Coronary endothelial dysfunction is regarded an early stage of atherosclerosis and associated with plaque vulnerability. In atherosclerosis, a systemic disease, plaque progression and complications occur in a focal, patchy pattern. The main challenge remains to predict which segments of a given coronary artery will show accelerated progression of atherosclerosis and potential unstable plaque.

Endothelial dysfunction may play a key role in determining the location of the genesis and progression of segmental coronary atherosclerosis. The purpose of the present study was to investigate the association between segmental coronary endothelial dysfunction and plaque progression by using serial intravascular ultrasound (IVUS) imaging in patients with non-obstructive coronary artery disease.

AIM

Using intravascular ultrasound (IVUS) the present study was designed to test the hypothesis that within the same coronary artery, segments with endothelial dysfunction show accelerated progression of atherosclerosis compared to segments with normal endothelial function.

METHODS

17 patients with coronary endothelial dysfunction, defined as an attenuated increase, <50% in coronary blood flow in response to graded infusion of Acetylcholine (Ach) and at least one segment with epicardial endothelial dysfunction, were enrolled in the study. Coronary endothelial function was evaluated by intracoronary infusion of Ach at increasing concentrations (10-6 to 10-4 mol/L) in the left anterior descending coronary artery (LAD). Normalized mean total atheroma volume (TAVmean), percent atheroma volume (PAV) and changes of atheroma volume were assessed IVUS at baseline and 6-month follow-up (Figure 1).

RESULTS

Baseline Characteristics
Baseline characteristics of the patients are shown in Table 1.

Segments with Endothelial dysfunction
Follow-up TAV and PAV were significantly increased in the segments with coronary endothelial dysfunction compared to baseline (median (IQR): 2.70 mm³ (1.50 to 3.67) to 3.15 mm³ (1.59 to 3.98), p<0.009; 21.8% (20.5 to 29.7) to 28.5% (21.1 to 30.2), p<0.018 (Figure 2 & 3).

Segments with normal endothelial function
There were no significant changes in follow-up TAV and PAV in segments with normal coronary endothelial function at six months compared to baseline: 3.35 mm³ (1.78 to 4.89) vs. 3.27 mm³ (1.97 to 5.0), p=0.568; 21.5% (8 to 30.0) vs. 25.1% (19.6 to 28.7), p=0.102 (Figure 2 & 3).

SUMMARY

This study demonstrates that coronary artery segments with endothelial dysfunction show accelerated plaque progression compared to those with normal endothelial function, independent of the severity of endothelial dysfunction. Assessment of coronary endothelial function may help in location determination of sites with early coronary artery disease prone to accelerated plaque progression. The study suggests that aggressive medical therapy targeting improvement of endothelial function may have a potential role in slowing segmental plaque progression, complications and, thus, future cardiac events.