

BONE DENSITY MEASUREMENT: Who, What and When?

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Bone health is an important concern for all physicians. As patients mature and hormones change there are developmental changes within the bone continuum. Bone health affects lower extremity physicians in many ways including bone healing, incidence of stress fractures, patient stability and surgical procedure selection. Often the first time a patient knows they have a problem with their bones is when it is identified on a pedal radiograph either for diagnosis of a condition or as an incidental finding. Early identification of osteopenia and/or osteoporosis can prevent many of the higher risk complications associated with poor bone health such as hip or vertebral fractures (Figure 1)

An extensive history will often give an indication of potential risk factors which can lead to osteopenia/osteoporosis. Diet, activity level, age, tobacco use, medications (steroids), decreased intake of calcium and vitamin D and a family history are questions that should be answered regarding bone health. Post-menopausal women or women with hysterectomies at an early age are also at risk for weakening of the bone due to loss of estrogen which helps to maintain bone strength. Physical examination will not usually give any specific indication of bone



Figure 1. Stress fractures or insufficiency fractures are an indication that abnormal bone mass is present and should be evaluated with Bone Mass Measurements.

health but other signs and symptoms of improper diet and nutrition and lack of exercise may provide clues to the need for further testing. The Foundation for Osteoporosis Research and Education (FORE) recommends bone density testing for:

- Perimenopausal and postmenopausal women who are not taking Hormone Replacement Therapy (HRT)
- Women who are 5 years postmenopausal and have not had Bone Mass Measurement (BMM)
- Women on HRT who want to discontinue or decrease therapy
- Women on HRT with new risk factors (fractures or radiographic decreased density)
- Women and Men with osteoporosis suspected based on plain radiographs
- Women or Men on Chronic Glucocorticoids, immunosuppressive drugs
- Hyperparathyroidism
- Hyperthyroidism
- Hypogonadism
- Organ transplant recipients
- Anti-osteoporosis therapy monitoring
- Patients with insufficiency fractures
- Women and Men over 65 who have not had BMM
- Women and Men with possible drug induced or other secondary forms of osteoporosis
- Children and adolescents with one or more insufficiency fractures

BONE MASS MEASUREMENT

Testing for osteoporosis and bone health is done through testing for Bone Mineral Density (BMD). Determining the BMD allows the physician to assess the patient's risk of fractures and allows initiation of treatment to slow or reverse bone density loss. Bone mass measurement is used to diagnose osteoporosis, predict fracture risk, quantify bone mass and to monitor bone loss or the effect of therapy. The BMD is inversely proportional to fracture risk and can be used a predictor in an attempt to initiate early therapy to prevent complications. Many sites can be used to test for BMD although the hip is an excellent predictor

for many types of fractures. Densitometers made for specific regions of the body are the most reliable for predicting bone health in those specific regions. Techniques for determining BMD include:

- Dual X-ray absorptiometry (DXA) – used to measure BMD in the spine, hip, or wrist. Radiation exposure is 1/10th that of standard chest x-ray.
- Peripheral Dual X-ray absorptiometry (pDXA) and Single-Energy X-ray absorptiometry (SXA) – used to measure bone density in the forearm, finger and calcaneus.
- Quantitative Computed Tomography (QCT) – used to measure trabecular and cortical bone density at various skeletal sites. Can also be measured in the periphery (pQCT).
- Ultrasound Densitometry – used to measure BMD at skeletal sites that are relatively superficial (patella, tibia, calcaneus).

The patient's BMD is then compared to two "normal" values to calculate bone health. The Z-score compares patient's BMD to the expected BMD of someone the same age and gender. The T-score compares the patient's BMD to "young normal" adults of the same gender also known as Peak Adult Bone Mass (PABM). These relative differences in the patient's BMD and the average normal values are expressed in terms of standard deviation (SD).

The following scores are used to evaluate BMD:

Normal

BMD above -1 SD from PABM

Osteopenia

BMD between -1 SD and -2.5 SD from PABM
 Does not mean bone loss has occurred
 Rule out secondary causes of Osteoporosis
 Treatment may be required based on risk factors and potential changes

Osteoporosis

BMD worse than -2.5 SD from PABM
 Make modifications and potentially initiate therapy

Early intervention is the key in rebuilding the osseous structure either through medications, exercise, supplementation or diet. The sooner the disease process is detected the earlier it can be halted or reversed to restore osseous health. This is done via osteoclast inhibition, osteoblast induction or providing more of the hormones and essential nutrients to stimulate bone growth. Various therapies are currently being used and are under development for the treatment of osteoporosis.

The key to successful management is detection and early intervention. The appropriate evaluation and appropriate referral when necessary will allow the patient to maintain normal function without increased risks or complications related to osteoporosis. This may be the initial introduction the patient has to osteoporosis and identifying those at risk will provide a great service now and in the future for these patients.

BIBLIOGRAPHY

- Foundation for Osteoporosis Research and Education. Osteoporosis: guidelines for the physician. Oakland (CA) The Foundation for Osteoporosis Research and Education; 2002.