*Nature Cell and Science* 2024;2(3):204–205
https://doi.org/10.61474/ncs.2024.00021

Perspective

OPEN ACCESS

# The Ideal Score for the Critical Scenario and the Non-ideal Scenario for the Perfect score; $CHA_2DS_2VASc$ *versus* Mehran's before Primary Percutaneous Coronary Intervention

Ahmad Samir[1,2*]

[1]*Cardiology Department, Kasralainy Faculty of Medicine, Cairo University, Cairo, Egypt;* [2]*Cardiac Center Hail, King Salman Hospital, Hail, Saudi Arabia*
[*]**Correspondence to:** Ahmad Samir, Cardiology Department, Kasralainy Faculty of Medicine, Cairo University, Cairo 11562, Egypt. ORCID: https://orcid.org/0000-0003-4401-4976. Tel: +966-533728571, Email: AhmadSamir11@cu.edu.eg

**Citation of this article:** Samir A. The Ideal Score for the Critical Scenario and the Non-ideal Scenario for the Perfect score; $CHA_2DS_2VASc$ *versus* Mehran's before Primary Percutaneous Coronary Intervention. *Nat Cell Sci* 2024;2(3):204–205. doi: 10.61474/ncs.2024.00021.

Catheterization-associated acute kidney injury, commonly referred to as contrast-induced nephropathy (CIN), remains a significant complication after contrast-involving cardiac procedures.[1] Despite the substantial improvement in the current iodinated contrast formulations, the incidence of CIN still ranges between 1% and 25% in routine coronary practice, depending on the characteristics of the studied population.[1,2] ST-elevation myocardial infarction (STEMI) remains one of the most critical and time-sensitive cardiac emergencies, where minimizing delays and prioritizing prompt revascularization, ideally through primary percutaneous coronary intervention (pPCI), is paramount.[3] Nevertheless, STEMI patients are generally at a high risk of CIN compared to elective patients, underscoring the need for an effective risk assessment tool to stratify patients and enable timely interventions to mitigate CIN occurrence.

The CIN rate is amplified by multiple risk factors, the identification of which over the years has facilitated the development of several robust and accurate prediction models.[4–7] Among the most widely used is Mehran's risk model, an 8-point score that assigns 5 points for hypotension, heart failure, or intra-aortic balloon pump use; 4 points for age >75 years; 3 points for anemia or diabetes; 1 point for every 100 milliliters of iodinated contrast; and 2, 4, or 6 points for estimated glomerular filtration rate (eGFR) of 60–40, 40–20 or <20 ml/min/1.73 $m^2$, respectively.[7]

Because acute myocardial infarction (AMI) was excluded from the development cohort, Mehran's score does not account for PCI for an AMI as an additional risk factor for CIN, in contrast to other prediction tools.[4] Nevertheless, Mehran's model was subsequently evaluated in acute coronary syndrome cohorts and showed reasonable predictive accuracy for CIN.[8]

However, due to its complexity and demanding calculation, the systematic use of Mehran's score in busy cath labs is limited. Practically, when a patient is anticipated to be at high CIN risk based on his/her clinical and laboratory profile, the operator often uses a web or smartphone calculator to accurately calculate the risk probability. Thus, while Mehran's score is an accurate estimator, its utilization in daily practice is selective, as it requires a conscientious operator and a time-lenient procedure, an ideal scenario that is rarely encountered in pPCI.

In contrast, in critical and time-sensitive scenarios such as acute STEMI, accuracy and timely application are equally important.[9] All practice guidelines recommend prioritizing pPCI for acute STEMI patients over delaying reperfusion to wait for laboratory results, including eGFR or Hb level.[3,9] Therefore, since Mehran's score depends on the total amount of contrast agent administered, as well as the patient's hemoglobin and kidney function, it cannot be calculated until after the pPCI is completed and after the necessary laboratory results have been obtained.[7]

Compared to elective PCI procedures, STEMI patients undergoing pPCI are often at higher risk for CIN, due to the higher likelihood of presenting with acute heart failure, hypotension, shock (requiring intra-aortic balloon pump), inadequate oral hydration during the preceding hours of pain and agony, and the lack of chances for preprocedural hydration.[4] Thus, in STEMI scenarios, it is crucial to identify patients at high risk of CIN prior to proceeding to pPCI. Only then can the operator conservatively manage the contrast volume limit the acquired projections and the contrast injections to the minimum needed to identify and treat the culprit lesion, and most importantly, avoid ad hoc treatment of severe non-culprit lesions.[3,9] Therefore, in such critical scenarios, a perfectscore based on total contrast volume and laboratory results may not adequately address the urgent needs of the moment.

It is unarguable that contrast volume and baseline kidney function are critical predictors for CIN that should be sought whenever feasible. Nevertheless, other patient characteristics, such as age, diabetes, heart failure, or reduced systolic function, provide a robust and timely prediction for CIN risk independent of contrast volume and eGFR.[10] To address this unmet need, the authors of "Predictive value of $CHA_2DS_2VASc$ score for contrast-induced nephropathy after primary percutaneous coronary intervention for patients presenting with acute ST-segment elevation myocardial infarction",[11] reasoned to evaluate the utility of the $CHA_2DS_2VASc$ score in STEMI patients undergoing pPCI. In a prospective study recruiting 500 STEMI patients presenting for pPCI (with the exclusion of cardiogenic shock,

**Received:** April 14, 2024 | **Revised:** September 19, 2024 | **Accepted:** September 21, 2024 | **Published online:** September 30, 2024

patients already with chronic kidney disease or previous serum creatinine ≥3 mg/dl), the investigators demonstrated that the $CHA_2DS_2VASc$ score can effectively and efficiently predict CIN with accuracy comparable to that of Mehran's score. Their results indicated that a $CHA_2DS_2VASc$ score of ≥4 predicted CIN occurrence with a sensitivity of 85.7%, specificity of 98.9%, and area under the curve of 98% ($p < 0.001$).[11]

Representing the major risk factors and disease markers of atherosclerotic cardiovascular disease, the $CHA_2DS_2VASc$ score has proven to be much more universal than its original purpose of predicting stroke in patients with atrial fibrillation. It has demonstrated broad applicability in several atherosclerotic cardiovascular disease conditions, including predicting recurrent stroke in patients without atrial fibrillation,[12] occurrence of no-reflow and short-term mortality after pPCI,[13] mortality in patients with chronic kidney disease[14] and major adverse events after acute coronary syndrome independent of AF rhythm.[15,16]

In addition to its simplicity and easy memorization for cardiology residents, the $CHA_2DS_2VASc$ score can be systematically and timely calculated for every STEMI patient prior to pPCI. By identifying the estimated risk at the appropriate time, $CHA_2DS_2VASc$ score can guide the PCI procedure accordingly, which better serves the purpose in STEMI settings than a more validated score that functions perfectly in ideal scenarios.

Notably, the exclusion of patients with cardiogenic shock and chronic kidney disease limits the generalizability of the proposed concepts to these specific populations.

To sum up, in acute STEMI patients, stratification according to CIN risk is imperative prior to proceeding with primary PCI. This requires a practical and rapid scoring system that can be timely and swiftly calculated in emergency situations. A $CHA_2DS_2VASc$ score of ≥4 has been shown to predict CIN occurrence with accuracy comparable to that of Mehran's score, which could only be completed after the procedure is completed.

## Acknowledgments

None.

## Funding

None.

## Conflict of interest

None.

## Author contributions

AS is the sole author of the manuscript.

## References

[1] McCullough PA. Contrast-Induced Nephropathy: Definitions, Epidemiology, and Implications. Interv Cardiol Clin 2014;3(3):357–362. doi:10.1016/j.iccl.2014.03.002, PMID:28582220.
[2] Mohammed NM, Mahfouz A, Achkar K, Rafie IM, Hajar R. Contrast-induced Nephropathy. Heart Views 2013;14(3):106–116. doi:10.4103/1995-705X.125926, PMID:24696755.
[3] Ibanez B, James S, Agewall S, Antunes MJ, Bucciarelli-Ducci C, Bueno H, *et al*. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC). Eur Heart J 2018;39(2):119–177. doi:10.1093/eurheartj/ehx393, PMID:28886621.
[4] Bartholomew BA, Harjai KJ, Dukkipati S, Boura JA, Yerkey MW, Glazier S, *et al*. Impact of nephropathy after percutaneous coronary intervention and a method for risk stratification. Am J Cardiol 2004;93(12):1515–1519. doi:10.1016/j.amjcard.2004.03.008, PMID:15194023.
[5] Stacul F, van der Molen AJ, Reimer P, Webb JA, Thomsen HS, Morcos SK, *et al*. Contrast induced nephropathy: updated ESUR Contrast Media Safety Committee guidelines. Eur Radiol 2011;21(12):2527–2541. doi:10.1007/s00330-011-2225-0, PMID:21866433.
[6] Brown JR, Robb JF, Block CA, Schoolwerth AC, Kaplan AV, O'Connor GT, *et al*. Does safe dosing of iodinated contrast prevent contrast-induced acute kidney injury? Circ Cardiovasc Interv 2010;3(4):346–350. doi:10.1161/CIRCINTERVENTIONS.109.910638, PMID:20587788.
[7] Mehran R, Aymong ED, Nikolsky E, Lasic Z, Iakovou I, Fahy M, *et al*. A simple risk score for prediction of contrast-induced nephropathy after percutaneous coronary intervention: development and initial validation. J Am Coll Cardiol 2004;44(7):1393–9. doi:10.1016/j.jacc.2004.06.068, PMID:15464318.
[8] Abellás-Sequeiros RA, Raposeiras-Roubín S, Abu-Assi E, González-Salvado V, Iglesias-Álvarez D, Redondo-Diéguez A, *et al*. Mehran contrast nephropathy risk score: Is it still useful 10 years later? J Cardiol 2016;67(3):262–267. doi:10.1016/j.jjcc.2015.05.007, PMID:26169247.
[9] Writing Committee Members, Lawton JS, Tamis-Holland JE, Bangalore S, Bates ER, Beckie TM, *et al*. 2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. J Am Coll Cardiol 2022;79(2):e21–e129. doi:10.1016/j.jacc.2021.09.006, PMID:34895950.
[10] Aktürk E, Aşkın L, Taşolar H, Kurtoğlu E, Türkmen S, Tanrıverdi O, *et al*. Evaluation of contrast nephropathy in percutaneous treatment of chronic total occlusions. Interv Med Appl Sci 2019;11(2):95–100. doi:10.1556/1646.11.2019.15, PMID:32148912.
[11] Samir A, Gabra W, Alhossary H, Bakhoum S. Predictive value of CHA(2) DS(2)VASC score for contrast-induced nephropathy after primary percutaneous coronary intervention for patients presenting with acute ST-segment elevation myocardial infarction. Egypt Heart J 2023;75(1):52. doi:10.1186/s43044-023-00378-x, PMID:37358644.
[12] Andersen SD, Gorst-Rasmussen A, Lip GY, Bach FW, Larsen TB. Recurrent Stroke: The Value of the $CHA_2DS_2VASc$ Score and the Essen Stroke Risk Score in a Nationwide Stroke Cohort. Stroke 2015;46(9):2491–7. doi:10.1161/STROKEAHA.115.009912, PMID:26304862.
[13] Ashoori A, Pourhosseini H, Ghodsi S, Salarifar M, Nematipour E, Alidoosti M, *et al*. CHA2DS2-VASc Score as an Independent Predictor of Suboptimal Reperfusion and Short-Term Mortality after Primary PCI in Patients with Acute ST Segment Elevation Myocardial Infarction. Medicina (Kaunas) 2019;55(2):35. doi:10.3390/medicina55020035, PMID:30717292.
[14] Goudis C, Daios S, Korantzopoulos P, Liu T. Does CHA2DS2-VASc score predict mortality in chronic kidney disease? Intern Emerg Med 2021;16(7):1737–1742. doi:10.1007/s11739-021-02799-5, PMID:34232486.
[15] Guerra F, Scappini L, Maolo A, Campo G, Pavasini R, Shkoza M, Capucci A. CHA2DS2-VASc risk factors as predictors of stroke after acute coronary syndrome: A systematic review and meta-analysis. Eur Heart J Acute Cardiovasc Care 2018;7(3):264–274. doi:10.1177/2048872616673536, PMID:27708110.
[16] Peng H, Sun Z, Chen H, Zhang Y, Ding X, Zhao XQ. Usefulness of the CHA2DS2-VASc Score to Predict Adverse Outcomes in Acute Coronary Syndrome Patients Without Atrial Fibrillation Undergoing Percutaneous Coronary Intervention. Am J Cardiol 2019;124(4):476–484. doi:10.1016/j.amjcard.2019.05.036, PMID:31235063.