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Editorial

Predicting neocommissural orientation during TAVI workup

La importancia de predecir la orientación de las neocomisuras al preparar un TAVI

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Bioprosthetic commissural alignment was not considered a relevant issue for transcatheter aortic valve implantation (TAVI) during its expansion from high- to low-risk elderly patients. As expected, in younger patients attention has focused on long-term outcomes, key among which is ensuring coronary access for future interventions.

So far, one of the clear advantages of surgical aortic valve replacement compared with TAVI has been the possibility of accurately positioning the bioprosthesis, aligning neocommissures with those of the native valve. Indeed, currently available TAVI delivery systems were not developed to achieve commissural alignment of the transcatheter aortic valve (TAV). The random orientation of the commissural posts along with the presence of a bare-metal stent that interposes between the bioprosthetic leaflets and coronary ostia could significantly impact on coronary reaccess after TAVI.[1]

In a recent paper published in *Revista Española de Cardiología*, Redondo et al.[2] reported for the first time the feasibility of predicting the final orientation of TAV commissures by analyzing preprocedural computed tomography scans, developing an accurate commissural alignment (ACA) implantation technique, which consists of inserting the delivery system with a patient-specific rotation.

Before the adoption of specific procedural techniques to align the commissures, commissural misalignment (CMA) was a frequent issue in patients undergoing TAVI, with neocommissures being well aligned in only about one fifth of cases.[3] The more severe the grade of CMA, the greater the risk of coronary overlap. Indeed, it has recently been shown that commissural alignment of self-expanding TAVs is feasible and can be obtained by orienting prosthetic landmarks.[4]

Tang et al.[4] demonstrated that the percentage of severe coronary overlap of one or both coronaries decreased from 74.1%-86.2% to 12.5%-14.3% when the ACURATE neo (Boston Scientific, United States) TAV is aligned with a commissural postpositioned at the center back or inner curve compared with when it is positioned at center front or outer curve. To specifically orientate the valve, in that study, the handle of the delivery catheter was torqued clockwise when the TAV was at the level of the ascending aorta, until 1 of the commissural posts faced the inner curve or the back of the aortic root. Tang et al. reported that the intended handling of the delivery system was unfeasible in about one third of the patients (2 out of 7) due to excessive torquing forces that would have affected proper device implantation.

Likewise, there is no currently validated method to achieve commissural alignment without applying torquing maneuvers on the delivery systems of any of the other currently available TAVs.

In this proof-of-concept study, Redondo et al.[2] developed a dedicated tool to accurately predict the axial rotation of the TAVI delivery system by analysis of the aortic centerline at preprocedural computed tomography assessment. After validating it by using silico models, the goodness of the ACA implantation technique was demonstrated in 3 consecutive patients both in vivo and in vitro using their 3-dimensional printed aortic models, and in 9 further consecutive patients in vivo. The authors showed that this new technique based on predicting the delivery rotation necessary to obtain commissural alignment without applying further torquing maneuvers resulted in the absence of coronary overlap in all patients and there was only 1 case of mild CMA.

Although this study investigated the feasibility of this new technique in a small series of patients and obviously needed a larger validation cohort, it represents a milestone for the next generation era of ad hoc tailored TAVI.

When pursuing the optimization of the TAVI procedure for younger patients, obtaining commissural alignment is of paramount importance not only to ensure coronary access for future coronary interventions but also because it has been argued that CMA could impact on blood flow creating a stagnation within the sinuses of Valsalva when neocommissures do not match with native ones. This phenomenon could in turn affect valve functioning and durability, which is particularly important for patients with long life expectancy.

However, it should be highlighted that commissural alignment does not always avoid coronary overlap, and even a mild grade of CMA could affect coronary reaccess in particular patients. Indeed, in a not negligible portion of patients, coronary ostia do not originate from the center of the sinuses of Valsalva but more laterally, closer to one of the commissures.

Current commissural alignment techniques are based on the positioning of radiopaque TAV landmarks in relation to the aortic cusps visualized on aortography; this approach does not allow orientation of the neocommissure taking into account the origin of coronary ostia.

In this pilot study, the ACA technique developed by Redondo et al.[2] seems to guarantee a patient-tailored commissural alignment, preventing any coronary overlap even in the case of abnormal origins, and avoiding the application of torquing forces on the delivery systems rotating it at the level of the aorta or in the

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aortic annulus, decreasing the related risk of vascular damage or debris embolization. In addition, this technique would be particularly useful in the case of native bicuspid valves, which are associated with a higher rate of abnormal coronary origin and in which a commissural alignment is not feasible by definition.

Finally, one of the more relevant advantages of the ACA technique is that it could be easily translated to other self-expanding TAVs and could represent a reliable method to obtain commissural alignment with balloon-expandable TAVs, for which a reproducible technique is currently lacking.

Of note, the authors report a certain discordance of CMA between in silico and in vivo cases, with the latter showing greater misalignment. Although they report only 1 case with mild CMA without overlapping the coronary ostia, it might be expected that outcomes of the ACA technique may be affected by the presence of severe tortuosity and calcification of patients' vessels.

Furthermore, the tool developed by the authors[2] did not take into account the anatomy of ileofemoral axes. In patients in whom the presence of calcification makes the vessels less stretchable, the native tortuosity of ileofemoral axes could significantly impact on the rotation of the delivery system when it is advanced up to the aortic valve. This is reasonably the underlying cause of residual misalignment, despite accurate prediction of the final bioprosthesis orientation. Waiting for the next generation of TAVI devices and delivery systems, which should definitely tackle the issue of CMA, the possibility of accurately predicting the final orientation and positioning of the TAVs and to consequently tailor the procedure for each patient is an exciting new horizon for patients affected by severe aortic stenosis and suitable for TAVI. The ACA technique is still in its infancy and requires larger validation series as well as simplification and standardization for any available TAVI device to be widely applied to everyday TAVI practice. Nevertheless, the technique has initiated a new era of patient-tailored procedures that we believe will serve to close the residual gap with surgery and clear the way for TAVI treatment in younger patients who are candidates for an aortic bioprosthesis.

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CONFLICTS OF INTEREST

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REFERENCES

1. Barbanti M, Costa G, Picci A, et al. Coronary Cannulation After Transcatheter Aortic Valve Replacement. *JACC Cardiovasc Interv*. 2020;13:2542–2555.
2. Redondo A, Valencia-Serrano F, Santos-Martínez S, et al. Accurate commissural alignment during ACURATE neo TAVI procedure. Proof of concept. –>*Rev Esp Cardiol*. 2022;75:203–212.
3. Fuchs A, Kofoed KF, Yoon S-H, et al. Commissural Alignment of Bioprosthetic Aortic Valve and Native Aortic Valve Following Surgical and Transcatheter Aortic Valve Replacement and its Impact on Valvular Function and Coronary Filling. *JACC Cardiovasc Interv*. 2018;11:1733–1743.
4. Tang GHL, Zaid S, Fuchs A, et al. Alignment of Transcatheter Aortic-Valve Neo-Commissures (ALIGN TAVR): Impact on Final Valve Orientation and Coronary Artery Overlap. *JACC Cardiovasc Interv*. 2020;13:1030–1042.