quantifiably better.

A Physician's Guide to QCT BMD Testing

A cost effective approach for better results

What is QCT?

Quantitative Computed Tomography or "QCT" is a fast, non-invasive bone mineral density (BMD) exam of the lumbar spine or proximal femur, which utilizes a standard Computed Tomography (CT) scanner[1].

Originally developed in the early 80's, QCT has several advantages over Dual-energy X-ray Absorptiometry (DXA) for the measurement of BMD in patients with degenerative disease and arthritis[2] but was superseded by DXA early on, primarily due to the high cost and limited availability of early CT scanners.

Today, QCT is one of three methods, including DXA, cited by the National Osteoporosis Foundation as safe and effective for the evaluation of BMD[3]. The QCT system comprises a CT scanner calibration device and a software application on a standalone Windows PC networked to the CT scanner.

Is QCT the same as DXA?

At the hip, QCT produces BMD T-Score measurements that are clinically equivalent to DXA measurements[5], but the exam can be done without the complex positioning requirements of DXA that some patients with arthritic hips may find uncomfortable.

At the spine QCT differs from DXA in that QCT is a truly 3-D bone density exam; meaning QCT can measure the metabolically-active trabecular (spongy) interior bone separately from the dense cortical (compact) bone forming the outside bone walls[2]. Since trabecular bone is affected earlier and to a greater degree than cortical bone, QCT is likely to detect low bone mass earlier in the spine than other bone mineral density exams[1].

In addition, QCT spine BMD measurements can be made for patients with scoliosis[8] ; and the artificially high BMD measurements that can affect DXA due to obesity[9], disc space narrowing or spinal degenerative diseases[10], aortic calcification[11] and osteophytes[12] in patients with arthritis can be avoided.

Measurement Precision

Published short-term precision estimates of BMD measurement by QCT have been calculated as CV% for volumetric BMD at the lumbar spine (0.8%)[4] and areal BMD at the total hip (0.82%) and femoral neck (0.69%)[5], using a nominal areal BMD of 1.0g/cm^2 at the hip. This compares favourably with DXA areal BMD measurements, for which published precision estimates are similar for the lumbar spine (1.1%)[6], total hip (0.65%) and femoral neck (1.66%)[7].

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The QCT Exam

A QCT exam takes about 5 minutes and is similar to an ordinary CT scan. During the exam, both the spine and hip are scanned and the information used for diagnosis of low bone mass (osteopenia) or osteoporosis. For dedicated QCT exams, low-dose CT scan protocols are used and so the amount of radiation required is commonly between 500-800µSv[13] or comparable to a set of mammograms. Analysis, including report generation, is carried out by a CT Technologist. Importantly, the QCT exam can be readily combined with other (non-IV contrast) abdominal/pelvic scans such as Virtual Colonography or oncology studies with no further image acquisition or radiation dose to the patient[14].

The QCT Bone Mineral Density Report

The average bone mineral density is calculated and then compared to age and sex matched controls. At the spine, a true volumetric BMD measurement is made and rather than using T-Scores, it is usually compared to guideline thresholds from the American College of Radiology (ACR)[15]: a BMD < 80 mg/cm^3 indicates osteoporosis; a BMD < 120 mg/cm^3 and > 80 mg/cm^3 indicates osteopenia; and a BMD above 120 mg/cm^3 is considered normal. At the hip, a DXA-equivalent areal BMD and T-score are calculated for comparisons to the WHO classification at the proximal femur as normal, osteopenia (T-Score < -1.0 and > -2.5) or osteoporosis (T-Score < -2.5)[16]. This areal BMD may also be used for fracture risk probability calculation in the WHO FRAX® tool[17] with "Mindways QCT" as the appropriate BMD setting. In addition, if a patient's previous examination is found as a match in the database, a comparison to the results of this examination may be made to assess changes in BMD.

Reimbursement of QCT

Bone mineral density measurement by QCT is reimbursed for the screening of postmenopausal women every two years by Medicare under CPT code 77078. Other eligible beneficiaries for QCT BMD exams include patients with vertebral fracture, hyperparathyroidism, or on long-term steroid therapy.

The current reimbursement rate is around $100, though confirmation of local coverage determination should be sought. The exam is simple and quickly performed so that typical uninsured fees for QCT exams are comparable to, or less than, those for a DXA exam.

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