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| **PROTOCOL TITLE:** Kidney and Pancreas Post Transplant Bone Disease Management |
| **APPLICABLE FACILITIES:**[x] EHC [ ] EDH [ ] EHH [ ] EHI [ ] EHN [ ] EJCH [ ] ELTAC [ ] ESJH[ ] EUH [ ] EUHM [ ] EUHS [ ] EUOSH [ ] EWWH [ ] RJV-ERH [ ] RJV-ESOP [ ] TEC/ESA |
| **EFFECTIVE DATE:** 11/13/2019 | **ORIGINATION DATE:** 11/04/2009 |

**SCOPE:**

All transplant program physicians, practitioners and clinical staff members are responsible for compliance with this clinical protocol.

**PURPOSE:**

This protocol is necessary for the protection of patients, physicians, and staff.

**PROTOCOL:**

* 1. **Bone Densitometry**
		1. A DEXA scan should be performed within the first 3 months post-transplant to establish the patient’s baseline BMD.
		2. A follow-up DEXA scan should be performed at 12-15 months post-transplant and then every 1-2 years thereafter as clinically indicated.
	2. **Lifestyle Modifications**
		1. Smoking cessation should be strongly encouraged.
		2. Patients should be encouraged to participate in weight bearing exercises in addition to regular daily exercise.
	3. **Laboratory Testing**
		1. Laboratory monitoring should be ordered according to the “Outpatient Post Renal Transplant First Year Timed Lab Orders” order set
			1. Serum calcium, phosphorous, bicarbonate, and PTH
				1. At the time of transplant, quarterly for 1 year post-transplant, and bi-annually thereafter at a minimum.
			2. 25-OH Vitamin D levels
				1. At the time of transplant, at 3, 6, and 12 months post-transplant, and as clinically indicated thereafter.
			3. Minerals and electrolytes
				1. At the time of transplant, and at each transplant clinic visit.
	4. **Persistent Hyperparathyroidism**
		1. For patients whose PTH and serum calcium levels are above goal, consider treatment with cinacalcet 30 mg PO daily.
			1. Increase dose by 30mg every 1-2 months if patient is not at goal.
				1. Maximum dose is 180 mg daily.
		2. Parathyroidectomy may be considered if intolerant to cinacalcet or if unable to medically manage.
		3. Oral vitamin D analogs should be considered in patients with persistently elevated PTH and normal serum calcium levels.
			1. Calcitriol 0.25 mcg PO daily may be started or patient’s home regimen resumed.
			2. Increase dose by 0.25 mcg/day every 4 – 8 weeks, up to 0.5 to 1 mcg/day.
	5. **Vitamin D Deficiency**
		1. Patients with Vitamin D levels ≤ 30 ng/mL without hypercalcemia should be treated with vitamin D
			1. Patients with 25-OH D levels ≤ 12 ng/mL should receive:
				1. Cholecalciferol (preferred) or ergocalciferol 50,000 units PO weekly x 8 weeks, then 1000 units PO daily thereafter.
			2. Patients with 25-OH D levels > 12 ng/mL to 20 ng/mL should receive:
				1. Cholecalciferol (preferred) or ergocalciferol 1,000 units PO daily with a repeat 25-OH Vitamin D level measurement in 3 months to assess efficacy.
			3. Patients with a 25-OH D level of 20-30 ng/ml should receive:
				1. Cholecalciferol (preferred) or ergocalciferol 1000 units PO daily.
			4. Check Vitamin D level according to “Laboratory Testing” above.
			5. In the setting of hypercalcemia, vitamin D supplementation should be held until serum calcium levels normalize.
			6. Defer initiation of Vit. D supplementation in post-transplant patients for the first 3 months post-transplant if they were on pre-transplant cinacalcet.
	6. **Calcium Supplementation**
		1. Calcium supplementation should be considered in all patients without hypercalcemia or significant hypophosphatemia.
		2. Begin supplementation once renal function has stabilized and the patient is not requiring phosphorous supplementation.
		3. Supplements containing 1000-1500mg Ca++ daily and 400 IU Vitamin D daily may be used.
			1. Examples: Caltrate 600+D or OsCal 500+D, take 2 tablets PO QHS.
	7. **Mineral-Electrolyte Abnormalities**
		1. Hypophosphatemia
			1. Patients with serum phosphorus < 2 mg/dL which does not improve with dietary intervention should receive treatment with K-phos neutral 500mg PO BID which can be titrated up based on response if needed.
			2. Hypophosphatemia usually resolves within a few months post-transplant.
			3. Continue treatment until phosphorous is > 2.5 mg/dL.
		2. Hypercalcemia
			1. Refer to Persistent Hyperparathyroidism management strategy above for cinacalcet dosing.
			2. Continue treatment until serum calcium is < 10.2 mg/dL.
		3. Hypomagnesemia
			1. Patients with serum magnesium ≤ 1.5 mg/dL may benefit from treatment with magnesium oxide 400mg PO BID if their magnesium level fails to improve with dietary supplementation.
			2. Magnesium supplementation should be separated from mycophenolate mofetil administration by at least 2 hours.
			3. Magnesium supplementation should be avoided in patients with diarrhea as it can further exacerbate symptoms.
		4. Metabolic Acidosis
			1. Patients with serum bicarbonate < 18 mmol/L should be treated with sodium bicarbonate 1300 mg PO BID and titrated up a needed.
			2. Continue treatment until serum bicarbonate level is 20-22 mmol/L.
	8. **Low Bone Mineral Density**
		1. Bisphosphonate therapy may be considered in patients with an eGFR of >30 ml/min/1.73 m2 whose risk of fracture outweighs the potential long-term risk of inducing irreversible low bone turnover.
		2. A bone biopsy could be considered prior to initiation of bisphosphonate therapy as these agents are most beneficial in patients who have increased bone resorption.
		3. There is insufficient data to guide long term management of bone disease in patients > 12 months post-transplant and treatment will need to be individualized.

**RELATED POLICIES / PROCEDURES: N/A**

**DEFINITIONS:** N/A

**REFERENCES AND SOURCES OF EVIDENCE:**

Torregrosa JV. Barros X. Management of hypercalcemia after renal transplantation. Revista Nefrologia 2013

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KDIGO Clinical Practice Guideline for the Diagnosis, Evaluation, Prevention, and Treatment of Chronic Kidney Disease-Mineral and Bone Disorder. 2009

**KEY WORDS:** kidney transplant, bone density