Assessment and Quantitation of Stent Results by Intracoronary Optical Coherence Tomography

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KEYWORDS

• OCT • Stent • Dissection • Malapposition

KEY POINTS

- Important characteristics that should be evaluated as part of a formal quantitative optical coherence tomography (OCT) analysis poststenting include stent expansion and stent malapposition; qualitative analysis includes the evaluation of tissue protusion, thrombus evaluation, and stent edge dissection.
- Stent expansion is expressed as the absolute minimum stent area (MSA) ratio, which compares the MSA with the reference lumen area or the mean stent area determined by volumetric analysis.
- Stent strut malapposition is present when the distance from the center of the blooming artifact of the stent to the surface of the lumen or adjacent plaque is greater than the sum of the known stent thickness and polymer thickness. Malappositon may also be reported as percent of total struts that are malapposed within the entire stent, or the percent malapposition area.
- Tissue protrusion can be described as percent tissue protrusion area, defined as the maximum tissue protrusion area divided by the stent area, and the residual effective lumen area, which is defined as the minimum lumen area within the region of tissue protrusion.
- Other OCT poststent qualitative evaluations include tissue protrusion (either plaque or thrombus) through the stent strut, semiquantitative thrombus evaluation, and stent edge dissection.
- Thrombus is defined as intraluminal tissue greater than 0.25 mm in diameter, with high backscatter and high attenuation (red-cell–rich thrombus), less backscatter with low attenuation (platelet-rich thrombus), or a mixture of both.
- Stent edge dissection is commonly observed on OCT; the severity of a dissection should be assessed by evaluation of dissection depth (intimal or into the medial); the angle of dissection flap; the residual effective lumen area inside of the dissection; and longitudinal length of the dissection.

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INTRODUCTION

Because most imaging data has been based on intravascular ultrasound (IVUS) studies,[1–8] the difference between optical coherence tomography (OCT) and IVUS should be recognized to better understand the results of OCT image analysis. The main difference between OCT and IVUS is a ten-fold better resolution with worse penetration.[9–11] In studies in which OCT and IVUS were compared in vivo, the mean differences in lumen area varied from 0.19 mm^2 to 1.15 mm^2; lumen area was consistently larger with IVUS than OCT, especially in smaller lumens and in nonstented segments.[12–16]

In addition to these differences in quantitative measurements, the incidence of certain qualitative poststent findings was more frequent with OCT. Kubo and colleagues[16] evaluated 100 patients with both OCT and IVUS and reported that the prevalence of tissue protrusion (95% vs 18%; $P<.001$), incomplete stent apposition (39% vs 14%; $P<.001$), stent edge dissection (13% vs 0%; $P = .0013$), and intrastent thrombus (13% vs 0%; $P = .013$) were greater by OCT compared with IVUS.[15–21]

Another important characteristic of OCT is that interobserver and intraobserver variability is better compared with that of IVUS.[16,22,23] The deviation between independent measurements of lumen area by IVUS was approximately twice as high compared with measurements by OCT.[16] Because the clearance of blood by flushing with contrast or dextran is required for OCT imaging, the border between the lumen and vessel structure is clearer than with IVUS, resulting in not only less variability of diagnosis, but also acceptable automatic contouring of the

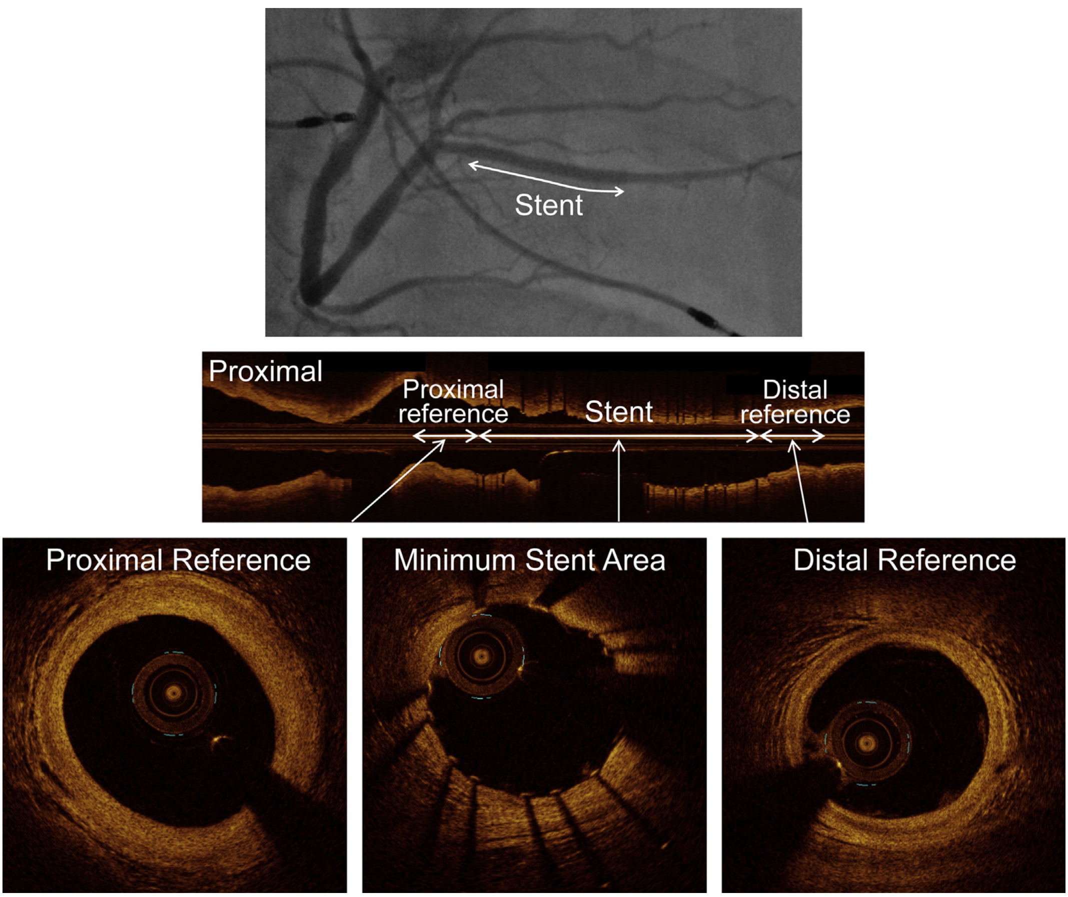

Fig. 1. Poststent OCT image with corresponding coronary angiography. After the entire stent segment is reviewed, the key slices having the minimum stent area, minimum lumen area, and proximal and distal most normal-looking slice are chosen and analyzed. The most normal-looking slices are defined as the slices having the largest lumen area within 5 mm of the stent edge but before a significant side branch. In this case, the minimum stent area slice is located in the middle of the stent.