What do we mean by complex PCI ?
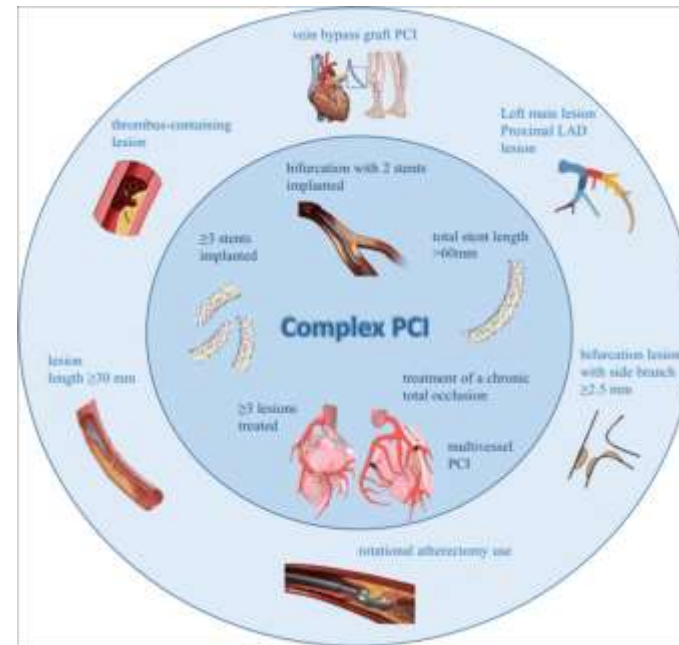

Mamas A. Mamas

Professor of Cardiology

University of Keele

@MMamas1973

Why is it important to define complex PCI

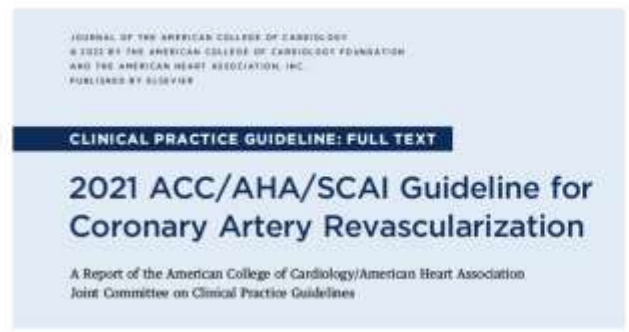**Table 11**   Risk criteria for extended treatment with a second antithrombotic agent

High thrombotic risk (Class IIa)	Moderate thrombotic risk (Class IIb)
Complex CAD and at least 1 criterion	**Non-complex CAD and at least 1 criterion**
Risk enhancers	
Diabetes mellitus requiring medication	Diabetes mellitus requiring medication
History of recurrent MI	History of recurrent MI
Any multivessel CAD	Polyvascular disease (CAD plus PAD)
Polyvascular disease (CAD plus PAD)	CKD with eGFR 15–59 mL/min/1.73 m^2
Premature (<45 years) or accelerated (new lesion within a 2-year time frame) CAD	
Concomitant systemic inflammatory disease (e.g. human immunodeficiency virus, systemic lupus erythematosus, chronic arthritis)	
CKD with eGFR 15–59 mL/min/1.73 m^2	
Technical aspects	
At least 3 stents implanted	
At least 3 lesions treated	
Total stent length >60 mm	
History of complex revascularization (left main, bifurcation stenting with ≥2 stents implanted, chronic total occlusion, stenting of last patent vessel)	
History of stent thrombosis on antiplatelet treatment	

In line with guideline recommendations, CAD patients are stratified into two different risk groups (high vs. moderately increased thrombotic or ischaemic risk). Stratification of patients towards complex vs. non-complex CAD is based on individual clinical judgement with knowledge of patients' cardiovascular history and/or coronary anatomy. Selection and composition of risk-enhancing factors are based on the combined evidence of clinical trials on extended antithrombotic treatment in CAD patients[162,212,214] and on data from related registries.[228–230]
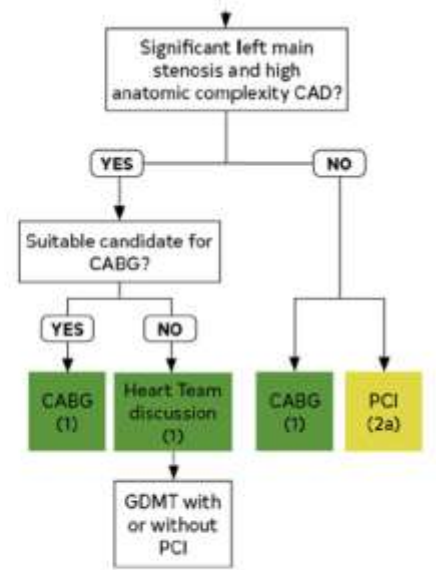
CAD = coronary artery disease; CKD = chronic kidney disease; eGFR = estimated glomerular filtration rate; MI = myocardial infarction; PAD = peripheral artery disease.

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Why is it important to define complex PCI

Keele Cardiovascular Research Group

2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization

CLINICAL PRACTICE GUIDELINE: FULL TEXT

A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

3. In patients with SIHD and significant left main stenosis, CABG is recommended to improve survival (9-12).

4. In selected patients with SIHD and significant left main stenosis for whom PCI can provide equivalent revascularization to that possible with CABG, PCI is reasonable to improve survival (9).

Significant left main stenosis and high anatomic complexity CAD?

- YES → Suitable candidate for CABG?
  - YES → CABG (1)
  - NO → Heart Team discussion (1) → GDMT with or without PCI
- NO →
  - CABG (1)
  - PCI (2a)

Recommendations on criteria for the choice between coronary artery bypass grafting and percutaneous coronary intervention

Recommendations	Class	Level
Assessment of CAD complexity		
In patients with LM or multivessel disease, it is recommended that the SYNTAX score is calculated to assess the anatomical complexity of CAD and the long-term risk of mortality and morbidity after PCI.[117–124]	I	B
When considering the decision between CABG and PCI, completeness of revascularization should be prioritized.[131,132,134–136]	IIa	B

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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	Level	Class	Level
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

What is complex PCI ?

Do PCI operators agree on what is complex PCI?
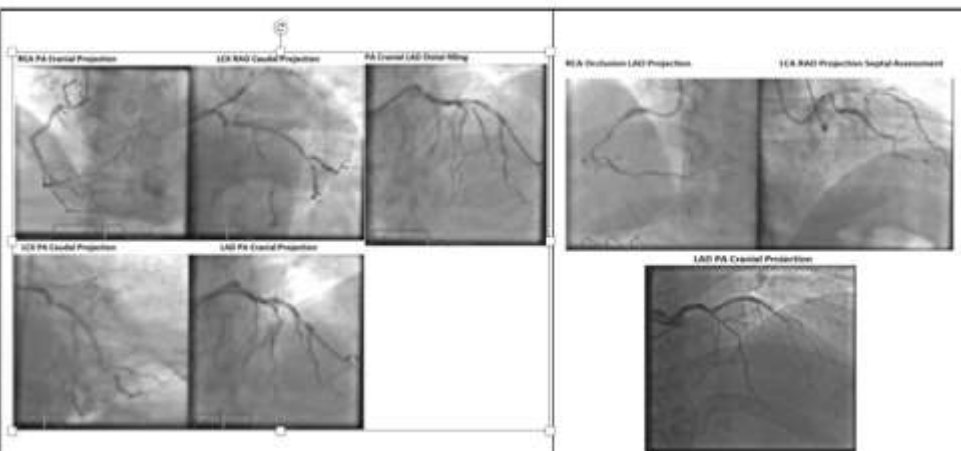
Scenario 1

- A 79 year-old man.
- Troponin negative acute coronary syndrome.
- Angina mobilising on ward.
- EF 20%.
- Moderate Aortic stenosis in context of severe LV dysfunction AVvmax 2.57m/s.
- Mean gradient 16.14mmHg.
- Dimensionless index 0.34. Aortic valve area 1.1cm2.
- Cardiac MRI confirmed limited subendocardial infarction in all coronary territories but with viability in all segments.
- eGFR >60mls/min.
- Hb 122g/L.
- Marked pressure damping engaging RCA ostium.

Scenario 2

- A 64 year-old male, 110kg.
- CCS3 Stable angina on 2 anti-anginals.
- Previous history of medically managed MI 1999.
- LV function normal, no valvular disease.
- eGFR >60mls/min and Hb 130g/L. LAD FFR 0.75

Scenario 3

- An 86-year-old man admitted with NSTEMI with a background of severe LV dysfunction, severe aortic stenosis and eGFR of 37mls/min

Scenario 4

- A 64-year-old man with stable angina came for PCI to the RCA.
- He has a background of previous PCI to the LAD and OM1 with widely patent stents.
- He has normal renal function and normal LV function.

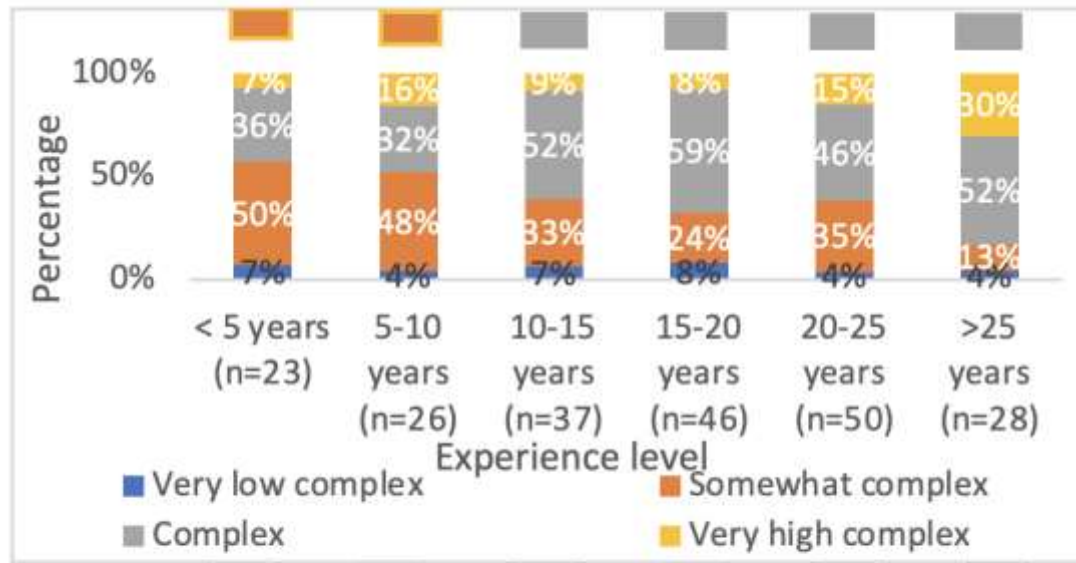## EAPCI Survey

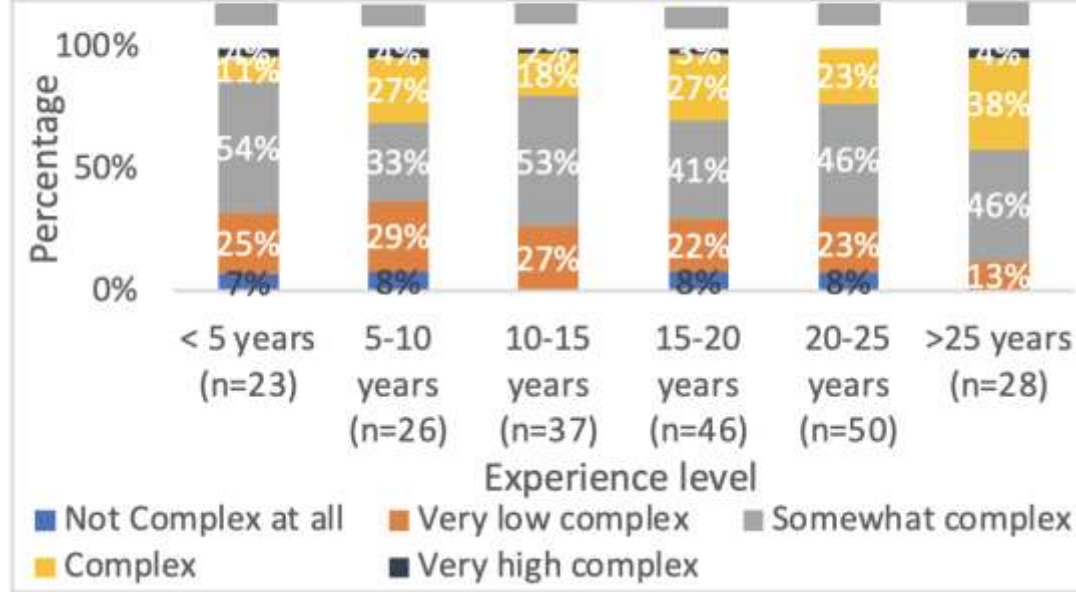**272 interventional cardiologists surveyed**

Mean interventional experience 14.7±8.3 yrs

Do PCI operators agree on what is complex PCI?
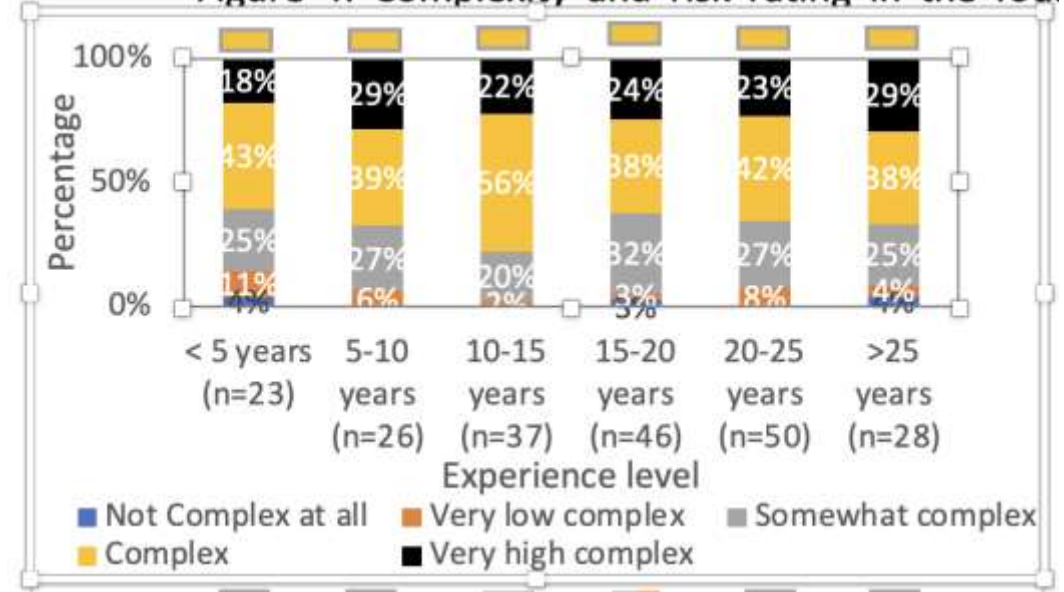
Figure 8: Rating the factors for classifying CHIP-PCI procedures. a represents rating the factors
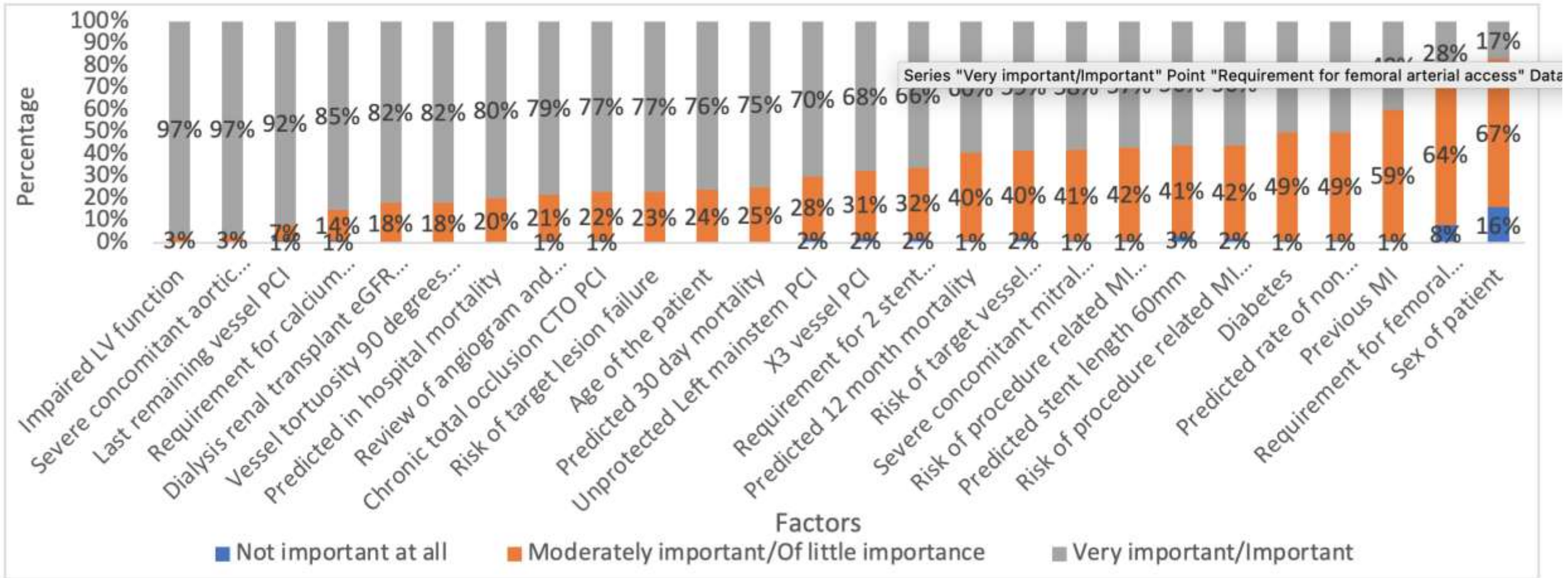
2018 ESC/EACTS Guidelines on myocardial revascularization

The Task Force on myocardial revascularization of the European Society of Cardiology (ESC) and European Association for Cardio-Thoracic Surgery (EACTS)

Developed with the special contribution of the European Association for Percutaneous Cardiovascular Interventions (EAPCI)

Keele Cardiovascular Research Group
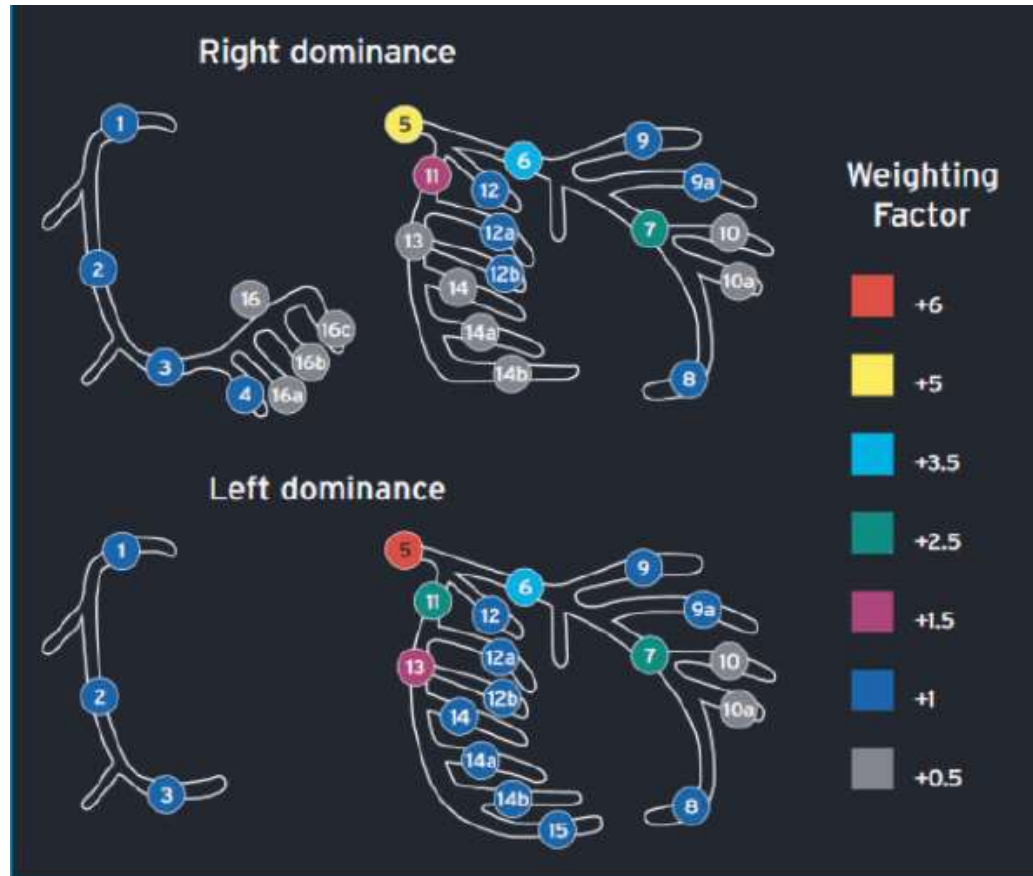
Percutaneous coronary intervention with drug-eluting stents versus coronary artery bypass grafting in left main coronary artery disease: an individual patient data meta-analysis

Marc S Sabatine*, Brian A Bergmark*, Sabina A Murphy, Patrick T O'Gara, Peter K Smith, Patrick W Serruys, A Pieter Kappetein, Seung-Jung Park, Duk-Woo Park, Evald H Christiansen, Niels R Holm, Per H Nielsen, Gregg W Stone, Joseph F Sabik, Eugene Braunwald
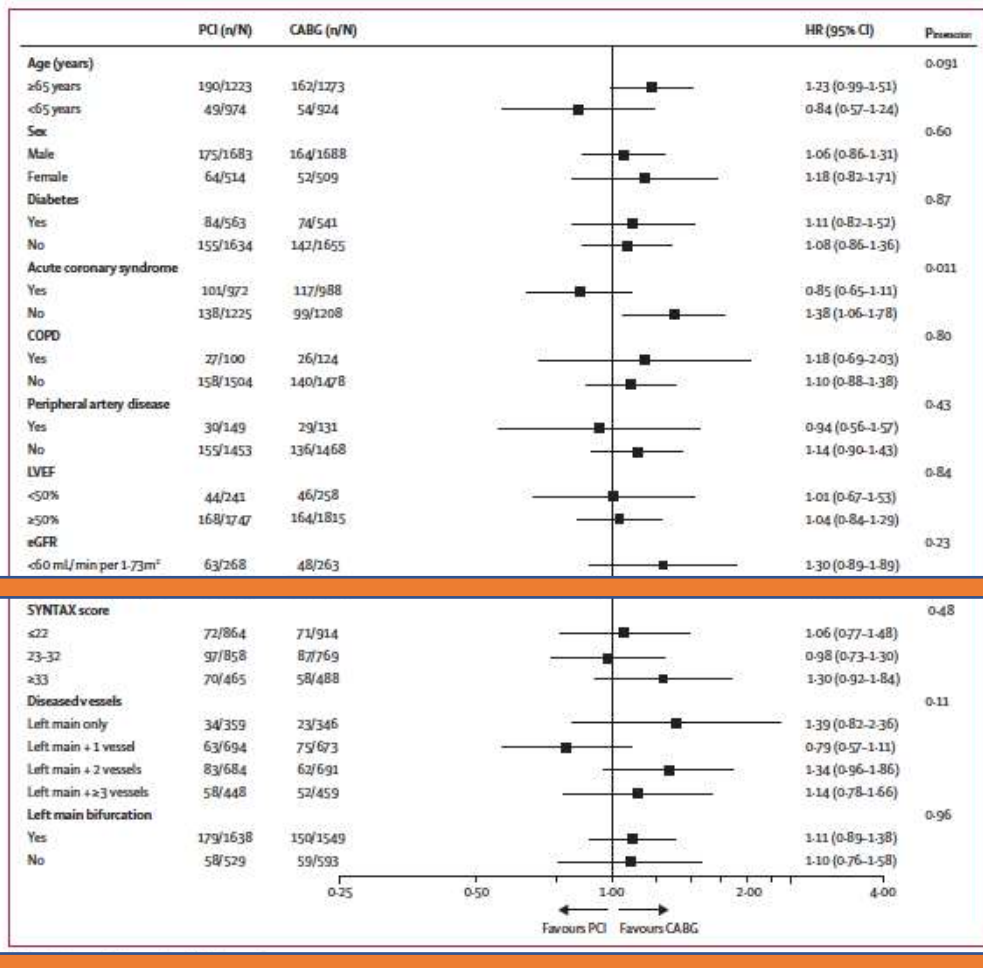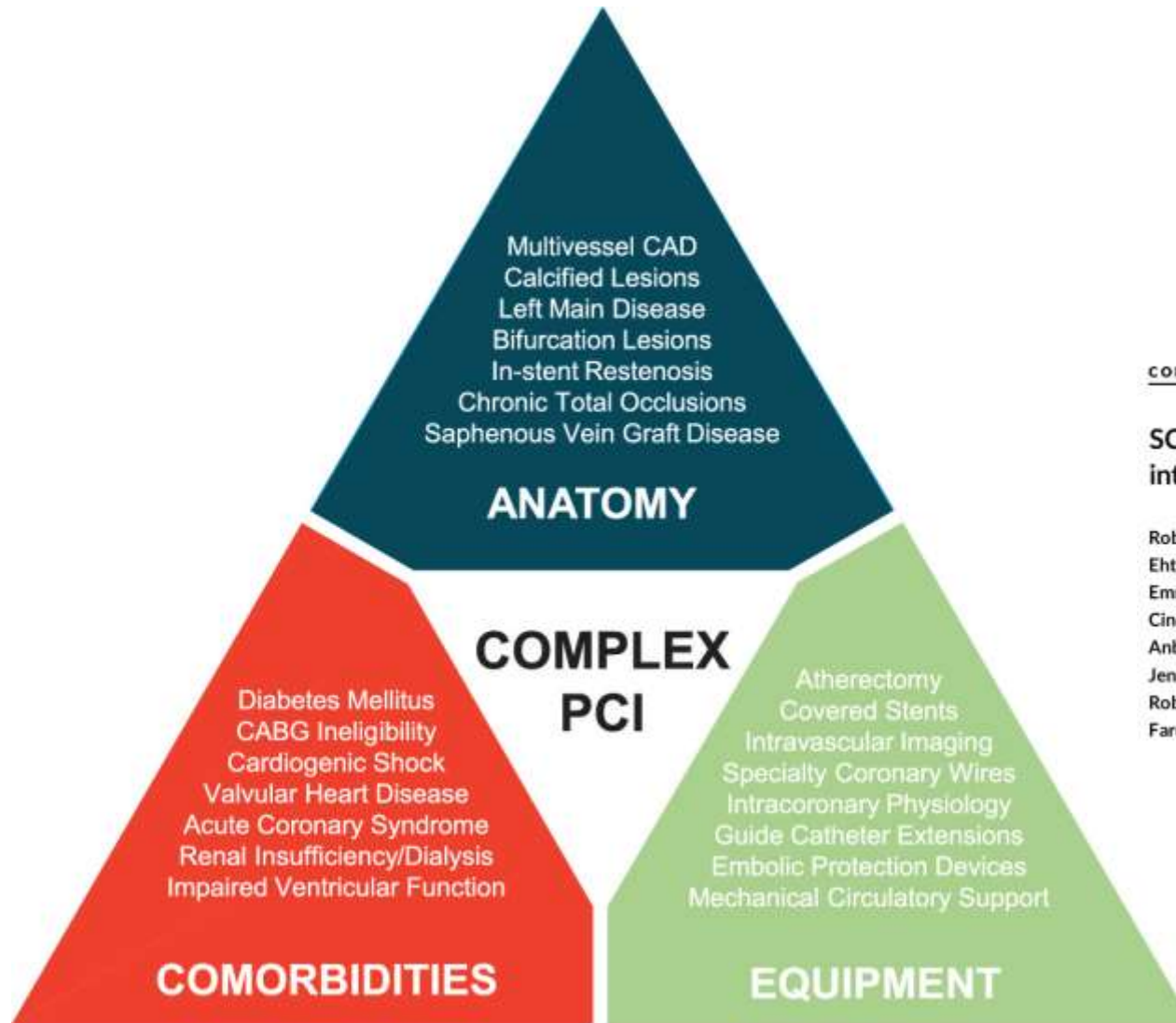
	PCI (n/N)	CABG (n/N)		HR (95% CI)	P_interaction
Age (years)					0·091
≥65 years	190/1223	162/1273		1·23 (0·99–1·51)	
<65 years	49/974	54/924		0·84 (0·57–1·24)	
Sex					0·60
Male	175/1683	164/1688		1·06 (0·86–1·31)	
Female	64/514	52/509		1·18 (0·82–1·71)	
Diabetes					0·87
Yes	84/563	74/541		1·11 (0·82–1·52)	
No	155/1634	142/1655		1·08 (0·86–1·36)	
Acute coronary syndrome					0·011
Yes	101/972	117/988		0·85 (0·65–1·11)	
No	138/1225	99/1208		1·38 (1·06–1·78)	
COPD					0·80
Yes	27/100	26/124		1·18 (0·69–2·03)	
No	158/1504	140/1478		1·10 (0·88–1·38)	
Peripheral artery disease					0·43
Yes	30/149	29/131		0·94 (0·56–1·57)	
No	155/1453	136/1468		1·14 (0·90–1·43)	
LVEF					0·84
<50%	44/241	46/258		1·01 (0·67–1·53)	
≥50%	168/1747	164/1815		1·04 (0·84–1·29)	
eGFR					0·23
<60 mL/min per 1·73m²	63/268	48/263		1·30 (0·89–1·89)	
SYNTAX score					0·48
≤22	72/864	71/914		1·06 (0·77–1·48)	
23–32	97/858	87/769		0·98 (0·73–1·30)	
≥33	70/465	58/488		1·30 (0·92–1·84)	
Diseased vessels					0·11
Left main only	34/359	23/346		1·39 (0·82–2·36)	
Left main + 1 vessel	63/694	75/673		0·79 (0·57–1·11)	
Left main + 2 vessels	83/684	62/691		1·34 (0·96–1·86)	
Left main + ≥3 vessels	58/448	52/459		1·14 (0·78–1·66)	
Left main bifurcation					0·96
Yes	179/1638	150/1549		1·11 (0·89–1·38)	
No	58/529	59/593		1·10 (0·76–1·58)	

Favours PCI   Favours CABG

CABG=coronary artery bypass grafting. COPD=chronic obstructive pulmonary disease. eGFR=estimated glomerular filtration rate (calculated using the Chronic Kidney Disease Epidemiology Collaboration formula). HR=hazard ratio. LVEF=left ventricular ejection fraction. PCI=percutaneous coronary intervention.

What is complex PCI ?

ANATOMY
- Multivessel CAD
- Calcified Lesions
- Left Main Disease
- Bifurcation Lesions
- In-stent Restenosis
- Chronic Total Occlusions
- Saphenous Vein Graft Disease

COMPLEX PCI

COMORBIDITIES
- Diabetes Mellitus
- CABG Ineligibility
- Cardiogenic Shock
- Valvular Heart Disease
- Acute Coronary Syndrome
- Renal Insufficiency/Dialysis
- Impaired Ventricular Function

EQUIPMENT
- Atherectomy
- Covered Stents
- Intravascular Imaging
- Specialty Coronary Wires
- Intracoronary Physiology
- Guide Catheter Extensions
- Embolic Protection Devices
- Mechanical Circulatory Support

CORE CURRICULUM   WILEY

SCAI position statement on optimal percutaneous coronary interventional therapy for complex coronary artery disease

Robert F. Riley MD, MS, FSCAI[1] | Timothy D. Henry MD, MSCAI[2] |
Ehtisham Mahmud MD, FSCAI[3] | Ajay J. Kirtane MD, SM, FSCAI[4] |
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Cindy L. Grines MD, MSCAI[7] | William L. Lombardi MD, FSCAI[8] |
Anbukarasi Maran MD, FSCAI[9] | Tanveer Rab MD, FSCAI[6] |
Jennifer A. Tremmel MD, MS, FSCAI[10] | Alexander G. Truesdell MD, FSCAI[11] |
Robert W. Yeh MD, MSc, MBA, FSCAI[12] | David X. Zhao MD, FSCAI[13] |
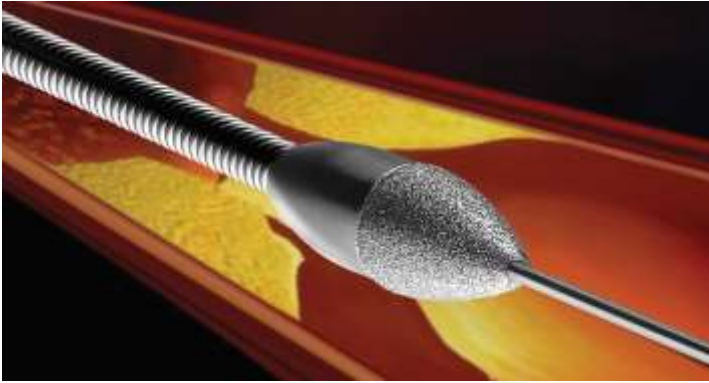Farouc A. Jaffer MD, PhD, FSCAI[14]

By lesion characteristics
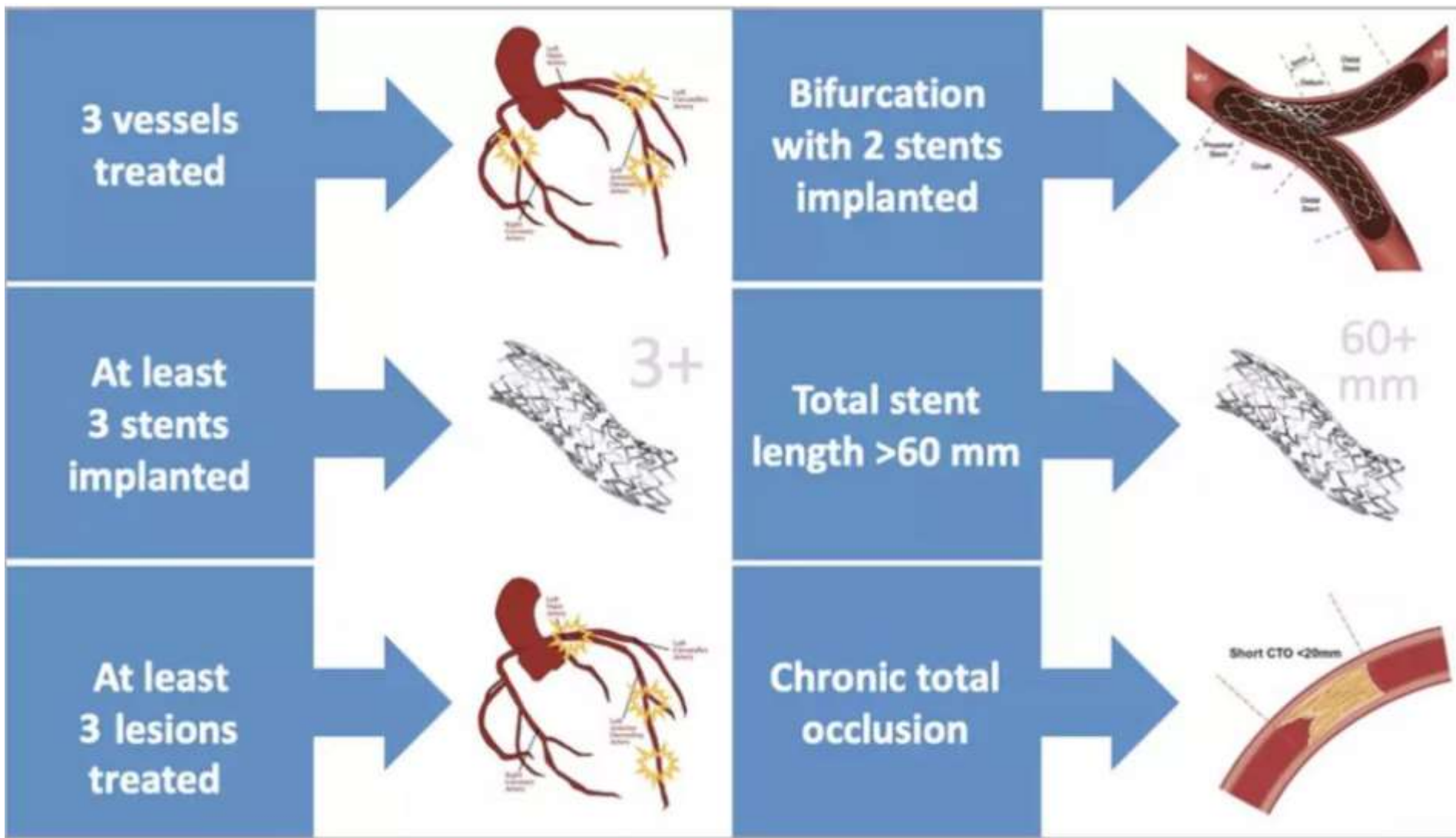
Complex PCI

Rotablation

Left main
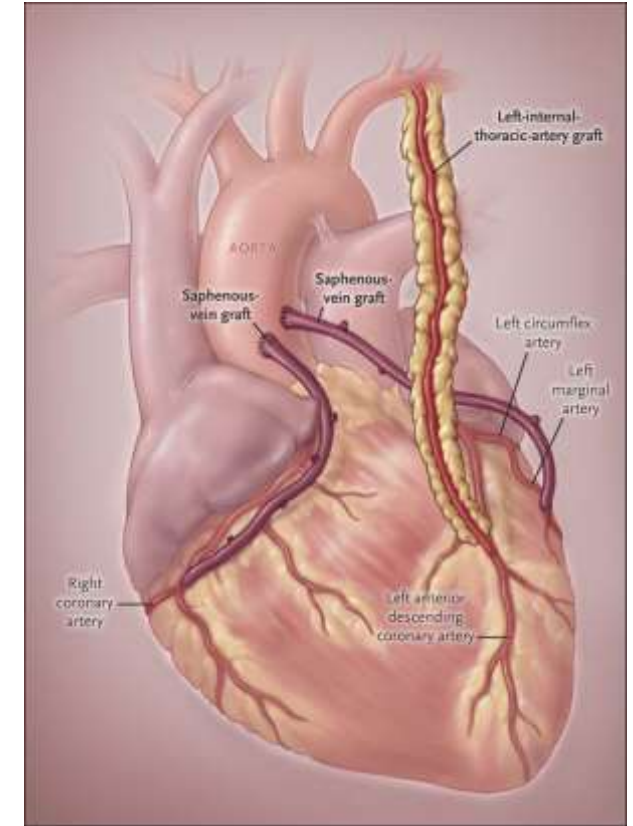
SVG disease

There are left mains and there are left mains !

Jessica Potts, MSc[c], Chun Shing Kwok, MBBS, MSc[a,c], Joie Ensor, PhD[a], Muhammad Rashid, MBBS[a],
Umesh Kadam, PhD[b], Tim Kinnaird, MD[c], Nicholas Curzen, BM PhD[d], Samir B. Pancholy, MD[c],
Danielle Van der Windt, PhD[a], Richard D. Riley, PhD[a], Rodrigo Bagur, MD PhD[f], and
Mamas A. Mamas, BM BCh DPhil[a,a]

Table 1
Charlson co-morbidity index

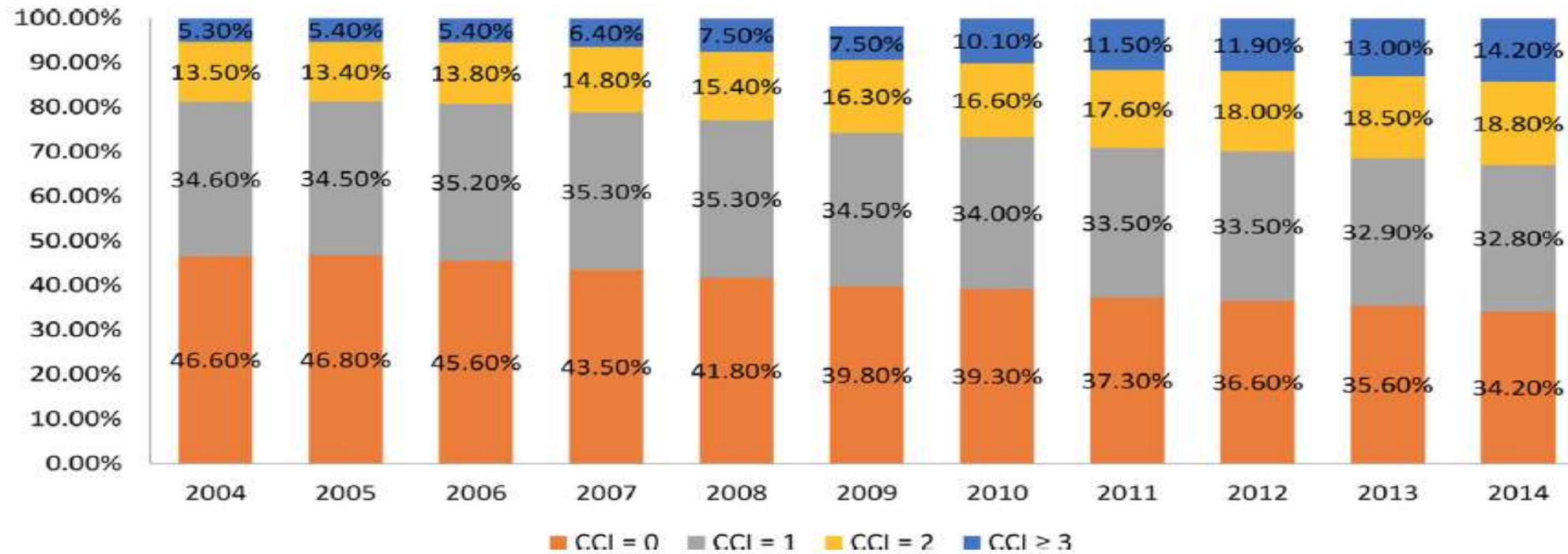Figure 2. Changes in Charlson Co-morbidity Index over time.

AIDS   0

Prevalence and Impact of Co-morbidity Burden as Defined by the Charlson Co-morbidity Index on 30-Day and 1- and 5-Year Outcomes After Coronary Stent Implantation (from the Nobori-2 Study)

Mamas A. Mamas, BM BCh, DPhil[a,b,c,*], Farzin Fath-Ordoubadi, MD[d], Gian B. Danzi, MD[e], Erik Spaepen, MSc[f], Chun Shing Kwok, MBBS[c], Iain Buchan, MD[a,b,c], Niels Peek, PhD[a,b,c], Mark A. de Belder, MD[g], Peter F. Ludman, MD[h], Dragica Paunovic, MD[i], and Philip Urban, MD[j]

Table 1
Charlson co-morbidity index

| Variable	Points
Myocardial infarction	1
Congestive heart failure	1
Peripheral vascular disease	1
Cerebrovascular disease	1
Dementia	1
Chronic obstructive pulmonary disease	1
Connective tissue disease	1
Peptic ulcer disease	1
Diabetes mellitus	1 if uncomplicated
	2 if end-organ damage
Moderate to severe chronic kidney disease	2
Hemiplegia	2
Leukemia	2
Malignant lymphoma	2
Solid tumour	2
	6 if metastatic
Liver disease	1 if mild
	3 if moderate to severe
AIDS	6

Influence of Charlson co-morbidity index (per unit score increase) on cardiac death and major adverse cardiovascular events at 30 days, 1-year and 5-years

Endpoint	Unadjusted OR (95%CI)	Adjusted OR (95%CI)*
30-days		
Cardiac death	1.47(1.20-1.80), P=0.0002	1.47(1.20-1.80), P=0.0002
Major adverse cardiovascular event	1.29 (1.14-1.47), P≤0.0001	1.27 (1.11-1.44), P=0.0005
1-year		
Cardiac death	1.48 (1.32-1.67), P<0.0001	1.46 (1.30-1.65), P<0.0001
Major adverse cardiovascular event	1.33 (1.24-1.43), P<0.0001	1.32 (1.23-1.42), P<0.0001
5-years		
Cardiac death	1.51 (1.39-1.64), P<0.0001	1.38 (1.24-1.53), P<0.0001
Major adverse cardiovascular event	1.29 (1.22-1.37), P<0.0001	1.29 (1.22-1.36), P<0.0001

Why are we trying to define complexity?

- The reason to identify **complexity** is to identify **risk**

- In high risk cases treatment can be personalized (ie more potent DAPT regimes, prolonged DAPT)

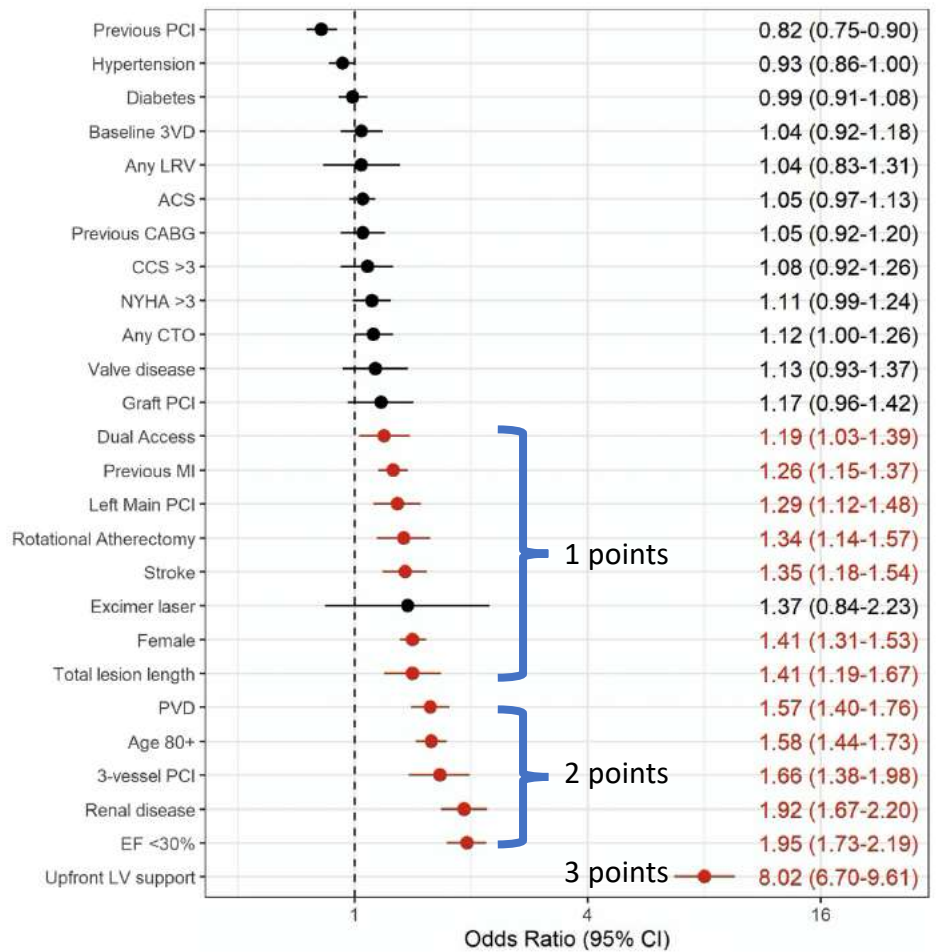- Complexity is subjective, risk via scoring systems isnt
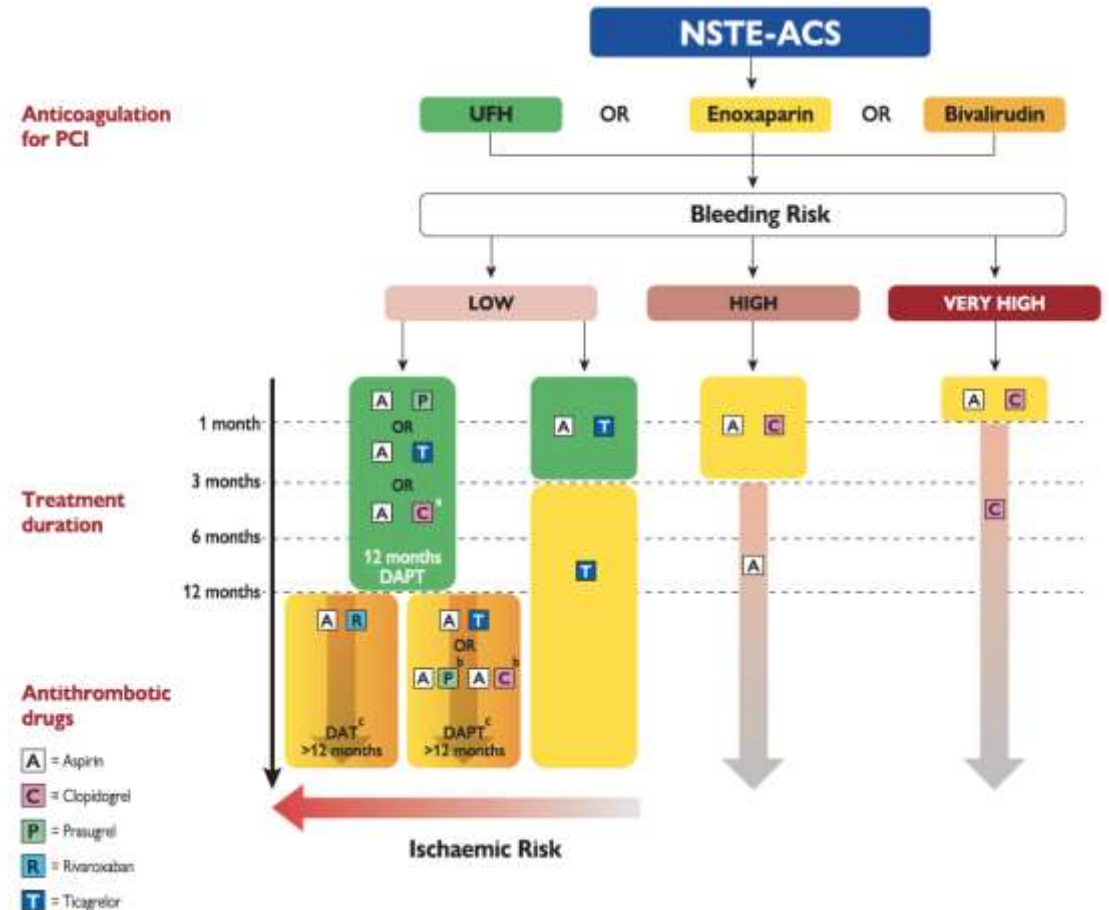
Defining Percutaneous Coronary Intervention Complexity and Risk
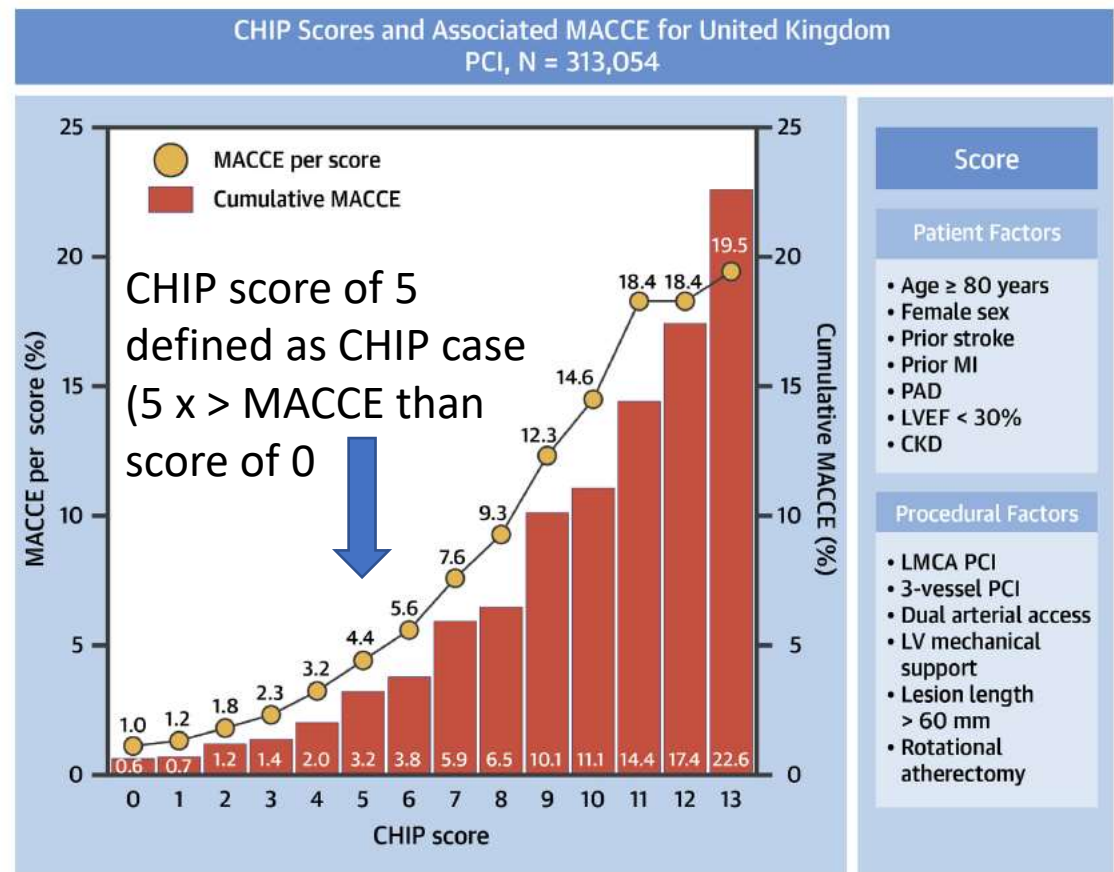
An Analysis of the United Kingdom BCIS Database 2006-2016

Majd Protty, MD,[a] Andrew S.P. Sharp, MD,[a] Sean Gallagher, MD,[a] Vasim Farooq, MD,[a] James C. Spratt, MD,[b] Peter Ludman, MD,[c] Richard Anderson, MD,[a] Margaret M. McEntegart, MD,[d] Colm Hanratty, MD,[e] Simon Walsh, MD,[f] Nick Curzen, PhD,[g] Elliot Smith, MD,[h] Mamas Mamas, DPhil,[i,j] Tim Kinnaird, MD[a,j]

FIGURE 1 Multivariate Adjusted Baseline and Procedural Covariates Associated With In-Hospital MACCE

CENTRAL ILLUSTRATION In-Hospital Major Adverse Cardiac or Cerebrovascular Events

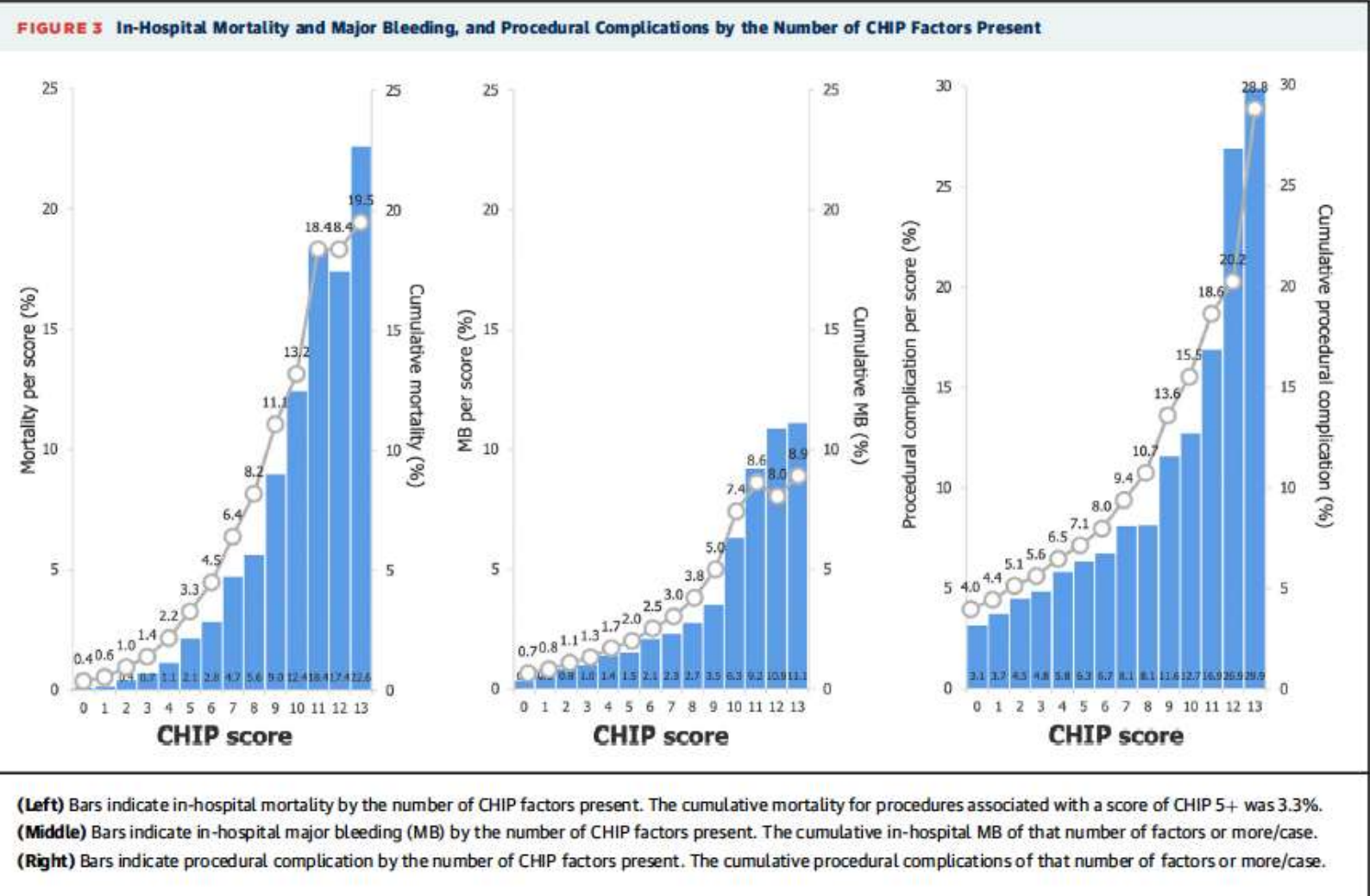CHIP score of 5 defined as CHIP case (5 x > MACCE than score of 0

Defining Percutaneous Coronary Intervention Complexity and Risk

An Analysis of the United Kingdom BCIS Database 2006-2016

Majd Protty, MD,[a] Andrew S.P. Sharp, MD,[a] Sean Gallagher, MD,[a] Vasim Farooq, MD,[a] James C. Spratt, MD,[b] Peter Ludman, MD,[c] Richard Anderson, MD,[a] Margaret M. McEntegart, MD,[d] Colm Hanratty, MD,[e] Simon Walsh, MD,[f] Nick Curzen, PhD,[g] Elliot Smith, MD,[h] Mamas Mamas, DPhil,[i,j] Tim Kinnaird, MD[a,j]

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FIGURE 3 In-Hospital Mortality and Major Bleeding, and Procedural Complications by the Number of CHIP Factors Present

(**Left**) Bars indicate in-hospital mortality by the number of CHIP factors present. The cumulative mortality for procedures associated with a score of CHIP 5+ was 3.3%.

(**Middle**) Bars indicate in-hospital major bleeding (MB) by the number of CHIP factors present. The cumulative in-hospital MB of that number of factors or more/case.

(**Right**) Bars indicate procedural complication by the number of CHIP factors present. The cumulative procedural complications of that number of factors or more/case.

Defining complexity

- Complexity should be defined by risk

- Accounted for by clinical factors, procedural factors and lesion characteristics

- Use patient centred clinically relevant endpoints such as MACCE to define complexity rather than isolated lesion / clinical / procedural characteristics

- With exception of LV support a single factor has only a modest impact on MACCE

- Therefore complex PCI should be considered in the context of multiple risk factors that may be pt level, lesion level or technical level.