AbstractID: 3582 Title: Three-dimensional reconstruction of an asymmetric vessel phantom using two x-ray projections

Purpose: Vascular lumen shape often predicts potential lumen occlusion and inadequate blood supply. Three-dimensional (3D) lumen information can facilitate diagnosis and interventional therapies. We present a technique for 3D reconstruction of asymmetric vessel lumens using two x-ray projections.

Method and Materials: Images were acquired of a contrast-filled vessel phantom with an asymmetric lesion. For two-view reconstruction, lumen diameters, lesion geometric characteristics in each view, and correspondence between views were determined using previously described methods. Intensity profiles across the vessel lumen were extracted along epipolar lines. The profiles were fit using an elliptical model, and the deviation from ellipticity was taken to correspond to intruding plaque. The fitted profiles from the two views were used to generate elliptical cross sections, and the plaque information was used to deform these cross sections asymmetrically. The 3D lumen was created by combining individual 2D cross sections along the vessel length. To verify the method, 3D reconstructions were obtained in two ways from a set of digital subtraction angiography (DSA) images of the phantom obtained using a high-resolution microangiographic detector (43 micron pixels): (a) using two orthogonal projections and our two-view method, and (b) using 180 projections and a Feldkamp algorithm. The two reconstructed lumens were superimposed and the root-mean-square (RMS) distance between the lumen boundaries and percent overlap of the lumen volumes were calculated.

Results: The RMS distance between the boundaries of the two-view and the micro-CT reconstructed lumens was less than 0.2 mm over the entire length of the vessel which had a diameter of 3.6 mm in non-lesion segments; the volume overlap was 94%.

Conclusion: Accurate 3D reconstruction of an asymmetrically stenosed vessel lumen was obtained using two radiographic projections as verified by comparison with microangiographic cone-beam CT reconstruction.

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