Left main PCI - who should do it and how?

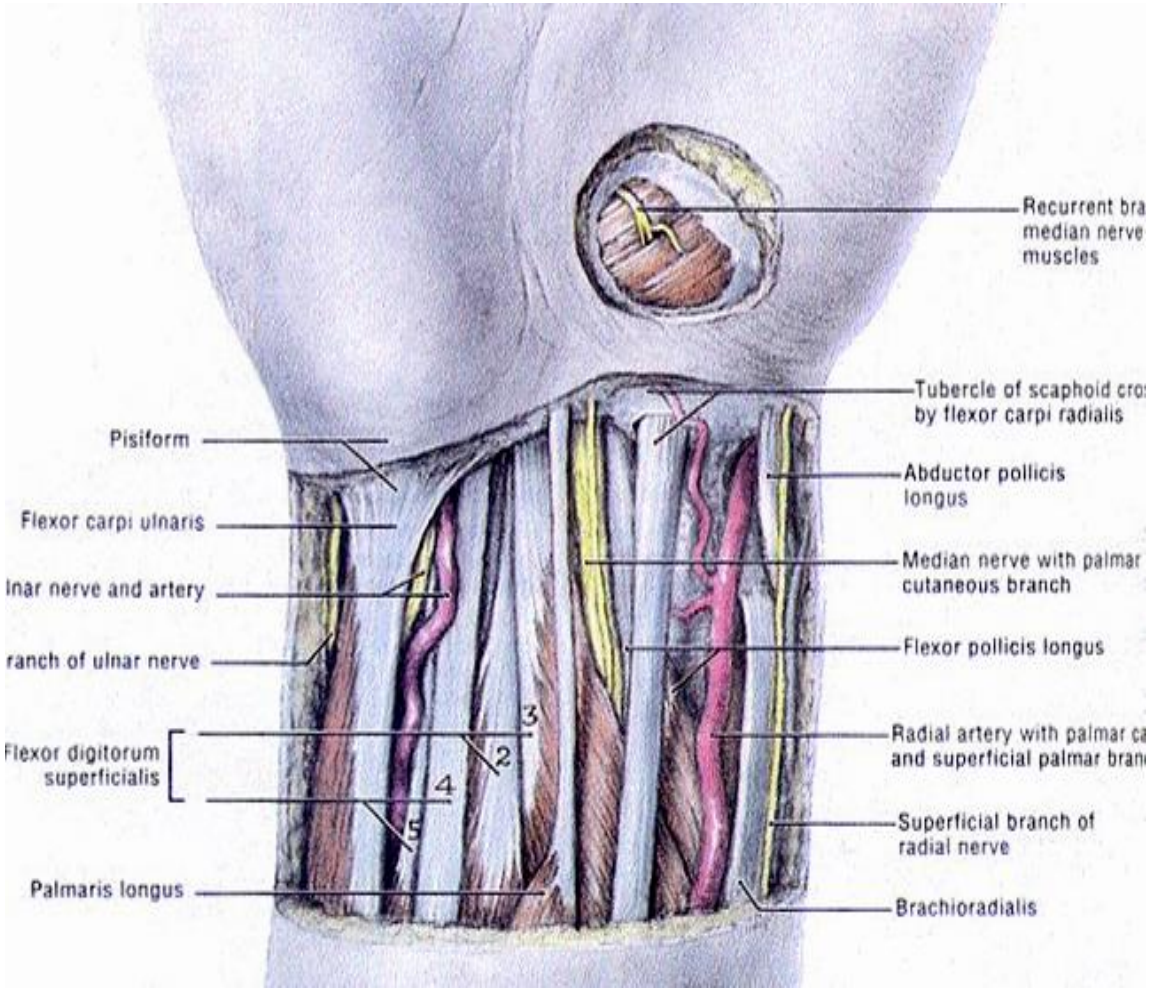
Mamas A. Mamas
Professor of Cardiology
University of Keele
@MMamas1973

What do guidelines tell us

Recommendation for the type of revascularization in patients with stable coronary artery disease with suitable coronary anatomy for both procedures and low predicted surgical mortality[d]

Recommendations according to extent of CAD	CABG		PCI	
	Class[a]	Level[b]	Class[a]	Level[b]
Left main CAD				
Left main disease with low SYNTAX score (0-22).[69,121,122,124,145–148]	I	A	I	A
Left main disease with intermediate SYNTAX score (23-32).[69,121,122,124,145–148]	I	A	IIa	A
Left main disease with high SYNTAX score (≥33).[c 69,121,122,124,146–148]	I	A	III	B

Access site choice

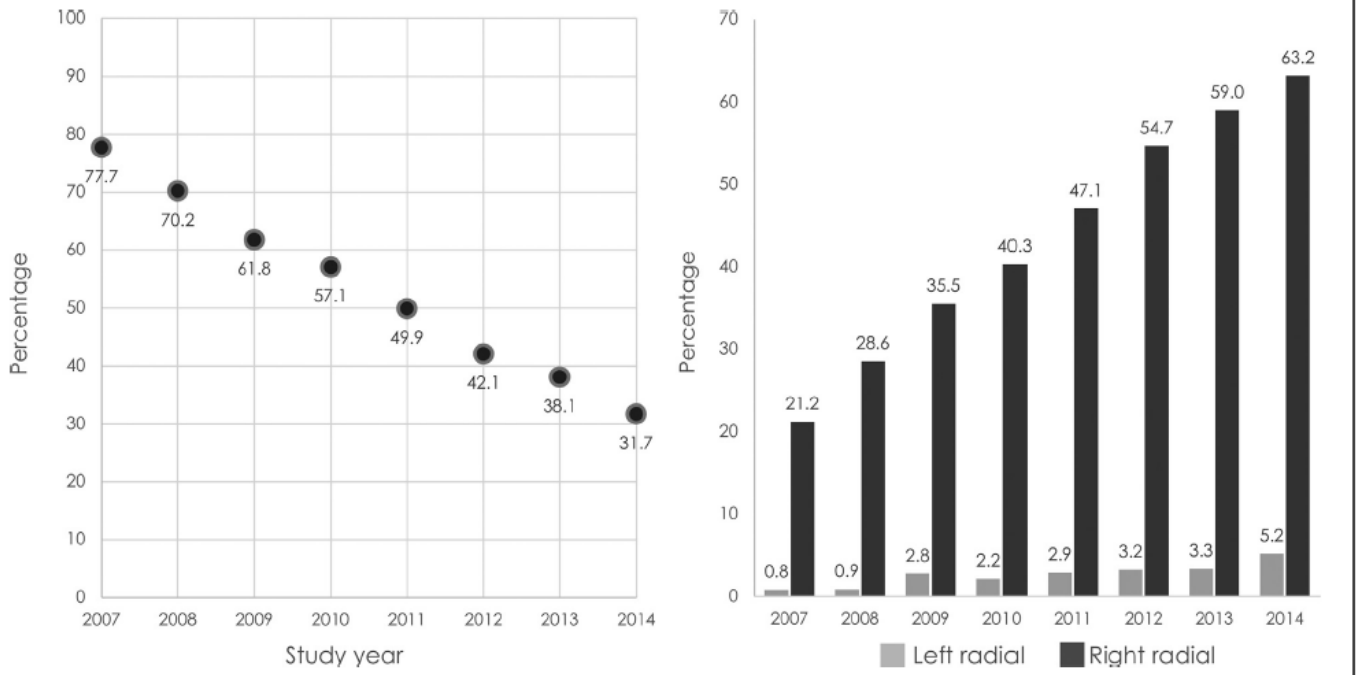


Access Site and Outcomes for Unprotected Left Main Stem Percutaneous Coronary Intervention

An Analysis of the British Cardiovascular Intervention Society Database

Tim Kinnaird, MD,[a,b] Richard Anderson, MD,[a] Sean Gallagher, MD,[a] Alex Sirker, PhD,[c] Peter Ludman, MD,[d] Mark de Belder, MD,[e] Samuel Copt, PhD,[f] Keith Oldroyd, MD,[g] Nick Curzen, PhD,[h] Adrian Banning, MD,[i] Mamas Mamas, DPhil[b,j]

FIGURE 3 Access Site by Study Year for LMS-PCI



(Left) Temporal change in femoral access use for unprotected LMS-PCI in England and Wales 2007 to 2014 ($p < 0.001$ for trend). **(Right)** Changes in left and right radial access for unprotected LMS-PCI in England and Wales 2007 to 2014 ($p < 0.001$ for both trends, $p < 0.001$ for comparison between trends). Abbreviations as in Figure 1.

TABLE 5 Adjusted Clinical Outcomes by Access for Unprotected LMS-PCI

	OR for Femoral Vs. Radial Access (95% CI)	p Value
Access site arterial complication	2.37 (1.32–4.28)	0.004
Access site bleeding	18.44 (2.46–138.25)	0.005
Periprocedural MI	1.15 (0.55–2.15)	0.717
Transfusion	2.71 (1.14–6.46)	0.024
In-hospital major bleed	1.79 (1.03–3.15)	0.033
In-hospital death	1.37 (1.01–1.86)	0.047
In-hospital MACE	1.48 (1.14–1.92)	0.003
Mortality at 30-days	1.13 (0.85–1.48)	0.401

Abbreviations as in Tables 1, 3, and 4.

JACC: CARDIOVASCULAR INTERVENTIONS
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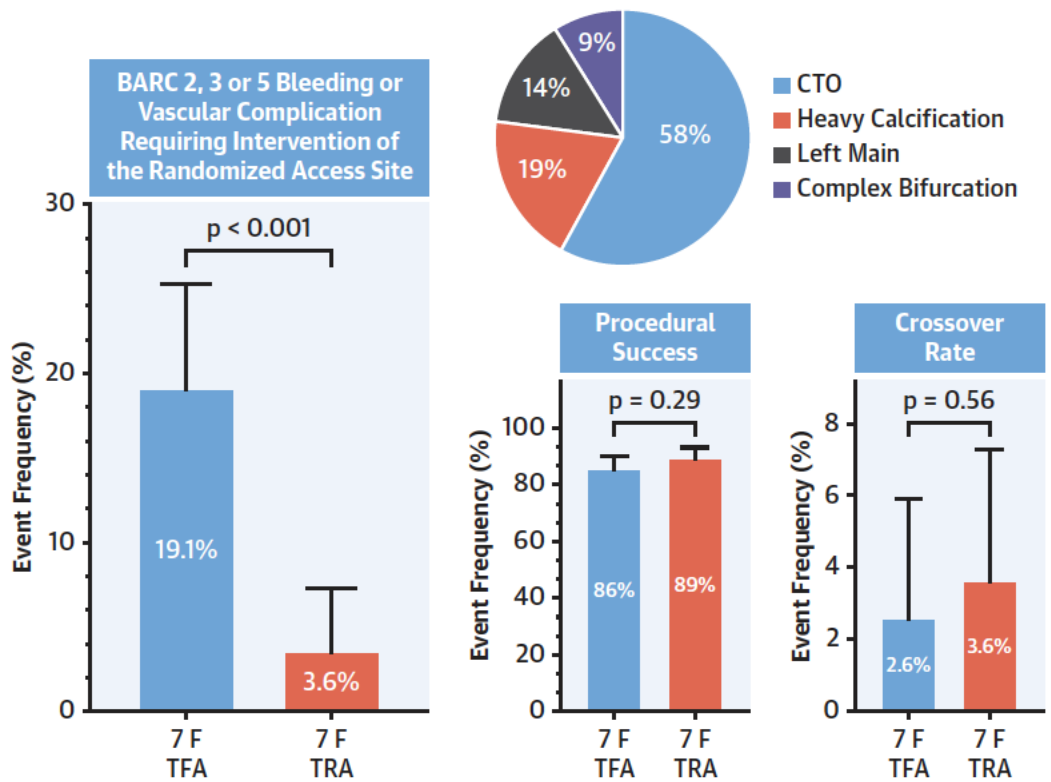
VOL. ■, NO. ■, 2021

Randomized Comparison Between Radial and Femoral Large-Bore Access for Complex Percutaneous Coronary Intervention

Thomas A. Meijers, MD,[a] Adel Aminian, MD,[b] Marleen van Wely, MD,[c] Koen Teeuwen, MD, PhD,[d] Thomas Schmitz, MD,[e] Maurits T. Dirksen, MD, PhD,[f] Sudhir Rathore, MD,[g] René J. van der Schaaf, MD, PhD,[h] Paul Knaapen, MD, PhD,[i] Joseph Dens, MD, PhD,[j] Juan F. Iglesias, MD,[k] Pierfrancesco Agostoni, MD, PhD,[l] Vincent Roolvink, MD, PhD,[a] Renicus S. Hermanides, MD, PhD,[a] Niels van Royen, MD, PhD,[c] Maarten A.H. van Leeuwen, MD, PhD[a]

CENTRAL ILLUSTRATION Access Site-Related Clinically Significant Bleeding or Vascular Complications in Large-Bore Percutaneous Coronary Intervention



Meijers, T.A. et al. J Am Coll Cardiol Intv. 2021;■(■):■-■.

BARC = Bleeding Academic Research Consortium; CTO = chronic total occlusion; TFA = transfemoral access; TRA = transradial access.

Circulation: Cardiovascular Interventions

ORIGINAL ARTICLE

Left Main Stem Percutaneous Coronary Intervention: Does On-Site Surgical Cover Make a Difference?

Muhammad Rashid, PhD*; Mahvash Zaman, MBChB*; Peter Ludman, MD; Harindra C. Wijeysundera, PhD; Nick Curzen, PhD; Tim Kinnaird, MD; Saadiq Moledina, MRCP; J. Dawn Abbott, MD; Cindy L. Grines, MD; Mamas A. Mamas, DPhil

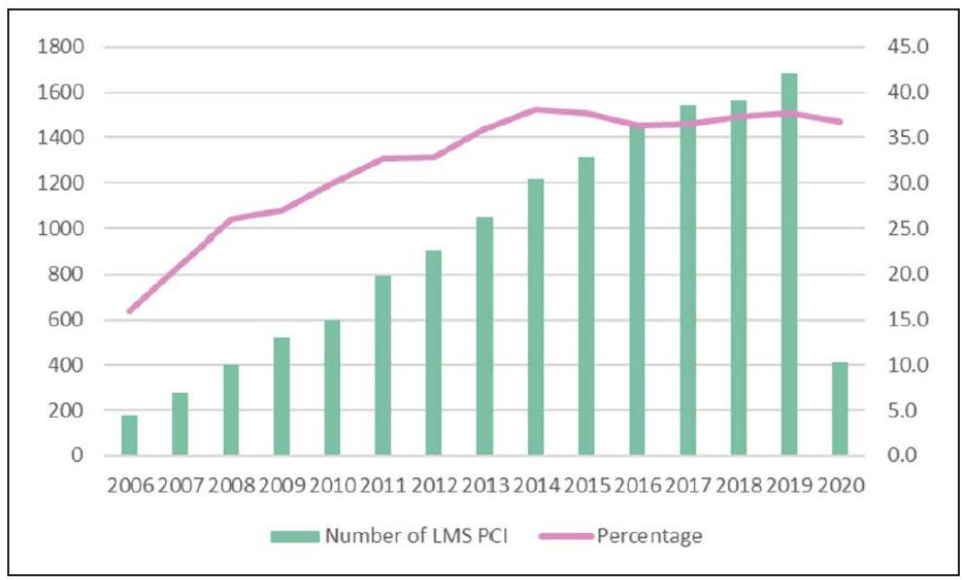


Figure 1. Temporal trends in left main stem (LMS) percutaneous coronary intervention (PCI) volumes performed in nonsurgical centers.

Table 2. Adjusted Odds of In-Hospital Outcomes in the Imputated Dataset

Outcomes	Reference	Odds ratio (95% CI)
In-hospital mortality	On-site surgical	0.92 (0.69–1.22)
In-hospital MACCE	On-site surgical	1.00 (0.79–1.25)
In-hospital bleeding	On-site surgical	0.53 (0.34–0.82)
Emergency CABG	On-site surgical	1.00 (0.95–1.06)

Intravascular imaging

Keele Cardiovascular Research Group

Mandatory in LMS

Imaging useful:

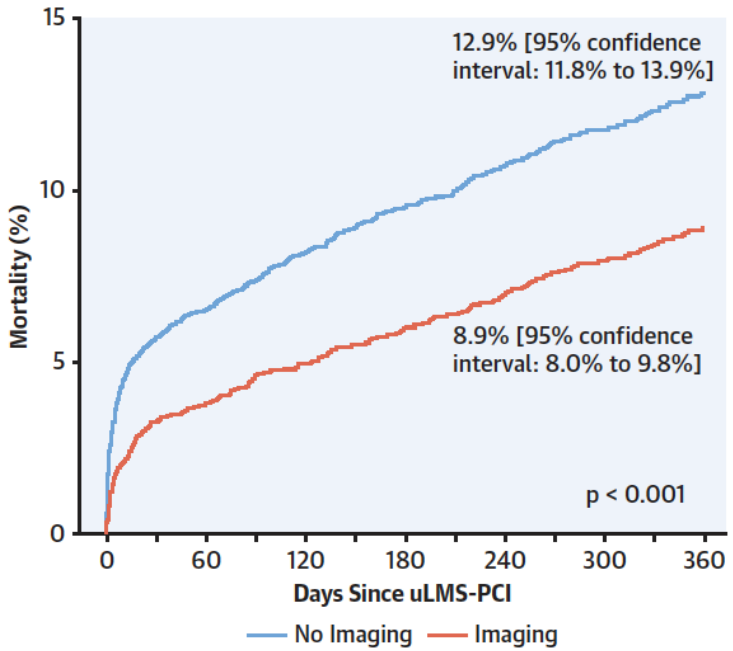
- Helps understand the plaque burden in MV + SB
- Help define bifurcation angle, particularly when angiogram views suboptimal
- Characterise Ca2+ (circumferential / depth) & guide lesion prep strategy
- Optimise expansion / stent result

Intravascular Imaging and 12-Month Mortality After Unprotected Left Main Stem PCI

An Analysis From the British Cardiovascular Intervention Society Database

Tim Kinnaird, MD,[a,b] Thomas Johnson, PhD,[c] Richard Anderson, MD,[a] Sean Gallagher, MD,[a] Alex Sirker, PhD,[d] Peter Ludman, MD,[e] Mark de Belder, MD,[f] Samuel Copt, PhD,[g] Keith Oldroyd, MD,[h] Adrian Banning, MD,[i] Mamas Mamas, DPhil,[a,j] Nick Curzen, PhD[k]

CENTRAL ILLUSTRATION **Survival by Intravascular Imaging Use After uLMS PCI in England and Wales From 2007 to 2014**



Kinnaird, T. et al. J Am Coll Cardiol Intv. 2020;13(3):346–57.

Kaplan-Meier curves of 12-month survival when intravascular imaging was used compared with when imaging was not used to guide unprotected left main stem percutaneous coronary intervention in England and Wales in from 2007 to 2014. This illustrates a significant association between improved survival and imaging use during unprotected left main stem percutaneous coronary intervention.

Circulation: Cardiovascular Interventions

Keele Cardiovascular Research Group

ORIGINAL ARTICLE

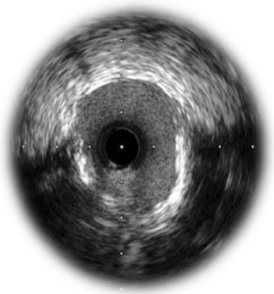
Long-Term Clinical Impact of Intravascular Ultrasound Guidance in Stenting for Left Main Coronary Artery Disease

Do-Yoon Kang, MD; Jung-Min Ahn, MD; Sung-Cheol Yun, PhD; Hanbit Park, MD; Sang-Cheol Cho, MD; Tae Oh Kim, MD; Sangwoo Park, MD; Pil Hyung Lee, MD; Seung-Whan Lee, MD; Seong-Wook Park, MD; Duk-Woo Park, MD; Seung-Jung Park, MD

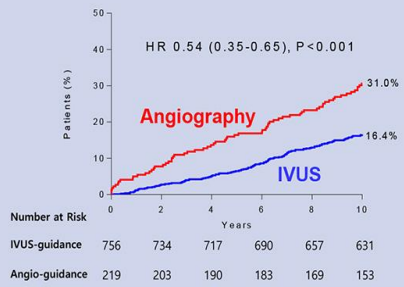
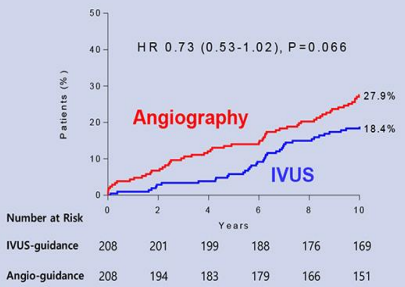
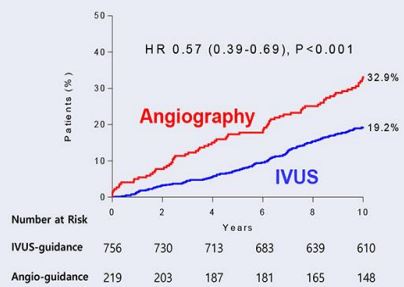
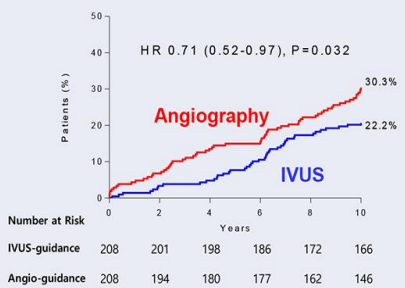
Long-term (10-year) Impact of IVUS-guidance for Left Main PCI

Left Main Disease

IVUS-guided PCI



10-Year Follow-up

	Overall Population	After Propensity-score Matching
All-cause death		
Composite of all-cause death, Q-wave MI, or stroke		

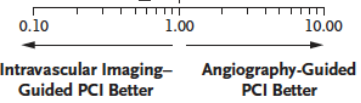
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Intravascular Imaging–Guided or Angiography-Guided Complex PCI

J.M. Lee, K.H. Choi, Y.B. Song, J.-Y. Lee, S.-J. Lee, S.Y. Lee, S.M. Kim, K.H. Yun, J.Y. Cho, C.J. Kim, H.-S. Ahn, C.-W. Nam, H.-J. Yoon, Y.H. Park, W.S. Lee, J.-O. Jeong, P.S. Song, J.-H. Doh, S.-H. Jo, C.-H. Yoon, M.G. Kang, J.-S. Koh, K.Y. Lee, Y.-H. Lim, Y.-H. Cho, J.-M. Cho, W.J. Jang, K.-J. Chun, D. Hong, T.K. Park, J.H. Yang, S.-H. Choi, H.-C. Gwon, and J.-Y. Hahn, for the RENOVATE-COMPLEX-PCI Investigators*

Subgroup	Intravascular Imaging–Guided PCI	Angiography-Guided PCI	Hazard Ratio (95% CI)
	no. of events/total no. of patients (cumulative incidence, %)		
Overall	76/1092 (7.7)	60/547 (12.3)	0.64 (0.45–0.89)
Type of imaging devices			
Intravascular ultrasonography	59/800 (8.0)	60/547 (12.3)	0.66 (0.46–0.95)
Optical coherence tomography	15/278 (5.8)	60/547 (12.3)	0.47 (0.27–0.83)
Type of complex coronary lesions			
True bifurcation	23/233 (10.3)	13/126 (11.8)	0.97 (0.49–1.93)
Chronic total occlusion	[illegible]	[illegible]	[illegible]
Unprotected left main coronary artery disease	9/138 (6.8)	11/54 (25)	0.31 (0.13–0.76)
Diffuse long coronary artery lesion	[illegible]	[illegible]	[illegible]
Multivessel PCI involving ≥2 major coronary arteries	36/409 (9.5)	22/213 (11.7)	0.84 (0.50–1.44)
Lesion necessitating use of ≥3 stents	16/208 (8.1)	6/97 (6)	1.24 (0.49–3.18)
Lesion with in-stent restenosis	22/158 (15.6)	12/78 (17)	0.90 (0.45–1.82)
Severely calcified lesion	11/157 (7.3)	11/74 (17)	0.46 (0.20–1.06)
Ostial lesions of major coronary artery	8/182 (4.4)	9/69 (16)	0.33 (0.13–0.85)
Initial presentation			
Stable ischemic heart disease	25/532 (5.0)	27/275 (10.4)	0.46 (0.27–0.80)
Acute coronary syndrome	51/560 (10.4)	33/272 (14.6)	0.74 (0.48–1.15)
Age			
<65 yr	36/517 (7.8)	23/238 (10.6)	0.72 (0.42–1.21)
≥65 yr	40/575 (7.4)	37/309 (13.6)	0.57 (0.36–0.88)
Sex			
Male	66/869 (8.3)	46/431 (11.7)	0.70 (0.48–1.02)
Female	10/223 (5.2)	14/116 (14.5)	0.35 (0.16–0.80)
Diabetes mellitus			
Yes	45/394 (12.9)	26/223 (12.3)	0.97 (0.60–1.57)
No	31/698 (4.7)	34/324 (12.2)	0.41 (0.25–0.67)
Chronic kidney disease			
Yes	22/203 (13.3)	19/93 (23)	0.51 (0.27–0.93)
No	54/889 (6.4)	41/454 (9.9)	0.66 (0.44–0.99)
Left ventricular ejection fraction			
<50%	22/210 (12.0)	12/84 (15)	0.72 (0.35–1.45)
≥50%	54/882 (6.7)	48/463 (11.8)	0.58 (0.39–0.85)



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963
JACC March 21, 2017
Volume 69, Issue 11

Interventional Cardiology

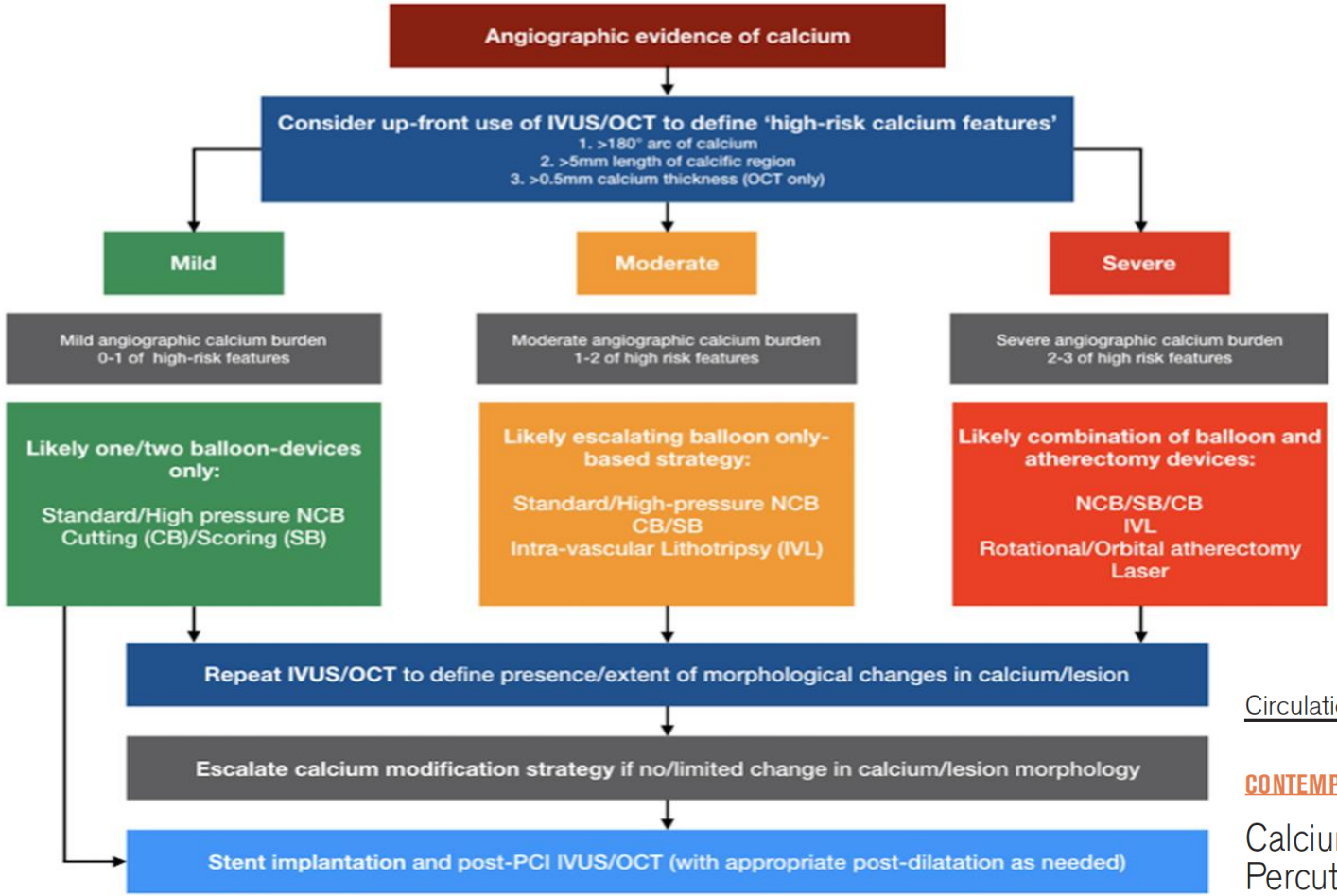
IMPACT OF FINAL MINIMAL STENT AREA BY IVUS ON 3-YEAR OUTCOME AFTER PCI OF LEFT MAIN CORONARY ARTERY DISEASE: THE EXCEL TRIAL

Authors: *Akiko Maehara, Gary Mintz, Patrick Serruys, A. Kappetein, David Kandzari, Erick Schampaert, Ad Van Boven, Ferenc Horkay, Imre Ungi, Samer Mansour, Adrian Banning, David Taggart, Manel Sabaté, Anthony Gershlick, Andrzej Bochenek, Jose Pomar, Nicholas Lembo, Nicolas Noiseux, John Puskas, W. Morris Brown, Roxana Mehran, Ori Ben-Yehuda, Charles Simonton, Joseph Sabik, Gregg Stone, Cardiovascular Research Foundation, New York, NY, USA, Columbia University Medical Center, New York, NY, USA*

3-year Outcome Stratified by Minimal Stent Area by IVUS

	Smallest tertile (n=172)	Intermediate tertile (n=169)	Largest tertile (n=163)	p-value Smallest vs Intermediate	p-value Smallest vs Largest
MSA range (mm^2)	4.4 - 8.7	8.8 - 10.9	11.0 - 17.8	-	-
3-year event rates					
Death/MI/stroke	19.4% (32)	16.1% (26)	9.6% (15)	0.45	0.01
Death	13.8% (22)	10.0% (16)	5.2% (8)	0.34	0.01
MI	10.5% (17)	8.2% (13)	3.7% (6)	0.49	0.02
Stroke	1.8% (3)	1.2% (2)	2.1% (3)	0.66	0.98
Definite/probable stent thrombosis	3.1% (5)	1.2% (2)	0.0% (0)	0.26	0.03
Left main revascularization	12.9% (19)	8.3% (13)	8.8% (14)	0.30	0.41

Familiarity with assessment of Ca and how to use tools ie RA, lithotripsy etc



Circulation: Cardiovascular Interventions

CONTEMPORARY REVIEWS IN INTERVENTIONAL CARDIOLOGY

Calcium Modification Techniques in Complex Percutaneous Coronary Intervention

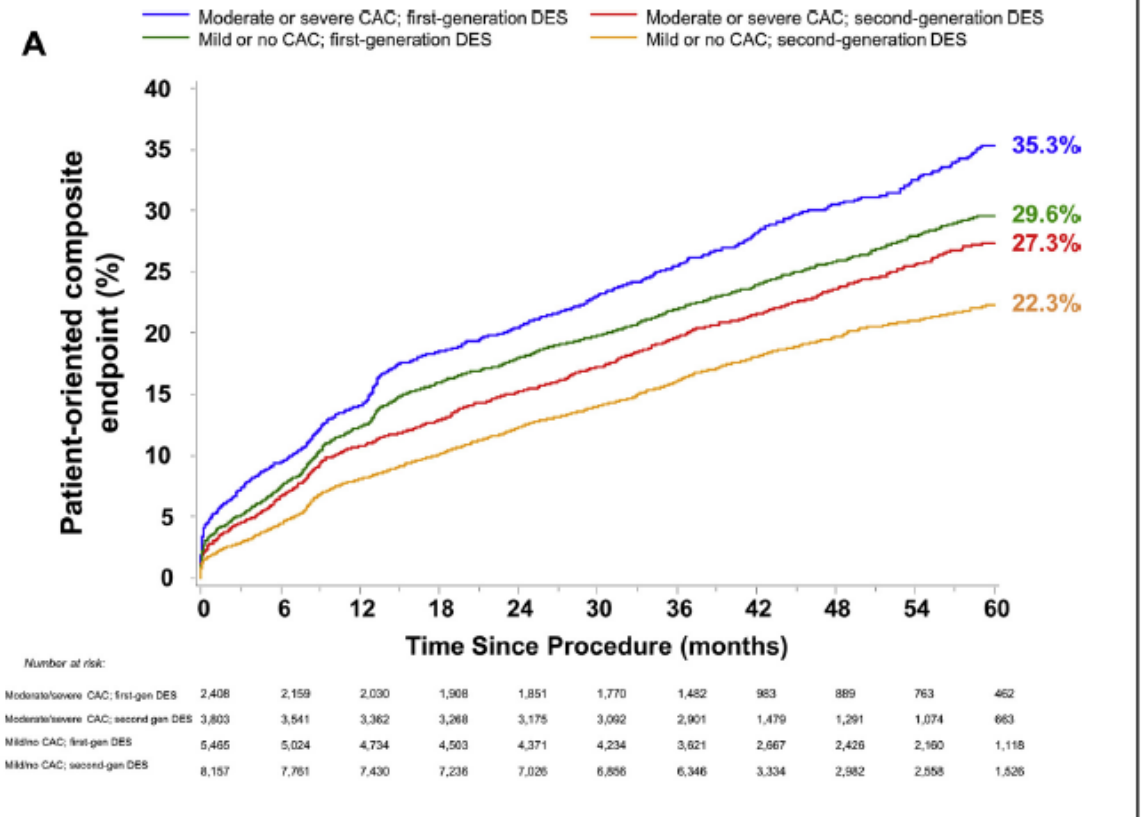
Mohammed Shah, BSc, MBChB; Osman Najam, MBChB, MRes; Ravinay Bhindi, MBBS, PhD; Kalpa De Silva, MBBS, PhD

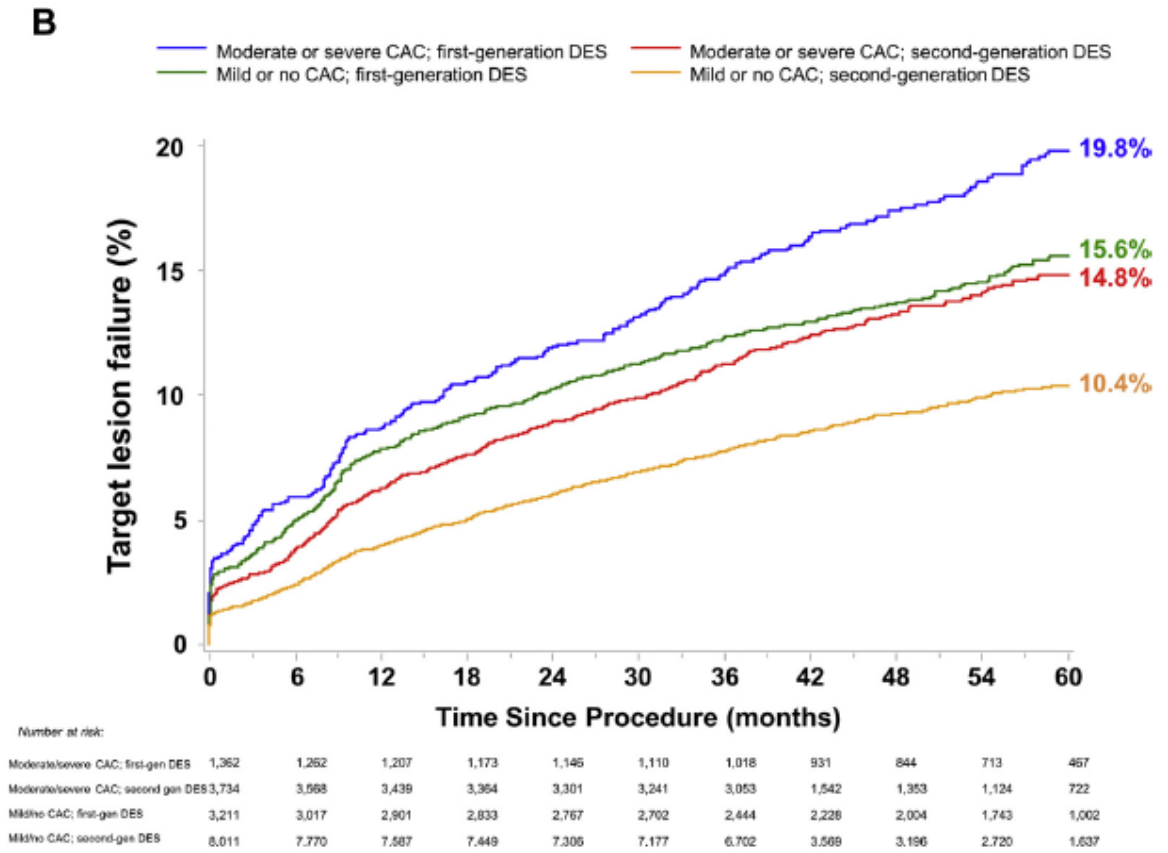
Coronary Calcification and Long-Term Outcomes According to Drug-Eluting Stent Generation

Paul Guedeney, MD,[a,b] Bimmer E. Claessen, MD, PhD,[a] Roxana Mehran, MD,[a,c] Gary S. Mintz, MD,[c] Mengdan Liu, MS,[c] Sabato Sorrentino, MD, PhD,[a] Gennaro Giustino, MD,[a] Serdar Farhan, MD,[a] Martin B. Leon, MD,[c,d] Patrick W. Serruys, MD, PhD,[e,f] Pieter C. Smits, MD,[g] Clemens von Birgelen, MD, PhD,[h,i] Ziad A. Ali, MD, DPhil,[c,d,j] Philippe Généreux, MD, PhD,[c,k,l] Björn Redfors, MD, PhD,[c,d,m] Mahesh V. Madhavan, MD,[c,d] Ori Ben-Yehuda, MD,[c,d] Gregg W. Stone, MD[a,c]

Keele Cardiovascular Research Group

FIGURE 2 Kaplan-Meier Curves of the 5-Year Rates of Adverse Events According to Drug-Eluting Stent Generation and the Severity of Coronary Artery Calcification





Consider platform for LMS

(Particularly in cases LMS to LAD)

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Table 2. Maximal stent expansion of some contemporary DES according to the manufacturers' instructions for use (IFU).

DES type	DES sizes	Maximal expansion according to IFU
XIENCE Sierra	2.25-3.25 mm	3.75 mm
	3.5-4.0 mm	5.50 mm
Resolute Onyx	2.25-2.5 mm	3.25 mm
	2.75-3.0 mm	3.75 mm
	3.5-4.0 mm	4.75 mm
	4.5-5.0 mm	5.75 mm
SYNERGY	2.25-2.75 mm	3.50 mm
	3.0-3.5 mm	4.25 mm
	4.0 mm	5.75 mm
Ultimaster	2.25-3.0 mm	3.50 mm*
	3.5-4.0 mm	4.50 mm*
Orsiro	2.25-3.0 mm	3.50 mm
	3.5-4.0 mm	4.50 mm

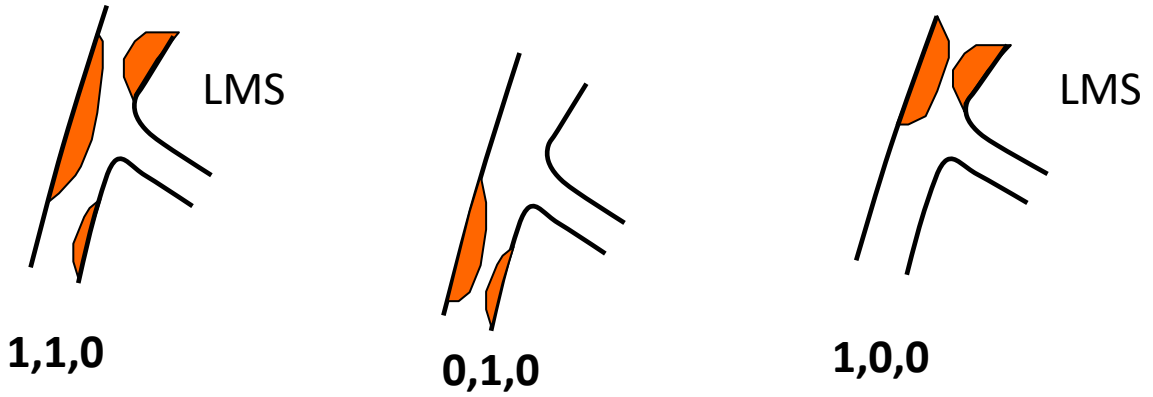
*manufacturer's advice, not in IFU.

EuroIntervention 2018;14:112-120

Percutaneous coronary intervention in left main coronary artery disease: the 13th consensus document from the European Bifurcation Club

One vs two stents

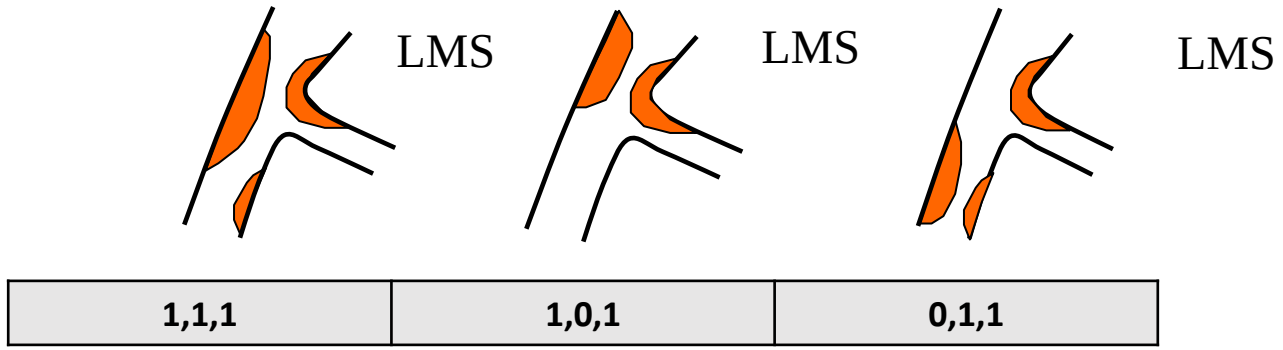
Non-true bifurcations



- Single 1 stent (provisional) approach sized to distal vessel
- Proximal optimization (POT)
- FKB if side branch compromise or future Cx access may be required
- Repeat POT if FKB performed ie POT-Kiss-POT

One vs two stents

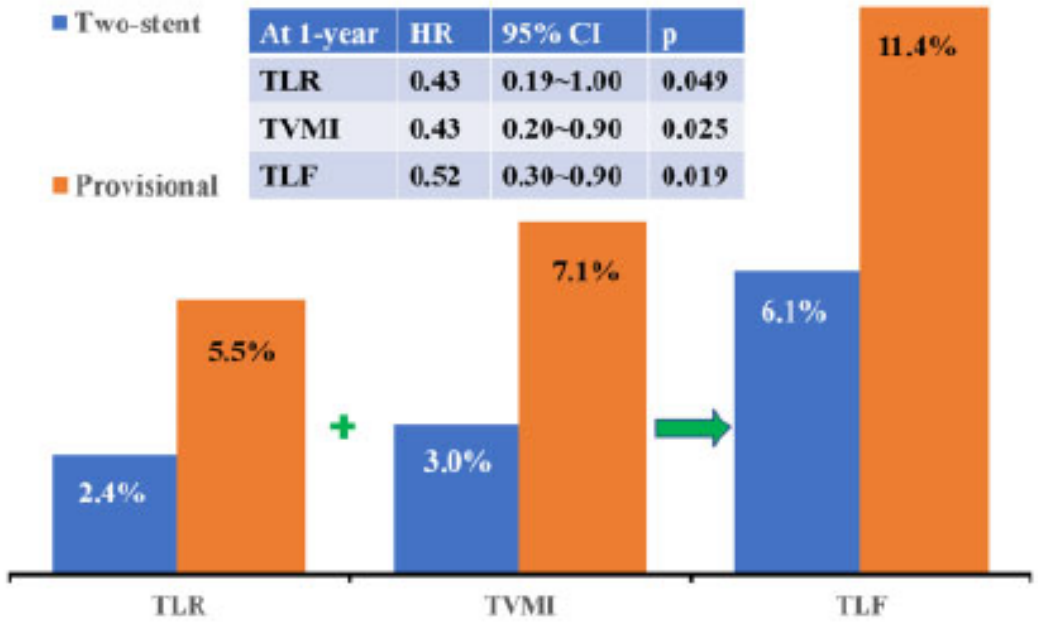
True bifurcation lesions



Approach depends on anatomy / severity of SB disease

ESC European Society of Cardiology
European Heart Journal (2020) 41, 2523–2536
doi:10.1093/eurheartj/ehaa543

Multicentre, randomized comparison of two-stent and provisional stenting techniques in patients with complex coronary bifurcation lesions: the DEFINITION II trial



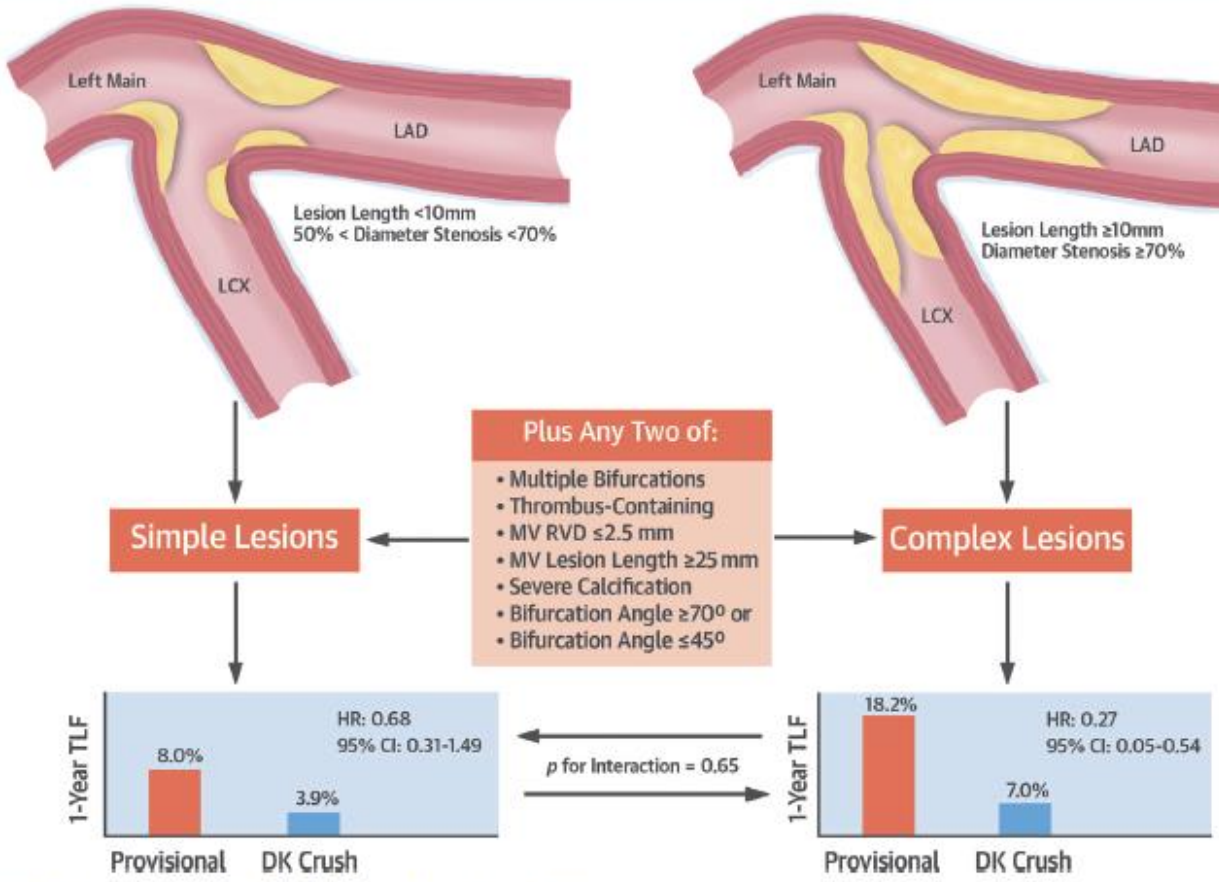
Take home figure For patients with complex bifurcation lesions defined by the DEFINITION criteria, systematic two-stent approaches were associated with a significant reduction of target lesion failure, compared with provisional stenting strategies. CI, confidence interval; HR, hazard ratio; TLF, target lesion failure; TLR, target lesion revascularization; TVMI, target vessel myocardial infarction.

Double Kissing Crush Versus Provisional Stenting for Left Main Distal Bifurcation Lesions

DKCRUSH-V Randomized Trial

Shao-Liang Chen, MD,[a] Jue-Jie Zhang, PhD,[a] Yaling Han, MD,[b] Jing Kan, MBBS,[a] Lianglong Chen, MD,[c] Chunguang Qiu, MD,[d] Tiemin Jiang, MD,[e] Ling Tao, MD,[f] Hesong Zeng, MD,[g] Li Li, MD,[h] Yong Xia, MD,[i] Chuanyu Gao, MD,[j] Teguh Santoso, MD,[k] Chootopol Paiboon, MD,[l] Yan Wang, MD,[m] Tak W. Kwan, MD,[n] Fei Ye, MD,[o] Nailiang Tian, MD,[o] Zhizhong Liu, PhD,[a] Song Lin, MD,[o] Chengzhi Lu, MD,[p] Shangyu Wen, MD,[q] Lang Hong, MD,[r] Qi Zhang, MD,[s] Imad Sheiban, MD,[t] Yawei Xu, MD,[u] Lefeng Wang, MD,[v] Tanveer S. Rab, MD,[w] Zhanquan Li, MD,[x] Guanchang Cheng, MD,[y] Lianqun Cui, MD,[z] Martin B. Leon, MD,[aa] Gregg W. Stone, MD[aa]

CENTRAL ILLUSTRATION Stenting for LM Bifurcations



Chen, S.-L. et al. J Am Coll Cardiol. 2017;70(21):2605–17.

ESC European Society of Cardiology
European Heart Journal (2021) 42, 3829–3839
doi:10.1093/eurheartj/ehab283
FASTTRACK CLINICAL RESEARCH
Ischaemic heart disease

The European bifurcation club Left Main Coronary Stent study: a randomized comparison of stepwise provisional vs. systematic dual stenting strategies (EBC MAIN)

David Hildick-Smith [1]*, Mohaned Egred [2], Adrian Banning [3], Philippe Brunel[4], Miroslaw Ferenc [5], Thomas Hovasse[6], Adrian Wlodarczak [7], Manuel Pan[8], Thomas Schmitz[9], Marc Silvestri[10], Andreis Erglis[11], Evgeny Kretov[12], Jens Flensted Lassen[13], Alaide Chieffo [14], Thierry Lefèvre[6], Francesco Burzotta [15], James Cockburn[1], Olivier Darremont[16], Goran Stankovic [17], Marie-Claude Morice[6], and Yves Louvard[6]

Table 2 *Continued*

	Stepwise provisional (*n* = 230)	Systematic dual (*n* = 237)
Rewiring second vessel		
Yes	212 (93%)	219 (95%)
No	15 (6%)	3 (1%)
Missing	3 (1%)	7 (4%)
Kissing balloons after first stent		
Yes	202 (89%)	15 (6%)
No	25 (11%)	—
Missing	3 (1%)	—
Further treatment to side vessel needed?		
Yes	59 (26%)	—
No	168 (74%)	—
Missing	3 (1%)	—
Stent to side/second vessel		
Yes	51 (22%)	217 (94%)
No	8 (4%)	12 (5%)
Missing	3	7
Second stent implantation technique		
Culotte	26 (11%)	121 (53%)
Crush (DK)	0 (0%)	11 (5%)
T or TAP	24 (11%)	76 (33%)
Not applicable	176 (78%)	22 (10%)
Missing data	3	7
Reason for second stent		
Dissection	22 (10%)	—
Residual stenosis	26 (12%)	—
Impaired flow	1 (1%)	—
Other	2 (1%)	—
Stent diameter side/second vessel, mm (SD)	3.5 (0.6)	3.6 (0.6)
Stent length to side/second vessel, mm (SD)	17.6 (6.9)	19.3 (6.7)
Kissing balloon inflations after 2nd stent?		
Yes	51 (22%)	217 (93%)
No	0 (0%)	13 (6%)
Not applicable	176 (78%)	—
Missing	3	7
Final POT		
Yes	184 (81%)	192 (84%)
No	43 (19%)	38 (17%)
Missing	3	7

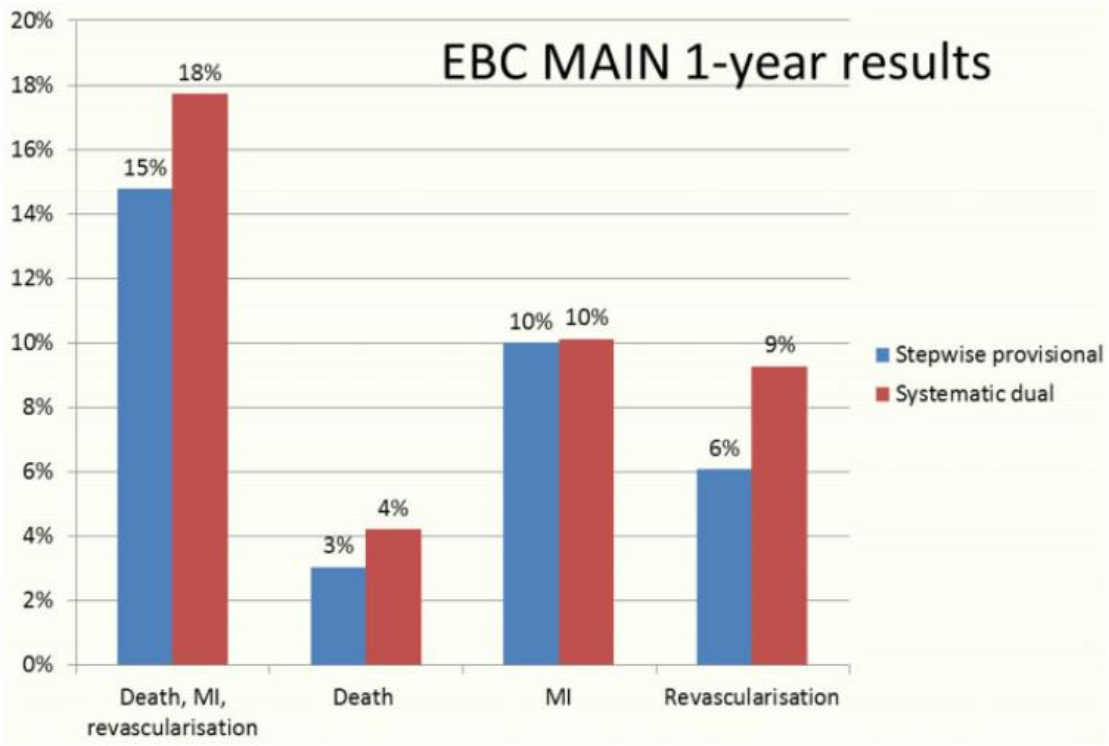


Figure 1 Graphical representation of the primary endpoint. MI, myocardial infarction.

Circulation: Cardiovascular Interventions

ORIGINAL ARTICLE

Are Higher Operator Volumes for Unprotected Left Main Stem Percutaneous Coronary Intervention Associated With Improved Patient Outcomes?

A Survival Analysis of 6724 Procedures From the British Cardiovascular Intervention Society National Database

Tim Kinnaird, MD; Sean Gallagher, MD; Richard Anderson, MD; Andrew Sharp, PhD; Vasim Farooq, PhD; Peter Ludman, MD; Samuel Copt, PhD; Nick Curzen, PhD; Adrian Banning, MD; Mamas Mamas, DPhil

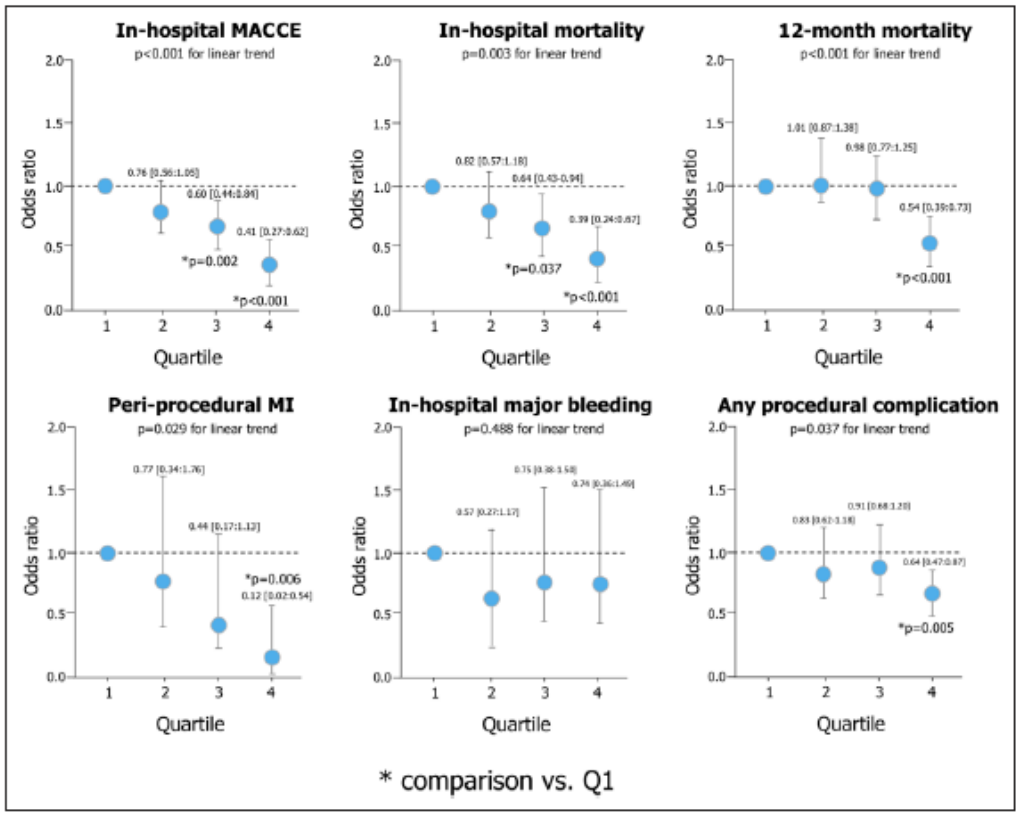


Figure 2. Operator volume and clinical outcomes after unprotected left main stem percutaneous coronary intervention (uLMS-PCI) in England and Wales, 2012 to 2014.
Top line: adjusted in-hospital major adverse cardiac and cerebral events (MACCE) and mortality and 12-mo mortality indicating an association between higher operator volume and improved clinical outcomes. Bottom line: adjusted in-hospital complications with an association observed between higher operator volume and fewer periprocedural complications. MI indicates myocardial infarction. *Comparison vs Q1.

Conclusions

- LMS PCI represents a reasonable treatment strategy for low and intermediate syntax score – importance of MDT
- Consider performance of platform you are using
- Radial approach, 6Fr unless rotablation- 7Fr
- Intracoronary imaging mandatory for all cases pre / post
- For simple cases provisional approach, for more complex cases 2 stent approach better
- Volume outcome relationship in LMS PCI.