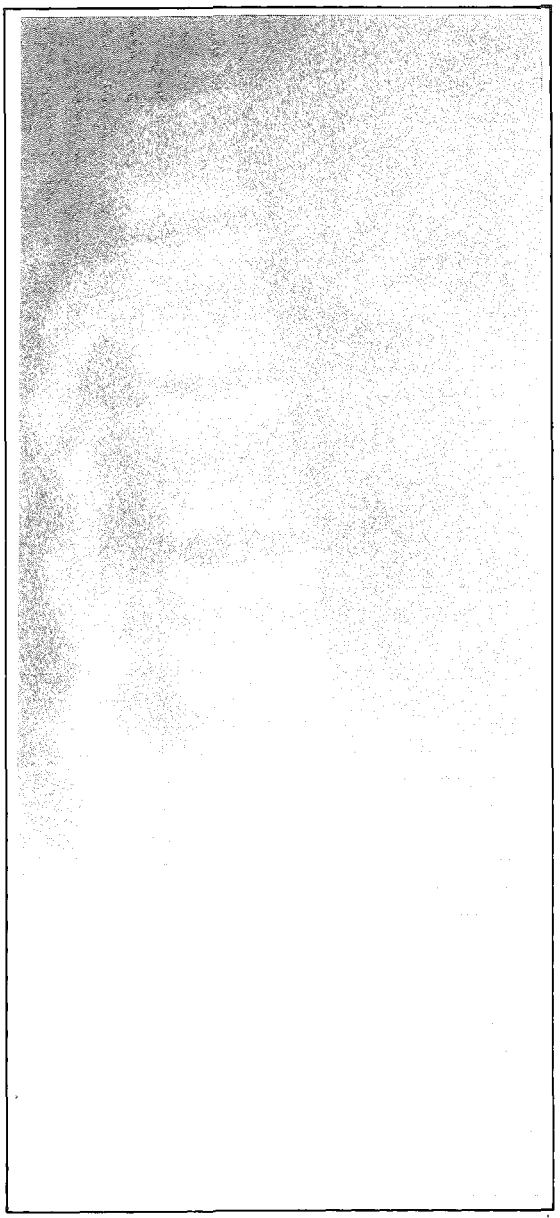

**Fig. 2 Chest: bilateral rib fractures due to osteomalaria.**

femoral heads and metatarsals (Table III). Vascular calcifications involve mainly the aorta and its major branches (Figs. 3, 4, Table VI). Osteosclerosis was noted in the lumbar spines giving rise to "rugger-jersey" appearance (Fig. 5).

**TABLE III**
**OVERALL PERIOD OF MAINTENANCE HDx**

| Fractures | |
|---|---|
| Ribs | 4 |
| Shoulder and Tibia | 1 |
| Femoral Head | 1 |
| Toe/Ribs | 1 |

**TABLE IV**
**OVERALL PERIOD OF MAINTENANCE HDx**

| Vascular calcification | |
|---|---|
| Aorta – Abdominal | 7 |
| – Thoracic | 1 |
| Carotid | 1 |
| Splenic | 1 |
| Carotid/Aortic/Pelvic | 2 |
| Shoulder/Femoral | 1 |

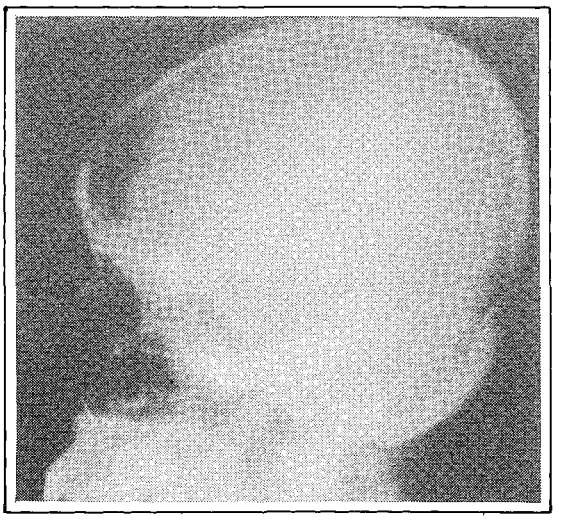

**Fig. 3 Skull: "pepper-pot" appearance and internal carotid artery calcification.**

## DISCUSSION

The present study shows that the radiographic

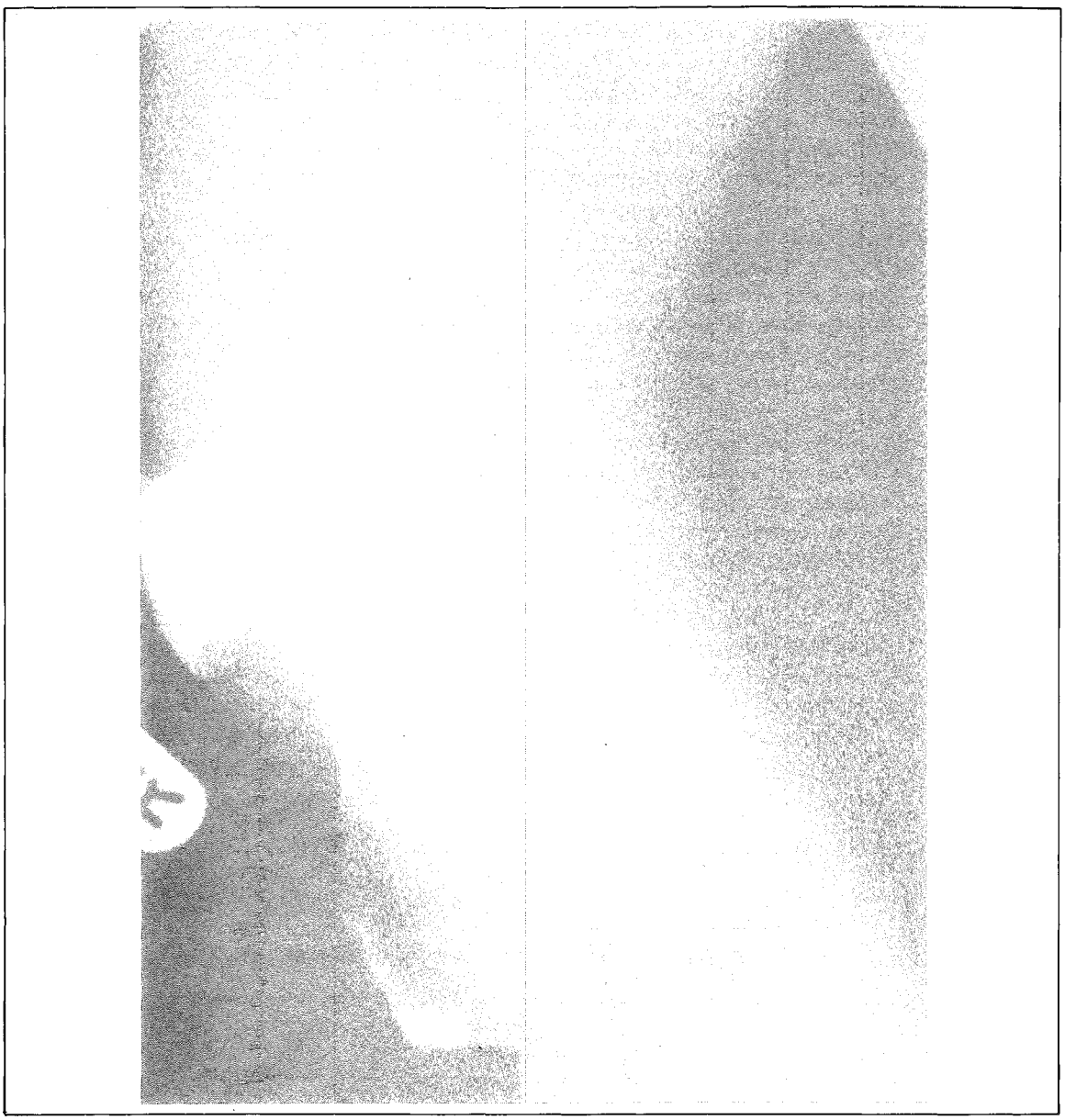

**Fig. 4 Calcification in the walls of the popliteal and tibial arteries.**

changes in chronic renal failure correspond to those of osteomalacia and secondary hyperparathyroidism, although the incidence in our series is less than that quoted by some authors (40%).[7,8]

There is also lack of overt changes such as subperiosteal resorption, periarticular erosions, periosteal reaction and soft tissue calcification other than vascular calcification. The incidence could well be increased if techniques such as magnification and using fine-grained films were employed, as has been the experience of other authors.[7,8]

There is also lack of other evidence of osteo-

malacia such as looser's zones, bowing or bending of bones or protrusio acetabuli.

The reason for this may be the fact that most of our patients presented late and were already in end-stage renal failure when first seen and hence the duration of follow-up prior to the institution of haemodialysis may not have been long enough for obvious signs to appear. It has been reported that the relative risk of developing renal bone disease in patients who had had renal failure for more than four years was twice as great as that in patients with a shorter duration of uraemia.[6] (The duration of renal failure being defined as the interval between the first recorded finding of a raised serum concentration of urea or creatinine and the initiation of regular haemodialysis treatment.) Another possible reason accounting for the less severe degree of osteomalacia may be contributed by adequate sunlight throughout the year in the tropics.

We are not in a position to establish age as a risk factor in the development of bone disease as the number of patients in the group of less than 20 years as well as more than 51 years is very much smaller than the other age groups (Table V). Hence a comparison cannot be made. Likewise we are not in a position to establish the type of renal disease as a risk factor as most of our patients present in terminal renal failure for the first time whence diagnostic procedures to establish the cause of renal failure cannot be performed.[9]

The increased incidence in osteoporosis may be due to some of the patients being on steroid therapy for nephrotic syndrome. However, radiographic changes are subjective and in the presence of a less severe degree of osteomalacia, the loss of bone density may be due to this rather than true osteoporosis, and hence we have included osteoporosis in our figure for significant bone changes (Tables VI, VII).

## CONCLUSION

In conclusion, significant bone changes are rare in maintenance haemodialysis patients in Malaysia. However, prospective studies incorporating bone biopsies and isotope imaging are required to obtain more specific and definite results.

TABLE V

EFFECT OF AGE ON PREVALENCE OF RENAL BONE DISEASE

| Age (years) | No. | Patients with significant radiographic changes | | SAP (IU/L)* |
|---|---|---|---|---|
| | | No. | (%) | |
| < 20 | 10 | 3 | 30.0 | 96 (53–165) |
| 21 – 30 | 52 | 6 | 11.5 | 147 (35–268) |
| 31 – 40 | 30 | 3 | 10.0 | 99 (96–103) |
| 41 – 50 | 23 | 8 | 34.8 | 146 (67–230) |
| > 51 | 7 | 4 | 57.1 | 127 (56–294) |

Male – 17/90 = 18.9%; Female = 7/32 = 21.9%.
* SAP = Serum alkaline phosphatase.

TABLE VI

EFFECT OF AGE ON THE PATTERN OF BONE DISEASE

| Age (years) | No: | No: of Patients with Radiographic | | | Total |
|---|---|---|---|---|---|
| | | Erosions | Osteosclerosis | Vascular calcification | |
| < 20 | 10 | 2 | 1 | 1 | 3 |
| 21 – 30 | 52 | 2 | 3 | 2 | 6 |
| 31 – 40 | 30 | 1 | 1 | 1 | 3 |
| 41 – 50 | 23 | 4 | 4 | 7 | 8 |
| > 51 | 7 | 2 | – | 4 | 4 |

TABLE VII

PATIENTS WITH ONLY RADIOGRAPHIC OSTEOPOROSIS

| Age (years) | No. | Patients with radiographic osteoporosis | | SAP (IU/L)* |
|---|---|---|---|---|
| | | No. | (%) | |
| < 20 | 10 | 6 | 60.0 | 155 (58–350) |
| 21 – 30 | 52 | 32 | 61.5 | 94 (13–218) |
| 31 – 40 | 30 | 20 | 66.7 | 97 (28–203) |
| 41 – 50 | 23 | 9 | 39.1 | 80 (35–140) |
| > 51 | 7 | 3 | 42.9 | 72 (51–100) |

Male – 51/90 = 56.7%; Female – 19/32 = 59.4%.

* SAP – Serum alkaline phosphatase.

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