BONE HEALTH and Vitamin D
Liver Transplant Candidates
University of Cincinnati

NOTE: This document is to serve as a guide for transplant clinicians to assist with assessment, evaluation and therapy options. Please contact attending physician for additional information and patient specific questions.

I. BONE HEALTH

a) Assess in all patients during the liver transplant EVALUATION phase by DEXA SCAN
b) DEXA scan should be repeated every 1-2 years (as dictated by insurance coverage) while the patient is awaiting liver transplantation
c) DEXA SCAN interpretation: (bone density measurement sites: spine, hip, total hip)
- T-score: compares the patient's bone mineral density (BMD) values with mean values found in young, healthy controls matched to the patient's gender
  - The T-score is used to determine bone health as follows:

	T-score (SD)
Normal	≥ -1.0
Osteopenia	-1 to -2.5
Osteoporosis	< -2.5

- Z-score: compares the patient's bone mineral density (BMD) values with mean of values found in subjects of this patient's gender, age, and race

d) Any patient with osteoporosis (T-score below -2.5) should be referred to an **endocrinologist**

II. TREAMENT ALGORITHM for our patients with cirrhosis:

a) Recommendations based on **T-score** and serum **25-OH Vitamin D levels** per the following table:

Any T-score (SD) value	25-OHD (ng/mL)	Calcium	Vitamin D	Bisphosphonate
≥ -2.5	> 20	1,200 mg/day	800 - 1000 units/day	Not Recommended
	< 20	1,200 mg/day	50,000 units once weekly for 6-8 weeks, then recheck level and treat accordingly	Not Recommended
< -2.5	> 20	1,200 mg/day	800 - 1000 units/day	Alendronate 70 mg q week[1] (or) Risedronate 35 mg q week[1]
	< 20	1,200 mg/day	50,000 units once weekly for 6-8 weeks, then recheck level and treat accordingly	Alendronate 70 mg q week[1] (or) Risedronate 35 mg q week[1]

[1] Start treatment and/or refer to endocrinologist. Do **NOT** prescribe alendronate (Fosamax) or risedronate (Actonel) if CrCl ≤ 35 mL/min

III. Vitamin D

a) Assess serum 25-OH vitamin D level in all patients undergoing liver transplant evaluation
    1. A level < 20 ng/mL is deficient; prescribe Vitamin D_3 50,000 IU orally once weekly (reassess serum 25-OH vitamin D levels every 6 – 8 weeks and dose accordingly)
    2. A level > 20 ng/mL requires supplemental therapy in cirrhotic patients at a dose of Vitamin D_3 800 to 1000 IU orally per day (OTC typically has 400 or 1000 IU per tablet)

IV. Calcium

a) Calcium levels are not routinely measured in our patient population

b) Cirrhotic patients should receive calcium supplementation at a dose of 1,200 mg orally per day
    1. Calcium is available in many OTC products, refer to package labeling for dosing in terms of elemental calcium

V. Calcium + Vitamin D combination products (preferred)

a) Recommend Os-Cal® or generic equivalent (contains 500 mg elemental calcium and 400 IU of Vitamin D); prescribe 1 tablet orally twice daily

b) Other combination products available but contain less vitamin D per tablet

VI. Bisphosphonates [e.g., Alendronate (Fosamax), Risedronate (Actonel)]

a) Bisphosphonate therapy is recommended for any T-score below -2.5

b) Do NOT prescribe in patients with renal insufficiency (creatinine clearance below 35 mL/min)

c) Tablets should be taken on an **empty stomach, first thing in the morning, with 8 ounces of plain water (no other liquid)**.
    a. After taking these medications, patients should refrain from eating, drinking or injecting any other medication for at least 60 minutes
    b. Patients should remain upright for at least one hour after taking the medication to reduce the risk of pill esophagitis and/or esophageal ulceration
    c. Side effects (similar for both drugs): GI problems (i.e. difficulty swallowing, inflammation of esophagus, gastric ulcers), osteonecrosis of the jaw
        i. Long-term use (> 3 years) may result in an increased risk of unusual fractures