Reviewer’s report

Title: The Extent of Papillary Muscle Approximation Affects Mortality and Durability of Mitral Valve Repair for Ischemic Mitral Regurgitation

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Reviewer: Robert WM Frater

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This is not a new subject. (The first presentation of annuloplasty to less than the normal systolic dimension of the annulus as a treatment for mitral insufficiency produced by ischemic ventricular disease was at the Berlin Conference on Ischemic Mitral Insufficiency in 1988). While this worked for acute myocardial ischemic mitral insufficiency it has been inadequate as a treatment for severe chronic ischemic mitral insufficiency. Failure of annuloplasty has been shown to occur once the ventricular diastolic and systolic dimensions reach a certain level. Professor Matsui and his colleagues recognized some years ago that the critical factor causing failure of annuloplasty to achieve correction and maintenance of correction of mitral insufficiency and correction of heart failure was papillary muscle displacement. They started writing on their efforts to incorporate papillary procedures in the surgery of myocardial ischemic mitral insufficiency about ten years ago. The present article summarises their experience and serves to illustrate the significant difficulties inherent in the subject. Kron (USA), Hvass (France), and Langer (Germany) are three authors who have presented papers on papillary repositioning for this condition. The series are small and the followups relatively short. Hvass has described encircling the papillary muscles at their bases (involving partly mobilising the muscles from the ventricular wall in some cases). He has tackled cases with ventricular dimensions that normally ensure the failure of “tight” annuloplasty alone and has reported significant improvement in mitral incompetence, ventricular function and congestive cardiac failure. By the criteria of Robert Dion, (end diastolic ventricular diameter of 65 mm and more is a contraindication), Hvass’ patients would not be offered tight annuloplasty because of the very high failure rate of annuloplasty alone once diastolic and systolic ventricular dimensions reach a certain level. A paper from Teheran presented at the STS in 2008 (Rashanali et al) showed that an interpapillary distance of 2.9 was a clear predictor of failure of tight annuloplasty. Despite work that shows the importance of papillary displacement in the consequences of myocardial ischemic mitral insufficiency and the possibility of improving the results of annuloplasty by papillary repositioning, the idea has simply not caught on. The present paper offers insight into why this should be so.

Let me start by stating that questions 1 to 5 and question 7 can all be answered affirmatively. I have a suggestion for the answer to Question 6 after the following comments.

In ten years the authors have built a series of 45 cases. This quite small number
may be due partly due to the size of the institution and partly to the referral patterns for what is essentially an experimental procedure. All of these patients have the combination of coronary artery disease with myocardial ischemia, usually an area of infarction, ventricular dilatation and the added deleterious effect on the ventricle of mitral insufficiency. These multiple factors must produce a very heterogeneous group of patients. In addition variability of papillary anatomy.

The authors found papillary approximation very difficult to do via the left atrium through the aortic valve. In 13 cases they were able only to achieve approximation from the tips to the midpoint of the muscles. These patients had a better ejection fraction than the remaining 32. This suggests that the 13 did not have scarred left ventricular infarcts that enabled a trans ventricular approach in the other patients.

Question 1). Were these patients early cases chosen because their ventricular dimensions were smaller?

Question 2). Was there a learning curve that could have contributed to the higher mortality and poorer maintenance of mitral competence?

Question 3). Was the discharge status of ventricular function and mitral competence the same in these 13 patients as in the remaining 32.

Question 4). Was the ventricular scar in the 9 patients who did not have ventricular plasty too small to allow overlapping closure of the incision and consequent reduction of transverse ventricular dimension?

Question 5). Did the infarct in the 9 cases that did not have a formal ventricular plasty involve the bases of the papillary muscles so that bringing them completely together would in fact achieve a reduction in ventricular dimension and volume achieved in the 22 cases that had a formal overlapping plasty?

I am asking these questions in order to be sure that the clear benefit of the complete approximation cases can be attributed entirely to the approximation and not also to the concomitant ventricular plasty? If the authors see my questions as reasonable, will they still want to emphasize only complete papillary approximation as the mechanism for improvement?

I believe this is an excellent contribution to the understanding and to the treatment of ischemic mitral insufficiency and heart failure. Although mitral insufficiency is known to reduce the survival of patients with heart failure, correcting the insufficiency does not result in automatic improvement of survival. Restoration of ventricular dimensions towards normal seems to need to be added to correction of mitral insufficiency.

This contribution should lead to an expansion of surgical treatment of this condition.

It is particularly notable for having been carried out by a single team with a single leader over a long period of time.

I am not a statistician. The numbers are small. Whatever the statistics show the
numbers will have to be much larger for this form of surgery to be accepted by the majority of cardiac surgeons who confine their treatment to “tight” annuloplasty and ignore the poor longterm results. It is important to encourage the pursuit of these efforts.

**Level of interest:** An article of importance in its field

**Quality of written English:** Acceptable

**Statistical review:** Yes, but I do not feel adequately qualified to assess the statistics.

**Declaration of competing interests:**

I have met Professor Matsui in the USA and in Japan.
I have absolutely no competing interests.