colleagues, one of these authors (E.A.G.) generated the hypothesis that reductions in diastolic stresses were altering signaling from titin and other mechano-transducers, decreasing the triggers for remote myocyte apoptosis and negative remodeling.

The model created by Onohara and colleagues will help us tease out these pathways, understand the ideal patients for reshaping therapy, and perhaps identify other therapies to block these remote effects. Effects are only spooky when you don't understand them.

References

1. Onohara D, Corporan DM, Kono T, Kumar S, Guyton RA, Madala M. Ventricular reshaping with a beating heart implant improves pump function in experimental heart failure. *J Thorac Cardiovasc Surg*. 2022;163:e343-55.
2. Mueller XM, Tevacearai, Boone Y, Augstburger M, von Segesser LK. An alternative to left ventricular volume reduction. *J Heart Lung Transplant*. 2002;21:791-6.
3. McCarthy PM, Takagaki M, Ochiai Y, Young JB, Tabata T, Shiota T, et al. Device-based change in left ventricular shape: a new concept for the treatment of dilated cardiomyopathy. *J Thorac Cardiovasc Surg*. 2001;122:482-90.
4. Guccione JM, Salahieh A, Moonly SM, Kortsmit J, Wallace AW, Ratcliffe MB. Myosplint decreases wall stress without depressing function in the failing heart: a finite element model study. *Ann Thorac Surg*. 2003;76:1171-80.
5. Fukamachi K, McCarthy PM. Initial safety and feasibility clinical trial of the Myosplint device. *J Card Surg*. 2005;20:S43-7.
6. Grossi EA, Patel N, Woo YJ, Goldberg JD, Schwartz CF, Subramanian V, et al. Outcomes of the RESTOR-MV Trial (Randomized evaluation of a surgical treatment for off-pump repair of the mitral valve). *J Am Coll Cardiol*. 2010;56:1984-93.
7. Carrick R, Ge L, Lee LC, Zhang Z, Mishra R, Axel L, et al. Patient-specific finite element-based analysis of ventricular myofiber stress after Coapsys: importance of residual stress. *Ann Thorac Surg*. 2012;93:1964-71.

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Commentary: Reshaping ventricular geometry of mice and men: How long is the string?

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Adverse left ventricular (LV) remodeling in ischemic cardiomyopathy is an appealing target for surgical therapy. First described by Cooley in 1958, surgical ventricular reconstruction promised improvements in LV volumes, ejection fraction, functional class, and even survival.^{1,2} Since then, a variety of techniques, with and without cardiopulmonary bypass, have been described.²⁻⁴ Onohara and colleagues⁵ report the results

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CENTRAL MESSAGE

Left ventricular reshaping can be achieved with an intracardiac string; this has potential clinical application.

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of an experimental trial of an LV shaping device used in

a rat model of ischemic cardiomyopathy. In their model, ischemic cardiomyopathy was induced via ligation of the coronary artery. Three weeks later the investigational group underwent an LV reshaping procedure by intraventricular string connected to silicone pads placed on the beating heart to reduce the short access diameter and restore elliptical LV shape (Figure 1, A and B). At 12 weeks, rats with the reshaping device had improved LV volumes, decreased wall stress, increased LV wall thickness, and decreased myocardial fibrosis. These

FIGURE 1. Schematic of ventricular reshaping using intracardiac string. In experimental postinfarction dilated cardiomyopathy, spherical left ventricular dilatation (A) is reshaped using intracardiac string with external pads (B). In clinical practice, the intracardiac string (C) has been used to reshape the left ventricle (LV) in patients with postinfarction cardiomyopathy and (D) plicate anterior left ventricular aneurysm. RV, Right ventricle.

positive findings suggested a potential benefit for LV reshaping, which theoretically can be achieved via a similar procedure without the need for cardiopulmonary bypass or aortic crossclamping. Where to from here? We could not help recalling the prophetic words of Scottish poet Robert Burns (1759-1796): “In proving foresight may be vain: The best laid schemes of mice and men go often awry.”

It should be remembered that surgical ventricular reconstruction with coronary artery bypass grafting, compared with isolated coronary artery bypass grafting, was studied in the Surgical Treatment for Ischemic Heart Failure randomized control trial.⁴ Despite achieving an improvement in LV volumes, there was no significant improvement in survival, hospitalization, or functional class with ventricular reconstruction. The negative results of this landmark trial have significantly decreased enthusiasm for surgical ventricular reconstruction. Yet, a novel remodeling technique using a similar principle of the intraventricular string (Revent-TC; Bioventrix, San Ramon, Calif) has been successfully used clinically and is now approved by the Food and Drug Administration.³ This device has the capacity to remodel the LV and to exclude ventricular aneurysm (Figure 1, C and D). Although this device

has demonstrated promising clinical results, it has not yet been subjected to a rigorous, randomized controlled trial. The technique does not require cardiopulmonary bypass and can be applied via less-invasive incisions. Because this device has been used clinically, the findings of the current study in rats can potentially be translated into clinical practice. Will this promising concept result in sustained long-term improvement in the outcomes of patients with ischemic cardiomyopathy? It is yet to be seen.

References

- Cooley DA, Collins HA, Morris GC Jr, Chapman DW. Ventricular aneurysm after myocardial infarction: surgical excision with use of temporary cardiopulmonary bypass. *JAMA*. 1958;167:557-60.
- Wakasa S, Matsui Y, Kobayashi J, Cho Y, Yaku H, Matsumiya G, et al. Estimating postoperative left ventricular volume: identification of responders to surgical ventricular reconstruction. *J Thorac Cardiovasc Surg*. 2018;156:2088-96.
- Klein P, Anker SD, Wechsler A, Skalsky I, Neuzil P, Annet LS, et al. Less invasive ventricular reconstruction for ischaemic heart failure. *Eur J Heart Fail*. 2019;21:1638-50.
- Jones RH, Velazquez EJ, Michler RE, Sopko G, Oh JK, O'Connor CM, et al. Coronary bypass surgery with or without surgical ventricular reconstruction. *N Engl J Med*. 2009;360:1705-17.
- Onohura D, Corporan DM, Kono T, Kumar S, Guyton RA, Padala M. Ventricular reshaping with a beating heart implant improves pump function in experimental heart failure. *J Thorac Cardiovasc Surg*. 2022;163:e343-55.