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APPENDIX. CONFERENCE DISCUSSION

Dr R. Dion *(Genk, Belgium)*: The authors have reviewed the outcome of 119 patients with mitral annulus calcification in myxomatous degenerative disease operated on between 2001 and 2011, so it is a quite recent cohort of patients. This represented about 19% of all the mitral valve repairs that they performed in the same time interval. The authors propose the conclusion of their work is that mitral annulus calcification is not associated with survival or recurrent mitral regurgitation, and they have to be commended for their excellent outcome, and particularly no deaths.

Although they wished to comment on long-term results, the mean follow-up is only 2.4 years, and of these 119 mitral annulus calcification patients, only 46 have more than half of the posterior annulus involved, and I personally reckon that only these patients may pose a technical issue. Of these patients, 13 received no annuloplasty but were treated either with an edge-to-edge repair or with neo-chordae PTFE; only 14 had a total debridement of the posterior annulus plus reconstruction with pericardium, and five ended up with mitral valve replacement because of a leaflet restriction problem after the repair. Mitral annulus calcification of a non-prolapsing area was ignored and an incomplete annuloplasty band was rotated in order to avoid the calcified area.

I have a few questions. First, in myxomatous disease, in my experience, the vast majority of mitral annulus calcifications are easily removed because the calcium does not invade the left ventricle. In your series, debridement was only attempted in 50% of the patients with extensive mitral annuloplasty; in the other 50% no annuloplasty was attempted, and you recommend edge-to-edge repair or PTFE, or even suggest in your manuscript the use of a MitraClip. My problem is that even Ottavio Alfieri doesn't find it a good idea to use the edge-to-edge repair in the presence of annular calcification precluding the use of an annuloplasty. So I would like to hear from you the outcome of this particular group of patients in whom you performed only an edge-to-edge without annuloplasty or used PTFE chords. What is the outcome of these cases in terms of recurrent mitral regurgitation, for instance?

Dr Mesana: You have rightly mentioned that we have 27 patients with more severe calcification. In this cohort of patients, we actually converted only two. Five patients is the overall cohort for the whole mitral annular calcification population, which is 119 patients. Therefore, we had two out of 27 that were converted. These are patients that were converted in the OR because of recurrent MR with some degree of restriction of the valve, and maybe in these patients we should have performed annular reconstruction and possibly have avoided conversion. One of them had it, actually. So regarding your question, I was actually surprised that we could have reasonable results with low recurrence of MR with the edge-to-edge technique, because Alfieri doesn't show that. Moreover, MitraClip is not recommended with a calcified annulus.

These patients were really old patients. Actually the young patients with mitral annulus calcification with a Barlow I think are easier to repair, as you rightly mentioned. Older patients may have calcifications going down into the LV, you don't want to extend the surgery, and edge-to-edge is a bailout procedure, preferable to a replacement. We have not had any reoperations in these patients so far. We found some of them had some moderate recurrent MR, but again, most of them are older and sicker patients and we believe it is an acceptable result.

Dr Dion: Personally in this type of situation I would augment one of the leaflets and have the same result as with an annuloplasty, because you increase the tissue within the annulus. I have a second question. In other patients with mitral annulus calcification in a non-prolapsing area, the annuloplasty band was rotated. And what about the anterior annulus then? How do you place the band? Do you resect a part of it?

Dr Mesana: As I showed in the slide, we basically abandoned full rings in 2004. We exclusively use a posterior semi-rigid ring, which actually covers two-thirds of the annulus. So we don't have the problem in the anterior leaflet because we don't put the ring there. It is a posterior band.

Dr Dion: But if you rotate the band, most of the opening is on the calcium.

Dr Mesana: Well, we rotate the band when there is a commissural calcification of the commissures, so we avoid the area of calcification.

Dr Dion: And my last question is that five of the 14 total debridements have led to mitral valve replacement because of a "restrictive leaflet" motion. How can it happen in a myxomatous disease, because you have excess tissue? How do you get two restrictive leaflets?

Dr Mesana: Again, I'm sorry, but that is not the case. It is two out of the 27, and one of them out of the 14 reconstructions. I believe the reason was that with some cases of posterior leaflet calcification we were left with not enough height of the posterior leaflet and probably have not extended the patch sufficiently. So maybe in this particular case that had to be converted, there was a technical problem. But I concur with your very good suggestion, to use more the patch augmentation for these patients. We should probably have done that for this particular case. That is actually only one patient.

eComment. Qualitative assesment of mitral annular calcification

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Mitral annular calcification (MAC) is a degenerative process involving fibrous annulus of the mitral apparatus. Mitral annular calcification is associated with various clinical risk factors, such as diabetes mellitus, hypertension and hypercholesterolaemia. It is also known that patients with MAC have a higher prevalence of cardiovascular events and stroke. The atherosclerotic process as result of endothelial disruption at the foci of increased mechanical stress has been proposed as the pathophysiology of MAC. In their paper, Chan *et al.* investigated the possible impact of MAC on outcomes of myxomatous mitral valve repair. They also defined risk factors for MAC in severe mitral regurgitation due to myxomatous degeneration [1]. Severity of MAC is generally graded qualitatively, with calcification of less than one-third of the annulus reported as "mild", and greater than two-thirds reported as "severe." The thickness of the calcific band is another determinant of severity and can be echocardiographically measured from the parasternal long-axis view. In a subgroup analysis of the Framingham Heart Study, risks of incident cardiovascular disease (CVD), cardiovascular death, and all-cause death was found to increase by approximately 10% per 1-mm increase in MAC thickness [2]. The Northern Manhattan Study enrolled 1955 subjects without prior myocardial infarction or ischaemic stroke and followed up for a mean duration of 7.4 years. The severity of MAC was considered mild to moderate if calcification thickness was between 1-4 mm and severe if >4 mm. MAC was associated with increased risk of MI (adjusted HR 1.75, 95% CI 1.13-2.69) and vascular death (adjusted HR 1.53, 95% CI 1.09-2.15). Increasing MAC severity was associated with worsening study outcomes [3].

In conclusion, the link between MAC and CVD risk is gradual upon calcification severity. When dealing with MAC, qualitative assessment of the calcification should be done specifically.

Conflict of interest: none declared.

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