

Predicting the future for left main revascularisation. Choosing the right fortune teller...



Philippe Généreux*, MD; Ali Seyar Rahyab, MD

Gagnon Cardiovascular Institute, Morristown Medical Center, Atlantic Health System, Morristown, NJ, USA

In this issue of EuroIntervention, Thuijs et al¹ report on the predictive performance of the Society of Thoracic Surgeons (STS) risk score in patients undergoing coronary artery bypass surgery (CABG) or percutaneous coronary intervention (PCI) for left main coronary artery disease (CAD) in a *post hoc* analysis of the EXCEL trial².

Article, see page 36

The authors have assessed the STS predicted risk of mortality, stroke, and renal failure risk models for 30-day outcomes in both the CABG and PCI cohorts. The main findings were the following: (1) the STS score predictive accuracy for 30-day mortality and acute kidney injury was good for CABG but poor for PCI; and (2) the STS score predictive accuracy for 30-day stroke was good for both CABG and PCI.

While the authors should be congratulated for a clear and concise presentation of the data, the findings are not surprising for several reasons. First, and as the authors point out, the STS score was originally derived from a logistic model sourced from a cohort of patients undergoing open heart surgery with variables independently associated with adverse events after CABG, not after PCI. Therefore, it is not surprising that the STS risk score demonstrated poor predictive accuracy for mortality and renal insufficiency after PCI. Indeed, the less invasive nature of percutaneous revascularisation is well known to be associated with significantly lower short-term mortality and major adverse events such as bleeding, infection, readmission, and acute kidney injury. Second, only a few factors predict periprocedural (30-day) mortality after PCI, with the anatomical/technical complexity of the procedure being, by far, the most important one³. The well-known SYNTAX score is probably the best tool to capture the anatomical complexity of a percutaneous procedure, and is, therefore, the most predictive score for major adverse events after PCI⁴. Obviously, the STS score does not consider the anatomical complexity and extent of

CAD, once again explaining the lack of predictive accuracy for 30-day adverse events. Finally, it is also not surprising that the STS score demonstrated a good predictive value for stroke among patients undergoing PCI. Indeed, a non-negligible proportion of stroke after PCI (and CABG) is explained not by technical factors but rather by patient-related factors and concomitant comorbidities (e.g., atrial fibrillation, peripheral vascular disease, prior stroke), which were similar at baseline in the PCI and CABG groups.

The lack of predictive accuracy of the STS score relative to non-surgical procedures (percutaneous intervention) has been shown in other fields. Indeed, the STS score was shown to be non-predictive for transcatheter aortic valve procedures⁵. This led to the development of more appropriate scores, such as the TAVR score⁶. To entertain the idea that a score developed from and for surgical procedures will also bring predictive value for less invasive counterparts could be seen as overly optimistic. Historically speaking, risk stratification for complex CAD or left main coronary artery revascularisation has evolved over the past decade and has consistently demonstrated the superiority of combining anatomic factors and clinical factors to ensure the accurate predictability of risk models⁷⁻⁹. These efforts culminated in the emergence of the individualised SYNTAX score II, in which six clinical variables were combined with the anatomical SYNTAX score to derive two distinct and individualised risks for PCI and CABG for a given patient¹⁰. Ultimately, the use of the SYNTAX score II paired with a Heart Team discussion, which provides a “safety net” for these scores, provides the best chance for appropriate risk stratification and selection of the most appropriate therapy for a given patient¹¹.

What does the article by Thuijs et al mean in practice? The clear message from this article is that a single score (STS in the current situation) is insufficient to capture the entire complexity of a patient in need of complex revascularisation and is insufficient for adequate risk stratification of patients undergoing left main

*Corresponding author: Gagnon Cardiovascular Institute, Morristown Medical Center, 100 Madison Avenue, Morristown, NJ 07960, USA. E-mail: philippe.genereux@atlantichalth.org

coronary artery (LMCA) revascularisation. While the quest to design a “perfect” predictive approach for both PCI and CABG is still ongoing (SYNTAX score II is a good start), most experienced clinicians, when facing complex CAD or CAD involving the left main coronary artery, sequentially do the following: (1) clinically assess patient risk for surgical revascularisation (visually/clinically and/or via STS or EuroSCORE calculation); (2) assess anatomical complexity for revascularisation (via SYNTAX score or visually/instinctively); and (3) discuss (in person or virtually) with involved colleagues (cardiothoracic surgeons and interventional cardiologists) and come to a consensus (officially called the Heart Team approach).

In brief, each patient presenting with LMCA disease is complex and deserves a comprehensive and individualised approach. Whether a single score would ever be able to capture, integrate, and deliver an accurate risk prediction leading to an appropriate revascularisation strategy recommendation remains to be demonstrated. In the meantime, a shared decision-making approach, integrating anatomical, clinical, and other holistic factors including a Heart Team approach, should remain the standard of care (Figure 1).

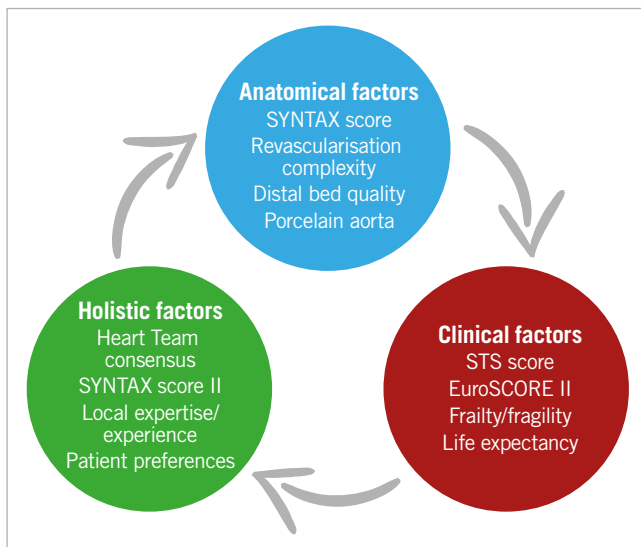


Figure 1. Potential factors and considerations involved in the shared decision-making process for patients undergoing complex and left main coronary artery disease revascularisation. STS: Society of Thoracic Surgeons

Conflict of interest statement

P. G n reux reports receiving speaker fees from Abiomed, Edwards Lifesciences and Cordis, being a consultant for Abiomed, Boston Scientific, Cardiovascular Systems, Inc., Cordis, Edwards Lifesciences, Medtronic, Opsons, Soundbite Medical Solutions Inc., Pi-Cardia, Saranas, Siemens and SIG.NUM, and being a shareholder in Soundbite Medical Solutions Inc., SIG.NUM, Pi-Cardia, and Puzzle Medical. The other author has no conflicts of interest to declare.

References

1. Thuijs DJFM, Habib RH, Head SJ, Puskas JD, Taggart DP, Stone GW, Zhang Z, Serruys PW, Sabik JF 3rd, Kappetein AP. Prognostic performance of the Society of Thoracic Surgeons risk score in patients with left main coronary artery disease undergoing revascularisation: a post hoc analysis of the EXCEL trial. *EuroIntervention*. 2020;16:36-43.
2. Stone GW, Sabik JF, Serruys PW, Simonton CA, G n reux P, Puskas J, Kandzari DE, Morice MC, Lembo N, Brown WM 3rd, Taggart DP, Banning A, Merkely B, Horkay F, Boonstra PW, van Boven AJ, Ungi I, Bogats G, Mansour S, Noiseux N, Sabat  M, Pomar J, Hickey M, Gershlick A, Buszman P, Bochenek A, Schampaert E, Pag  P, Dressler O, Kosmidou I, Mehran R, Pocock SJ, Kappetein AP; EXCEL Trial Investigators. Everolimus-Eluting Stents or Bypass Surgery for Left Main Coronary Artery Disease. *N Engl J Med*. 2016;375:2223-35.
3. G n reux P, Giustino G, Redfors B, Palmerini T, Witzensbichler B, Weisz G, Stuckey TD, Maehara A, Mehran R, Kirtane AJ, Stone GW. Impact of percutaneous coronary intervention extent, complexity and platelet reactivity on outcomes after drug-eluting stent implantation. *Int J Cardiol*. 2018;268:61-7.
4. Sianos G, Morel MA, Kappetein AP, Morice MC, Colombo A, Dawkins K, van den Brand M, Van Dyck N, Russell ME, Mohr FW, Serruys PW. The SYNTAX Score: an angiographic tool grading the complexity of coronary artery disease. *EuroIntervention*. 2005;1:219-27.
5. Beohar N, Whisenant B, Kirtane AJ, Leon MB, Tuzcu EM, Makkar R, Svensson LG, Miller DC, Smith CR, Pichard AD, Herrmann HC, Thourani VH, Szeto WY, Lim S, Fischbein M, Fearon WF, O'Neill W, Xu K, Dewey T, Mack M. The relative performance characteristics of the logistic European System for Cardiac Operative Risk Evaluation score and the Society of Thoracic Surgeons score in the Placement of Aortic Transcatheter Valves trial. *J Thorac Cardiovasc Surg*. 2014;148:2830-7.
6. Edwards FH, Cohen DJ, O'Brien SM, Peterson ED, Mack MJ, Shahian DM, Grover FL, Tuzcu EM, Thourani VH, Carroll J, Brennan JM, Brindis RG, Rumsfeld J, Holmes DR Jr; Steering Committee of the Society of Thoracic Surgeons/American College of Cardiology Transcatheter Valve Therapy Registry. Development and Validation of a Risk Prediction Model for In-Hospital Mortality After Transcatheter Aortic Valve Replacement. *JAMA Cardiol*. 2016;1:46-52.
7. Capodanno D, Miano M, Cincotta G, Caggegi A, Ruperto C, Bucalo R, Sanfilippo A, Capranzano P, Tamburino C. EuroSCORE refines the predictive ability of SYNTAX score in patients undergoing left main percutaneous coronary intervention. *Am Heart J*. 2010;159:103-9.
8. Garg S, Sarno G, Garcia-Garcia HM, Girisic C, Wykrzykowska J, Dawkins KD, Serruys PW; ARTS-II Investigators. A new tool for the risk stratification of patients with complex coronary artery disease: the Clinical SYNTAX Score. *Circ Cardiovasc Interv*. 2010;3:317-26.
9. Farooq V, Vergouwe Y, R ber L, Vranckx P, Garcia-Garcia H, Diletti R, Kappetein AP, Morel MA, de Vries T, Swart M, Valgimigli M, Dawkins KD, Windecker S, Steyerberg EW, Serruys PW. Combined anatomical and clinical factors for the long-term risk stratification of patients undergoing percutaneous coronary intervention: the Logistic Clinical SYNTAX score. *Eur Heart J*. 2012;33:3098-104.
10. Farooq V, van Klaveren D, Steyerberg EW, Meliga E, Vergouwe Y, Chieffo A, Kappetein AP, Colombo A, Holmes DR Jr, Mack M, Feldman T, Morice MC, Stahle E, Onuma Y, Morel MA, Garcia-Garcia HM, van Es GA, Dawkins KD, Mohr FW, Serruys PW. 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;381:639-50.
11. Campos CM, Stanetic BM, Farooq V, Walsh S, Ishibashi Y, Onuma Y, Garcia-Garcia HM, Escaned J, Banning A, Serruys PW; SYNTAX II Study Group. Risk stratification in 3-vessel coronary artery disease: Applying the SYNTAX Score II in the Heart Team Discussion of the SYNTAX II trial. *Catheter Cardiovasc Interv*. 2015;86:E229-38.