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Bone densitometry in post renal transplant patients

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Abstract

Rapid bone loss is reported after renal transplantation due to use of immunosuppressive drugs. DEXA is a simple and accurate way of estimating the bone mineral density(BMD). 200 stable post renal transplant patients were subjected to distal forearm densitometry using DEXA. Amongst the 150 male patients 35 had normal BMD, 94 had osteopenia and 21 osteoporosis. Amongst the 50 female patients 8 had normal BMD, 24 had osteopenia and 18 osteoporosis.

Introduction

Chronic renal failure patients are at a higher risk for bone loss and fractures because of defective bone mineral metabolism. Reduced bone mass increases the risk for bone fractures. Bone mass can be estimated by several non-invasive methods. Out of these, the most recently developed is the DEXA system (Dual Energy X-ray Absorptiometry)[1]. Following successful kidney transplantation, it is expected that the bone density would improve because of the correction of the metabolic abnormality. However persistent hyperparathyroidism and use of immuno-suppressive drugs specially steroids can worsen the bone density [2,3,4]. This study was undertaken to measure the BMD in post renal transplant Indian patients.

Materials and Methods

This cross-sectional study was done in 200 post renal transplant patients (males 150, females 50 Table 1). The age group ranged between 12 – 70 yrs. The post renal transplant period was between 8 to 130 months (Table 2). All these patients had stable renal functions – serum creatinine below 2.5mg% over a period of 6 months (Table 3). Majority of the patients were asymptomatic whereas a few patients (8%) had bone pain especially in the low back, forearm and leg bones. Two patients developed bone fractures, one in the elbow and another in the femur after a trivial fall, 2 had avascular necrosis of the femoral heads. All the patients were on triple immunosuppressive drugs – prednisolone, azathioprine and cyclosporin. No other drugs know to produce osteoporosis were given. All these patients were not receiving calcium or vitamin D analogues. Patients with malignancy, prolonged immobilization or prolonged infections were not included in the study. In all these patients, BMD was measured in the distal forearm bones using XR 26 (Norland Corporation) DEXA. A T-score of

Table 1 : Age distribution of transplant patients

Age group (Yrs)	Males(Nos)	Females(Nos)
10-20	7	3
21-30	26	5
31-40	35	15
41-50	48	14
51-60	24	9
61-70	10	4

Table 2 : Interval from the date of transplantation

Post Tx Period (Months)	Males (Nos)	Females (Nos)
0 – 12	31	10
13 – 24	28	5
25 – 36	15	2
37 – 48	20	16
49 – 60	25	5
61 – 84	15	4
85 – 108	5	2
109 – 130	11	6

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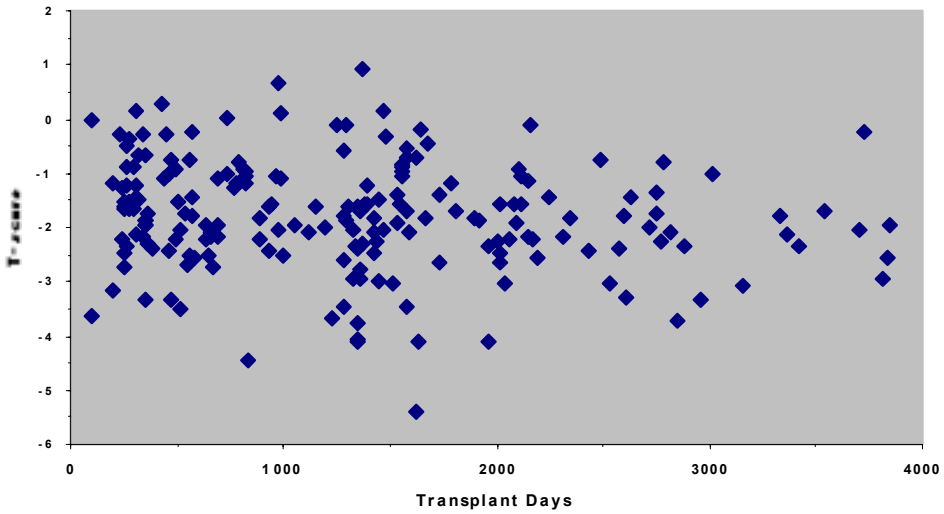

Figure 1 : Correlation between the degree of osteoporosis (T-score) and post transplant period (days)

–1 to +1 standard deviation was considered as normal BMD. A T-score of –1 to –2.5 SD was considered as osteopenia and T-score of more than –2.5 SD was considered as osteoporosis as per WHO criteria [5].

Results

Among 150 male patients, normal BMD was observed in 35 patients (23.3%). Osteopenia was observed in 94 patients (62.6%). 21 patients had osteoporosis (14%). Among 50 females, normal BMD was observed in 8 patients (16 %) 24 patients had osteopenia (48%). Remaining 18 patients had osteoporosis (36%).

Actual value for BMD is shown in Table 4. The BMD is significantly reduced both in males and females when compared to healthy controls.

The correlation between severity of osteoporosis and duration of post renal transplant period was insignificant ($P > 0.1$) (Figure 1). Osteoporosis in patients more than 50 yrs of age was (51 %) (24 patients out of 47).

Table 3 : Biochemical parameters

	Range	Mean
Urea (mg%)	30 – 65	47.5
Creatinine(mg%)	1 – 2.5	1.75
Calcium(mg%)	8.1 – 10.4	9.7
Phosphorous (mg%)	2.5 – 4.5	3.5
Uric acid(mg%)	5.2 – 7.1	6.1
Alkaline phosphatase (IU/L)	112 – 168	140

Discussion

Renal transplantation is associated with skeletal morbidity. Osteopenia is frequent and fracture risk is increased[6]. Rapid bone loss occurs in the first year of transplantation in a sex dependent fashion: females lost mass from the lumbar spine and males from femoral neck[7]. Bone loss occurs during the first six months at a very high rate and subsequently undergoes slowing or stabilization [8,9,10,11]. Glucocorticoids and cyclosporin are thought to be implicated although the role of latter is controversial[10,11]. Glucocorticoids inhibit intestinal calcium absorption, increase calciuria and reduce the secretion of sex hormones[13,14]. Glucocorticoids also have direct and complex effects on bone metabolism with clear cut osteoblast toxicity and enhanced resorptive responsiveness to parathyroid hormone[15]. Alfonso etal have compared the BMD in 3 groups of transplant patients (cyclosporin monotheray, azathioprin plus predisolone, and triple immunotherapy). They found no difference in all the three groups. Osteopenia was seen in the appendicular skeleton in all the patients[16].

In the present study, we have chosen to measure the BMD in the distal forearm bones for the following reasons. (a) convenience (b) low cost (c) lack of false positives due to weight bearing or degeneration. This is the first study in India to measure the BMD in post renal transplant patients. Our results are similar to the western literature[12,13,16]. Serial estimation of BMD by DEXA would be of great importance for following renal transplantation as it has been shown that with the use of biphosphonates it is possible to prevent bone loss following renal transplantation[17].

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Table 4 : Comparative value of BMD in transplant patients and healthy controls

			BMD(gm/sqcm)		
No	Age years	Sex	Patients Mean (SD)	Controls Mean(SD)	P value
150	12-76	Male	0.304(0.063)	0.393(0.055)	<0.01
21	<40	Female	0.248(0.051)	0.350(0.045)	<0.01
29	>40	Female	0.231(0.065)	0.293(0.041)	<0.01

References

1. Question & Answers: Diagnostic and Therapeutic Technology Assessment (DATTA)-Measurement of bone mineral density by DEXA. Am J Med Assoc Jan 1997;2671(2):286-93.
2. Lukert BP, Raisz LG. Glucocorticoid induced Osteoporosis, Pathogenesis and management. Ann Int Med 1990;112:352-364.
3. Reid IR. Steroid Osteoporosis Calci. Tissue Int.1989;45:63-67.
4. Adino AD, Hollister JR. Steroid induced fractures and Bone loss in patients with Asthma. N Engl J Med 1983;309:265-268.
5. World Health Organization study group. Assessment of fracture risk and its application to screening for post menopausal osteoporosis. WHO Technical Report Series 843. Geneva, Switzerland,1994.
6. Malluche H, Faugere MC. Renal bone disease 1990 – An unmet challenge for the nephrologist. Kidney Int. 1990;38:193-211.
7. Main J, Velasco N, Catto GR, Fraser RA, Edward N, Adami S, O'Riodan JL. The effect of haemodialysis, vitamin D metabolites and renal transplantation on the skeleton demineralization associated with renal osteodystrophy. A computerized histomorphometric analysis. Clin Neph 1986;26:279-287.
8. Huffer WE, Kuzela D, Popovite MM, Starzl TE. Metabolic bone disease in chronic renal failure II. Renal transplant patients. Am J Path 1986;78:385-400
9. Shane E, Rivas M, Silverberg S, Kim T, Stardon R, Bilezikian J. Osteoporosis after cardiac transplantation. Am J Med 1993;94:257-264
10. Grotz WH, Mundiger FA,Gugel B, Exner V, Kriste G, Schollmeyer PJ. Bone fracture and osteodensitometry with dual energy X-ray absorptionmetry in kidney transplant patients. Transplantation 1994;58:912-915
11. Julian BA, Laskow DA, Dubovsky J, Curtis J, Quarles D. Rapid loss of vertebrae mineral density after renal transplantation. N Engl J Med 1991;325:544-550.
12. Grotz WH, Mundinger FA, Rasenack J, Speidel L, Olschenwski M, Xner VM, Schollmeyer PJ. Bone loss after kidney transplantation – A longitudinal study in 115 graft recipients. Nephrol Dial Transplant 1995;10:2096-2100.
13. Pichette V, Bonnardeaux A, Prudhomme L, Gagne M, Cardicnal J, Quimet D. Longterm bone loss in kidney transplant recipitents: A cross sectional and longitudinal study. AM J Kidney is 1996;28:105-111.
14. Slatopolsky E, Martin K. Glucocorticoids and renal transplant osteonecrosis. Adv Exp Med Biol 1984;171:353-359.
15. Luckert BP, Raisz LG. Glucocorticoid – induced osteoporosis. Pathogenesis and management. Ann Int Med 1990;112:352-364.
16. Alfonso M, Cueto-Manzano, Shaikh Konel, Alasrair J Hutchison, Vivion Crowley, Michael W France, Anthony J Freemont, Judith E, Adams, Barbare Mawer And Ram Gokal. Bone loss in longterm renal transplantation. Histopathology and densitometry analysis. Kidney Int 1999;55:2021-2029.
17. Stanley L-S Fan, Michael K Almond, Elizabeth Ball, Kathy Evans And John Cunningham. Pamidronate therapy as prevention of bone loss following renal transplantation. Kidney Int 2000;57:684-690.

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