

was different between B-TVA and R-TVA patients. Consequently, the results obtained can in no way be considered conclusive and should be confirmed by future prospective studies including three-dimensional echocardiographic assessment or magnetic resonance imaging.

CONCLUSION

The early surgical treatment of functional TR using an annuloplasty device also for less than severe regurgitation provides a significant reduction in the tricuspid annulus that effectively reduces leaflet tenting and increases leaflet coaptation. This tricuspid valve reverse remodelling improves tricuspid repair durability and helps to create an effective reverse remodelling of the right heart. Although flexible band and rigid ring annuloplasty seem to be equally effective in the long-term treatment of functional TR, there are two different patterns of right heart reverse remodelling, which is more complete when a ring has been used.

SUPPLEMENTARY MATERIAL

Supplementary material is available at *ICVTS* online.

Conflict of interest: none declared.

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eComment. Is flexible band or rigid ring the best choice for functional tricuspid regurgitation?

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We read with great interest the paper by Gatti *et al.* who compared the early and late outcomes of tricuspid valve annuloplasty with a flexible band (B-TVA) or a rigid ring (R-TVA). The authors found that the annuloplasty of tricuspid valve with rigid ring was associated with higher rates of low cardiac output and transient complete atrioventricular block. No significant difference was observed in hospital mortality between R-TVA and B-TVA. There were also no significant differences in freedom from all-cause death, cardiac, cerebrovascular deaths and grade of TR ≥ 2 . The reverse remodelling of the right atrium and tricuspid valve, which was combined with reverse remodelling of the right ventricle occurred after R-TVA and not after B-TVA [1].

We would like to add some thoughts about tricuspid valve annuloplasty using a flexible band or a rigid ring. Phannmuller *et al.*, in their retrospective analysis of 820 patients who underwent tricuspid valve repair with either a flexible band or a rigid ring, showed that patients who received a rigid ring had a 9-fold greater incidence of ring dehiscence than did patients who received a flexible band. These ring dehiscences were almost exclusively located at the septal leaflet portion of the annulus.

The authors observed that the area where they found the ring dehiscences corresponded to the end of the annular section that was most prone to dilatation. Taking into account the systolic-diastolic dynamics of tricuspid annular motion and the rigidity of the annuloplasty device, they concluded that greater forces might exist on the sutures attached to a rigid ring than on those attached to a flexible band, which might follow the natural motion of the tricuspid annulus more easily [2]. Zhu *et al.* in their review, concluded that although there was less risk of ring dehiscence or ring fracture in the flexible group, the rigid ring, particularly the new three-dimensional MC3 ring, was inclined to be better than the flexible band in terms of a sustained effect for maintaining stable postoperative grade of regurgitation according to the current available evidences [3].

Izutani *et al.*, in their analysis of tricuspid ring annuloplasty using a flexible band or the MC3 rigid ring, showed that rigid ring annuloplasty might be more effective for decreasing functional TR in immediate and mid-term postoperative periods [4].

Both tricuspid valve annuloplasty methods are feasible and durable for correcting functional TR. The ring of choice though (rigid enough to reduce the size of the tricuspid annulus adequately and flexible enough to conserve the motion of the ring and the action of the sphincter) is yet to be found.

Prospective studies, with a large number of patients and new ring designs, are needed for confirming the best choice.

Conflict of interest: none declared.

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eReply to eComment: Is flexible band or rigid ring the best choice for functional tricuspid regurgitation?

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I sincerely thank Tourmousoglou and colleagues for their interest and for the constructive and complementary comments [1] to our article [2] where early and late outcomes of tricuspid valve annuloplasty with a flexible band (B-TVA) or a rigid ring (R-TVA) were compared. The most important conclusion of our analysis was that, although flexible band and rigid ring annuloplasty seem to be equally effective in the long-term treatment of functional tricuspid regurgitation, there are two different patterns of right heart reverse remodelling, which is more complete (see RV involvement) when a ring has been used - at least that is what we think.

As stated in the Discussion section of our paper, annuloplasty bands could offer specific benefits (over rings) due to the inherent flexibility and the simpler design and technique of implantation, at least on a speculative basis. There is a lower risk of device dehiscence or fracture and tricuspid stenosis, even after undersized annuloplasty. There is virtually no risk of injuring the conduction tissue and the right coronary artery, or the aortic box during implantation within a beating heart. Finally, flexible bands could best preserve RV function and help RV functional recovery after surgery. Nevertheless, despite all these benefits, there is no evidence of the superiority of B-TVA over R-TVA. If anything, the opposite is true. However, we did not explore the specific mechanisms of late failure of TVA. As we performed no comparison between two- and three-dimensional rings. In effect, in the reported experience, the two types of rigid rings were used during two very different periods: the Carpentier-Edwards classic (Edwards Lifesciences, Irvine, CA, USA) two-dimensional ring has been used until 2003 whilst both the Edwards MC3 and the Carpentier-Edwards Physio rings have been adopted since 2010. Thus, any interpretation of the results could be very difficult and not conclusive. I absolutely agree with Tourmousoglou *et al.* that prospective studies involving a large number of patients and new ring designs are needed for confirming the best annuloplasty device that has to be used to repair functional tricuspid regurgitation. In the meantime, we would stress the concept that the right heart reverse remodelling should be considered in every future study.

Conflict of interest: none declared.

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