

Treating Bifurcation Coronary Artery Disease

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For decades, percutaneous coronary revascularization has been a rapidly evolving discipline. Physicians who perform coronary interventions have demonstrated an insatiable need to address increasingly complex coronary artery lesions and industry has continuously provided the technology to make this vision a reality.

Bifurcation coronary artery disease remains a stubbornly challenging lesion subset, comprising 15% to 20% of all interventions. Bifurcation lesions are not homogeneous and, in fact, the differences within this population run a broad gamut. The severity of the disease in the main branch (MB) and side branch (SB), the absolute and relative diameters of the involved vessels, the amount and distribution of calcium and fibrous tissue in the lesion, the angle of the bifurcation, and the nature of the lipid pool in the vessel walls are only some of the factors that must be considered when devising a revascularization strategy.

The bare metal stent (BMS) gave way to the drug-eluting stent (DES) shortly after the introduction of the DES in 2003. Using historical outcomes of BMSs in bifurcation lesions, DESs are associated with a reduction in both target lesion revascularization (TLR) as well as major adverse cardiac events (MACE). It is generally accepted that these improved outcomes result from the DES-related reduction of new intimal proliferation.

Emboldened by improved outcomes with the DES, interventionalists have ventured into a far more complex spectrum of lesion subsets.

Improved outcomes have not led to unanimity in technical approach and application of DES technology. A point of major discussion remains the question of whether a single-stent strategy involving the MB or an upfront 2-stent strategy (MB and SB) should be the preferred approach.

Several recently published randomized trials suggest that there is no significant reduction in TLR or MACE with an upfront 2-stent strategy. Trials including CACTUS, Nordic, BBC ONE, and BBK suggest no improvement in restenosis rates between 1- and 2-stent strategies. One related conclusion that can be drawn from these trials is that there is generally no penalty for the addition of a second stent to treat SB disease when necessary.

Although the data allow operator preference to guide the selection between 1- and 2-stent strategies, the data are clear that final kissing balloon angioplasty is essential. With respect to both clinical and angiographic parameters, final kissing balloon angioplasty has been shown to improve both the short- and long-term outcome in bifurcation stenting, and this applies to both the MB and the SB.

The results of nearly a decade of intense study in the field of bifurcation coronary disease provided the foundation for a symposium at

the Transcatheter Cardiovascular Therapeutics (TCT) meeting in San Francisco, CA, on September 21, 2009. I was privileged to serve as co-moderator of this symposium with Dr. James B. Hermiller and there was an excellent panel comprised of Dr. Roxana Mehran, Dr. John Hodgson, and Dr. Timothy Sanborn.

This supplement to *Reviews in Cardiovascular Medicine* contains articles based on selected presentations from that symposium. The result is a thought-provoking summary of the current state of intervention in bifurcation coronary artery disease accompanied by insights into where we hope our field can go. Included are a superb review of present research endeavors, clinical practice patterns, and the clinical controversies that have been debated in editorial format during recent years. Also included is an excellent summary of current strategies under consideration for the development of dedicated bifurcation devices, some of which are drug-eluting devices and some which are bare metal iterations. The strides made in bifurcation disease therapy since 2003 provide tremendous promise for the future of our field.

This issue opens with an article by Drs. Adam J. Saltzman, Roxana Mehran, and George D. Dangas that addresses critical safety issues in the treatment of bifurcation coronary artery disease. There are a number of procedural and technical challenges

facing interventionalists when approaching a branching coronary geometry; these include negotiating the SB ostium, minimizing associated vessel injury, and scaffolding issues when deploying stents. The authors thoughtfully address how morphologic issues, including bifurcation angle and vessel architecture, affect and guide the selection of an appropriate bifurcation treatment strategy. They conclude their article with a comprehensive discussion of simple versus complex stenting strategies for the heterogeneous bifurcation lesion subset.

Dr. Timothy A. Sanborn thoroughly summarizes current bifurcation lesion classification schemes. These classification schemes are cumbersome and often confusing, making their clinical application less useful. To simplify our understanding of bifurcation classifications, the Medina scheme was proposed. This scheme employs a more straightforward nomenclature based on plaque involvement in the major anatomic segments surrounding the carina of the vessel. Sanborn concludes his comprehensive review of bifurcation classification schemes with a discussion of the Movahed classification. He describes this bifurcation classification scheme as “overcoming the shortcomings of other bifurcation classifications” by taking into account vessel morphology and proximal vessel size.

Dr. James B. Hermiller discusses contemporary bifurcation treatment strategies against the background of current slotted tube stent technology. No single approach can completely circumvent the limitations of current slotted tube stent platforms. Dr. Hermiller emphasizes the importance of operator familiarity with a variety of 1- and 2-vessel treatment strategies, including the provisional stent methodology. He notes that although there are no large bifurcation-specific trials studying DESs versus BMSs, there is mounting data that DESs significantly reduce

restenosis rates in both the MB and the SB. Moreover, there appears to be significant reduction in major adverse cardiac events with the DES strategy. Debate is ongoing as to whether a 1- or 2-stent strategy should be the preferred approach and multiple recent trials support a provisional strategy as the generally accepted default methodology for most coronary artery bifurcation lesions. Dr. Hermiller concludes his article by emphasizing that ready utilization of intravascular ultrasound (IVUS) and fractional flow reserve (FFR) may enhance optional stent deployments.

Drs. David Rizik and Kevin Klassen examine a variety of dedicated devices industry is currently developing for the treatment of bifurcation lesions. In this comprehensive review, the discussion focuses on the potential differences with which these devices may be used in bifurcation treatment; specifically, there are differences in the amount of coverage each device may provide to the SB ostium. There are also fundamental differences in that some of the dedicated bifurcation devices being developed are BMSs, whereas others are drug eluting.

Several of these devices are primarily MB implants, allowing simple access to the SB. These potentially offer a great deal of versatility for both 1- and 2-stent strategies. In contradistinction, several stents being developed primarily employ a “save the side branch” strategy, as they are primarily SB devices with no significant limb of metal offering MB scaffolding. Perhaps most intriguing are those devices that provide a marriage of these 2 approaches, extending a continuous limb of metal into the MB and into the SB.

Irrespective of the basic concept of a dedicated device, there can be no clear 1-size-fits-all technology—the wide variation in the nature of the bifurcation lesions themselves precludes this. What is clear is that the creativity and tenacity of our

partners in industry bodes well for their overcoming the clinical and regulatory hurdles that stand between their drawing boards and our patients.

In their article on adjunctive imaging modalities used in treating bifurcation lesions, Drs. Ismail L. Bekdash and John Hodgson discuss the utility of performing IVUS prior to intervention. IVUS assists the interventionalist in determining whether MB stenting alone is sufficient. The relative merit of each approach is discussed in detail. What is made clear is that angiographic data alone may be inadequate to determine the best approach.

This supplement to *Reviews in Cardiovascular Medicine* is an important compilation of current knowledge on the management of bifurcation coronary artery disease. Special recognition is due to each author for their time and expertise.

I would also like to offer my gratitude to the Dr. Mark Slater and the Research Staff at Scottsdale Healthcare Hospitals for their vigorous efforts and support of our ongoing clinical investigations in bifurcation coronary artery disease. Much pioneering work in the treatment of bifurcation coronary artery disease has been performed in our cardiac catheterization laboratory. I am proud to have headed the team that a decade ago was the first in the world to implant DESs when treating complex bifurcation coronary artery lesions. The work of Scottsdale Healthcare’s research team and cath lab staff has been crucial in our efforts to help make advances in the treatment of bifurcation disease a reality; I am grateful to each member of these teams. ■

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