

# QCT Case Report No. 1

Clinical utility of QCT versus DXA in an osteoporotic woman treated with estrogen and calcium.



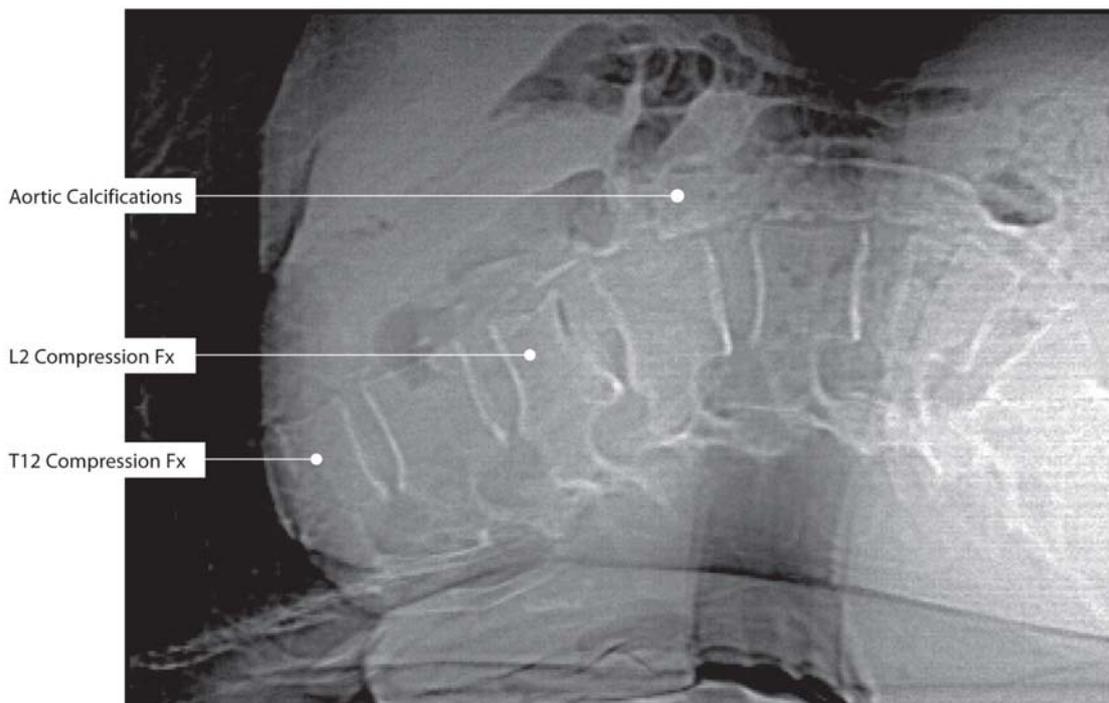
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quantifiably better.

A 66 year old woman was referred for QCT bone densitometry following an equivocal DXA result obtained in a clinic doing osteoporosis research. The DXA BMD of the left hip showed significant osteoporosis, with T-score for all regions below -3.1 and Z-score -1.8 to -2.3. In the spine, only L1 had a T-score indicating osteoporosis, -2.9, with L2 (-1.5), L3 (-2.4) and L4 (-2.2) being considerably higher. Lumbar vertebra BMD ranged from 80 to 103% of age-matched means. No lumbar spine film was available to aid in interpretation of the DXA results. The patient had also had a right hip replacement because of cartilage degeneration, and it was unclear if bilateral disease might also affect the hip DXA results.

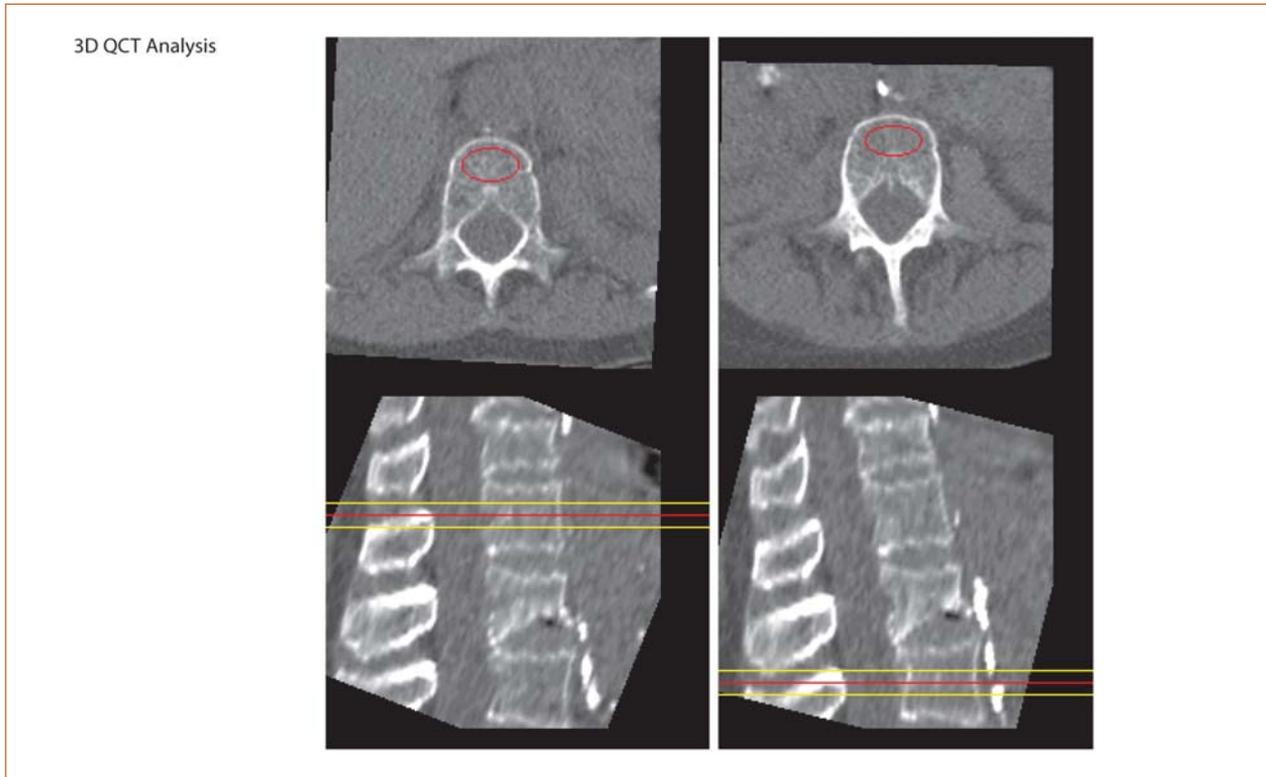
3D QCT was done using a GE scanner at 80kVp. Localizer scans of the thoracic and lumbar spine were obtained. A mild compression of T9 and moderate compression of L2 were noted. Significant aortic calcification over the lumbar spine was also noted. Contiguous 3 mm thick scans were obtained from the top of T12 to the bottom of L3.

On review of the axial CT images some problems were noted. Even though T12 did not appear compressed on the localizer scans, the reformatted sagittal and coronal images showed that the superior plate was starting to compress. Retrospective review of the localizer scans showed this compression, but it was difficult to visualize because T12 was overlying the dome of the liver. In addition, some of the images contained significant lung field around the bone, producing artefacts in the CT numbers. For these reasons, T12 was excluded from the analysis.

Analysis of L1 and L3 gave trabecular BMD results of 80 and 58 mg/cc, respectively, indicating a potential diagnosis of osteoporosis. There was a small amount of aortic calcification over L1, but substantial quantities over L2 and L3, explaining the increased DXA BMD values in the lower lumbar spine. The patient also had gallstones, reported as an incidental finding.



The patient returned for 1-year follow-up BMD studies, being treated in the interim with estrogen and calcium. The hip DXA results showed no change in BMD (neck +2.2%, total +0.4%/yr, non-significant change). The total L1–L4 spine BMD showed a 3% decrease, but when L2 was excluded from the analysis BMD changed from 0.756 to 0.722 g/cm<sup>2</sup>, or 4.6% decrease. A follow-up QCT was done to try to ascertain whether the patient was losing bone or not. The QCT results for L1 and L3 were 73 and 48 mg/cc respectively, on average a 12.2% decrease, confirming the spine DXA results. A QCT analysis of T12 (using a 5 mm thick slice to avoid the compressed area) showed a change from 81 to 62 mg/cc, similar to changes in the non-compressed vertebrae.



The DXA studies in this case were done at a research clinic specializing in osteoporosis studies, where the precision for spine measurements is about 1.2% and for hip measurements about 2.0%. The 3D QCT studies have a reproducibility of 1%. In order to be considered significant change, there would have to be 3.4% DXA spine, 5.6% DXA hip, and 2.8% QCT spine differences between the two exams.

A common recommendation for DXA studies in the older population is to scan both the spine and the hip, and if the spine is high, assume it is in error and disregard the results. More recently, some investigators have recommended that only the hip be scanned in the over-60 population. In this case, if only the hip measurement was done at the first exam, the patient would have been diagnosed as osteoporotic, but the follow-up results would have been inconclusive. If only the spine had been done by DXA, the compressed vertebra would have been missed because the BMD was similar to L3 and L4 which had overlying aortic calcification. Not only would the patient have been misdiagnosed, but the serial exams would have shown a non-significant 3% decrease. Only if a spine film had been done with the DXA would the serial measurements have been of use. The QCT results made the classification of low BMD accurately, identified the vertebral compression without an extra spine film, and documented significant bone loss even with the treatment. The clinical management of the patient is currently under review, with the possibility of adding a bisphosphonate to the current regimen of estrogen and calcium.

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