AbstractID: 7411 Title: Determination of pixel-value to x-ray path-length conversion factor from single angiograms.

Purpose: Currently, 3D vessel lumen data are available via intravascular ultrasound or multiple angiographic views. However, when the relationship between pixel value and x-ray path length through the vessel is known, the 3D lumen shape can be estimated from only a single view. Therefore, we have developed methods to determine this relationship from single angiograms.

Method and Materials: Angiograms are acquired, and vessel centerlines are indicated. Profiles are extracted perpendicular to the vessel centerlines. The background in each profile is estimated and subtracted, and the subtracted profiles are individually fit using elliptical models. The constants (K) relating pixel value to x-ray path length are determined from the elliptical fits. A histogram of these constants is generated, and the constant corresponding to the maximum in the histogram is taken as the final value for K. Blurring is taken into account and used to refine the value of K. The ensemble of vessel profiles is convolved with a Gaussian the width of which is varied iteratively. The Gaussian providing the best fit over the ensemble is taken as an estimate of the resolution function. We evaluated our technique using computed simulated x-ray images of cylindrical rods with blurring included, x-ray images of aluminum rods and of clinical coronary angiograms.

Results: In simulation studies, errors in K were less than 10% for signal to noise ratios as small as 5 and blurring of 1.0 mm widths. In phantom studies, the errors in K were less than 5%. For coronary vessels, K varies by less than 10% in three consecutive images.

Conclusion: These techniques provide values for K and should provide the basis for reconstruction of the vessel lumen from a single view.

Conflict of Interest: This study was supported by NIH Grant # HL052567 and Toshiba Medical Systems Corporation.