

# An updated classification of bifurcation stenting technique: MADS 2

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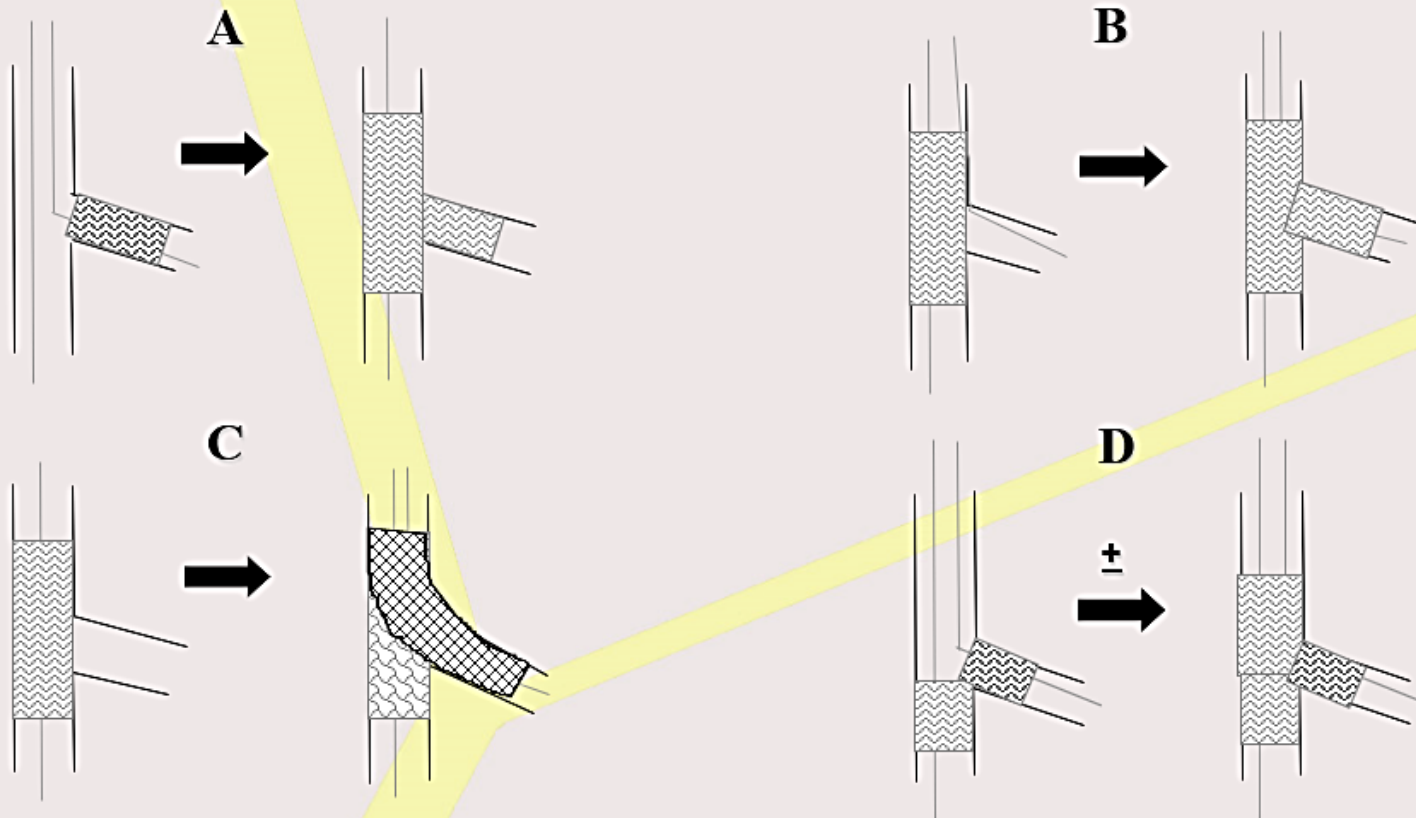
**No conflict of interest to disclose**

# Classification of coronary bifurcation treatments



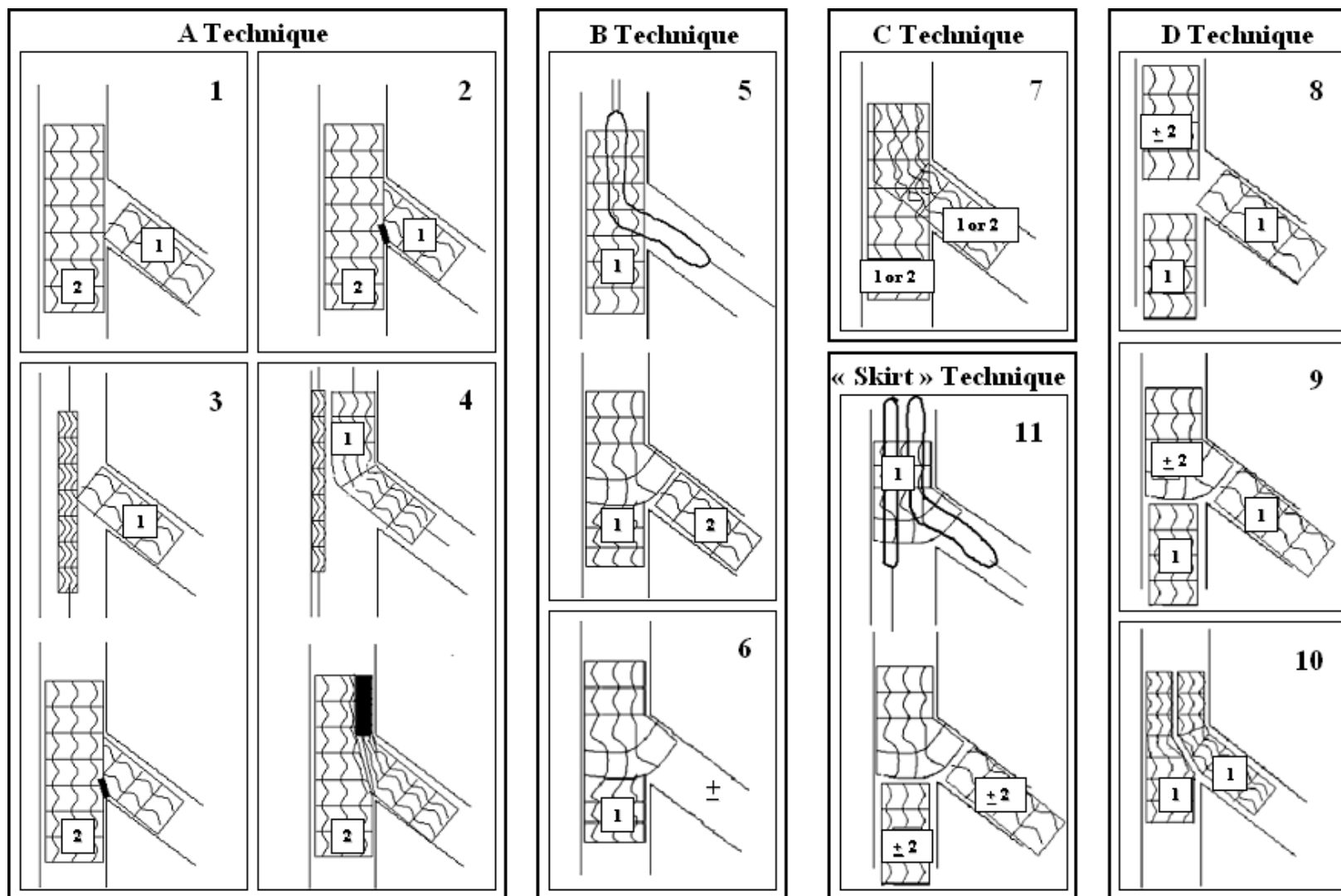
EUROPEAN  
BIFURCATION CLUB

## Classification of treatments



High Tech meeting 1997

# Classification of Treatments



## Why a classification of coronary artery stenting techniques ?

- one technique / single name and one name / single technique
- simplify description of techniques
- research classification
- randomized trial and audited registries
- teaching based on technical similarities inside families

## The ideal classification

- Open
- Simple:
  - visual
  - based on families

## Family classification: which families ?

- Number of stents ?
- Final aspect of the stented segment ?
- Strategy ?

## Classification of Coronary Artery Bifurcation Lesions and Treatments: Time for a Consensus!

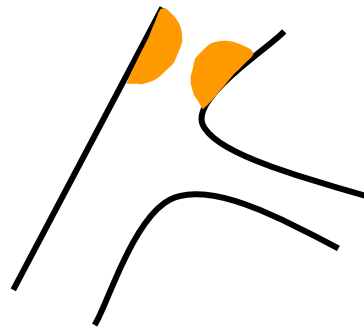
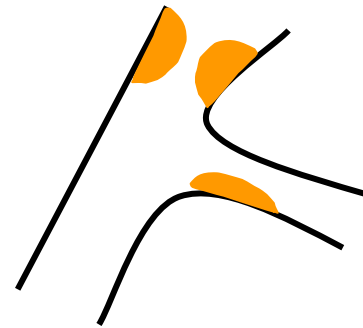
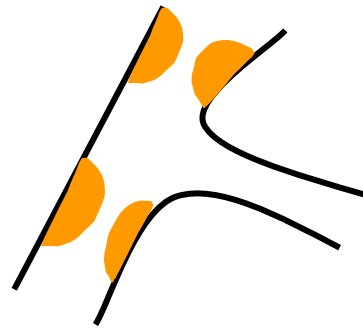
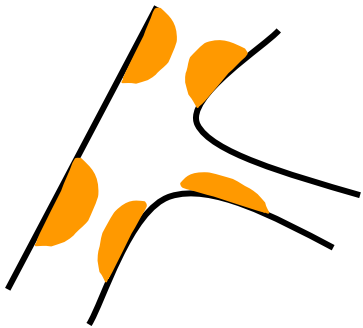
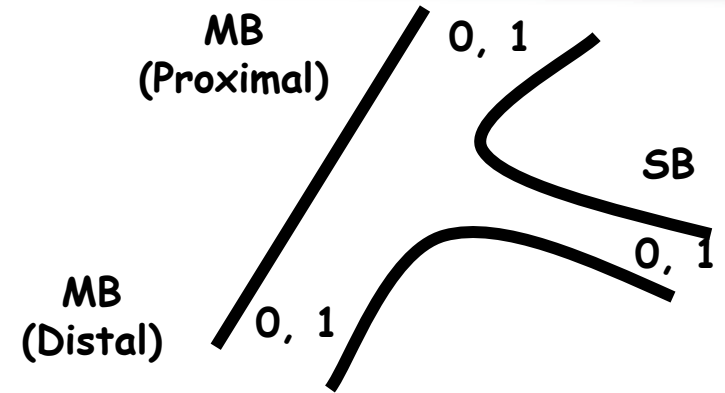
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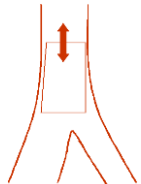
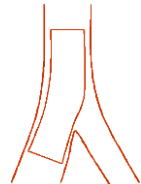
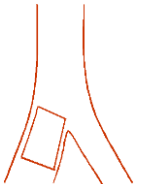
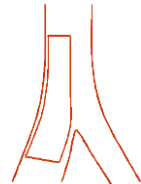
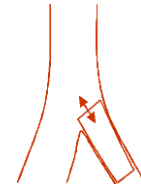
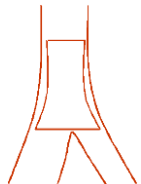
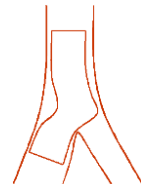
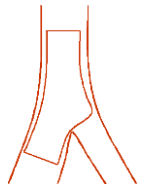
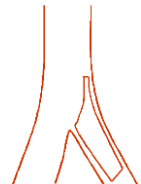
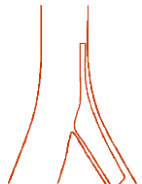
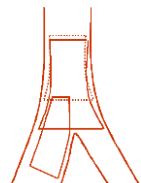
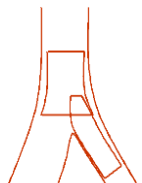
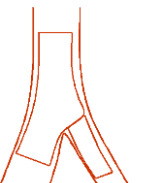
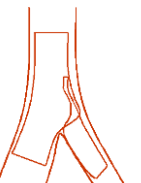
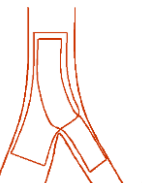
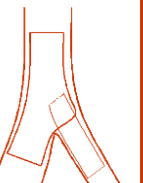
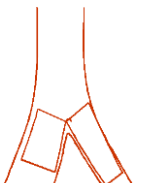
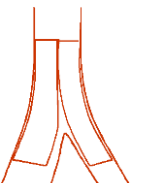
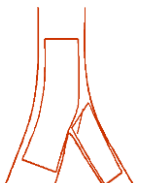
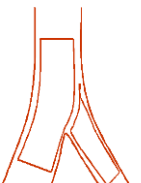
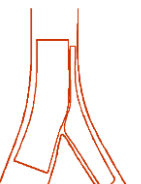
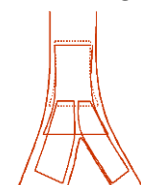
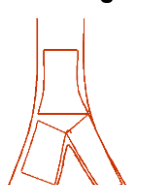
**Background:** Percutaneous coronary intervention (PCI) of coronary bifurcation lesions remains a subject of debate. Many studies have been published in this setting. They are often small scale and display methodological flaws and other shortcomings such as inaccurate designation of lesions, heterogeneity, and inadequate description of techniques implemented. **Methods:** The aim is to propose a consensus established by the European Bifurcation Club (EBC), on the definition and classification of bifurcation lesions and treatments implemented with the purpose of allowing comparisons between techniques in various anatomical and clinical settings. **Results:** A bifurcation lesion is a coronary artery narrowing occurring adjacent to, and/or involving, the origin of a significant side branch. The simple lesion classification proposed by Medina has been adopted. To analyze the outcomes of different techniques by intention to treat, it is necessary to clearly define which vessel is the distal main branch and which is (are) the side branch(es) and give each branch a distinct name. Each segment of the bifurcation has been named following the same pattern as the Medina classification. The classification of the techniques (MADS: Main, Across, Distal, Side) is based on the manner in which the first stent has been implanted. A visual presentation of PCI techniques and devices used should allow the development of a software describing quickly and accurately the procedure performed. **Conclusion:** The EBC proposes a new classification of bifurcation lesions and their treatments to permit accurate comparisons of well described techniques in homogeneous lesion groups. © 2008 Wiley-Liss, Inc.

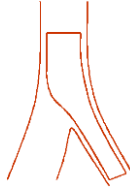

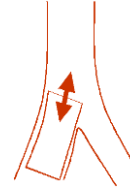
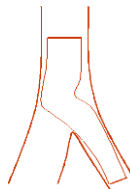
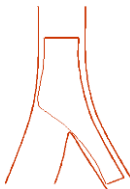
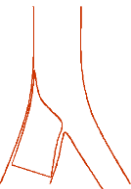
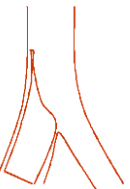
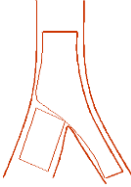

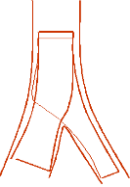
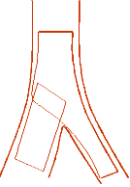



**Key words:** bifurcation lesions; QCA; classification of bifurcation lesions; classification of treatments



# Medina Classification



	<b>M</b> Main prox. first	<b>A</b> Main Across side first	<b>D</b> Double first	<b>S</b> Side branch first							
<b>1<sup>st</sup> stent</b>	 <b>PM stenting</b>	 <b>MB stenting across SB</b>	 <b>DM stenting</b>	 <b>Provisional SKS</b>	 <b>SB ostial stenting</b>						
<b>After balloon</b>	 <b>Skirt</b>	 <b>MB stenting + SB balloon</b>	 <b>MB stenting + kissing</b>	 <b>SB minicrush</b>	 <b>SB crush</b>						
<b>2 stents</b>	 <b>Skirt + DM</b>	 <b>Skirt + SB</b>	 <b>Elective T stenting</b>	 <b>Internal crush</b>	 <b>Culotte</b>	 <b>TAP</b>	 <b>V stenting</b>	 <b>SKS</b>	 <b>Syst. T Stenting</b>	 <b>Minicrush</b>	 <b>Crush</b>
<b>3 stents</b>	 <b>Extended V</b>		 <b>Trouser legs and seat</b>								

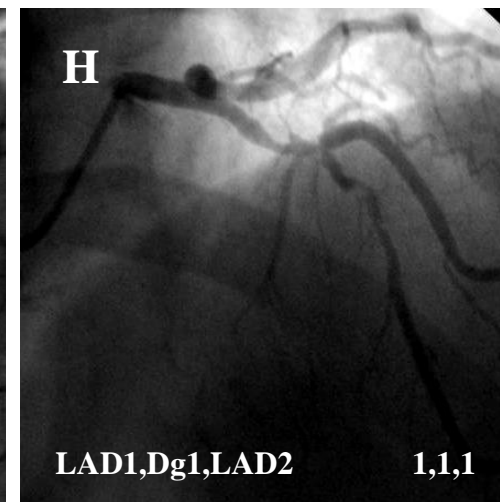
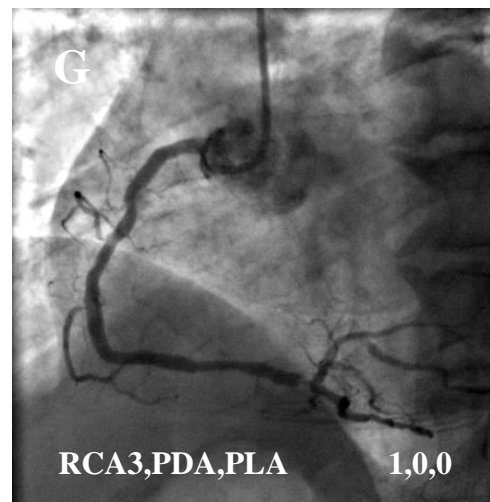
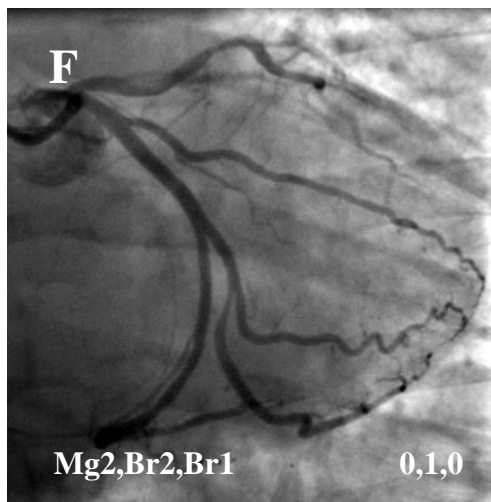
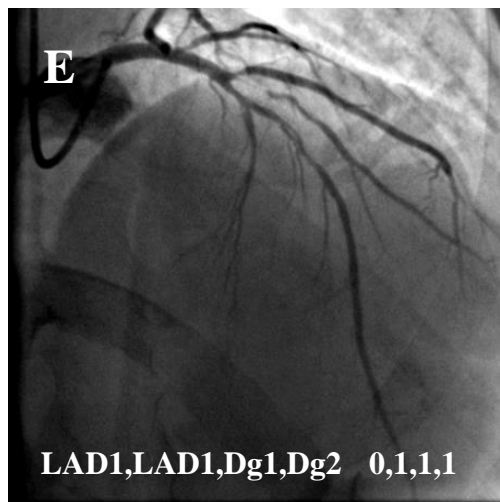
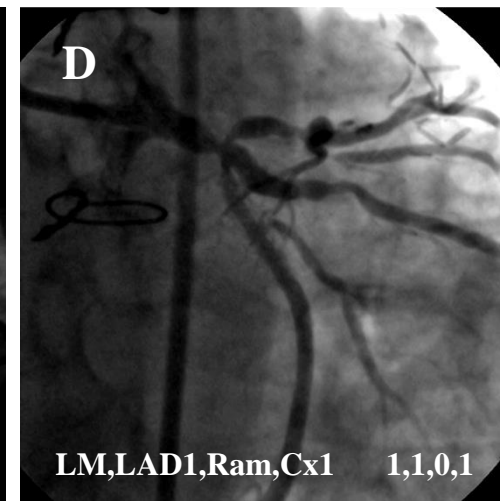
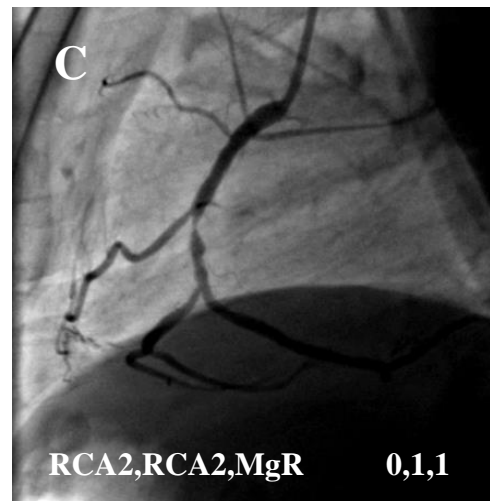
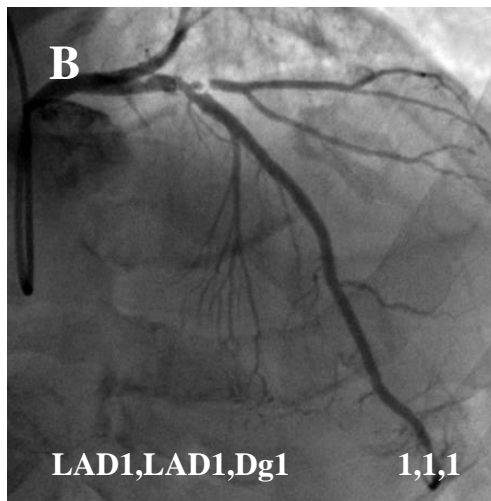
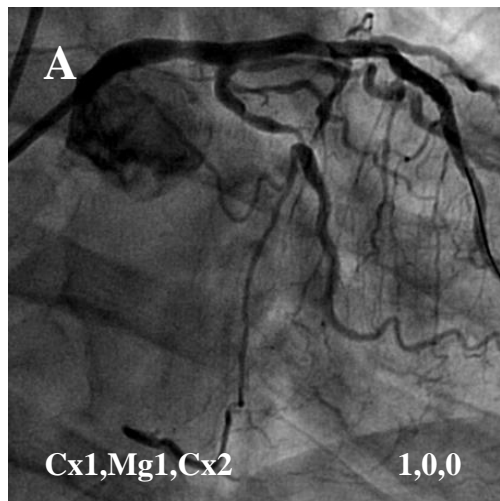
	<b>M</b> Main prox. first	<b>A</b> Main <b>A</b> cross side first	<b>D</b> Distal first	<b>S</b> Side branch first
<b>1<sup>st</sup> stent</b>		 Inv. MB stenting across SB	 Inv. Provisional SKS	 DM ostial stenting
<b>After balloon</b>		  MB to SB stenting + DM balloon      MB to SB stenting + kissing		  DM minicrush      DM crush
<b>2 stents</b>		    Inv. Elective T stenting      Inv. Internal crush      Inv. Culotte      Inv. TAP		   Inv. Syst. T Stenting      Inv. Minicrush      Inv. Crush
<b>3 stents</b>				

## Why to name a bifurcation lesion ?

It is important to define **before the procedure** which of the two distal vessels is the side branch ?

- to define the most important branch
- to define the technique: classical / inverted
- to define the **intention to treat**

## How to name a coronary bifurcation lesion ?



## Editorial Comment

### **Is a Rose Just a Rose?: Comment on the Classification of Coronary Artery Bifurcation Lesions and Treatments: Time for a Consensus!—Article by Louvard et al.**

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Members of the European Bifurcation Club have written on the need for the consensus regarding the classification of bifurcation coronary artery lesions and their treatment. The club has proposed a new system of naming of bifurcation lesions and their associated treatment approaches to delivering multiple stents in a systematic manner to permit accurate comparisons of well-described techniques in homogeneous lesion groups.

This extensive opinion article expertly identifies the quagmire of describing the bifurcation lesion anatomy and subsequent interventional technique used to stent these complicated lesions. Of course, several of the major types of bifurcations defy classification with particular critical outcomes. Such lesions include left main ostial (i.e. exceptionally short LM) and distal bifurcations, and nearly any trifurcation lesions in which no true minor side branch can be identified. Aside from this unique grouping, the approach to classifying lesions using the Medina Classification is fairly simple, describing proximal, distal, branch vessels coded by lesion presence or absence (e.g. LAD/Diagonal as 1, 0, 1 with lesion in proximal, none distal, and lesion in side branch). The angulation of side branches which may be relevant to success and outcomes is not included into the Medina Classification. Although many lesion characteristics such as length, eccentricity, and complexity are not described, quantitative coronary angiography (QCA) is strongly recommended. I would like to remind the angiographers that especially for bifurcation lesions, even QCA of a 70% diameter narrowing does not always constitute a clinically important stenosis necessarily deserving of treatment. Studies of fractional flow reserve in jailed side branches [1] and ostial segments of bifurcations [2] certainly support its strong clinical role in this setting.

The Branch Club addresses the complexity of coding the PCI techniques by the MADS nomenclature. Putting a stent into the Main branch or Across the side branch and/or into the Distal, and Side branches (MADS) incorporates descriptions of at least 20 different techniques such as the Skirt, Extended V, Elective T, internal crush, Culotte, TAP, V Stenting trousers, legs and seat; simultaneous kissing stents, T, minicrush, crush, inverted system T, inverted minicrush, inverted crush, etc. Needless to say, computerizing the database by which these lesions have been addressed would be an advance for data collection and perhaps lead to best clinical outcomes based on technique. Dedicated stents designed for bifurcations are forthcoming and the use of such classifications would indeed assist us in knowing who is best treated and by which technique.

As a clinician, it is difficult to appreciate exactly where and how many of these bifurcation techniques should be employed since the outcomes are so varied with much of the outcome depending on the anatomy and much of it depending on the operator. In the end, any classification system should be tied to clinical outcomes and thus justify the rationale for classifying certain lesions in the ways provided here.

I believe that the proponents of any classification system will attach the available clinical outcomes to each of their descriptions to enforce the fact that indeed these classifications may or may not vary in terms of approach, technical performance, and benefit. Otherwise, a bifurcation is just a bifurcation, something we certainly do not believe when confronted with this thorny problem in practice.

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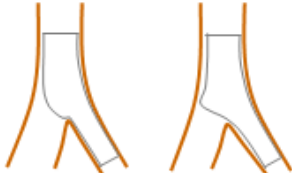


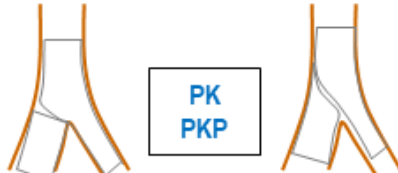
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# MADS 2

	<b>M</b> Main prox. first	<b>A</b> Main Across side first (Provisional)	<b>D</b> Double prox. lumen	<b>S</b> Side branch first
<b>1<sup>st</sup> stent</b>	 PM stenting			 SB ostial stenting
<b>Ballooning</b>	 Skirt (K)	   <div style="border: 1px solid black; padding: 2px; display: inline-block;">                     S PS PK PSP PKP                 </div>		<div style="border: 1px solid black; padding: 2px; display: inline-block;">                     S K                 </div>  Balloon SB crush
<b>2<sup>nd</sup>-3<sup>rd</sup> stent, (and further ballooning)</b>	 Extended skirt (K)	   <div style="border: 1px solid black; padding: 2px; display: inline-block;">                     K KP                 </div>	 V / SKS	<div style="border: 1px solid black; padding: 2px; display: inline-block;">                     PK PKP                 </div>  Intentional T stenting  Step/DK crush
<b>Dedicated Device:</b>	Axxess	Bioss LIM, Xposition Stentys, Nile SIR		Capella Side-Guard

# MADS 2

Inverted		<h2>Inverted A</h2> <p>Across distal main first (Inverted Provisional)</p>		<h2>DM</h2> <p>Distal Main first</p>
1 <sup>st</sup> stent		 <p>MB to SB stenting</p>		 <p>DM ostial stenting</p>
Ballooning		 <p>POT      Kissing</p> <div data-bbox="1095 639 1192 789" style="border: 1px solid black; padding: 2px; display: inline-block;">             PS PK PSP PKP         </div>		 <p>Balloon DM crush</p> <div data-bbox="1688 668 1785 746" style="border: 1px solid black; padding: 2px; display: inline-block;">             S K         </div>
2 <sup>nd</sup> stent (and further ballooning)		 <p>Inv. T      Inv. TAP      Inv. Culotte</p> <div data-bbox="1095 932 1192 1018" style="border: 1px solid black; padding: 2px; display: inline-block;">             K KP         </div>		 <p>Inv. Intentional T stenting      Inv. Step / DK crush</p> <div data-bbox="1688 939 1785 1018" style="border: 1px solid black; padding: 2px; display: inline-block;">             PK PKP         </div>
Dedicated Device:		<p>Tryton</p>		



**ORIGINAL STUDIES**

**Application of the MADS classification system in a “mega**

**Results:** Among 15,991 patients enrolled in the trial, 22,957 lesions treated at the index and staged procedure were available for analysis and 2,765 of these lesions were bifurcations. The e-CRF-based MADS classification was achieved in 2,759 of these lesions (99.8%). 80.3% of bifurcations were treated using a single stent, 18.8% using 2 stents and 1% using 3 stents. Overall, the “main across side first” approach (A) was used in 77.4% with the “side branch first” approach (S) being the second most frequently used technique (10.2%). A single stent was used in the majority of the “A” approach (88%). A reduction in the use of 2-stent techniques (from 33.9 to 18.8%) was observed between GLOBAL LEADERS and I-BIGIS. The “A” approach was the most frequently used technique in GLOBAL LEADERS, while in COBIS the “S” strategy was most frequently employed.

**Conclusions:** Application of the MADS classification through an e-CRF was feasible in the largest stent trial today and provided useful information about the trends observed overtime in the treatment of bifurcation lesions.

**1 | INTRODUCTION**

Bifurcation lesions remain one of the classic high risk lesion subset in interventional cardiology, with worse procedural success and complication rates and increased major adverse cardiac events during

follow-up compared with non-bifurcation lesion interventions.<sup>1-5</sup> As a consequence, the interventional treatment of bifurcation lesions is subject to ongoing debate and research.<sup>6-15</sup>

In the quest for the optimal management of bifurcation lesions with percutaneous coronary intervention, their angiographic

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**JACC STATE-OF-THE-ART REVIEW**

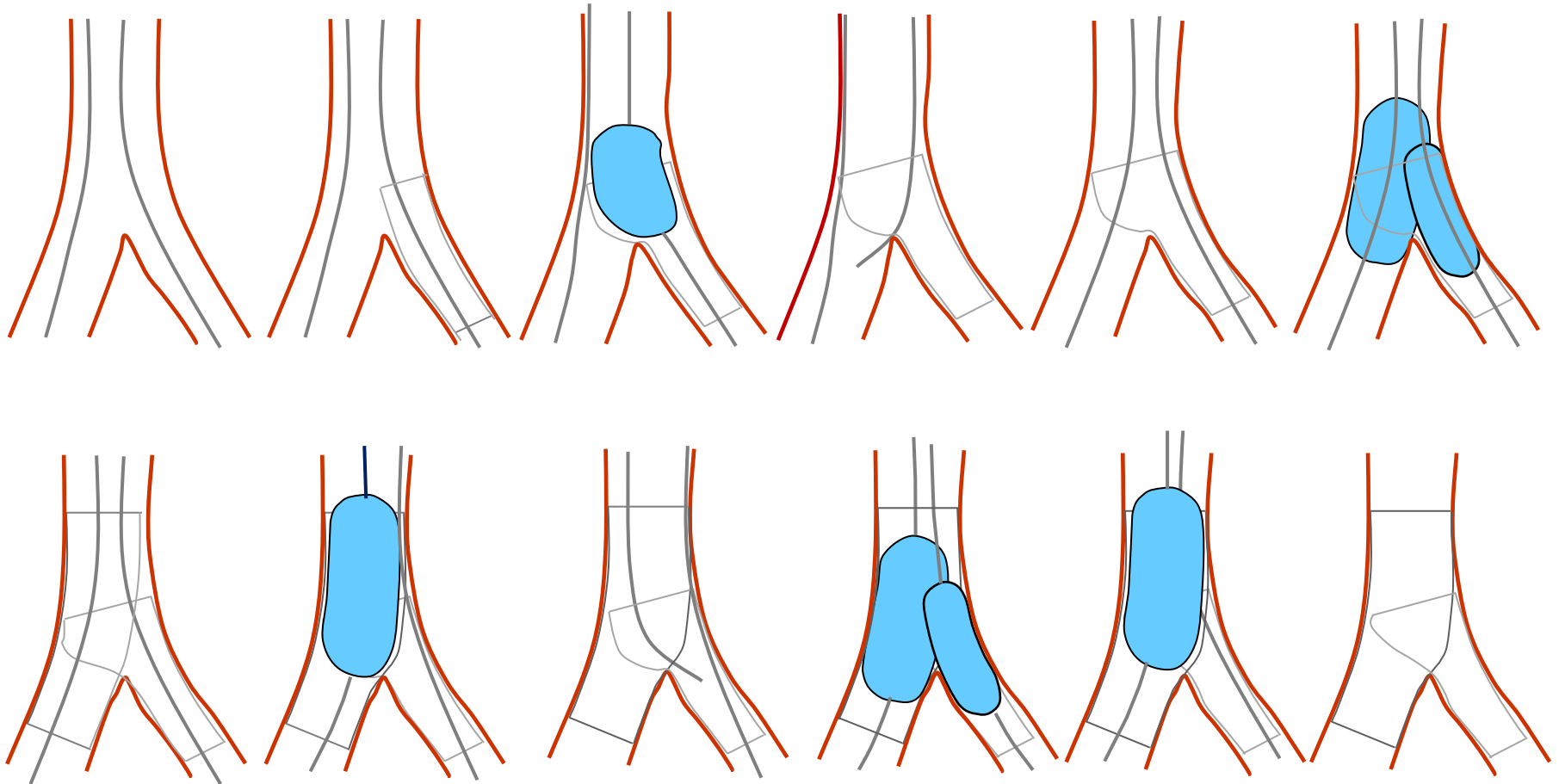
# Definitions and Standardized Endpoints for Treatment of Coronary Bifurcations

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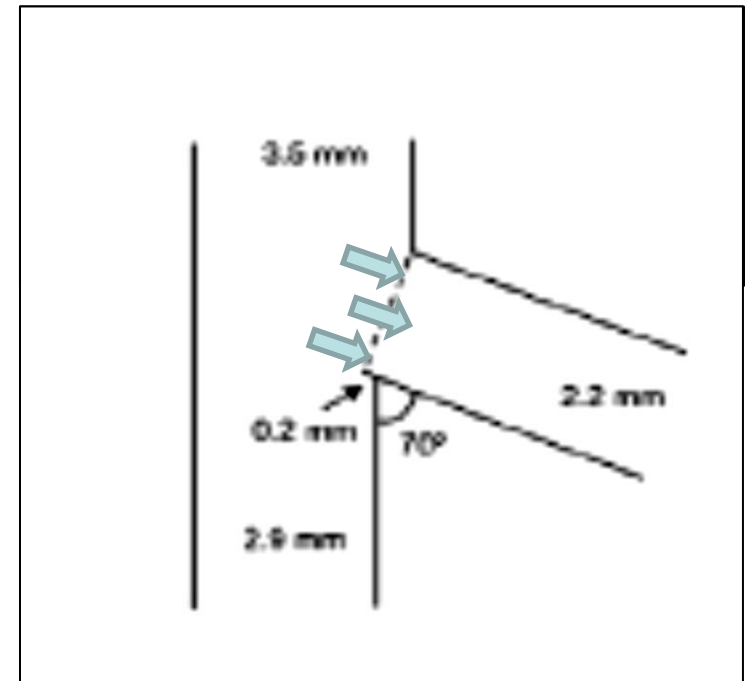
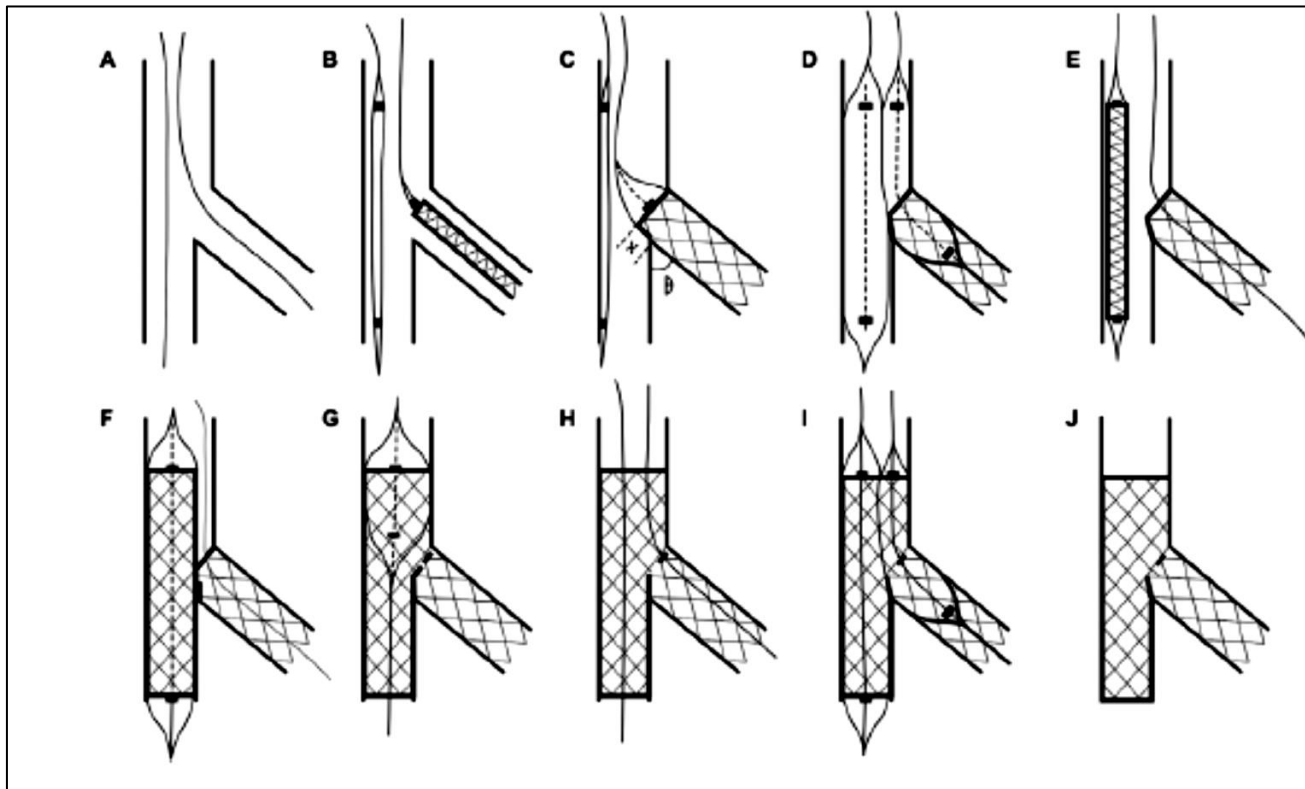
## Is MADS enough to describe the procedure ?: No !

- No description of lesion preparation
- No description of prevention and treatment of SB occlusion
- No description of complications and possible solutions
- No description of intravascular imaging (SB wire reentry site, stent deployment, apposition, overlap) or CT Scan, QCA ...
- No information about intravascular physiology
- No description of alternative treatment like DCB
- ...

## Mini inverted Culotte (« double provisional »)



## Double-Kissing Nanocrush for Bifurcation Lesions



Concertina (J. Ormiston)

## e-CRF filled immediately after the procedure / online / corelab

- Open
- « Easy and quick »
- Using schemas like in MADS (and EBC consensus) translated immediately in numerical datas
- Useful for CRO to verify the respect of protocol in randomized trial or perform « as treated » analysis
- Useful for massive registries to be analysed by artificial intelligence