



**HAL**  
open science

## **VARC3 criteria: adding prognosis to injury**

Paul Guedeney, Gabriel Chevrot, Jean-Philippe Collet

► **To cite this version:**

Paul Guedeney, Gabriel Chevrot, Jean-Philippe Collet. VARC3 criteria: adding prognosis to injury. JACC: Cardiovascular Interventions, 2023, 16 (10), pp.1233-1235. 10.1016/j.jcin.2023.04.012 . hal-04107914

**HAL Id: hal-04107914**

**<https://hal.sorbonne-universite.fr/hal-04107914>**

Submitted on 7 Sep 2023

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## **VARC3 criteria: adding prognosis to injury**

Paul Guedeney, MD<sup>1</sup>, Gabriel Chevrot, MD<sup>1</sup>, Jean Philippe Collet, MD, PhD<sup>1</sup>

### **Affiliations**

Sorbonne Université, ACTION Study Group, INSERM UMRS\_1166 Institut de cardiologie (AP-HP), Paris, France

### **Corresponding author : Dr Paul Guedeney**

ACTION group, Institut de cardiologie, Centre hospitalier Universitaire, Pitié-Salpêtrière, 47 boulevard de l'hôpital, 75013 Paris, France. Tel: +33 1 42 16 30 03 Fax: +33 1 42 16 29 31.

E-mail: [paul.guedeney@aphp.fr](mailto:paul.guedeney@aphp.fr)

### **Disclosure**

-Prof. Collet reports the following disclosure from AstraZeneca, Boston Scientific, Bristol-Myers Squibb, COR2ED, Lead-Up, Medtronic, WebMD.

The other authors do not report any disclosure

How to best define periprocedural myocardial infarction (PPMI) in the setting of transcatheter aortic valve replacement (TAVR) remains challenging. PPMI is inevitable with transapical TAVR as a result of direct myocardial mechanical trauma. It is the mainstay with other vascular approaches consequent to hypotension, valve delivery mechanical trauma, calcific embolization, acute bleedings or valvular prosthetic coronary artery obstruction, occurring in frail patients commonly burdened with underlying coronary artery disease (1). The valve academic research consortium (VARC) was precisely initiated to provide with standardized consensus definitions, paving the way for randomized controlled trials (RCT) and observational studies ever since. Back in 2011, the VARC-1 defined PPMI as an acute ischemic event associated with documented and clinically significant myocardial necrosis occurring within 72h of the procedure(2). Cardiac necrosis was defined by the continuous elevation of cardiac biomarkers on consecutive samples, preferably, creatinine kinase-MB (CK-MB) (**Figure 1**). In 2012, the VARC criteria were updated and PPMI characterization was simplified, with only one post-procedural abnormal sample required, while the threshold values were adjusted to account for different use of CK-MB or cardiac troponin (cTn) (3). Interestingly enough, this updated definition of PPMI was not consistently associated with adverse outcomes following TAVR, suggesting that different thresholds could be considered(4,5).

Following numerous controversies on MI definition in RCT, the VARC-3, released in 2021, proposed a pragmatic and exhaustive interpretation on myocardial lesions adapted from the 4<sup>th</sup> universal, SCAI and ARC-2 definitions(6). PPMI is rendered as occurring within 48h of the procedure with a clear distinction between type 4a, subsequent to percutaneous coronary intervention (PCI)-related MI, when performed, and type 5, subsequent to SAVR or TAVR. Both types now include increased thresholds of cardiac biomarkers to characterize myocardial injury, with 10 and 70 times the upper reference limit for CK-MB and cTn respectively, to

account for the large use of high-sensitivity cTn (hs-cTn), or half the amount if associated with clear electrical, angiographic or imaging signs of myocardial injury.

In this issue of the journal, Real and coauthors provide the first external validation of the updated VARC 3 PPMI definition, using a prospective international cohort study(7). They included 1394 consecutive patients undergoing TAVR from 2015 to 2022, as this time period corresponds to the implementation of hs-cTn in both participating centers. In this cohort, 193 (14%) patients presented PPMI according to VARC-3 criteria, versus 817 (59%) according to VARC-2 criteria. Interestingly, the occurrence of PPMI according to VARC-3 criteria was associated with an increased all-cause mortality at both 30 days and one year (HR: 2.69, 95%CI: 1.50 to 4.82, and HR: 1.54, 95%CI: 1.04 to 2.27, respectively), as well as cardiovascular (CV) mortality at one year, conversely to the VARC-2 criteria for PPMI which were not significantly associated with neither all-cause nor CV death. Consistently, the authors reported the optimal cut-off value of hs-cTn elevation to define PPMI to be 82-fold, which is much in range of the VARC-3 rather than the VARC-2 criteria. Of note, it should be noted that the impact on mortality of the VARC-3 criteria PPMI is quite similar to what has been reported following post-PCI, with consistent definition of PPMI(8).

What conclusion should we draw from this study? First, it validates the VARC-3 PPMI criteria with the use of a hs-cTn troponin threshold that is adapted to current clinical practice. Second, PPMI is rarer with this updated definition but more impactful in term of prognosis. Much more remains to be done to better assess if PPMI is a marker of risk or a risk factor with potential preventable upstream actions. Indeed, the only independent determinants of VARC-3 PPMI in the present study were female sex and peripheral artery disease. The Direct Transcatheter Aortic Valve Implantation (DIRECTAVI) reported the use of systematic balloon aortic valvuloplasty prior to Edward Sapien 3 valve implantation to increase the risk of VARC-2 PPMI by 2.8 fold(9,10). In the present study, both pre and post-dilatation were

associated with a higher risk of VARC-3 PPMI, albeit not reaching statistical significance with p-values of 0.053 and 0.059 respectively, warranting further investigation. Consistently the impact of the occurrence of PPMI on post-TAVR left ventricle ejection fraction evolution should be investigated in larger dedicated studies to confirm the statistically significant, yet potentially clinically irrelevant, observed improvement in the present study. Finally, pre-TAVR CT features might be key players further adding prognosis to injury with potentially preventive approaches.

## References

1. Guedeney P, Tchétché D, Petronio AS, Mehili J, Sartori S, Lefèvre T, et al. Impact of coronary artery disease and percutaneous coronary intervention in women undergoing transcatheter aortic valve replacement: From the WIN-TAVI registry. *Catheter Cardiovasc Interv.* 4 déc 2018;
2. Leon MB, Piazza N, Nikolsky E, Blackstone EH, Cutlip DE, Kappetein AP, et al. Standardized endpoint definitions for Transcatheter Aortic Valve Implantation clinical trials: a consensus report from the Valve Academic Research Consortium. *J Am Coll Cardiol.* 18 janv 2011;57(3):253-69.
3. Holmes DR, Mack MJ, Kaul S, Agnihotri A, Alexander KP, Bailey SR, et al. 2012 ACCF/AATS/SCAI/STS expert consensus document on transcatheter aortic valve replacement. *J Am Coll Cardiol.* 27 mars 2012;59(13):1200-54.
4. Sinning JM, Hammerstingl C, Schueler R, Neugebauer A, Keul S, Ghanem A, et al. The prognostic value of acute and chronic troponin elevation after transcatheter aortic valve implantation. *EuroIntervention.* 20 avr 2016;11(13):1522-9.
5. Dagan M, Dawson LP, Stehli J, Koh JQS, Quine E, Stub D, et al. Periprocedural Myocardial Injury and Coronary Artery Disease in Patients Undergoing Transcatheter Aortic Valve Replacement. *Cardiovasc Revasc Med.* févr 2022;35:8-15.
6. VARC-3 WRITING COMMITTEE:, Généreux P, Piazza N, Alu MC, Nazif T, Hahn RT, et al. Valve Academic Research Consortium 3: Updated Endpoint Definitions for Aortic Valve Clinical Research. *J Am Coll Cardiol.* 1 juin 2021;77(21):2717-46.
7. Real C, avvedimento marisa, nuche J, Franzone A, Farjat-Pasos JI, Kim-Hoang, et al. Myocardial Injury After Transcatheter Aortic Valve Replacement According to VARC-3 Criteria. *JACC Cardiovasc Interv.* 2023;
8. Garcia-Garcia HM, McFadden EP, von Birgelen C, Rademaker-Havinga T, Spitzer E, Kleiman NS, et al. Impact of Periprocedural Myocardial Biomarker Elevation on Mortality Following

Elective Percutaneous Coronary Intervention. *JACC Cardiovasc Interv.* 14 oct 2019;12(19):1954-62.

9. Leclercq F, Robert P, Akodad M, Macia JC, Gandet T, Delseny D, et al. Prior Balloon Valvuloplasty Versus Direct Transcatheter Aortic Valve Replacement: Results From the DIRECTAVI Trial. *JACC Cardiovasc Interv.* 9 mars 2020;13(5):594-602.
10. Akodad M, Roubille F, Marin G, Lattuca B, Macia JC, Delseny D, et al. Myocardial Injury After Balloon Predilatation Versus Direct Transcatheter Aortic Valve Replacement: Insights From the DIRECTAVI Trial. *J Am Heart Assoc.* 15 déc 2020;9(24):e018405.

**Figure 1**

| <b>Definition of peri-procedural myocardial infarction</b>  |   |   |
|---|---|---|
| <b>VARC 1</b>   | <b>VARC 2</b>   | <b>VARC 3</b>   |
| <b>2011</b>   | <b>2012</b>   | <b>2021</b>   |
| Based on 1 <sup>st</sup> universal definition   |   | Based on 4 <sup>th</sup> universal, modified SCAI and ARC-2 definitions   |
| Delay = within 72h of procedure   |   | Delay = within 48h of procedure   |
| New ischemic symptoms or signs<br><b>AND</b><br>≥2 samples separated by ≥6h<br><b>WITH</b><br>20% increase of cardiac biomarker in second sample<br><b>AND</b><br>peak value of cardiac biomarkers >20URL<br><b>OR</b><br>>5 URL with new Q-waves | New ischemic symptoms or signs<br><b>AND</b><br>≥1 sample with CK-MB >5URL<br><b>OR</b><br>cTn(I or T) >15URL<br>If at baseline | CK-MB ≥10ULN or ≥5ULN with new Q-waves<br><b>OR</b><br>cTn(I or T) ≥ 70ULN<br><b>OR</b><br>cTn(I or T) ≥ 35ULN<br><b>WITH</b><br>new Q-waves or LBBB or flow-limiting angiographic complications or loss of myocardium on imaging |

VARC: Valve academic research consortium; URL: upper reference limit; ULN: upper limit of normal; CK-MB: creatinine kinase-MB; cTN: cardiac troponin; LBBB: left bundle branch block; SCAI: society of cardiovascular angiography and intervention; ARC: academic research consortium