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## Potential myocardial regeneration with CorMatrix ECM: A case report

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Video clip is available online.

Pericardial and polytetrafluoroethylene patches are currently the most commonly used materials for intraventricular repair but are limited by calcification and retraction. The extracellular matrix (ECM) biomaterial CorMatrix ECM (CorMatrix Cardiovascular, Inc, Roswell, Ga) is an absorbable tissue scaffold synthesized from decellularized porcine small intestinal submucosa that is rich in collagen, glycosaminoglycans, and growth factors. Furthermore, in experimental models of myocardial infarction and ventricular repair, ECM patches have been shown to stimulate infiltration of cells, including cardiomyocytes, as well as ECM production.<sup>1,2</sup>

The epicardial application of CorMatrix ECM has been demonstrated to decrease infarct size and scar formation after myocardial infarction.<sup>3</sup> We have previously studied the operative safety of the use of CorMatrix ECM for left ventricular aneurysm repair and ventricular septal defect repairs, with no primary repair failures.<sup>4</sup> Here we report a case of ventricular false aneurysm repair with

CorMatrix ECM, which resulted in improvement of ventricular contractile activity at 1-year follow-up.

### CLINICAL SUMMARY

A 75-year-old female patient underwent 3-vessel coronary artery bypass grafting 9 years before the index visit, then 3 years before the index visit had an acute infarction with ventricular rupture. She underwent sutureless repair of a false aneurysm with Bioglue (CryoLife, Inc, Kennesaw, Ga) closure of the lateral ventricular wall.

The patient reported chest pain and syncope. Angiography revealed a superficial false aneurysm (54 × 24 mm) superimposed on a deeper false aneurysm (72 × 49 mm; [Figure 1, A](#), and [Video 1](#)). Transthoracic echocardiography demonstrated inferior and inferolateral hypokinesis of the left ventricle (left ventricular ejection fraction 20%-40%), ventricular dilation (left ventricular end-systolic diameter 39 mm and left ventricular end-diastolic diameter 53 mm), mild mitral regurgitation, and large false aneurysms.

The patient underwent CorMatrix ECM false aneurysm repair with femoral cannulation through a left thoracotomy. The false aneurysm was opened under deep hypothermic circulatory arrest (28°C). The communication between the superficial and deep false aneurysm was approximately 20 × 20 mm, and the more recent false aneurysm was filled with thrombus. The neck of the old false aneurysm extending from the base of the papillary muscles to the apex was closed with CorMatrix ECM with running 4-0 monofilament suture. The superficial false aneurysm was then closed. The patient was rewarmed and decannulated.

Immediate postoperative echocardiography demonstrated inferolateral and anterolateral mid-to-apical akinesis of the left ventricle (left ventricular ejection fraction 35%-45%, left ventricular end-systolic diameter 35 mm, left ventricular end-diastolic diameter 42 mm; [Figure 1, B](#)

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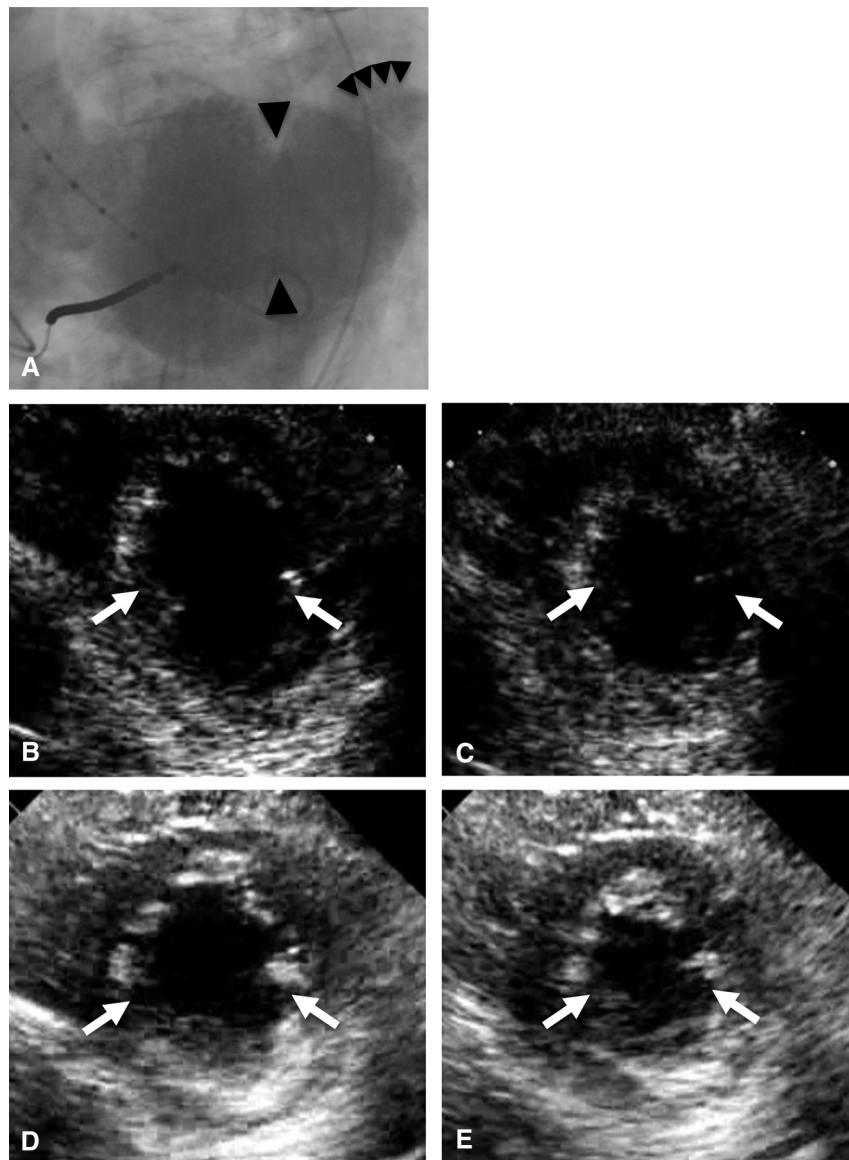
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**FIGURE 1.** Images of CorMatrix ECM intraventricular repair. A, Preoperative angiography demonstrating contrast into the neck of an initial false aneurysm (arrows) and a superimposed false aneurysm (arrowheads). B and C, Postoperative transesophageal echocardiography shows the noncontractile CorMatrix ECM patch (bordered by arrows) in diastole (B) and systole (C). D and E, Transesophageal echocardiograph at 1-year follow-up shows a contractile posterior left ventricular wall in the area of previous CorMatrix ECM patch repair (bordered by arrows) in diastole (D) and systole (E).

and C, and [Video 2](#)). There was no aneurysm and no patch leak. The patient was discharged from the hospital on postoperative day 10.

At 1 year, the patient had returned to her baseline function without any limitations. Transthoracic echocardiography demonstrated preserved left ventricular end-systolic diameter (36 mm) and left ventricular end-diastolic diameter (44 mm) and, to our surprise, restoration of left ventricular function (left ventricular ejection fraction >60%). Furthermore, the area of the CorMatrix ECM patch appeared to have increased wall thickness and synchronous contractile activity ([Figure 1, D and E](#), and [Video 3](#)).

## DISCUSSION

This is the first clinical report to demonstrate an increase in myocardial wall thickness and ventricular contractile activity with the use of CorMatrix ECM and to document associated clinical improvement. The use of Dacron polyester fabric patch for ventricular aneurysm repair has been associated with early improvement in ventricular function (left ventricular ejection fraction from 28% to 39%;  $P = .007$ ).<sup>5</sup> Generation of myocardial wall thickness and improvement in systolic function, however, have not previously been shown. As mentioned, several experimental studies have demonstrated cellular regeneration with ECM deposition within

small intestinal submucosa ECM grafts.<sup>1-2</sup> Although we have not shown cellular regeneration, our findings of contractile activity support the continued use and study of CorMatrix ECM cardiac repair.

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# Staged total aortic hybrid repair for DeBakey type I dissection: Report of a case

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Open surgical repair for extensive aortic disease represents a great challenge, and staged approaches involving multiple hybrid procedures have emerged as an appealing alternative to conventional open repair.<sup>1</sup> We report a case of DeBakey type I aortic dissection treated with a total aortic repair through a staged hybrid approach.

## CLINICAL SUMMARY

A 45-year-old man who had undergone a Bentall procedure for an acute DeBakey type I aortic dissection (Figure 1, A-C) 7 years previously was referred to our institution. Computed tomographic scan (Figure 1, D-F) documented a chronic postdissection aneurysm of the aortic arch and thoracoabdominal aorta (70 mm) with proximal entry tears at the brachiocephalic trunk and aortic isthmus. At the descending thoracic aorta, the true lumen was narrow (4 mm) and circumferentially dissected; multiple reentry tears were located in the distal aorta, and all visceral vessels originated from the true lumen except for the right renal artery. A staged hybrid approach was offered. The patient initially underwent a complete arch replacement with a wide fenestration of the descending intimal flap and elephant trunk construction. The arch vessels were reimplemented by means of the separate graft

technique with a 28-mm Siena 4-branched aortic graft (Vascutek Ltd, Glasgow, Scotland; Figure 1, G-I). Antegrade selective cerebral perfusion with moderate hypothermia was used for cerebral protection.<sup>2</sup> Two months later, graft replacement (28 mm) of the descending thoracic aorta was performed with temporary left heart bypass, sequential clamping, and cerebrospinal fluid drainage for spinal and visceral protection (Figure 1, J-L). Four months later, the patient was readmitted for treatment completion of the residual thoracoabdominal aortic aneurysm. Through a median laparotomy with a transperitoneal approach, the infrarenal abdominal aorta was replaced and the visceral vessels were revascularized with a 28-mm multi-branched Coselli thoracoabdominal graft (Vascutek). Selective renal perfusion with cold crystalloid solution was used for renal protection (Figure 2, A-D). During the same hospitalization, endovascular exclusion of the remaining thoracoabdominal aorta was then performed; 2 Valiant Medtronic stent-grafts (34-36 mm) were implanted with a 20% to 30% oversizing. Graft-to-graft overlaps of 4 and 3 cm were achieved in the proximal and distal landing zones, respectively. Cerebrospinal fluid drainage was applied for spinal cord protection. The predischarge computed tomographic scan showed a total aortic replacement with a partially thrombosed false lumen as a result of residual endograft porosity (Figure 2, E-H). All postoperative courses were totally uneventful. At 6-month follow-up, the patient remains well, with unchanged aortic appearances and stable aortic diameters.

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## DISCUSSION

Reoperations for extensive open aortic replacement are associated with considerable morbidity and mortality. During the last decades, hybrid and endovascular repair