

Editorial

# Long Time No See! Revisiting Single-Vessel Revascularization: Importance of Robust Study Design and Database Utilization

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The group around Gabriel Yeap et al. has used the National In-Patient Sample (NIS) database, and in a propensity-matched approach with 273,380 patients over four years, they have shown that those patients receiving coronary artery bypass grafting for pure single-vessel revascularization ended up with more complications and higher all-course mortality than patients subjected to PCI for the same condition in a similar scenario. Moreover, besides worse short-term outcomes, coronary artery bypass grafting, as expected, was associated with higher healthcare costs [1]. Neither finding is a surprise for any informed reader (with an interest in coronary disease management), but rather a self-fulfilling prophecy. The readership of HEARTS understands that a significant amount of effort went into this now-published project on strategies for single-vessel revascularization, but the reality is that conclusions are nebulous and serious questions remain unanswered.

First, how is it possible to find such a high number of single-vessel coronary bypass operations in the current era unless the NIS database search is unspecified?

Second, what is the motivation for such a study, loaded with methodological shortcomings, resulting in misleading information considering that extraction of data from NIS is unlikely to be a reliable source of information, as NIS exclusively documents in-patients?

Third, single-vessel interventions are already established as a predominant and undisputable signature scenario for PCI, as listed in recent guidelines [2–4].

The list of shortcomings in this publication is substantial, beginning with the nature of both revascularization strategies; for both PCI and surgical revascularization, neither the target coronary arteries nor the technical details, such as off-pump surgery, use of arterial or vein grafts, or endoscopic surgery, has been specified. Even the specific reasons for surgical revascularization of a single vessel are not given or identified, which, most likely, is a tribute to the lacking granularity of data captured in NIS.

Second, the patients for this comparative study were selected according to their “Procedural Codes” and not based on the diagnosis of single- or multi-vessel disease. This fact has a serious impact on the validity of the entire paper and raises even more red flags, as an unknown percentage of patients may have multi-vessel coronary artery disease, with only a single-vessel PCI performed or a single graft placed on one of the arteries (for unknown reasons, ranging from staged PCI to hybrid revascularization in both acute and chronic clinical scenarios). The population may even consist of patients with multi-vessel coronary artery disease who could not undergo total revascularization by PCI as intended and were then referred for complete revascularization by surgery (because of relevant CTO or failed PCI attempts) [5]. Conversely, the PCI cohort may even include patients undergoing primary PCI in the setting of acute coronary syndrome with no indication for surgery whatsoever, even if they have multivessel disease.

Third, both single-vessel intervention groups comprise patients with left main coronary artery disease, but while a percutaneous strategy would indeed address a single vessel (the left main stem), the surgical strategy would require at least two bypasses or more. This



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means that all left main disease patients would only be found in the PCI group or would have received only one bypass in the surgical group, which would make little sense [3,6]. This consideration may be final proof of a comparison between apples and oranges in a world that knows their false equivalence well.

Finally, the mortality figures for both procedures, i.e., 2.7% for single-vessel PCI and 2.8% for single-vessel coronary artery bypass grafting (CABG) (both in the pre-propensity-matched sample as well as in the propensity-matched sample), are astonishingly high, adding to the confusion and suggesting that a high number of patients were treated in the acute setting of evolving myocardial infarction, or under other critical conditions for which an open-heart surgical bypass constitutes a well-known risk higher than that of any percutaneous revascularization strategy [2,7]. Other prognostically relevant information in this context, such as dysfunction of the left or right ventricle, is not listed or available.

With all due respect, we can finally conclude the following from this paper. We learn that there are more short-term complications with a surgical revascularization strategy on a single coronary vessel than with a percutaneous strategy (PCI) on a single vessel in this undefined mixed bag of acute and chronic coronary patients, which is very much common sense, but what is new here? And why was surgery used in the first place for a single-vessel procedure? We do not know whether a Heart Team was involved in any decision making [7].

We realize that the NIS registry may not be an ideal source of data relevant to this topic, as non-complex PCI can be performed as a day-case procedure without the need for hospital admission, whereas surgery implies admission; remember that NIS only captures data from admitted in-patients.

We acknowledge that even studies and analyses with unsuitable designs and potentially misleading messages (as if open surgical revascularization of a single coronary artery is a routine and justifiable established strategy) sometimes need to be in the public domain in order for their validity to be critically discussed.

The incoming generation of medical students and young colleagues in cardiovascular medicine must learn to distinguish research with a meaningful impact on clinical practice from less influential studies; the incoming generation deserves good coaching and involvement in relevant and controversial discussions about burning issues, as well as support to ask the right questions. Valuable research ideally addresses a gap in evidence and tries to answer a hypothesis—essentially common sense—but unfortunately, the answer is not always found. Finally, relevant conclusions can only be derived from good data generated from properly designed studies or granular prospective registries. Time and effort for research are precious and should be invested in a smart way.

**Conflicts of Interest:** The authors declare no conflicts of interest.

## References

1. Yeap, G.; Ramphul, K.; Ahmed, J.M.; Shah, A.; Jeelani, S.; Sakthivel, H.; Dulay, M.S.; Shahid, F.; Ahmed, R. Characteristics and In-Hospital Outcomes of Single-Vessel Coronary Disease Intervention: A Propensity-Matched Analysis of the National Inpatient Sample Database 2016–2020. *Hearts* **2024**, *5*, 557–568. [[CrossRef](#)]
2. Neumann, F.J.; Sousa-Uva, M.; Ahlsson, A.; Alfonso, F.; Banning, A.P.; Benedetto, U.; Byrne, R.A.; Collet, J.P.; Falk, V.; Head, S.J.; et al. 2018 ESC/EACTS Guidelines on myocardial revascularization. *Eur. Heart J.* **2019**, *40*, 87–167. [[CrossRef](#)] [[PubMed](#)]
3. Byrne, R.A.; Femes, S.; Capodanno, D.; Czerny, M.; Doenst, T.; Emberson, J.R.; Falk, V.; Gaudino, M.; McMurray, J.J.; Mehran, R.; et al. 2022 joint ESC/EACTS review of the 2018 guideline recommendations on the revascularization of left main coronary artery disease in patients at low surgical risk and anatomy suitable for PCI and CABG. *Eur. Heart J.* **2023**, *44*, 4310–4320. [[CrossRef](#)] [[PubMed](#)]
4. Alkhouli, M.; Alqahtani, F.; Kalra, A.; Gafoor, S.; Alhajji, M.; Alreshidan, M.; Holmes, D.R.; Lerman, A. Trends in characteristics and outcomes of patients undergoing coronary revascularization in the United States, 2003–2016. *JAMA Netw. Open* **2020**, *3*, e1921326. [[CrossRef](#)] [[PubMed](#)]
5. Nathan, A.; Hashemzadeh, M.; Movahed, M.R. Percutaneous coronary intervention of chronic total occlusion associated with higher inpatient mortality and complications compared with non-CTO lesions. *Am. J. Med.* **2023**, *136*, 994–999. [[CrossRef](#)] [[PubMed](#)]

6. Mäkikallio, T.; Holm, N.R.; Lindsay, M.; Spence, M.S.; Erglis, A.; Menown, I.B.; Trovik, T.; Eskola, M.; Romppanen, H.; Kellerth, T.; et al. Percutaneous coronary angioplasty versus coronary artery bypass grafting in treatment of unprotected left main stenosis (NOBLE): A prospective, randomised, open-label, non-inferiority trial. *Lancet* **2016**, *388*, 2743–2752. [[CrossRef](#)] [[PubMed](#)]
7. Tsang, M.B.; Schwalm, J.D.; Gandhi, S.; Sibbald, M.G.; Gafni, A.; Mercuri, M.; Salehian, O.; Lamy, A.; Pericak, D.; Jolly, S.; et al. Comparison of Heart Team vs Interventional Cardiologist recommendations for the treatment of patients with multi-vessel coronary artery disease. *JAMA Netw. Open* **2020**, *4*, e2012749. [[CrossRef](#)] [[PubMed](#)]

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