Intravascular ultrasound (IVUS) is a valuable adjunct to angiography, providing new insights in the diagnosis of and therapy for coronary disease. Angiography depicts only a 2D silhouette of the lumen, whereas IVUS allows tomographic assessment of lumen area, plaque size, distribution, and composition. The safety of IVUS is well documented, and the assessment of luminal dimensions represents an important application of this modality. Comparative studies show the greatest disparities between angiography and ultrasound after mechanical interventions. In young subjects, normal intimal thickness is typically $\approx 0.15$ mm. With IVUS, lipid-laden lesions appear hypoechoic, fibromuscular lesions generate low-intensity echoes, and fibrous or calcified tissues are echogenic. Calcium obscures the underlying wall (acoustic shadowing). The extent and severity of disease by angiography and ultrasound are frequently discrepant. Arterial remodeling refers to changes in vascular dimensions during the development of atherosclerosis. At diseased sites, the external elastic membrane may actually shrink in size, contributing to luminal stenosis. The interpretation of IVUS relies on simple visual inspection of acoustic reflections to determine plaque composition. However, different tissue components may look quite similar, and artifacts may adversely affect ultrasound images. IVUS commonly detects occult disease in angiographically “normal” sites. In ambiguous lesions, ultrasound permits lesion quantification, particularly for left main coronary disease. IVUS has emerged as the optimal method for the detection of transplant vasculopathy. An important potential application of ultrasound is the identification of atheromas at risk of rupture. The mechanisms of action of interventional devices have been elucidated using IVUS, and ultrasound is used by some operators to select the most suitable interventional device. IVUS–derived residual
plaque burden is the most useful predictor of clinical outcome. In restenosis after balloon angioplasty, negative remodeling is a major mechanism of late lumen loss. IVUS is not routinely used for stent optimization, and there is no consensus regarding optimal procedural end points. Ultrasound has proven useful in evaluating brachytherapy. New and emerging applications for IVUS are continuing to evolve, particularly in atherosclerosis regression–progression trials.

Intravascular Ultrasound
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