INDIAN HEART JOURNAL 68 (2016) 1–5

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/ihj

Editorial

Balancing idealism with realism to safeguard the welfare of patients: The importance of Heart Team led decision-making in patients with complex coronary artery disease

Keywords:
Heart Team
Coronary artery bypass graft surgery
Percutaneous coronary intervention
SYNTAX score
Decision-making

"Idealism is like a castle in the air if it is not based on a solid foundation of social and political realism."
Claude McKay, Jamaican-American writer and poet.

The concept of the Heart Team – consisting of at least a cardiac surgeon and an interventional cardiologist – in guiding decision making on the optimal revascularization modality in patients with complex coronary artery disease (CAD) has had a relatively short history.[1,2] Prior to the publication of the landmark randomized SYNTAX Trial in 2009,[1–4] decision-making between coronary artery bypass graft (CABG) surgery and percutaneous coronary intervention (PCI) in patients with complex CAD was very much at the discretion of the interventional cardiologist, who acted as the "gate-keeper". Such an approach appropriately drew heavy criticism from cardiac surgeons and the cardiology community alike, since patients with complex CAD were being denied evidence-based surgical revascularization, and undergoing the then non-evidenced-based practice of multivessel PCI.[5,6] SYNTAX represented the largest assessment of revascularization with CABG or PCI in subjects with complex CAD, and aimed to supply a body of evidence to support the rapidly expanding practice of multivessel PCI. In addition, through an *all-comers*, randomized trial design, SYNTAX aimed to eliminate the profound selection bias that had plagued earlier trials comparing CABG and PCI. Namely, that these trials enrolled highly selected, "cherry-picked," patients, with less complex coronary anatomy (predominantly single or double vessel disease) and lower co-morbidity (such as impaired left ventricular function), and thus being largely unrepresentative of conventional clinical practice.[5,7,8]

One of the unique aspects of the SYNTAX Trial was that a Heart Team – consisting of at least a cardiac surgeon and an interventional cardiologist – was required to use the SYNTAX score (www.syntaxscore.com) as an objective anatomical scoring tool that forced the Heart Team to systematically analyze the coronary angiogram, and agree that equivalent anatomic revascularization between CABG and PCI could be achieved, based on a vessel size of 1.5 mm. Subjects were randomized if the Heart Team agreed that equivalent anatomic revascularization could be achieved; subjects not suitable for randomization were nested in CABG (PCI-ineligible patients for predominantly too complex CAD that could not be revascularized to the same extent as CABG) and PCI (CABG-ineligible patients for predominantly too high operative risk) registries and followed up.[1]

Since publication of the SYNTAX Trial, it is noteworthy that both the Heart Team approach and the anatomical SYNTAX score are advocated in both European and US revascularization guidelines,[9–15] with the Heart Team given a class 1 recommendation.

1. Does the Heart Team have the appropriate clinical tools to aid decision making?

One may argue that the Heart Team, in open dialog with the patient, allows for a consensus to be reached that would only

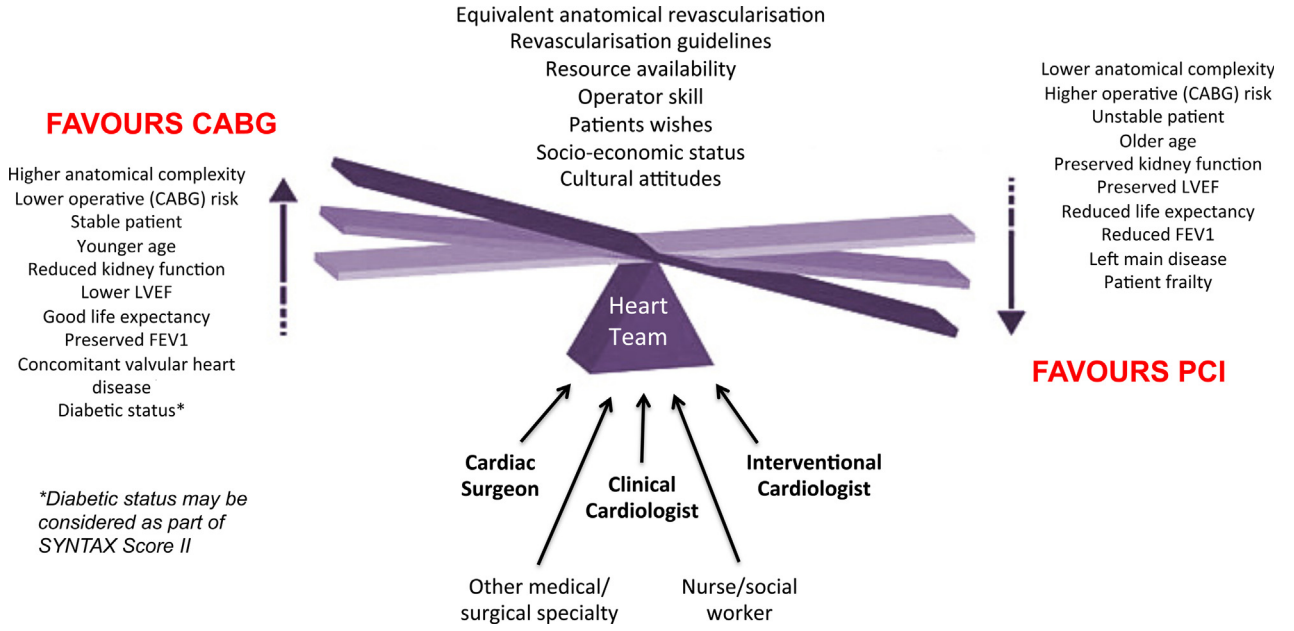

Fig. 1 – Complex coronary artery disease – the Heart Team in action. Key factors in guiding decision-making on the optimal revascularization strategy in patients with complex coronary artery disease. The Heart Team must balance patient wishes, clinical evidence and approved international revascularization guidelines, ability to achieve equivalent anatomical revascularization, and clinical symptoms, when determining the most appropriate revascularization strategy. Various clinical tools are available to aid the Heart Team approach, and allow for more objective decision-making. These include assessment of anatomical complexity (SYNTAX score), anatomical complexity augmented with clinical variables (SYNTAX score II), surgical operative risk tools (e.g. EuroSCORE, STS score), and tools to aid in the assessment of completeness of revascularization (e.g. residual SYNTAX score[35]). In addition, the involvement of necessary multidisciplinary specialties and the patient are required to facilitate shared decision-making. Abbreviations: CABG – coronary artery bypass graft surgery, LVEF – left ventricular ejection fraction, FEV1 – forced expiratory volume in 1 s, PCI – percutaneous coronary intervention.

serve to offer our patients the optimal revascularization modality based on the best available clinical evidence. Such a practice has been shown to reduce physician bias and allows for guideline directed decision-making.[16–18] One may however ask in retort, can the Heart Team really assimilate all the clinical evidence to help direct appropriate decision-making? Fig. 1 illustrates this complex relationship, which may be regarded as a set of scales, with factors pushing toward either surgical or percutaneous-based revascularization. Clinical tools such as the anatomical SYNTAX score and SYNTAX score II are detailed below to aid the Heart Team in simplifying this process. The development of non-invasive anatomical assessments (with for example a multislice computed tomography [MSCT] derived SYNTAX score) is ongoing, and will ultimately serve to streamline the Heart Team process by allowing for non-invasive decision-making.[19,20]

1.1. *Anatomical SYNTAX score*

Based primarily on the results of SYNTAX, current European revascularization guidelines[10] gives subjects with three vessel diseases and low SYNTAX scores (0–22), a level of evidence of IA for CABG and IIa B for PCI. In subjects with unprotected left main coronary artery (ULMCA) disease and low to intermediate SYNTAX scores (<33), a level of evidence of IA is given for CABG and IIb B for PCI. Furthermore, US guidelines now give surgical revascularization for ULMCA disease a Class 1B recommendation,[11,12] compared to a Class 1A recommendation in previous guidelines.[21]

The randomized EXCEL (Evaluation of XIENCE PRIME™ or XIENCE V® Everolimus Eluting Stent System Versus Coronary Artery Bypass Surgery for Effectiveness of Left Main Revascularization; ClinicalTrials.gov identifier: NCT01205776) and NOBLE (Nordic-Baltic-British Left Main Revascularization Study, ClinicalTrials.gov Identifier: NCT01496651) trials will ultimately provide a much stronger evidence base for the practice of left main intervention. EXCEL recently completed recruitment of 1905 patients with ULMCA disease and investigator reported SYNTAX scores <33, randomized to CABG (n = 957) or PCI with contemporary stents (n = 948). The Primary Endpoint is a composite measure of all-cause death, MI, or stroke at 3 years post revascularization.[22]

1.2. *SYNTAX score II*

The SYNTAX score II[23–25] augments the purely anatomical SYNTAX score with anatomical and clinical factors that were shown to alter the threshold value of the anatomical SYNTAX score that would lead to similar long-term mortality between CABG and PCI. Based on this principle, younger age, female gender and reduced LVEF favored CABG compared to PCI on long-term prognostic grounds. Thus, in such patients, a

LOWER anatomical SYNTAX score would be required in order to achieve a similar long-term mortality between CABG and PCI. By contrast, older age, chronic obstructive pulmonary disease or ULMCA disease favored PCI compared to CABG and thus, in this type of patient, a HIGHER anatomical SYNTAX score would be needed for the long-term mortality between CABG and PCI to be similar.

The above findings are supported from a recent sub analysis of the Surgical Treatment of IsChemic Heart failure (STICH) Trial[26] demonstrating that in subjects with more advanced ischemic cardiomyopathy, more extensive CAD and worse myocardial dysfunction and remodeling, that a net longer-term prognostic benefit was seen for CABG compared to optimal medical therapy, despite the short term (30-day) mortality risk being higher with CABG. In addition, a population-based study of patients with chronic kidney disease and multivessel coronary disease from the Ontario provincial registry, demonstrated that CABG was associated with improved early and late mortality benefit compared to PCI.[27] Findings that raise the possibility that excess plaque burden and vulnerability may play a role in decision-making between CABG and PCI.[28] Namely, that patients with these characteristics are more likely to derive a longer-term prognostic benefit from surgical revascularization, despite the potentially higher operative risks associated with reduced left ventricular ejection fraction or impaired kidney function. Findings which may in part be due to the potential protective effects of a bypass graft in passivating the entire vessel from future cardiac events for the lifespan of the graft – unlike PCI which would treat the obstructive lesion alone.[5,23,27,29]

External validation of the SYNTAX score II has retrospectively been performed in the multinational Drug Eluting stent for Left main coronary Artery disease (DELTA) Registry ($n = 2891$; 14 centers in Europe, US and South Korea),[30] and the Japanese Coronary REvascularization Demonstrating Outcome Study in Kyoto (CREDO-Kyoto) PCI/CABG multicenter registry ($n = 1796$).[31] Prospective validation of the SYNTAX score II is currently ongoing in EXCEL and the SYNTAX II (ClinicalTrials.gov Identifier: NCT02015832) trials. As part of the prospective validation of the SYNTAX score II in EXCEL, the SYNTAX score II has predicted at least an equipoise for long-term mortality between CABG and PCI in subjects with ULMCA disease up to an intermediate anatomical complexity (anatomical SYNTAX score <33).[25]

2. Indian subcontinent

Against this backdrop, in this issue of The Indian Heart Journal, are two important, real world, single center registries from India (Ray et al., Goel et al.)[32,33] describing outcomes relating to unprotected left main PCI. It is noteworthy that both registries, despite their limited size, support the EXCEL hypothesis as described earlier. Namely, that there was a clear difference in outcomes between low to intermediate SYNTAX scores (<33) and high SYNTAX scores (>32), the latter of which was shown to be an independent predictor of adverse clinical outcomes in both registries. In addition, these findings support the concept that it is not the presence of left main disease per se that drives adverse clinical outcomes and decision making between CABG and PCI, but the complexity of the CAD downstream from the left main.[23] The more complex the downstream CAD, the greater plaque burden/vulnerability necessitating the potential protective effects of a bypass graft.[5,23,27,29] It has previously been hypothesized that the presence of left main disease is akin to single vessel,[20,23] and provided that the interventional center has the technical ability to perform the procedure safely and efficaciously; outcomes are excellent.

Another notable observation is that Ray et al.[32] demonstrated that impaired left ventricular function to be an independent predictor of adverse outcomes in patients undergoing left main PCI. Such findings were also seen in the SYNTAX Trial during development of the SYNTAX score II, where it was shown that much lower anatomical SYNTAX scores were required for equipoise for long-term mortality between CABG and PCI.[23] In addition, Ray et al. elegantly demonstrated that distal left main disease was only associated with an excess hazard of adverse outcomes in the presence of high SYNTAX scores (>32). Findings that again support the EXCEL hypothesis, and the fact that outcomes related to distal (bifurcation) left main disease are confounded by the complexity of the downstream CAD, and it is the latter that drives adverse outcomes, not the presence of distal left main disease per se.

It is however important to emphasize that the concept of the Heart Team is not yet an accepted part of mainstream practice in India, and as a consequence, left main PCI may be being over utilized (Personal Communication: Professor Sundeep Mishra, Editor-in-Chief, Indian Heart Journal, 5th July 2015). In the two registries described in this issue of the Indian Heart Journal,[32,33] one describes the use of a multidisciplinary Heart Team approach and the other does not. Given the complexity of decision making (Fig. 1), danger of physician bias as previously described,[5,16–18] the awaited outcomes from EXCEL/NOBLE, and prospective validation studies of the SYNTAX score II, the logic of not adopting a Heart Team approach to ensure decision making is made on the best available clinical evidence and guidelines, is difficult to comprehend. Whether one wishes to use Western guidelines or develop local guidelines that may be more relevant to Indian practice is of course welcomed.[34] Decision-making based on the best available clinical evidence and the consensus of the Heart Team should ultimately be the idealism we should strive for. Ensuring the social and political will is present will guarantee that the Heart Team concept is built on a solid foundation that will ultimately serve to safeguard the welfare of our patients we treat every day…

Conflicts of interest

The authors have none to declare.

REFERENCES

1. Ong AT, Serruys PW, Mohr FW, et al. The SYNergy between percutaneous coronary intervention with TAXus and cardiac surgery (SYNTAX) study: design, rationale, and run-in phase. *Am Heart J*. 2006;151:1194–1204.
2. Serruys PW, Morice MC, Kappetein AP, et al. Percutaneous coronary intervention versus coronary-artery bypass

grafting for severe coronary artery disease. *N Engl J Med*. 2009;360:961–972.
3. Kappetein AP, Feldman TE, Mack MJ, et al. Comparison of coronary bypass surgery with drug-eluting stenting for the treatment of left main and/or three-vessel disease: 3-year follow-up of the SYNTAX trial. *Eur Heart J*. 2011;32:2125–2134.
4. Mohr FW, Morice MC, Kappetein AP, et al. Coronary artery bypass graft surgery versus percutaneous coronary intervention in patients with three-vessel disease and left main coronary disease: 5-year follow-up of the randomised, clinical SYNTAX trial. *Lancet*. 2013;381:629–638.
5. Taggart DP, Thomas B. Ferguson lecture. Coronary artery bypass grafting is still the best treatment for multivessel and left main disease, but patients need to know. *Ann Thorac Surg*. 2006;82:1966–1975.
6. Patel MR, Dehmer GJ, Hirshfeld JW, Smith PK, Spertus JA. ACCF/SCAI/STS/AATS/AHA/ASNC 2009 appropriateness criteria for coronary revascularization: a report of the American College of Cardiology Foundation Appropriateness Criteria Task Force, Society for Cardiovascular Angiography and Interventions, Society of Thoracic Surgeons, American Association for Thoracic Surgery, American Heart Association, and the American Society of Nuclear Cardiology: endorsed by the American Society of Echocardiography, the Heart Failure Society of America, and the Society of Cardiovascular Computed Tomography. *Circulation*. 2009;119:1330–1352.
7. Soran O, Manchanda A, Schueler S. Percutaneous coronary intervention versus coronary artery bypass surgery in multivessel disease: a current perspective. *Interact Cardiovasc Thorac Surg*. 2009;8:666–671.
8. Farooq V, Serruys PW. Cherry-picking patients for randomized, controlled trials-reliving the past. *J Am Coll Cardiol*. 2013;61:2492.
9. Patel MR, Dehmer GJ, Hirshfeld JW, Smith PK, Spertus JA. ACCF/SCAI/STS/AATS/AHA/ASNC/HFSA/SCCT 2012 appropriate use criteria for coronary revascularization focused update: a report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force, Society for Cardiovascular Angiography and Interventions, Society of Thoracic Surgeons, American Association for Thoracic Surgery, American Heart Association, American Society of Nuclear Cardiology, and the Society of Cardiovascular Computed Tomography. *J Am Coll Cardiol*. 2012;59:857–881.
10. Wijns W, Kolh P, Danchin N, et al. Guidelines on myocardial revascularization. *Eur Heart J*. 2010;31:2501–2555.
11. Hillis LD, Smith PK, Anderson JL, et al. 2011 ACCF/AHA guideline for coronary artery bypass graft surgery: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Developed in collaboration with the American Association for Thoracic Surgery, Society of Cardiovascular Anesthesiologists, and Society of Thoracic Surgeons. *J Am Coll Cardiol*. 2011;58:e123–e210.
12. Levine GN, Bates ER, Blankenship JC, et al. 2011 ACCF/AHA/SCAI guideline for percutaneous coronary intervention, a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines and the Society for Cardiovascular Angiography and Interventions. *J Am Coll Cardiol*. 2011;58:e44–e122.
13. Montalescot G, Sechtem U, Achenbach S, et al. 2013 ESC guidelines on the management of stable coronary artery disease: the task force on the management of stable coronary artery disease of the European Society of Cardiology. *Eur Heart J*. 2013;34:2949–3003.
14. Windecker S, Kolh P, Alfonso F, et al. 2014 ESC/EACTS guidelines on myocardial revascularization. *EuroIntervention*. 2015;10:1024–1094.
15. Windecker S, Kolh P, Alfonso F, et al. 2014 ESC/EACTS guidelines on myocardial revascularization: the Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS) developed with the special contribution of the European Association of Percutaneous Cardiovascular Interventions (EAPCI). *Eur Heart J*. 2014;35:2541–2619.
16. Head SJ, Kaul S, Mack MJ, et al. The rationale for Heart Team decision-making for patients with stable, complex coronary artery disease. *Eur Heart J*. 2013;34:2510–2518.
17. Mishra S. What ails the practice of medicine: the Atlas has shrugged. *Indian Heart J*. 2015;67:1–7.
18. Valooran GJ, Nair SK, Chandrasekharan K. Strategies for the coronary surgeon to remain competitive and co-operative in the PCI era. *Indian Heart J*. 2015;67:351–358.
19. Papadopoulou SL, Girasis C, Dharampal A, et al. CT-SYNTAX score: a feasibility and reproducibility study. *JACC Cardiovasc Imaging*. 2013;6:413–415.
20. Farooq V, Head SJ, Kappetein AP, Serruys PW. Widening clinical applications of the SYNTAX score. *Heart*. 2014;100:276–287.
21. Kushner FG, Hand M, Smith Jr SC et al. 2009 focused updates: ACC/AHA guidelines for the management of patients with ST-elevation myocardial infarction (updating the 2004 guideline and 2007 focused update) and ACC/AHA/SCAI guidelines on percutaneous coronary intervention (updating the 2005 guideline and 2007 focused update) a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol*. 2009;54:2205–2241.
22. Farooq V, Serruys PW, Stone GW, Virmani R, Chieffo A, Fajadet J. *Left Main Coronary Artery Disease. Percutaneous Interventional Cardiovascular Medicine. The PCR-EAPCI Textbook*. EUROPA ed. Toulouse, France: PCR Publishing; 2012:407–445 [Part 3, chapter 12].
23. Farooq V, van Klaveren D, Steyerberg EW, et al. Anatomical and clinical characteristics to guide decision making between coronary artery bypass surgery and percutaneous coronary intervention for individual patients: development and validation of SYNTAX score II. *Lancet*. 2013;381:639–650.
24. Farooq V, van Klaveren D, Steyerberg EW, Serruys PW. SYNTAX score II – authors' reply. *Lancet*. 2013;381:1899–1900.
25. Campos CM, van Klaveren D, Farooq V, et al. Long-term forecasting and comparison of mortality in the evaluation of the Xience everolimus eluting stent vs. coronary artery bypass surgery for effectiveness of left main revascularization (EXCEL) trial: prospective validation of the SYNTAX score II. *Eur Heart J*. 2015;36:1231–1241.
26. Panza JA, Velazquez EJ, She L, et al. Extent of coronary and myocardial disease and benefit from surgical revascularization in LV dysfunction. *J Am Coll Cardiol*. 2014;64:553–561.
27. Chan W, Ivanov J, Ko D, et al. Clinical outcomes of treatment by percutaneous coronary intervention versus coronary artery bypass graft surgery in patients with chronic kidney disease undergoing index revascularization in Ontario. *Circ Cardiovasc Interv*. 2015;8:.
28. Farooq V, Di Mario C, Serruys PW. The triad of residual ischaemia, plaque burden, and plaque vulnerability: a known known?…a known unknown?…or an unknown unknown? *EuroIntervention*. 2015;11:611–619.
29. Panza JA, Velazquez EJ, She L, et al. Extent of coronary and myocardial disease and benefit from surgical revascularization in ischemic LV dysfunction [corrected]. *J Am Coll Cardiol*. 2014;64:553–561.
30. Chieffo A, Meliga E, Latib A, et al. Drug-eluting stent for left main coronary artery disease: the DELTA registry: a multicenter registry evaluating percutaneous coronary

intervention versus coronary artery bypass grafting for left main treatment. *JACC Cardiovasc Interv*. 2012;5:718–727.
31. Campos CM, van Klaveren D, Iqbal J, et al. Predictive performance of SYNTAX score II in patients with left main and multivessel coronary artery disease. *Circ J*. 2014;78:1942–1949.
32. Ray, et al. *Indian Heart J*. 2015.
33. Goel, et al. *Indian Heart J*. 2015.
34. Mishra S, Chaturvedi V. Are western guidelines good enough for Indians? My name is Borat. *Indian Heart J*. 2015;67:85–89.
35. Farooq V, Serruys PW, Bourantas CV, et al. Quantification of incomplete revascularization and its association with five-year mortality in the synergy between percutaneous coronary intervention with taxus and cardiac surgery (SYNTAX) trial validation of the residual syntax score*clinical perspective. *Circulation*. 2013;128:141–151.

Vasim Farooq MBChB, MRCP, PhD*
Institute of Cardiovascular Sciences, Manchester Academic Health Sciences Centre, University of Manchester and Manchester Heart Centre, Manchester Royal Infirmary, Central Manchester University Hospitals NHS Trust, Manchester, United Kingdom

Carlo Di Mario MD, PhD
NIHR Cardiovascular BRU, Royal Brompton & Harefield NHS Foundation Trust and Imperial College London, London, United Kingdom

Patrick W. Serruys MD, PhD[a,b]
[a]*Emeritus Professor of Medicine with a Chair in Interventional Cardiology at the Erasmus University, Rotterdam, The Netherlands*
[b]*International Centre for Circulatory Health, NHLI, Imperial College, London, United Kingdom*

*Corresponding author
E-mail address: vasimfarooq@icloud.com (V. Farooq)

Available online 12 January 2016

http://dx.doi.org/10.1016/j.ihj.2015.10.385
0019-4832/