

Dr De Bonis: I will try to be brief. Right ventricular function is extremely important. Severe right ventricular dysfunction is another exclusion criterion for surgery; we use a TDI measurement of the systolic movement of the tricuspid annulus to decide whether or not to operate on those patients; if you have important right ventricular dysfunction, you should not operate. But in terms of tricuspid function (you might have missed one of my slides), we performed about 30% concomitant tricuspid annuloplasty, which is very low but is due to an old-fashioned style, which we are changing, in terms of concomitant tricuspid repair. So 30% had tricuspid annuloplasty, but this rate, which is certainly low, is due to the fact that in the beginning we were not using more aggressive surgery from that point of view.

As far as your second question is concerned, this morning we presented our data on a propensity score matched population of 132 patients submitted to mitral valve repair and mitral valve replacement. We are waiting for results of the randomized trial. Unfortunately in our series of consecutive patients, propensity score adjusted, we had hospital mortality of 2.3 in mitral valve repair, 12.7 in mitral valve replacement, highly significant, and a difference in terms of survival at 2.5 years of more than 20%. So, as far as our data is concerned, we are still afraid that replacement has a major impact on LV function, much more so than mitral valve repair. We will see the randomized trial.

Dr A. Golino (Bradenton, FL, USA): A couple of questions. You said you use the GeoForm now for all the patients, right?

Dr De Bonis: Yes, I said that.

Dr Golino: How do you address people with P3 tethering with the GeoForm? Have you ever seen any paravalvular leak with the GeoForm? Also the last quick question is, you showed an increase in ejection fraction. That is different from the classical style, as shown by Bolling, where there was increased quality of life but no increase of ejection fraction. Do you do resynchronization or do you see the same without resynchronization therapy?

Dr De Bonis: I will start from the last question. We have seen increasing ejection fraction also in patients without CRT and ablation of atrial fibrillation, but the rate is less compared to the other group. So, of course, you can also have reverse remodelling in patients without ablation of atrial fibrillation and resynchronization. It depends on how dilated the ventricle is before surgery. But the rate is much higher when you do associate the other two procedures.

As far as P3 tethering is concerned, of course you can have P3 tethering and also a regurgitant commissural jet, but you should take into consideration that the GeoForm ring as well as the IMR ring have an antero-posterior distance which is very, very small. So when you apply a GeoForm ring, certainly you are acting on the central portion of the valve, but you are working very aggressively as well on the commissure. So I don't see a problem from that point of view. You can correct the commissural jet and P3 tethering by putting in a GeoForm ring.

Dr Golino: So the GeoForm does the same as IMR for P3?

Dr Mohr: Can you have a private discussion afterwards as we must continue with the next talk, please.

Dr De Bonis: No paravalvular leak, anyway.

European Journal of Cardio-Thoracic Surgery 42 (2012) 646–647
doi:10.1093/ejcts/ezs132 Advance Access publication 18 April 2012

EDITORIAL COMMENT

Mitral repair for functional mitral regurgitation in idiopathic dilated cardiomyopathy: a good operation done well may help

Steven F. Bolling*

Department of Cardiac Surgery, The University of Michigan, Ann Arbor, USA

* Corresponding author. Department of Cardiac Surgery, The University of Michigan Hospitals, Cardiovascular Center 5144-5864, Ann Arbor, MI 48109, USA. Tel: +1-734-9364981; fax: +1-734-7642255; e-mail: sbolling@umich.edu (S.F. Bolling).

Keywords: Heart failure • Cardiomyopathy • Mitral regurgitation • Mitral valve repair

In this issue, De Bonis *et al.* [1] described a very interesting retrospective series of 54 patients with idiopathic dilated cardiomyopathy who underwent mitral valve repair for severe functional mitral regurgitation. No patients had coronary artery disease. These patients, very typically, had severe mitral regurgitation, class III–IV New York Heart Association failure with large ventricles, poor ejection fractions, and many had atrial fibrillation and tricuspid regurgitation. In this series, as has been shown by others, the patients underwent correction of their mitral regurgitation with low in-hospital mortality (5%). The actuarial survival at 6.5 years was ~70%. The survival was further improved if the patients had either atrial fibrillation ablation or cardiac resynchronization therapy. In follow-up, patients showed improvement in their left ventricular geometry, ejection fraction and in NYHA class. Most importantly, in this series, the freedom from recurrence of significant mitral regurgitation was ~90% at 6.5 years.

Functional mitral regurgitation is a complication of idiopathic dilated cardiomyopathy, occurring secondary to left ventricle

geometrical distortion from stenting, inferobasilar migration, apical displacement, annular dilation and posterior leaflet restriction, with altered ventricular shape and/or regional LV wall dysfunction. Mitral regurgitation (MR) leads to a vicious cycle of LV volume overload, geometric distortion and progressive MR. MR complicating congestive heart failure (CHF) predicts poor survival [2]. Mitral reconstruction surgery to treat MR in dilated cardiomyopathy has been undertaken with an acceptably low operative mortality [3, 4]. However, MR surgery for these patients remains controversial, as substantial residual or recurrent MR has been noted, and may mitigate any benefits. In fact, some series show an early (6 months) recurrence rate of significant MR of up to 50%, which certainly negatively influences or obscures potential survival advantage [5, 6]. When reviewing literature series of both surgical and percutaneous outcome studies on patients with MR in dilated idiopathic cardiomyopathy, one should be critically aware of the negative impact, mechanism and rates of recurrent MR.

At present, many of the mechanisms of recurrent functional MR have been elucidated and include annular level and subvalvular components. Predictors of recurrent MR have included LV size >65 mm, a coaptation depth of >1 cm below the annular plane and angulation of the mitral valve apparatus, all of which indicate a degree of LV distortion [6]. We have also learned that the intertrigonal distance is not stable, with dilatation occurring along both the insertion of the posterior leaflet, but also in the anterior portion. This intertrigonal portion dilates and, although at one time, was considered to be a stable 'measurable' standard by which to size annuloplasty rings, we now know from a landmark paper of Hueb *et al.* [7] that this is not the case. Therefore, our previous method of sizing was incorrect and 'undersizing' rings has become the standard for these functional MR patients. This may partly explain the operation 'failing' and recurrence of mitral regurgitation in functional MR patients when using too large 'standard-sized' rings or when using a partial or flexible rings.

Perhaps, the most important mechanistic predictor of recurrent mitral regurgitation is an increased anterior-posterior or septal-lateral mitral annular diameter. This CHF-related change has been shown not only in animal models, but also in humans. Three-dimensional magnetic resonance imaging and echo studies showed that the mitral annulus flattens and significantly increases its anterior-posterior (AP) diameter. Kongsarepong *et al.* [8] found that the strongest predictor of a recurrent MR, following mitral repair, was a residual large AP diameter, i.e. a 'too large' ring size. Finally, Spoor *et al.* [9] demonstrated that the use of flexible rings (which flex and allow the largest AP diameter) as opposed to a rigid complete ring was associated with a five times higher recurrent mitral regurgitation rate. At present, numerous rigid, complete rings with stable AP dimension reduction are available [10].

In this present series, all patients were uniformly treated with an undersized rigid complete ring. The authors noted an extremely low long-term rate of recurrent MR, with excellent LV remodelling and survival. The use of a rigid complete ring has been adopted for these functional MR patients by a majority of surgeons and is becoming our best practice standard. Of course, many factors in these difficult patients determine the long-term outcome including patient comorbidities, some of which (atrial fibrillation, tricuspid regurgitation, cardiac resynchronization therapy) have been

shown by these authors to be beneficial when corrected. In dealing with functional MR in idiopathic cardiomyopathy, it has been noted that a good operation when done poorly will not help; however, the manuscript by De Bonis *et al.* reveals that a good operation *done well* will help these functional MR patients.

Conflict of interest: none declared.

REFERENCES

- [1] De Bonis M, Taramasso M, Verzini A, Ferrara D, Lapenna E, Calabrese MC *et al.* Long-term results of mitral repair for functional mitral regurgitation in idiopathic dilated cardiomyopathy. *Eur J Cardiothorac Surg* 2012;42:640-6.
- [2] Wu AH, Aaronson KD, Bolling SF, Pagani FD, Welch K, Koelling TM. Impact of mitral valve annuloplasty on mortality risk in patients with mitral Regurgitation and Left Ventricular Systolic Dysfunction. *J Am Coll Cardiol* 2005;45:381-7.
- [3] Bolling SF, Deeb GM, Brunsting LA, Bach DS. Early outcome of mitral valve reconstruction in patients with end-stage cardiomyopathy. *J Thorac Cardiovasc Surg* 1995;4:676-83.
- [4] Bach DS, Bolling SF. Early improvement in congestive heart failure after correction of secondary mitral regurgitation in end-stage cardiomyopathy. *Am Heart J* 1995;129:1165-70.
- [5] McGee EC, Gillinov AM, Blackstone EH, Rajeswaran J, Cohen G, Najam F *et al.* Recurrent mitral regurgitation after annuloplasty for functional ischemic mitral regurgitation. *J Thorac Cardiovasc Surg* 2004;128:916-24.
- [6] Hung J, Papakostas L, Tahta SA. Mechanism of recurrent ischemic mitral regurgitation after annuloplasty: continued LV remodeling as a moving target. *ACC Curr J Rev* 2005;14:83-4.
- [7] Hueb AC, Jatene FB, Moreira LF, Pomerantz PM, Kallás E, de Oliveira SA. Ventricular remodeling and mitral valve modifications in dilated cardiomyopathy: new insights from anatomic study. *J Thorac Cardiovasc Surg* 2002;124:1216-24.
- [8] Kongsarepong V, Shiota M, A. Gillinov AM, Song JM, Fukuda S, McCarthy PM *et al.* Echocardiographic predictors of successful versus unsuccessful mitral valve repair in ischemic mitral regurgitation. *Am J Cardiol* 2006;98:504-8.
- [9] Spoor MT, Geltz A, Bolling SF. Flexible versus nonflexible mitral valve rings for congestive heart failure: differential durability of repair. *Circulation* 2006;114 (1 Suppl):I67-71.
- [10] Bothe W, Swanson JC, Ingels NB, Miller DC. How much septal-lateral mitral annular reduction do you get with new ischemic/functional mitral regurgitation annuloplasty rings? *J Thorac Cardiovasc Surg* 2010;140:117-21.