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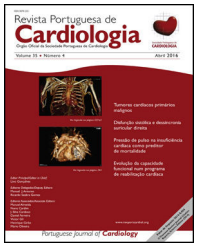

EDITORIAL COMMENT

Transapical off-pump mitral valve repair with NeoChord implantation: Is less better?

Implantação de neocordas por via trans-apical: quanto menos melhor?

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I start this editorial comment disclosing my conflict of interest, which is I am cardiac surgeon who firmly believes that, theoretically all degenerative mitral regurgitation (DMR) can be repaired. Likewise, open mitral valve (MV) repair is the gold standard of treatment for this disease, based on the superb early and long-term results, which have also been demonstrated in the Portuguese population.[1–3] MV surgery should carry an <1% mortality risk and low morbidity, as well as a long-lasting durability of repair should be pursued (20 year freedom from recurrent moderate to severe MR >80%), since the majority of patients are otherwise healthy except for their MR.[4,5] In addition, modern reconstructive MV surgery is based on three main pillars, in order to provide not only a functional but also an anatomical approach: 1. restoring or preserve appropriate leaflet mobility; 2. ensuring a large leaflet coaptation; and 3. remodeling and stabilizing the annulus. Therefore, this should be viewed as the benchmark against which other new techniques or devices should be compared or what they should try to attain.

However, medical practice involves innovation and creativity to achieve the best results for patients and in the least invasive way possible. This path is seldom straightforward and less than perfect results should be admitted in a provisional phase, to pave the way for modernization and for perfecting the techniques.

In recent years, Carpentier leaflet resection techniques have been challenged by the introduction of more tissue-sparing approaches, which include the implantation of artificial ePTFE chords to restore physiological leaflet behavior. Of note, this new technique showed similar results to the classical resection techniques and paved the way for the emergence of transapical implantation of neochords, of which the NeoChord DS1000 Artificial Chordae Delivery System (NeoChord Inc., St. Louis Park, MN, USA) is the most commonly used.

Teixeira et al. present eighteen consecutive patients who underwent a transapical off-pump beating heart chordal implantation procedure. This is the largest series of this kind of patients in Portugal.[6] They should also be congratulated on their results, because they have demonstrated an immediate high procedural success rate (100%), defined as implantation of at least two neochords with residual MR$\leq$2+, zero mortality, and very low morbidity. Notably, these results are not very different to the largest series published to

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date. Gerosa et al. recently published their medium-term outcomes of 203 patients who underwent the NeoChord procedure, and revealed that at one-year follow-up the patient success rate was 91.2%±2.0% and 111 patients (74%) presented residual MR mild or less (1+). At three-year follow-up the patient success rate was 81.2%±3.8% and 32 patients (64%) had a residual MR mild or less (1+).[7] The authors expressed a word of caution regarding specific anatomical and echocardiographic features that should be considered during patient selection. MV anatomical Type C (anterior or bileaflet prolapse and/or flail) and D (paracommissural prolapse and/or flail or any type of disease with the presence of significant leaflet and/or annular calcifications) are associated with dismal prognosis, especially the latter. In respect of echocardiographic parameters, leaflet-to-annulus index (LAI) [ratio between the sum of anterior leaflet length (AML) and posterior leaflet length (PML) over antero-posterior (AP) length, (AML+PML)/AP] has been reported as a positive prognostic predictor of follow-up outcomes at one year. The cut-off value of 1.2, corresponding to a 20% excess of leaflet tissue, is significantly related with an MR mild at one year follow-up. LAI can also be considered as an expression of the leaflet-annulus mismatch.[8] As with any adoption of a new technique there is always an inherent learning curve,[9] but interestingly this did not seem to have had an impact on the results of the Teixeira et al. study. Probably, starting later has the advantage of not repeating someone's errors and learning potential tips and tricks from others. One technical issue that the pioneer group of the procedure mentioned is to place the entry site of the left ventricle (LV) about 2-4 cm posterolaterally from the real apex, to obtain a perfect posterior and symmetrical alignment with the papillary muscles.[10]

We cannot overemphasize the crucial role of the two-dimensional/three-dimensional (2D/3D) real-time transesophageal echocardiography (TEE) guidance, in fact the correct positioning of the neochord is only possible with superior imaging resolution and operating skills. LV navigation is performed using 2D X-plane views observing the standardized step-by-step guide that considers the LV in two zones: ''chordal free'' and ''chordal zone''. Once the MV plane is crossed, 3D TEE is the leading imaging source. The target portion of the valve is identified, the device is opened, and the leaflet is captured using the fiber optic monitor to confirm good leaflet grasp.[10]

This device has passed the proof of efficiency and safety with distinction. Furthermore, the technique has been standardized and it is reproducible among different groups. With the recent technological breakthrough of endovascular procedures, there has also been a strong interest in moving from a transapical procedure toward a fully transcatheter (transfemoral and transeptal) procedure, as shown by the increasing number of preclinical programs under development. However, obtaining positive results in hard outcomes such as mortality, morbidity and procedural success, does not offset the answer to the critical question, which is: will the repair last? There are not sufficient data or follow-up to get a sense of the durability of the repair with transapical chords in the long run, but it is clear that it is inferior in comparison with conventional techniques. In the most experienced group, at three years of follow-up, 36% of patients had MR greater than mild and 6.4% of patients had been reoperated for recurrent MR. The rate of patient success was significantly different (p=0.001) between anatomical categorical types; >88% and 83% in Type A and B patients respectively, while <72% and 57% in Type C and D patients respectively. This means that this technique is not fit for the whole DMR spectrum.[7] In our experience in Coimbra, we have shown that freedom from MV reoperation at 15 years was 97.4±1.1% when there is isolated posterior prolapse. Posterior prolapse represents around 65-75% of the DMR and in our institution we repaired 98.4% of these patients.[3] Regarding anterior or bileaflet prolapse, which are known to be more demanding to repair, our repair rate was 94.8% and interestingly patients operated on earlier (New York Heart Association I-II) had a greater repair rate (98.4%). Additionally, the 20-year rate of freedom from reoperation was 88±2.7%.[2]

There are other concerns that should be listed with this new technique: Firstly, the neochords are secured and tied in the ventricular wall and not in the papillary muscles, which is its correct anatomical positioning and the site where they are placed in open surgery. The consequence is that with the reduction of the LV dimensions due to ventricular remodeling after eliminating MR, the neochords can lose tension and prolapse supervenes with MR recurrence; secondly, making a hole in the LV wall and tying afterwards with a suture will damage that area permanently. Nonetheless, Gerosa et al. confirmed the observation that device insertion could generate a localized impairment of function with localized myocardial edema, but observed during multiple echocardiographic examination that the impairment was reversible in all cases because of the disappearance of the trauma-induced edema; finally, and most importantly, the absence of a ring to reshape the annulus and promote better leaflet surface coaptation can impair the durability of the repair in the long-term. Unfortunately, there is not yet a stable and predictable catheter-delivered device to perform an annuloplasty, and this is the Achilles' heel of this technique as it has been for the Mitraclip™.

So, ''Is less better?'' I would say no in this instance. However, this is a valid and safe technique, and very useful as an addition to surgeons' armamentarium, particularly in situations where open mitral valve surgery (sternotomy or mini thoracotomy) is deemed too risky.

Conflicts of interest

The author has no conflicts of interest to declare.

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