

TITLE

Vertebral shape: automatic measurement by MXA using overlapping statistical models of appearance.

CATEGORY

1st Choice:

New Techniques

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ABSTRACT CONTENT

PURPOSE: Morphometric vertebral assessment for vertebral fracture can be made from DXA images of the spine (MXA), but manual reference point placement used currently is time-consuming. Quantitative morphometric methods for classifying fractures may be unreliable for mild (Grade I) fractures, because subtle shape information is not used. This study aimed to accurately automate extraction of full vertebral shape, and produce a prototype clinical tool.

MATERIALS AND METHODS: A dataset of 98 DXA (mainly normal) images was obtained, and the vertebral body outlines were annotated manually from L4 to T7. Statistical models of vertebral shape and texture were derived, with the spine modelled by a sequence of overlapping vertebral triplets. The tool user fits the models to an unseen image by initialising a solution using three points. The algorithm then fits the best sequence of models to the image. "Miss-N out" tests were run to obtain estimates of accuracy, comparing the automatic and manual shapes.

RESULTS: A mean point-to-line accuracy of 0.75mm was obtained (on normals), well within the limits of manual precision, (95th percentile error of 1.6mm). This is significantly better than previous automatic approaches.

CONCLUSION: Detailed vertebral shape can be automatically extracted from MXA scans with good accuracy, although matching to the full range of fractured shapes requires further work. This will enable current quantitative methods to be extended by using the full shape and texture. This technique has the potential to be used in pharmaceutical trials, with considerable reduction in radiation dose.