Early Post Renal Transplantation Hypophosphatemia

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Introduction

Hypophosphatemia is the most common complication after renal transplantation (Tx). For long it was believed that hyperparathyroidism causes hypophosphatemia after renal Tx. However hypophosphatemia exists even after parathyroid hormone (PTH) is normalized.
This indicates that other factors such as FGF-23 may also be responsible for hypophosphatemia after renal Tx. This study aimed to investigate the prevalence of hypophosphatemia in early post renal Tx period and the associated risk factors.

Material and Methods

Fifty renal Tx patients (37 male, 13 female, mean age 44±10.4 years) were studied for serum phosphate (P) level on the day before (-1) and on days 10 (+10) and 30 (+30) after renal Tx. Levels of serum creatinine, P, vitamin D (D3), intact PTH (iPTH), and FGF-23 concentrations and the 24 hour urinary excretion of P and creatinine and the ratio of transport maximum of P to estimated GFR (eGFR) i.e. TMP/GFR were measured at the same days.

Results

Mean concentrations of serum P were 5.8±1.7, 3±1.53 and 2.74±0.87 mg/dl on days -1, +10 and +30, respectively and was higher in cadaveric vs. live donor Tx, on days +10 and +30 (4.6±3.15 vs. 2.78±1.06 mg/dl, p= 0.02 and 3.03±.0.66 vs. 2.70±0.9 mg/dl, p= 0.01, respectively). On days -1, +10 and +30, hypophosphatemia (plasma P<2.5 mg/dl) was observed in 0%, 40% and 42% of the patients, respectively. eGFR as calculated by MDRD equation was 55.36±18.81 and 56.99±12.97 ml/min on days +10 and +30. D3 deficiency (D3 level <30 ng/ml) was detected on 32%, 42%, and 46% of the
patients on days -1, +10 and +30, respectively. Hyperparathyroidism (iPTH> 300 Pg/ml in pre-Tx and iPTH> 70 Pg/ml in post- Tx period with normal eGFR or >110 Pg/ml with GFR between 15-30 ml/min)
was observed in 34%, 66% and 52% of the patients, on days -1, +10 and +30, respectively. Mean eGFR was significantly higher in hypophosphatemic compared to normophosphatemic patients on days +10 and +30 (64.6±14.3 vs. 49.16±18.9 ml/min, p=0.001 and 62.9±8.1 vs. 52.7±14.2 ml/min, p=0.001, respectively). D3 and iPTH levels significantly decreased after Tx (46.25±2.57 ng/ml vs. 35.61±1.7 ng/ml, p=0.01 and 286±198 vs. 95.22±65.9, p=0.001, respectively). There was no significant difference between D3 and iPTH levels in patients with and without hypophosphatemia. Mean FGF- 23
concentration was 707.4±897.53, 181.01±339.9 and 32.98±39.18 Pg/ml on days -1, +10 and +30. FGF-23 level was significantly higher in hypophosphatemic compared to normophosphatemic patients on days +10 and +30 (1128.1±1117.4 vs. 426.9±582.7 Pg/ml, p= 0.01 and 1027.4±1069.2 Pg/ml vs. 475.6±678.7, Pg/ml, p= 0.04 respectively).

Daily urine phosphorus concentration increased following Tx. But the level was not significantly different between hypophosphatemic and normophosphatemic patients on days +10 and +30 (1027.25±500.8 vs. 967.8±487.8 mg/24 hour, p=0.6 and 817.5±356.2 vs. 890.6±291.8 mg/24 hour, p=0.4, respectively). Mean TMP/GFR was significantly lower in hypophosphatemic patients on days +10 and +30 (0.74±0.45 vs. 3.1±0.95 p= 0.01 and 0.9±0.4 vs. 2.23±0.76, p= 0.001, respectively).
Mean TMP/GFR was significantly lower in hypophosphatemic patients (0.64 vs 2.05 respectively, p-value: 0.01 and 0.9 vs. 2.28 p-values: 0.00).

Conclusions

In our study the main determinants of post Tx hypophosphatemia were FGF-23 level, post Tx eGFR and TMP/GFR . Post Tx PTH and D3 levels did not significantly influence post Tx hypophosphatemia. Further studies on other phosphaturic hormones are suggested.

Table 1- Laboratory Parameters on days -1, +10 and +30 in 50 Renal Transplant Patients

Variables	Pre Tx-1 (Mean±SD)	Pos Tx+10 (Mean±SD)	Post- Tx+30 (Mean±SD)	F
P (mg/dL)	5.8±1.7[a]	3±1.53[b]	2.74±0.87[b]	74.7***
Cr (mg/ dL)	8.6±2.56[a]	1.6±1.2[b]	1.33±0.28[b]	318.74***
eGFR (MDRD) (ml/min/1.73m^2)	7±2.55[a]	55.2±18.8[b]	56.9±12.9[b]	198.51***
Ca (mg/ dL)	9.05±0.8[a]	8.92±0.63[a]	9.3±0.51[b]	5.67**
Mg (mg/ dL)	2.34±0.31[a]	1.7±0.23[b]	2.5±0.31[c]	50.78***
K (mg/ dL)	5.7±0.7[a]	4.4±0.49[b]	4.53±0.61[b]	20.16***
VitD (ng/ dL)	46.25±2.57	37.01±1.76	35.61±1.7[b]	3.84*
PTH (Pg/ dL)	286±198[a]	115±101[b]	95.22±65.9[b]	30.72***
FGF-23 (Pg/ dL)	707±897.5[a]	181±339.9[b]	32.98±39.18[b]	20.43***
Urine p	41.5±84.1[a]	991±488[b]	848±229[c]	110.98***
TMP/GFR	4.72±2.5[a]	1.48±1.03[b]	1.7±0.95[b]	59.25***
Hb (mg/ dL)	12. 2±2.3[a]	10.8±2.21[b]	12.61±1.8[a]	9.53***

a-b-c : Letters shows the significantdifferences among items, *: 0.05<P<0.01, **: 0.001<P<0.01, ***: P<0.001
NS : Not significant

Table 2- Frequency of post- Transplant Hypophosphatemia, High PTH and FGF-23 and low PTH in 50 Renal Transplant Patients

Variable	-1	+10	+30
Hypophosphatemia (%)	0	40	42
Hyperparathyroidism(%) (PTH according to KDIGO stage)	34	66	52
Vitamin D deficiency (%)	32	42	46
Increased FGF -23 (%)	88	52	16

Table 3- Correlation between Laboratory Parameters and presence of hypophophatemia on days +10 and +30 in 50 Renal Transplant Patients

ariables	PosTx+10 (Mean±SD)			PostTx+30 (Mean±SD)		
	Hypopho-P	Normo-P	t	Hypo-P	Normo-P	t
mg/ dL)	1.83±0.39	3.78±1.51	6.78**	1.91±0.38	3.34±0.6	10.37***
(mg/ dL)	1.2±0.22	1.88±1.48	2.4*	1.19±0.14	1.43±0.32	3.5**
R (CC/min/1.73m^2)	64.67±14.08	49.16±19.2	3.29**	62.8±8.1	52.7±14.2	3.19**
(mg/ dL)	9.1±0.5	8.8±0.7	1.79ns	9.23±0.48	9.44±0.52	1.45ns
(mg/ dL)	1.77±0.25	1.76±0.24	0.06ns	1.85±0.27	1.93±0.37	0.87ns
(mg/ dL)	4.6±0. 5	4.3±0.45	2.17*	4.52±0.54	4.54±0.67	0.13ns
D (ng/ dL)	40.46±18.3	34.63±17.14	1.12ns	36.4±22.3	35.1±12.6	0.24ns
H (Pg/ dL)	106.7±76.66	120.8±115.4	0.52ns	108.3±65.44	85.75±5.72	1.2ns
F-23 PreTX (Pg/dl)	1128.1±1117.4	426.93±582.74	2.58*	1027.4±1069.24	475.64±678.74	2.08*
ine p (mg/24h)	1027.2±500.8	967.8±487.8	0.41ns	890.57±291.76	817.52±356.18	0.79ns
MP/GFR	0.64±0.44	2.05±0.93	7.2***	0.91±0.38	2.29±0.81	7.99***
(mg/ dL)	11.04±2.63	10.71±1.93	0.48ns	12.6±1.87	12.61±1.78	0.02ns

a-b-c : Letters shows the significant differences between items, *: 0.05<P<0.01, ,**: 0.001<P<0.01, ***: P<0.001, NS : Not significant

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