Restraining Infarct Expansion Preserves Left Ventricular Geometry and Function After Acute Anteroapical Infarction

To the Editor:

We enjoyed reading the recent article by Kelly et al.1 but would like to point out 3 deficiencies that we feel detract from the final conclusion that preventing infarct expansion with a nondistendable mesh preserves left ventricular (LV) geometry and function.

First, by incising the pericardium, the authors ignore its critical contributions to wall stress and its effect on ventricular expansion. Pericardial excision causes an immediate 10% increase in segment length and a 33% increase in LV volume,2 leading to a subsequent increase in LV mass.3 This resultant increase in myocardial deformation has many repercussions, including activation of the Starling mechanism, increased vagal tone, and release of atrial natriuretic peptide.4 Furthermore, the restraining effects of the pericardium become even more important as the heart dilates after myocardial infarction.5 Consequently, we believe that animal models of myocardial infarction that examine the effects of myocardial geometry on LV function lose considerable fidelity if the pericardium is incised.

Second, we are concerned about the excess mortality in the mesh-treated group. Half the mesh-treated sheep died between 2 and 8 weeks, whereas in the control group, there were no similar deaths during this period. It is possible that these deaths occurred in animals with the most disordered LV function. Hence, animals with the better-preserved LV function survived, which artificially increased the ejection fraction and cardiac output of this group.

Finally, the authors make the assumption that infarct volume is identical between groups. However, infarct volume, the most important determinant of LV geometry after infarction,6 was not reported and does not even appear to have been measured.

Response

In our study,1 the pericardium was incised but not removed 10 to 14 days before infarction, at the time coronary arterial snare and atrial pacing wires were placed and mesh was applied in group 2 animals. We do not deny a role of intact pericardium in some patients after acute myocardial infarction but point out the ability of the pericardial compartment to enlarge as the heart enlarges in chronic diseases, including remodeling after acute myocardial infarction. The pericardial incision, common to both groups, hardly explains the geometric and functional differences between groups. Anteroapical infarctions in sheep evolve into anteroapical aneurysms even if the pericardial windows made to place coronary arterial snares are closed.

Four animals in group 2 died after the 5-week study, but 2 had euthanasia because of laparotomy wound infections and complications. As indicated in the article,1 2 others died of noncardiac causes; the embolic cerebral stroke occurred during the 5-week study; the animal did not awaken after the study and died the next day. No investigative team was more reluctant than ourselves to euthanize 2 animals, but humanitarian concerns took precedence. There were no signs of heart failure, arrhythmias, or other suggestions of cardiac dysfunction in any of the 4 animals that died after 5 weeks or in the 6 animals that completed the protocol. Other than coincidence, there is no evidence that the mesh restraint contributed to the death of any animal.

We have previously determined the size of the infarction after ligation of the distal left anterior descending artery and second diagonal artery in sheep.2 Infarct size was determined by use of tetrazolium chloride staining and planimetry within hours after the infarction to preempt changes in the proportions of infarcted and noninfarcted myocardium due to remodeling and healing. We did not attempt to quantify the proportionate ventricular masses after remodeling for lack of rationale.

We hope that these responses refocus attention to the principal conclusion of our study: preventing expansion of acute myocardial infarctions better preserves left ventricular geometry and function.

We appreciate the correspondents’ interest in our work and the opportunity to address the concerns they have raised.

Robert C. Gorman, MD
Joseph H. Gorman III, MD
Benjamin M. Jackson, MS
Ramin Malekan, MD
Rolf C. Gorman, MBBS, FRCPC
Martin G. St. John Sutton, MBBS, FRCPC
L. Henry Edmunds Jr, MD


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Richard J. Edwards and Michael S. Marber

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