Left Main and Bifurcation PCI: Dedicated Bifurcation Stents

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Disclosure Statement of Financial Interest

Physician Name	Company/Relationship
Eberhard Grube, MD	Medtronic: C, SB, AB, OF Direct Flow: C, SB, AB Mitralign: AB, SB, E Symetis: AB Boston Scientific: C, SB, AB Biosensors: E, SB, C, AB Cordis J&J: AB Kona Medical: E, AB Maya Medical: E, AB Abbott Vascular: AB Capella: SB, C, AB InSeal Medical: AB Valtec: E, SB Claret, SB

Design Approach

Fundamentally there exist two design philosophies:

1. Modified Provisional:

Objective: Provide sidebranch access without main branch compromise.

e.g. BSC petal, Abbott Frontier, Trireme Antares, Stentys.

2. Dedicated devices:

Objective: Provide treatment of the bifurcation segment using an anatomically considered design.

e.g. Cappella Sideguard, Tryton, Axxess.

1. Modified Provisional:

Pro's:

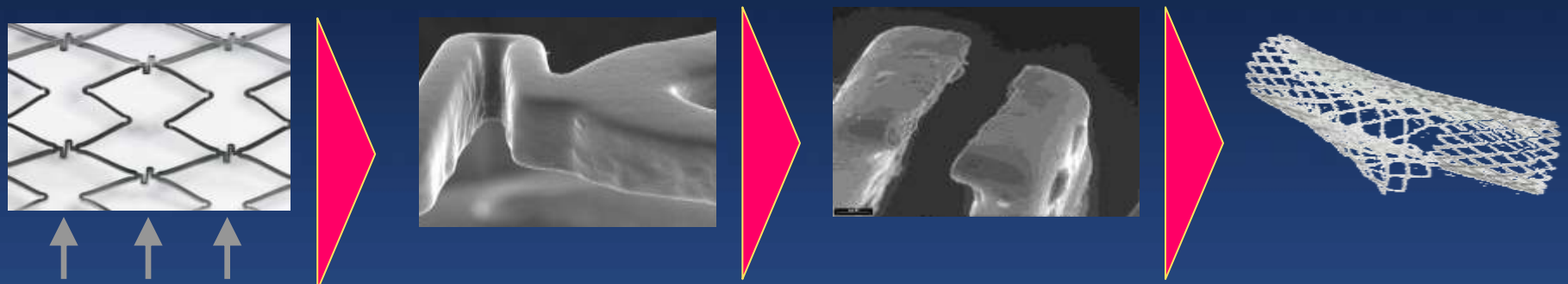
- Simplest design concept.
- Cost effective, single stent for majority.
- Conceptually easy to use.

Con's:

- Deliverability.
  - Guidewire twist, guidewire bias, technically more demanding

STENTYS® Technology

- Nitinol, self-apposing stent (BMS and DES)
- 6F single-wire, rapid exchange, CE-marking
- Disconnectable struts over full length*



Disconnectors along the stent

Disconnectable interconnector

Disconnection

** Except the first and last 2mm*

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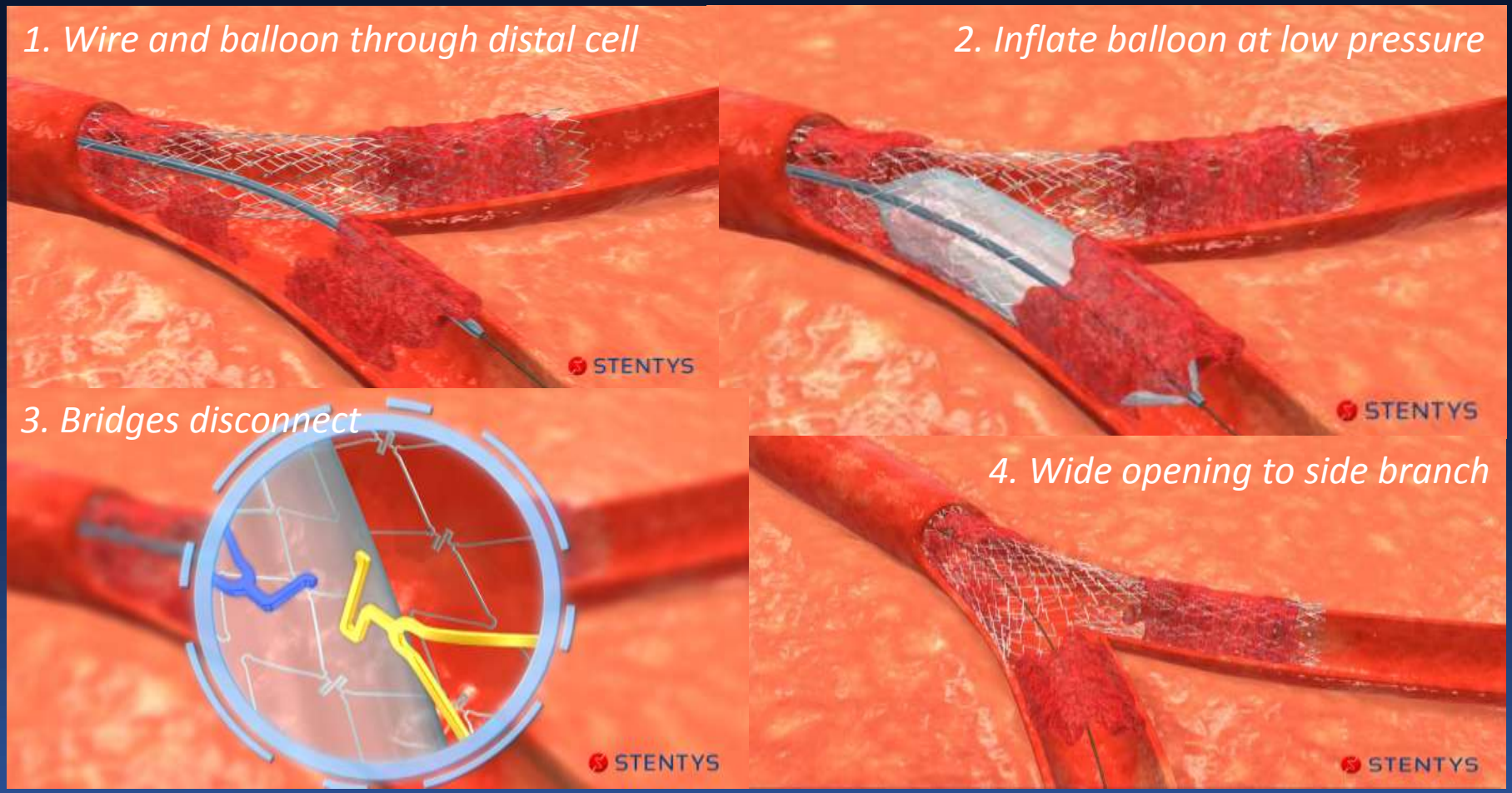
STENTYS Disconnection Technology



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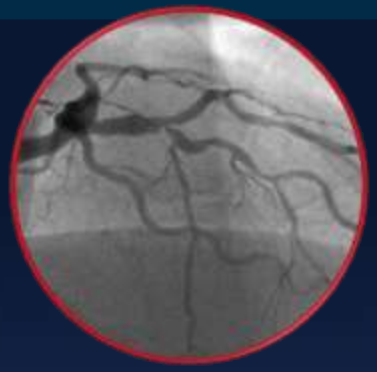
Current and next Indications

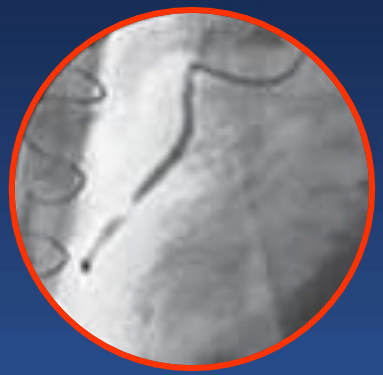
CE Marked indications

Acute Coronary Syndrome

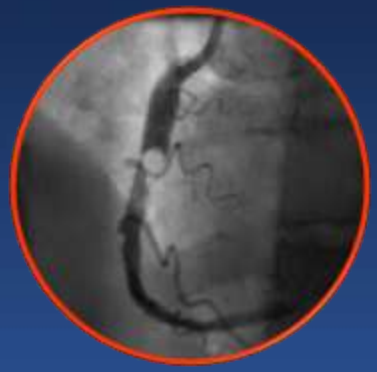


Bifurcation

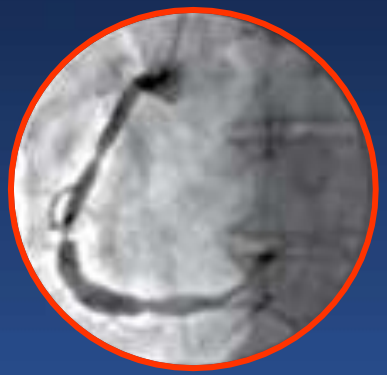
New indications



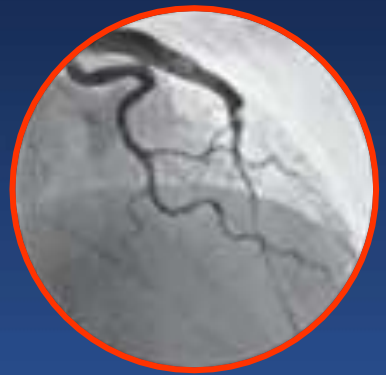
By-pass grafts



Large vessels



Ectatic vessels



Tapering vessels

STENTYS Clinical Program

APPOSITION (STEMI)	
I	**Feasibility trial**: Single Arm – STENTYS BMS (N=25) → 3 day and 6 month QCA and IVUS
II	**Randomized trial**: STENTYS BMS vs ABBOTT VISION/Medtronic Driver (N=80) → 3 day QCA and OCT, 6 month clinical
III	**"Real life" study**: Single arm – STENTYS BMS & DES (N=1000) → 30 day and 12, 24 month MACE
IV	**Randomized trial**: STENTYS Sirolimus DES(S) vs Medtronic Resolute (N=150) → 4 or 9 month OCT
V	**IDE - Randomized trial:** STENTYS BMS vs ABBOTT Multi-link (N=880) → 12 month TVF, IVUS/OCT sub-study – *ENROLLMENT IN PROGRESS*
OPEN (Bifurcation)	
I	**Feasibility trial**: Single Arm – STENTYS BMS & DES (N=60) → 6 month QCA and IVUS
II	**"Real life" study**: Single Arm – STENTYS DES (N=200) → 6 month MACE, OCT sub-group
ADEPT (SVG)	
SVG	**Randomized trial**: STENTYS BMS vs STENTYS DES (N=80) → 6 months QCA – late loss – *ENROLLMENT IN PROGRESS*
All-comers	
SIZING	All-comers registry: STENTYS BMS & DES in ACS (STEMI, NSTEMI) and stable patients (bifurcation, ectatic, tapered, aneurysm, SVG) (N=3000) – *ENROLLMENT IN PROGRESS*

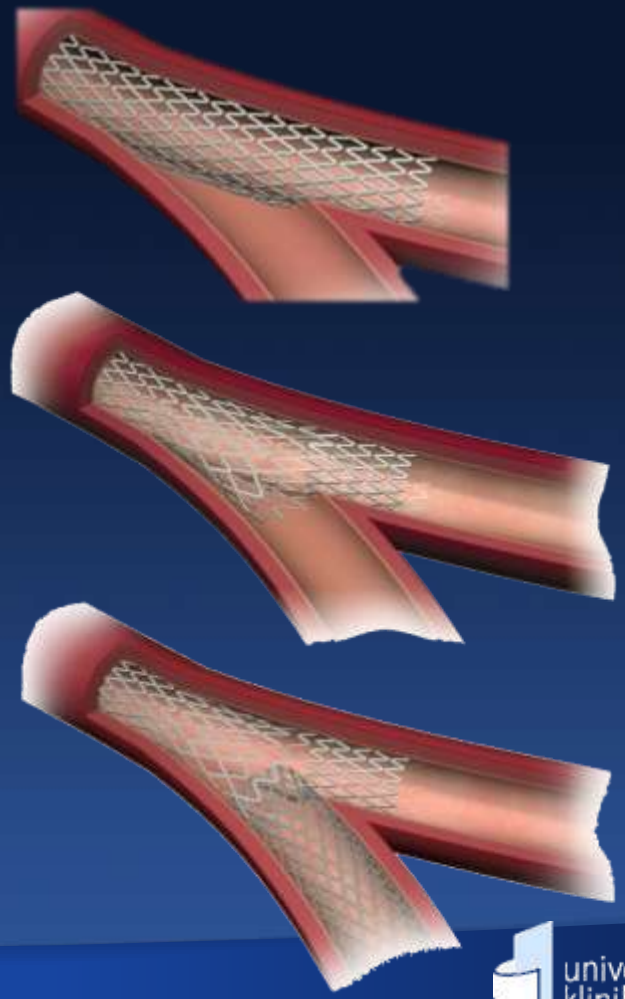
Reduce Complexity

3 Options in the Provisional Approach

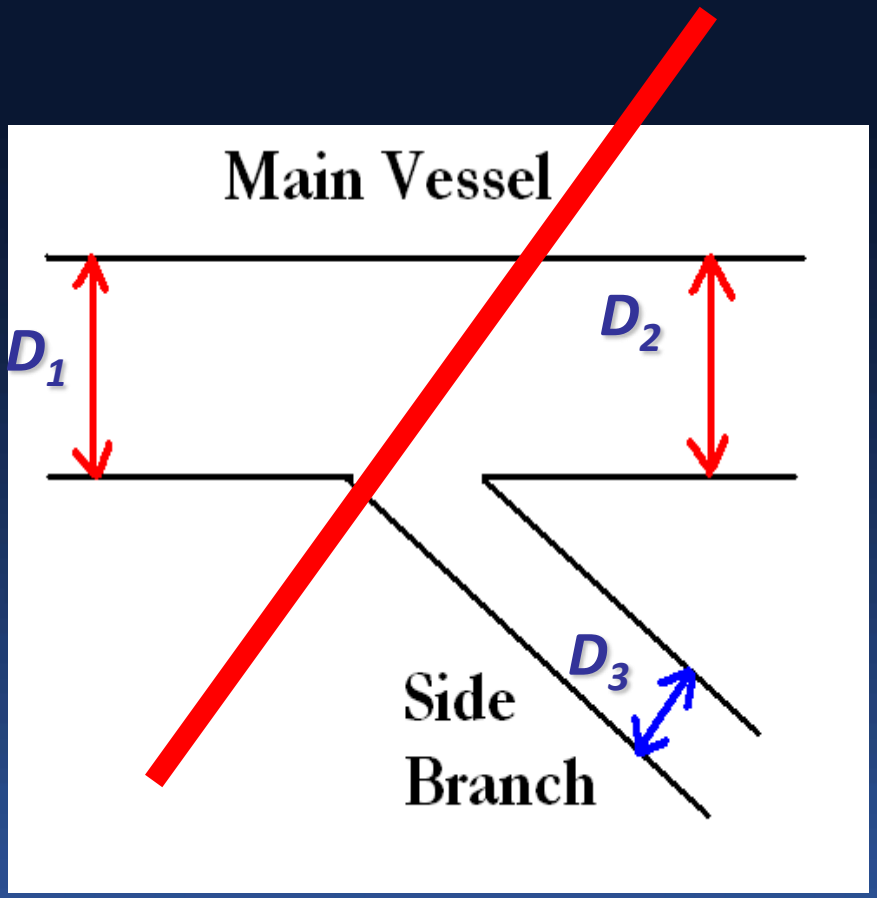
A. Deploy and STOP

B. Deploy and Disconnect

C. Deploy, Disconnect and Stent



Bifurcation sizing Dilemma



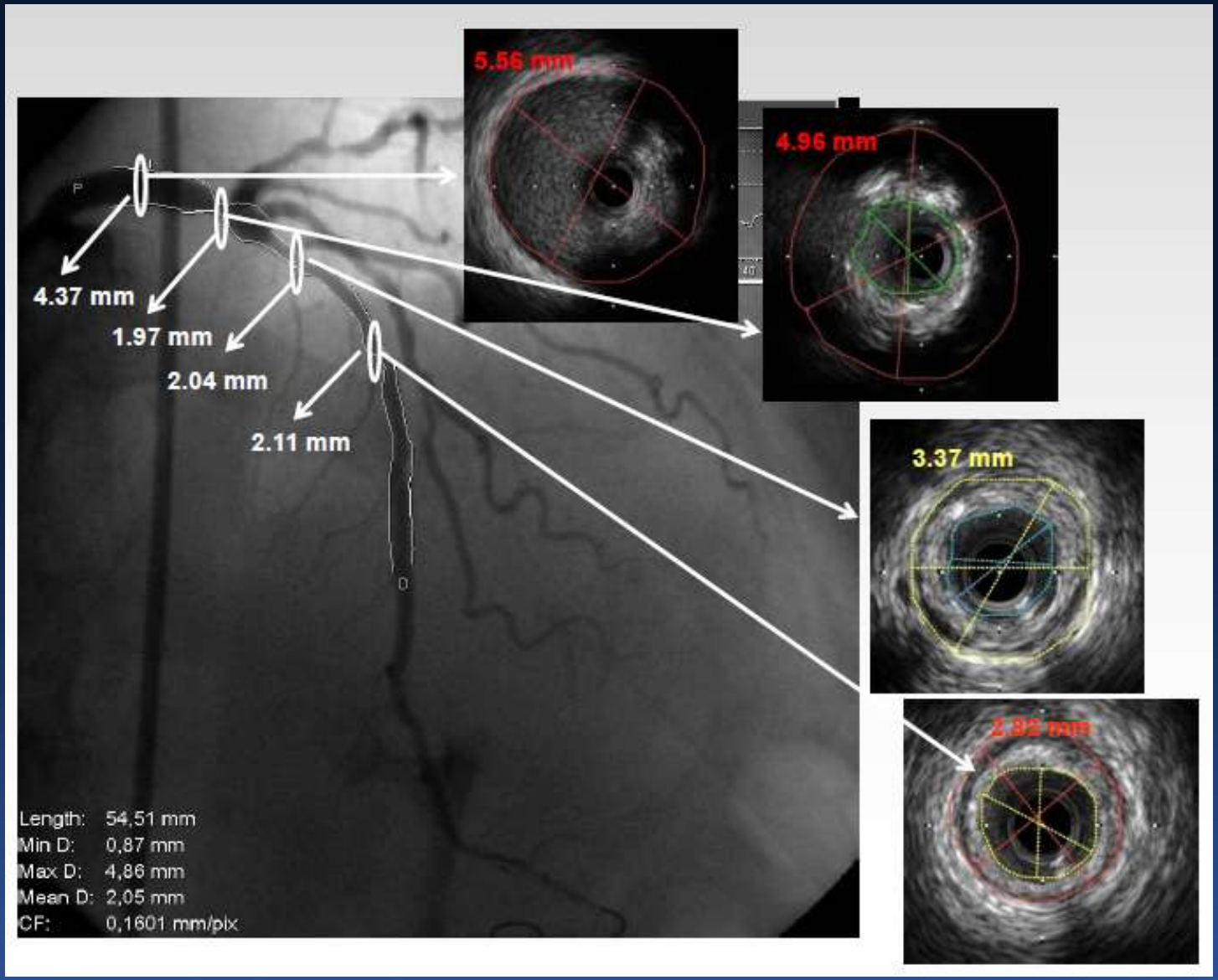
Finet's law

$D_1 = 0.678\ (D_2 + D_3)$

$D_1^3 = D_2^3 + D_3^3$ (*Murray's law*)

Adapted from Koo et al. EBC 2008

Case study



Courtesy Dr Briguori (9th EBC meeting)

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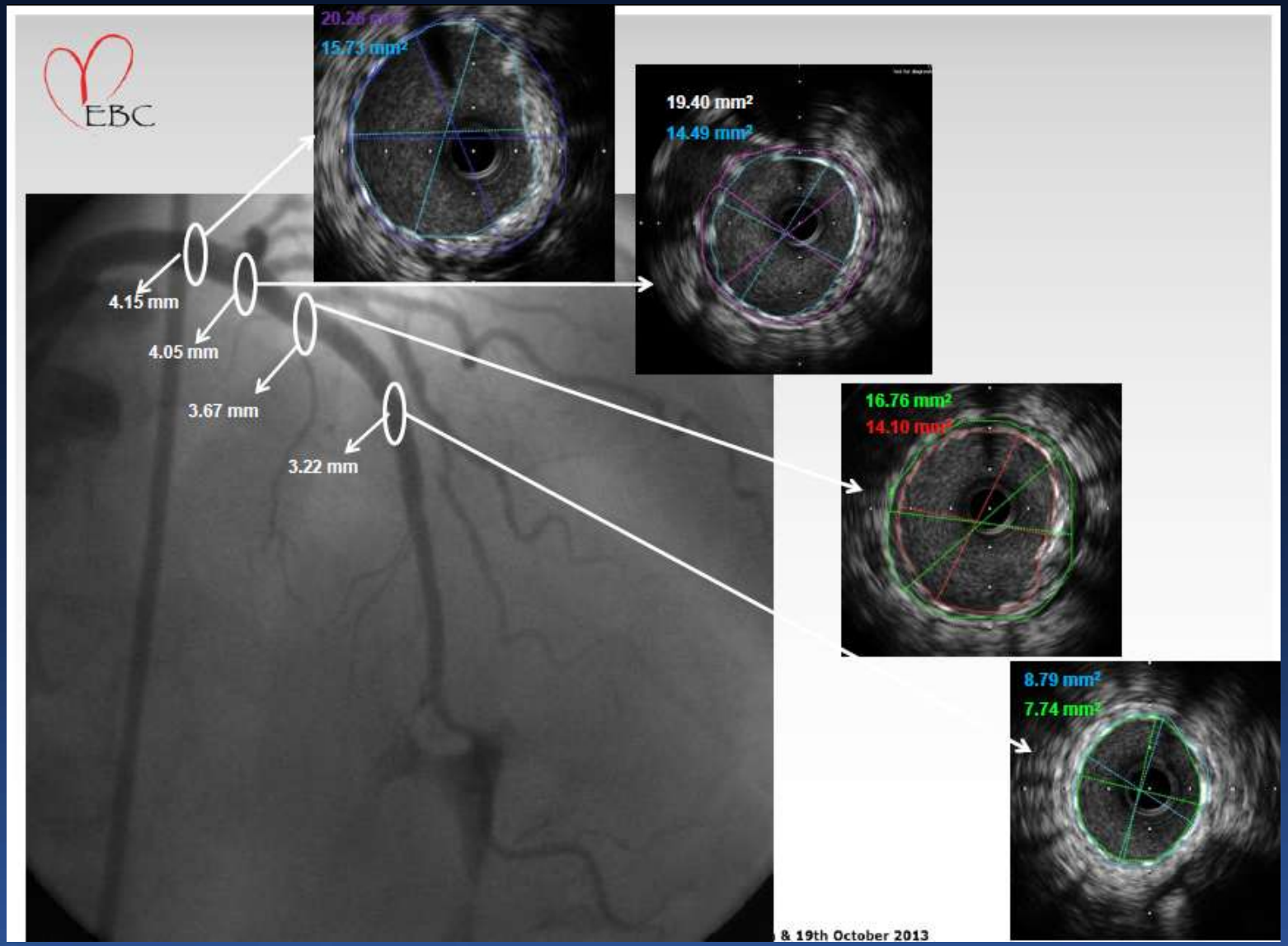
Case study: after STENTYS implantation



Courtesy Dr Briguori (9th EBC meeting)

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Take-home Messages

- Vessel tapering, stent sizing, and malapposition are some of the challenges in the treatment of bifurcation lesions
- The STENTYS Self-Apposing stent provides a simple provisional-approach to treating bifurcation lesions with adaptation to vessel size, excellent apposition and full sidebranch access
- Clinical data from OPEN I showed a 3.7% MACE at 6 months (1 TLR) with STENTYS DES(P)
- Data from OPEN II will provide results in a larger, real-life population

2. Dedicated Devices:

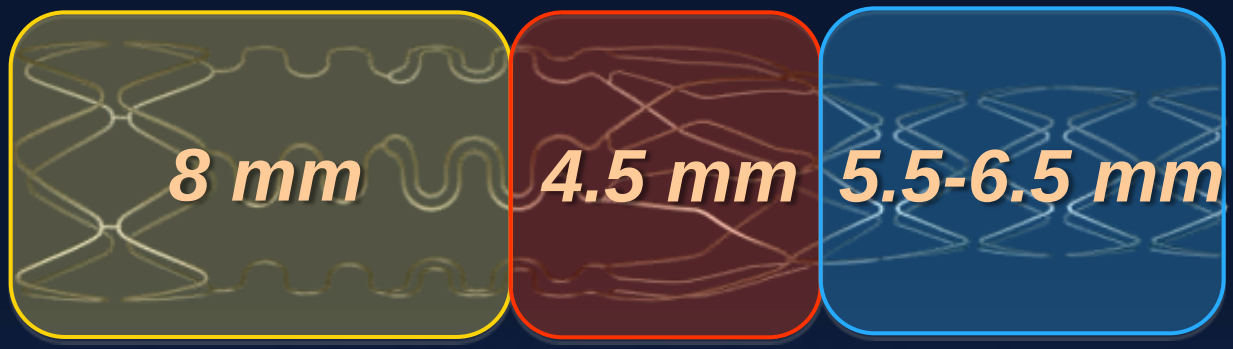
Pro's:

- Effective treatment of entire bifurcation anatomy.
- Minimal main branch impact.

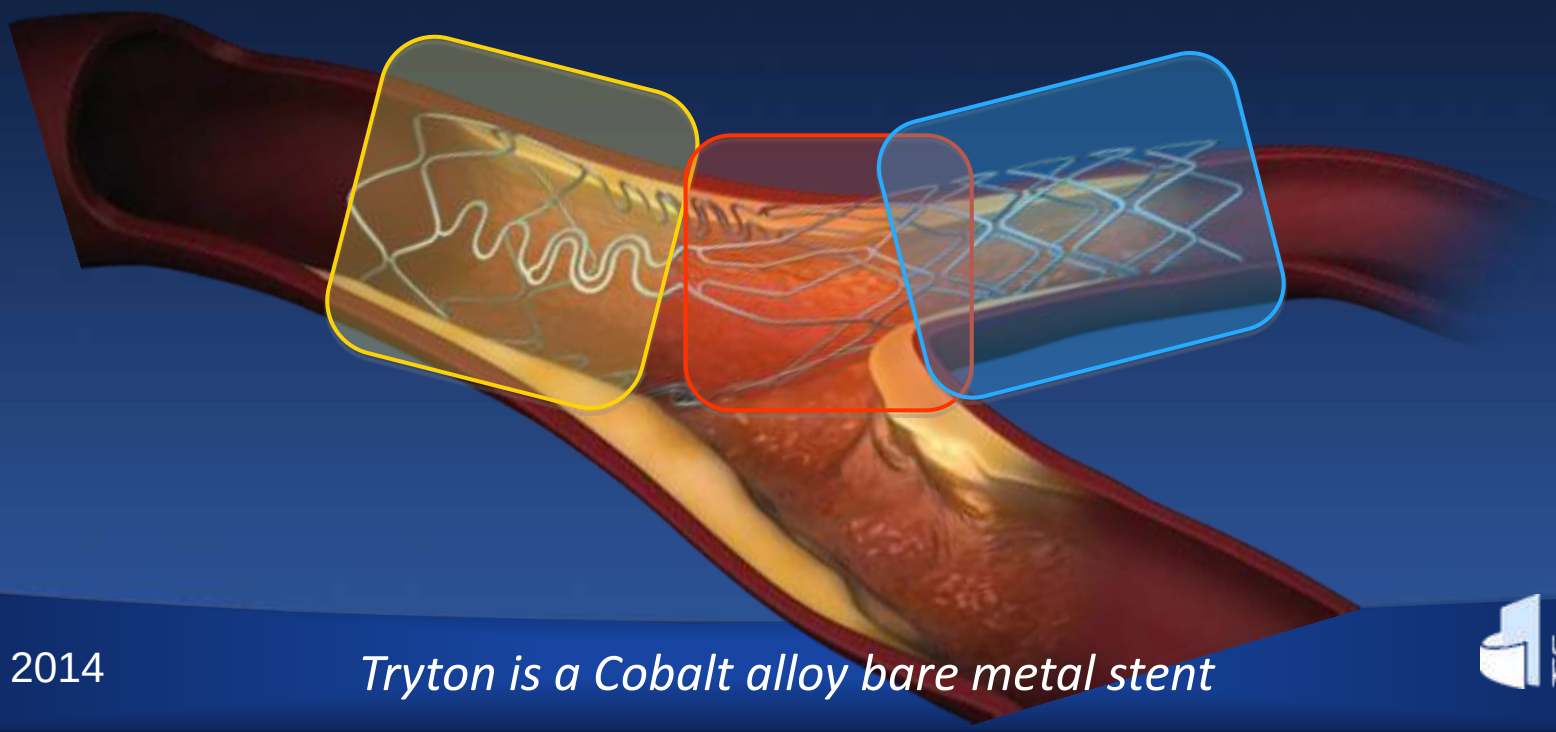
Con's:

- Price and Time since occ. 2 stents required.
- More complex design than modified provisional.

Tryton Side Branch Stent



Main Branch Zone *Transition Zone* *Side Branch Zone*



Tryton is a Cobalt alloy bare metal stent

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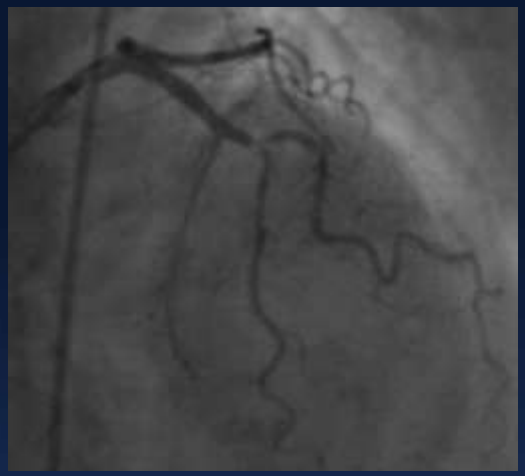
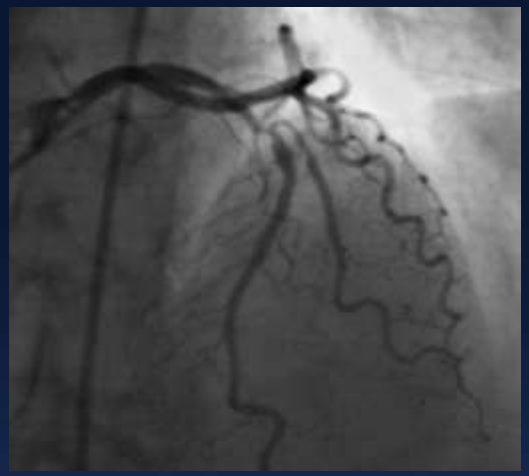
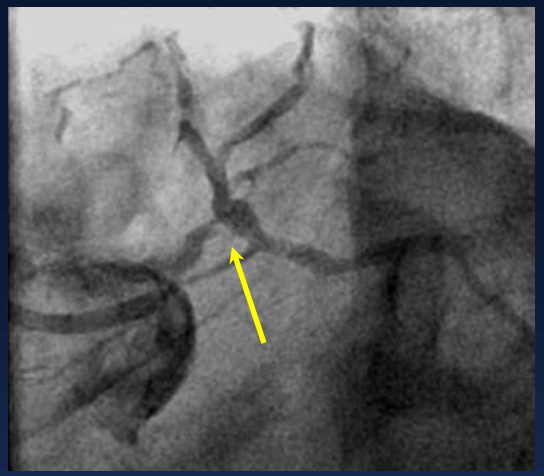
Tryton Cases

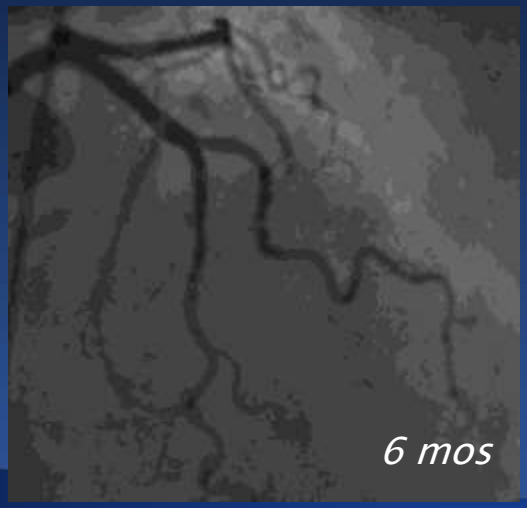
PRE

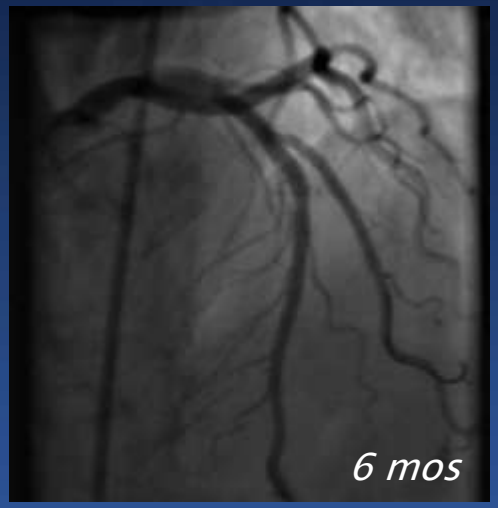


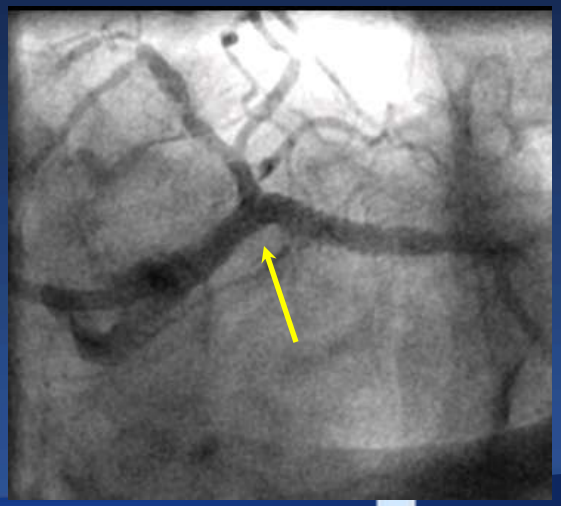




POST



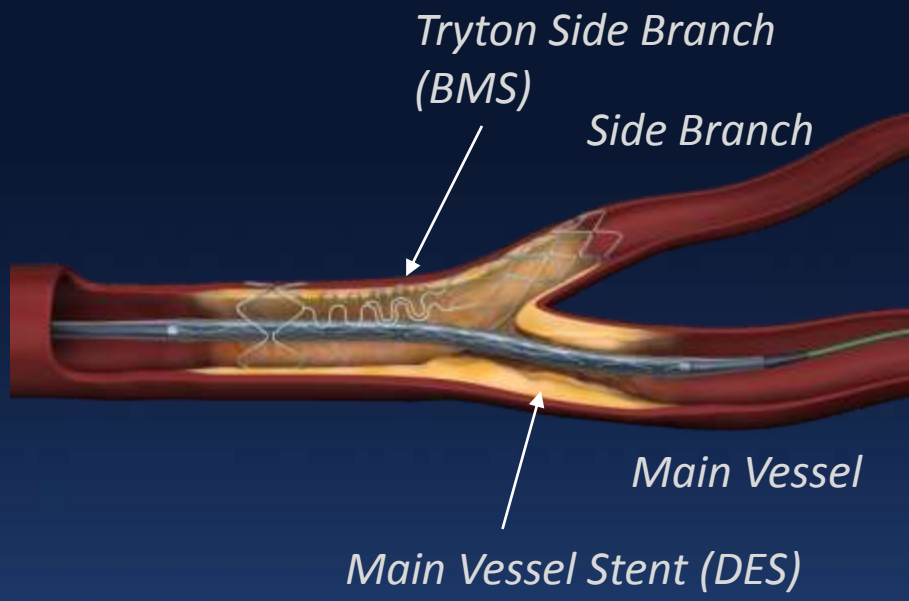




Tryton 1: Conclusions

- Tryton Side-Branch Stent when used in conjunction with a 'workhorse' DES
- Procedural Results:
  - Feasible
  - Excellent Safety Profile
- Six Month Results
  - Low Target Lesion revascularization rates (3%)
  - Low Late Loss at 6 months

	mm
Main Vessel (Proximal)	0.25 ±0.43
Main Vessel (Distal)	0.00 ±0.31
Side-Branch:	**0.17 ±0.35**



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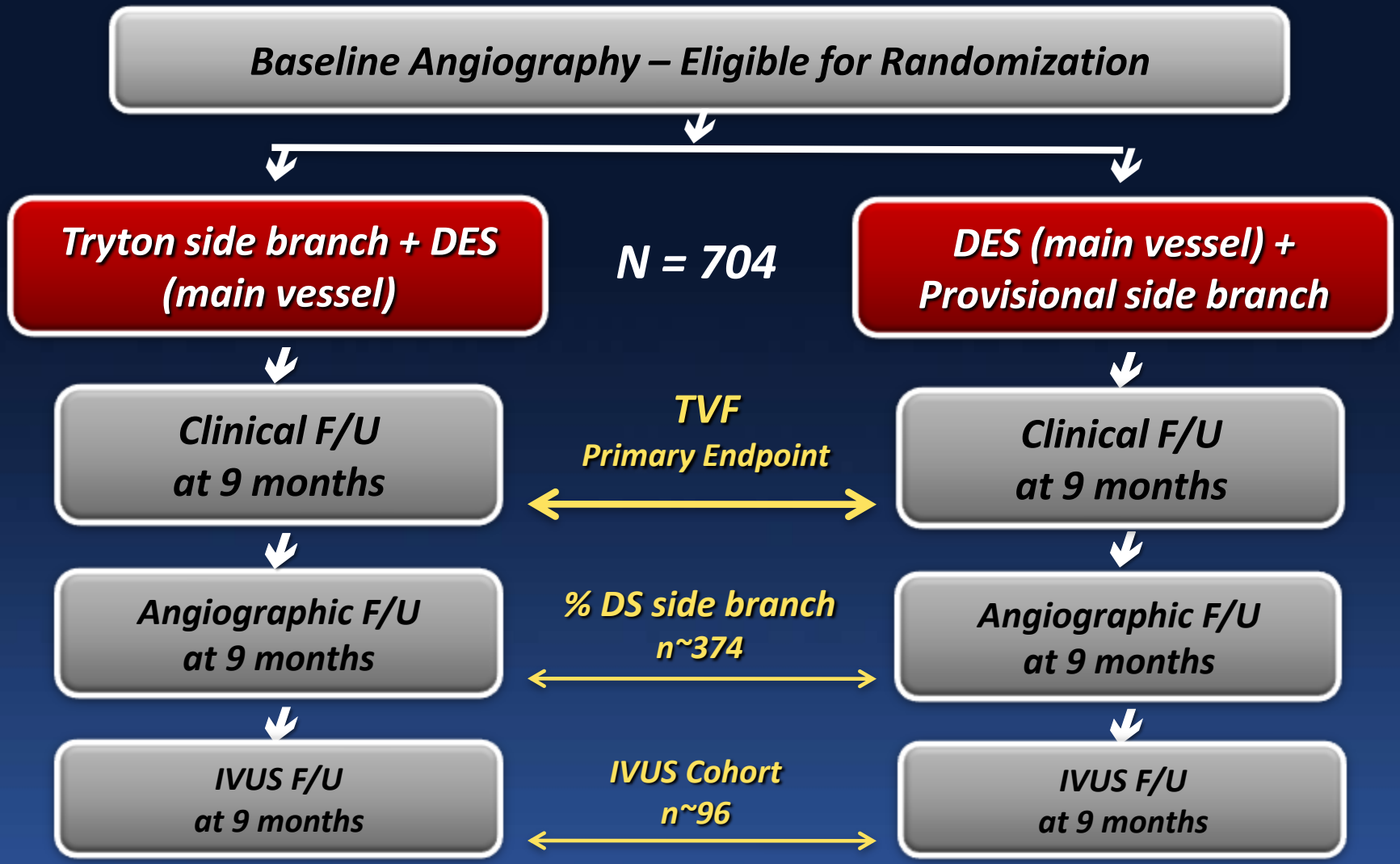
Tryton US-IDE Study Design



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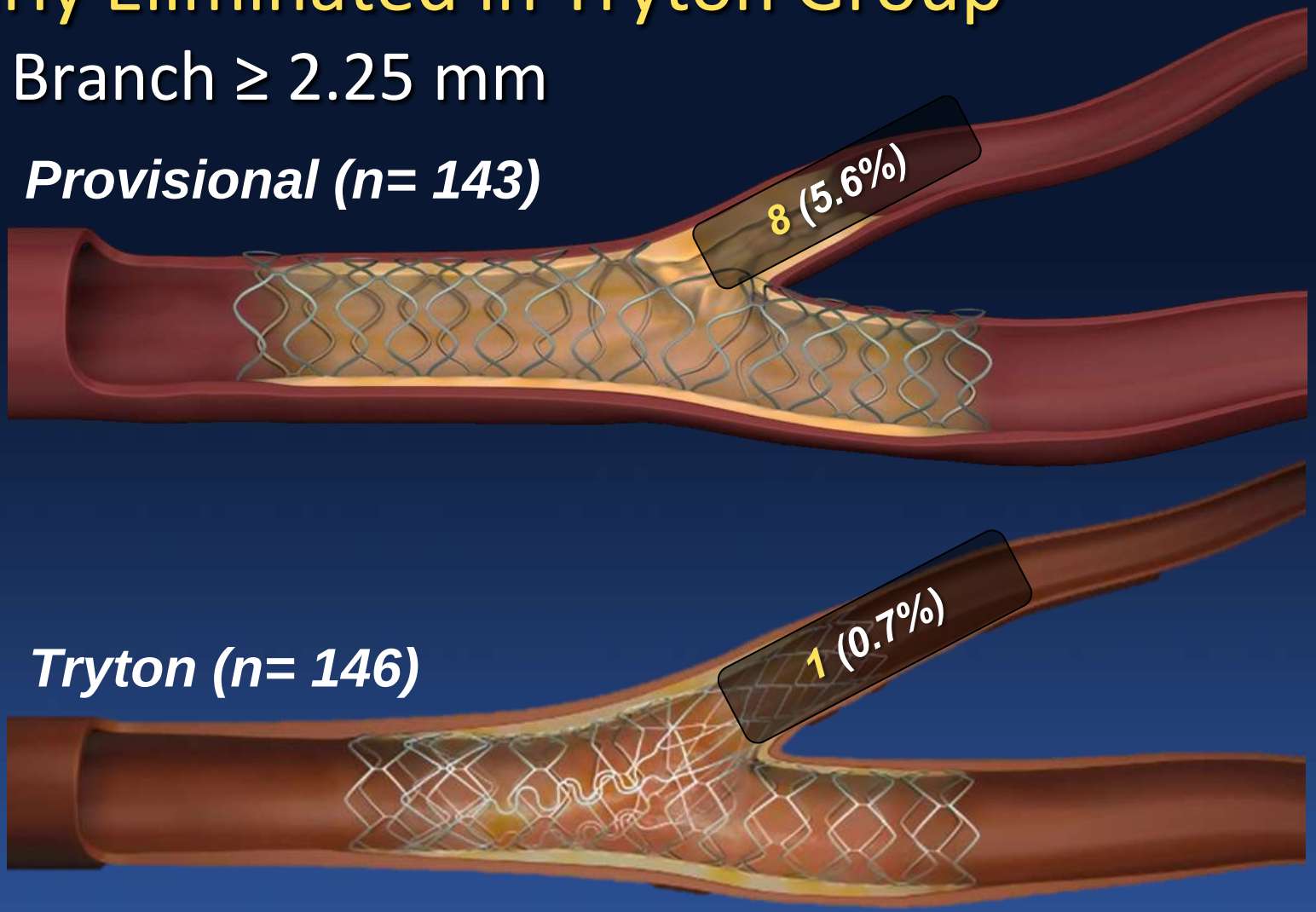
Conclusion TRYTON trial

- The Tryton two-stent strategy in true bifurcations (88%) compared with the provisional strategy (8.0% side branch stents) *did not meet the non-inferiority clinical endpoint (TVF)*, due to a relatively higher frequency of small peri-procedural CK-MB elevations.
- However, both strategies were safe (rare clinically significant MIs and stent thrombosis) and both had low 9-month clinically-driven TVR (P:3.6%,T:4.7%).
- Tryton improved side branch % diameter stenosis at FU (secondary endpoint; P=0.002)

Side Branch Bail Out Stenting

Nearly Eliminated in Tryton Group

Side Branch ≥ 2.25 mm



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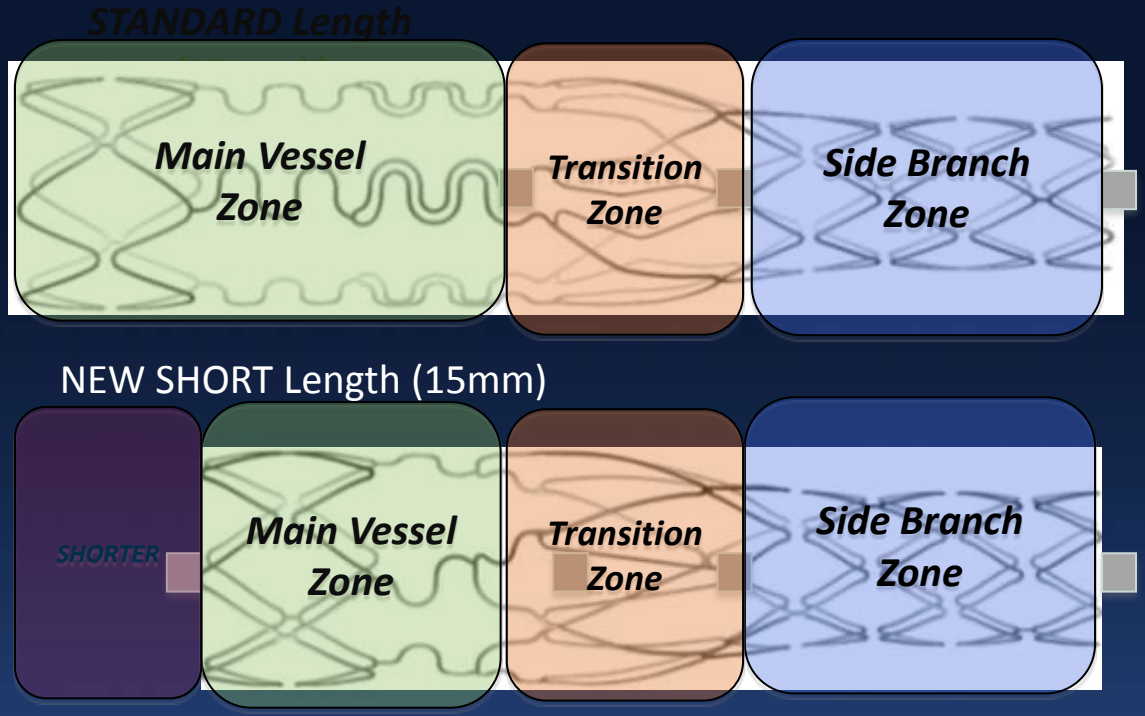
SHORT
Product Details



New Design Features

- *Stent Design: 3 mm shorter main vessel zone*
- *Markers Position Optimized for Large Vessels*
- *Improved delivery system*

** Large vessels sizes*

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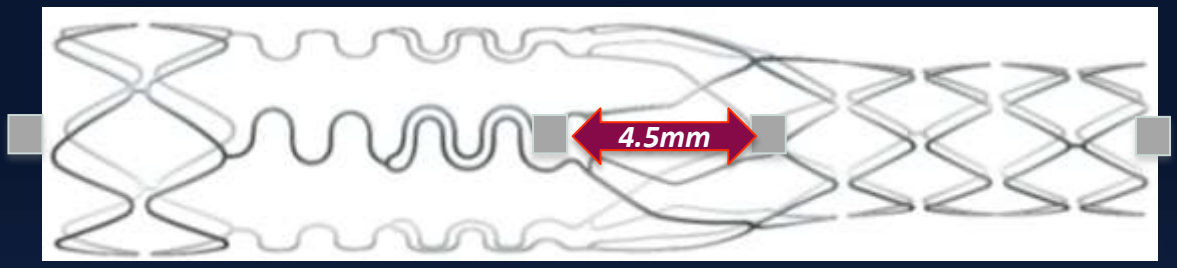
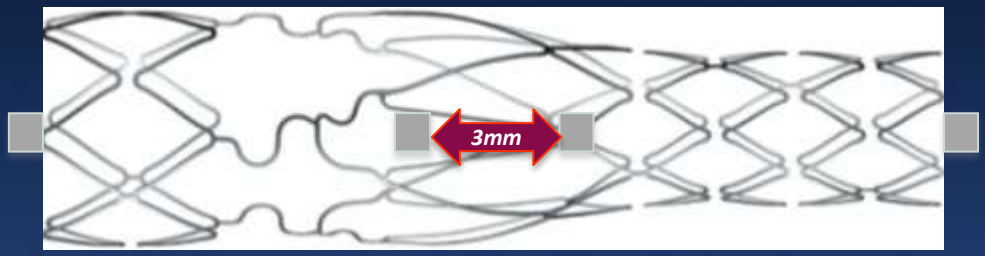
SHORT
Product Details

*STANDARD Length (18mm)**



NEW SHORT Length (15mm)



New Design Features

- *Stent Design: 3 mm shorter main vessel zone*
- *Markers Position Optimized for Large Vessels*
- *Improved delivery system*

* Large vessels sizes

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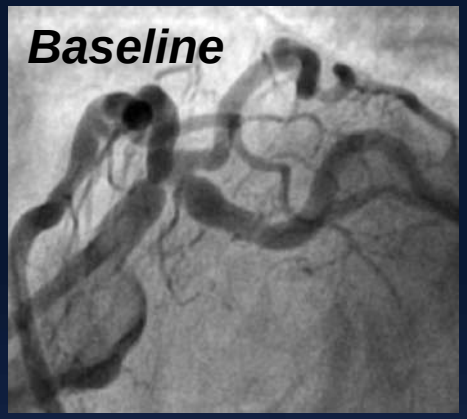
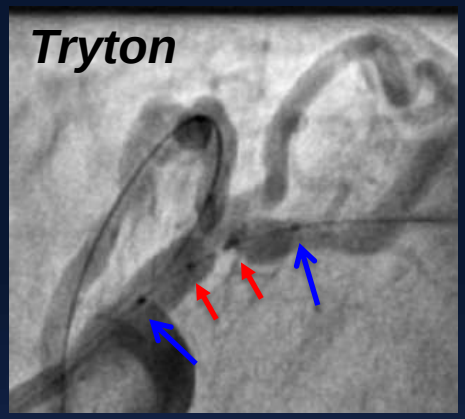
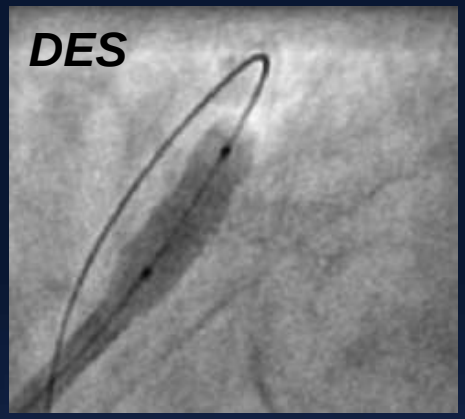
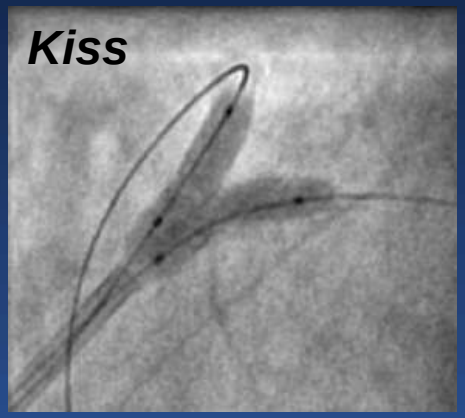
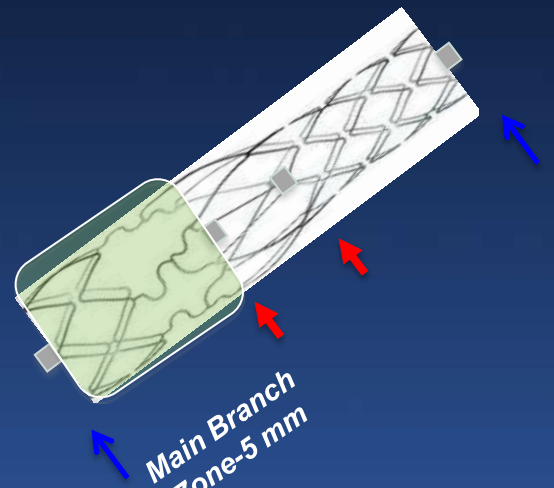
Left Main Treated with SHORT

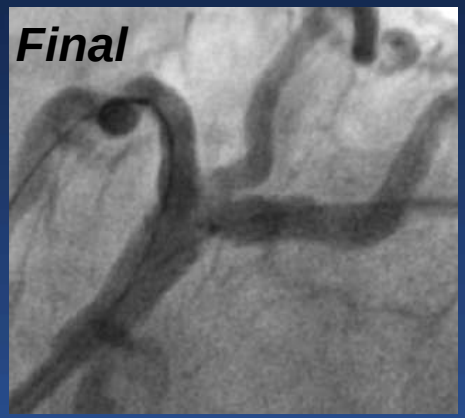












Prof. Mohan Suvinathan
Spire Leeds Hospital

Growing Clinical Evidence in LM

- Retrospective Registry
  - RJ Van Geuns and PW Serruys
  - Investigator-Sponsors
  - n ~50 patient

Periprocedural adverse events	
Procedure-related MI	6% (3/50)
Target vessel revascularisation	0 (0/50)
ARC definite stent thrombosis	0 (0/50)
Cardiac death	0 (0/50)
MACE (hierarchical)	6% (3/50)
30-day adverse events	
Myocardial infarction	6% (3/50)
Target vessel revascularisation	0% (0/50)
ARC definite stent thrombosis	0% (0/50)
All-cause death	4% (2/50)
Cardiac death	0% (0/50)
MACE (hierarchical)	6% (3/50)
6-month adverse events	
Myocardial infarction	10% (5/50)
Target vessel revascularisation	12% (6/50)
Main vessel	12% (6/50)
Side branch	2% (1/50)
ARC definite stent thrombosis	0% (0/50)
All-cause death	6% (3/50)
Cardiac death	2% (1/50)
MACE (hierarchical)	22% (11/50)

CLINICAL RESEARCH

Acute procedural and six-month clinical outcome in patients treated with a dedicated bifurcation stent for left main stem disease: the TRYTON LM multicentre registry

Conclusions: The use of the Tryton stent for treatment of LM bifurcation disease in combination with a conventional drug-eluting stent is feasible and achieves an optimal angiographic result. Safety of the procedure and six-month outcome are acceptable in this high-risk lesion PCI. Further safety and efficacy studies with long-term outcome assessment of this strategy are warranted.

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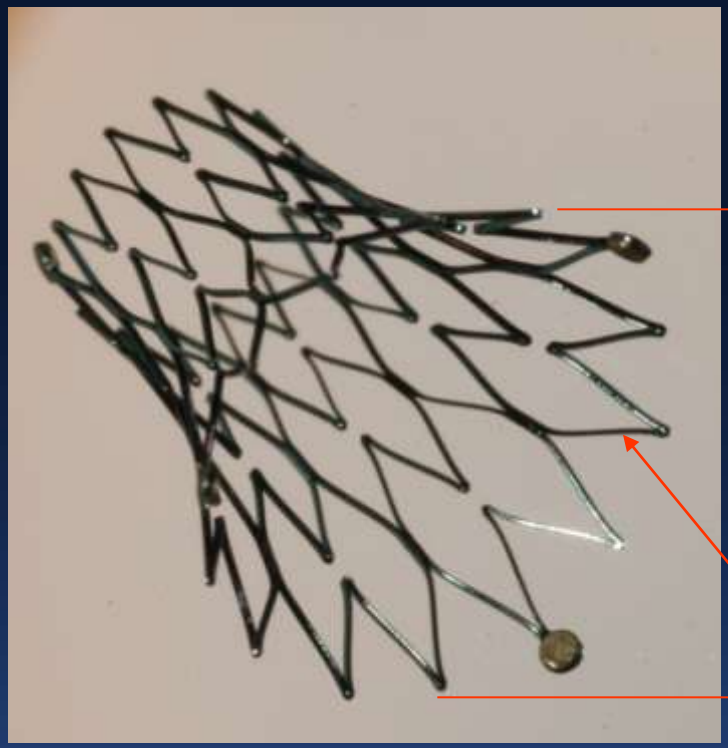
Tryton Medical Receives CE-mark for the Left Main Indication

Tryton Medical first & only coronary bifurcation stent indicated for Left Main

Durham, N.C. – February 13, 2014 – Tryton Medical, Inc., the leading developer of stents designed to treat bifurcation lesions, announced that it has received CE Mark for the treatment of Left Main Coronary artery disease. With this approval, Tryton Medical becomes the first company to earn a CE Mark for this indication.

AXXESS System

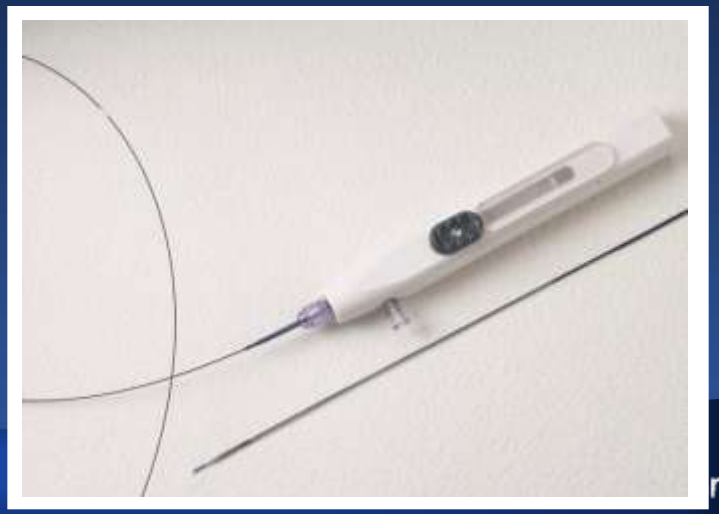


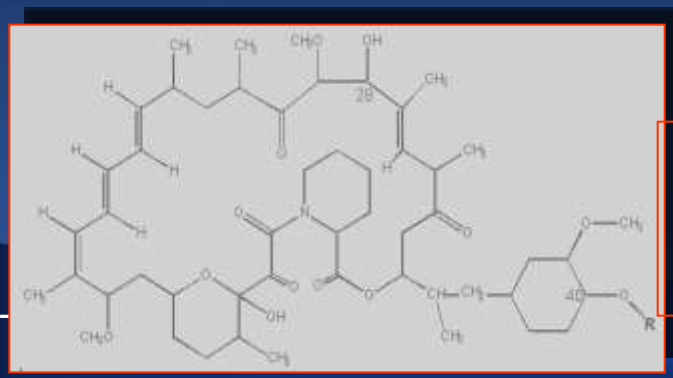
Flared Distal-End Stent Design

Self Expanding Nitinol Material

6, 8, 10, or 12 mm flare diameter

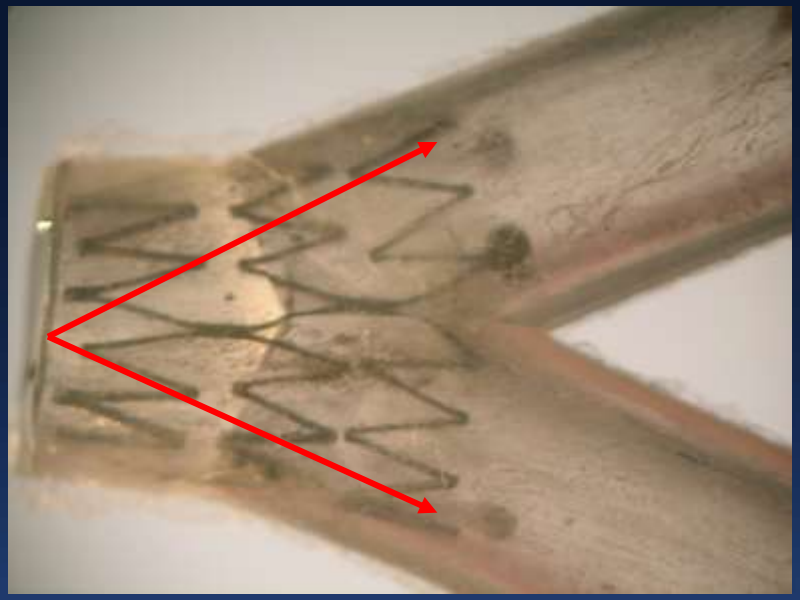
4.8F Rx Delivery System



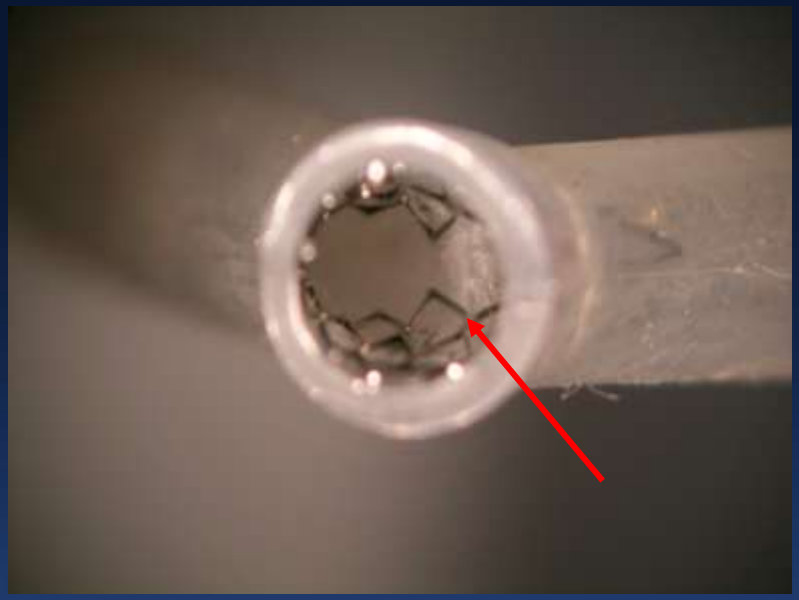


Biolimus A9 antiproliferative strut coating

Complete Ostial Coverage

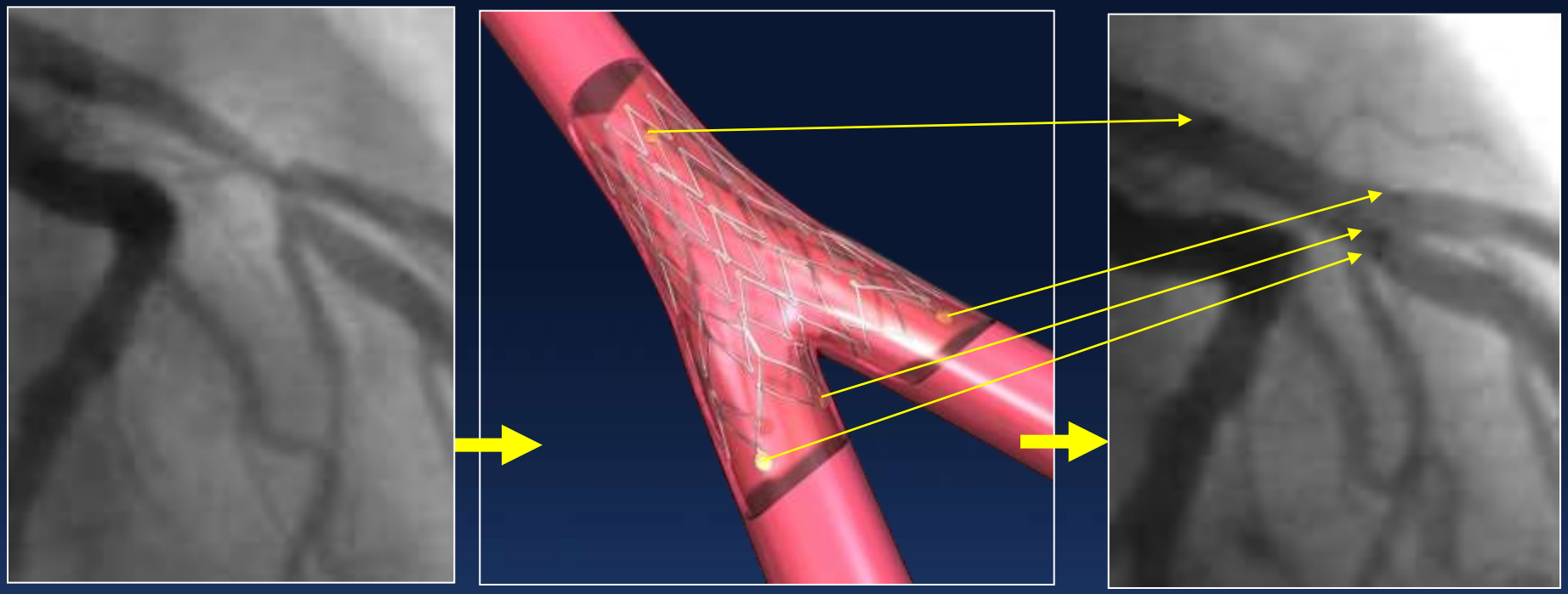


Stent flares to cover ostia of Both branching vessels



Carina area is covered By stent struts

Goal: Span Both Vessels



- *Cover the proximal lesion segment*
- *Cover the ostium of the side branch and distal parent vessel without compromising access to the side branch*
- *This is accomplished if 2 markers are in 1 branch and 1 is in the other*
- *Provide a convenient placement marker for additional distal stents*

Biolimus A9™ / Abluminal Biodegradable Polymer Bifurcation DES
Axxess™ Clinical Program

More than 500 patients, up to 5-year follow-up

AXXESS N=43	○ France and Germany ○ Pilot study using bare metal stent Axxess Platform ○ In-segment restenosis at 6 months ○ 6 month follow-up completed, study completed
AXXESS PLUS N=139	○ Europe, Brazil and New Zealand ○ FIM Safety and performance evaluation of Axxess DES ○ Parent vessel and side branch in-stent late loss at 6 months measured by QCA ○ 5 year follow-up completed, study completed
DIVERGE N=302	○ Europe, Australia and New Zealand ○ Evaluated best practices from AXXESS PLUS ○ MACE[1] at 9 months ○ 5 year follow-up available, study completed
AXXENT N=33	○ Europe ○ Pilot study for Axxess LM DES[2] ○ MACE[3] at 6 months ○ 12 month follow-up available, study completed
COBRA N=40	○ Europe ○ Randomized multicenter trial to compare Axxess DES along with BioMatrix™ with Cullotte technique using Xience V® ○ Stent strut coverage assessed by OCT at 9 months ○ PE bein analyzed – accepted for LBT at EuroPCR 2014

[1]MACE: Composite of death, MI and ischemia-driven TLR
[2]LM stent is not CE approved and not available
[3]MACE: composite of death, MI, or TLR by surgery or percutaneous intervention

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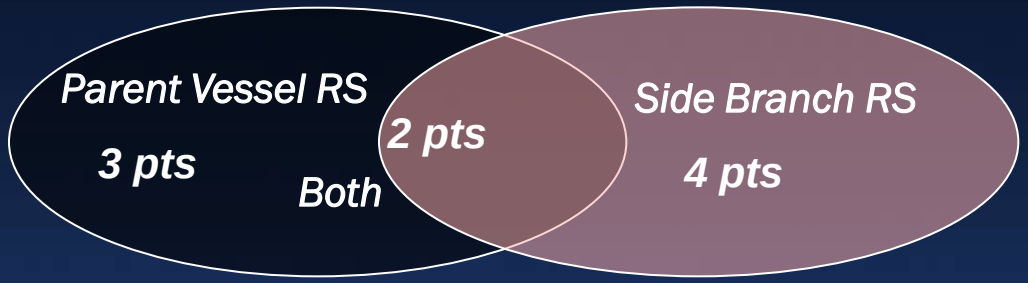
Primary Endpoint
In-Stent Late Lumen Loss @ 6 Months

	Axxess BA9 Stent	Axxess Bare Metal Stent[1]	*p*
N (%)	126 (93%)	37 (90%)	
Late Lumen Loss - Axxess Stent	0.09 ± 0.56 mm	0.46 ± 0.51 mm	<0.001

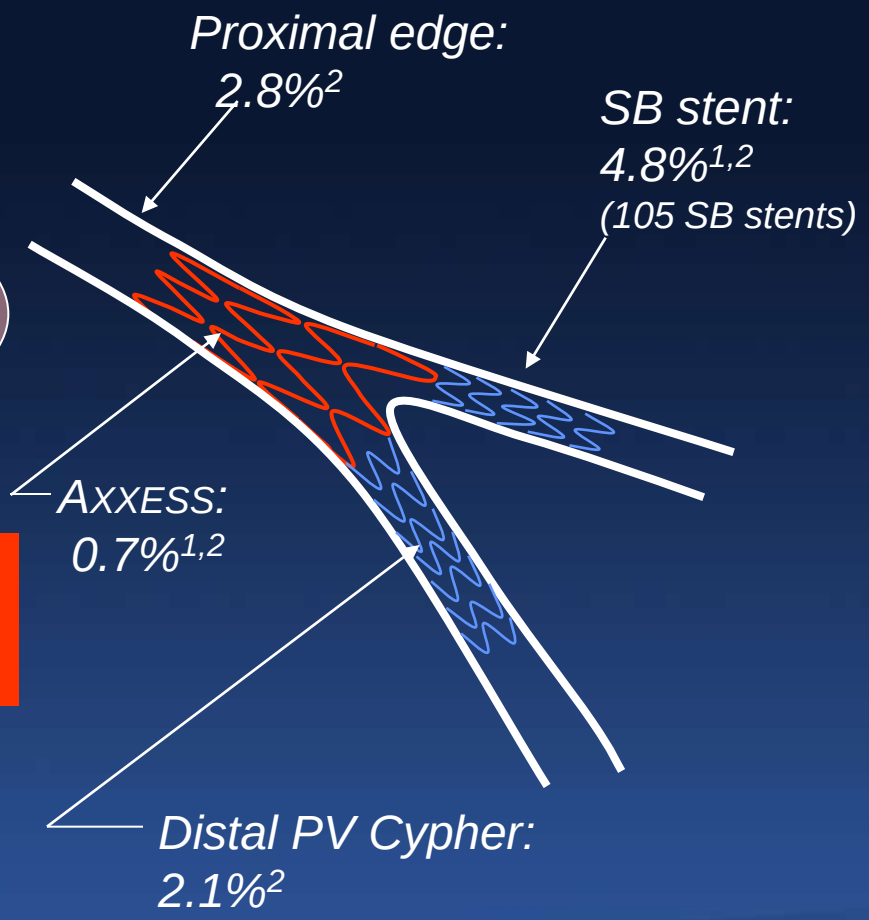
9 Month Restenosis DIVERGE Trial

Any In-segment bifurcation restenosis:
6.4% (9/140 at 9 months)[1,2]



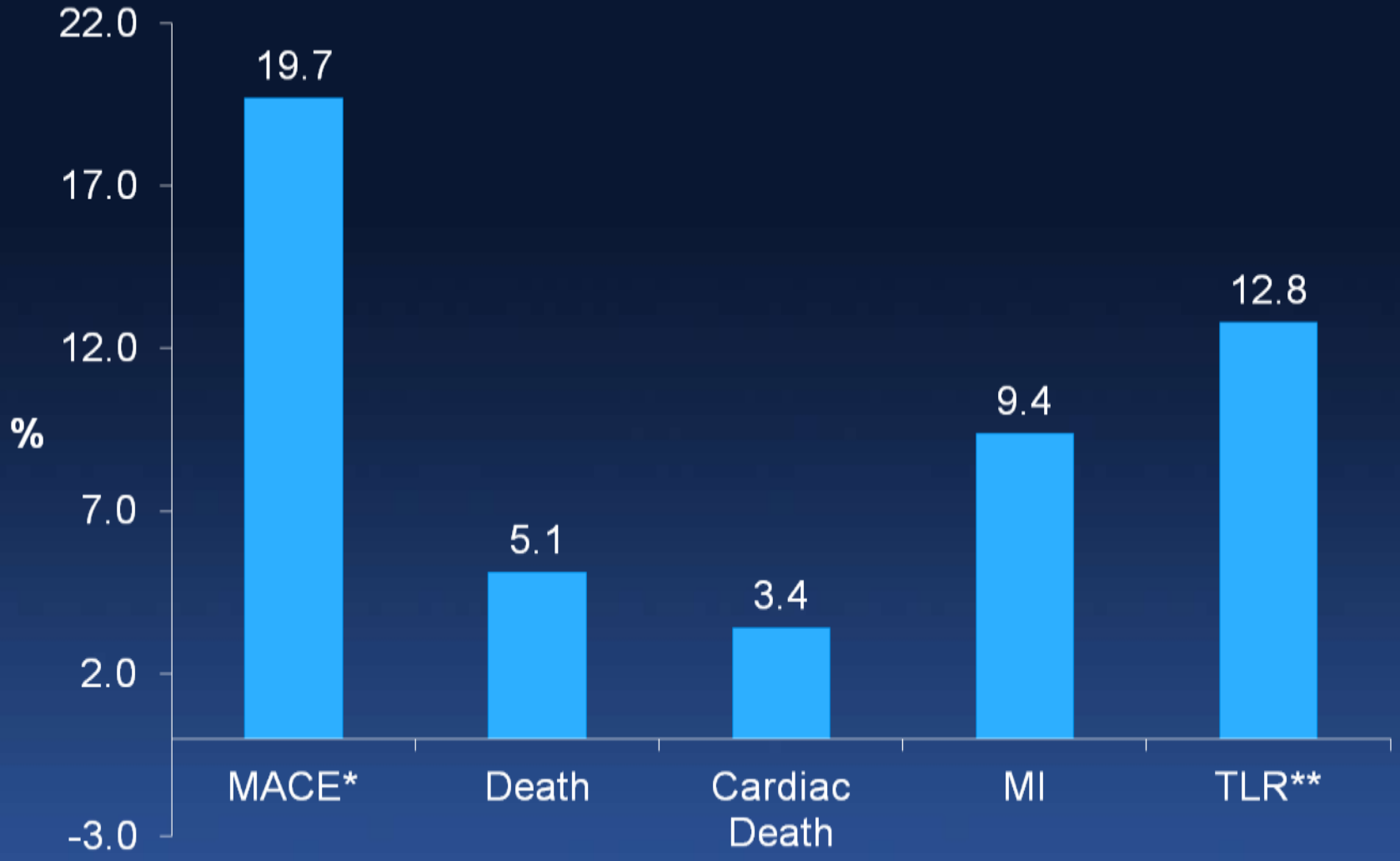
Very low restenosis rate in bifurcation lesions.

Location Analysis:



1. Verheye S. et al, J Am Coll Cardiol, 2009
2. Verheye S. et al, oral presentation, TCT 2009

5-year Clinical Outcomes
Cumulative Rates



*Defined as cardiac death, MI, ischemia-driven TLR and emergent CABG

**Ischemia-driven TLR

Conclusions 1

Stenting coronary bifurcations requires more than deciding to implant 1 or 2 stents

The most important decisions should be taken by examining:

-the clinical setting (age of the patient, general conditions, extent of ischemia),

- the extent of the disease of both branches,
- their size,
- the territory of distribution and
- how confident is the operator with a specific approach

Conclusions 2

- Dedicated bifurcation stents address ideally the specific needs of bifurcation lesions
- Due to the variable anatomy of bifurcation lesions, variable stent designs or deployment techniques are most likely needed
- Dedicated bifurcation DES are needed to combine the benefits of both technologies


Thank You !