

Use of an Extracellular Matrix Patch for Sternal Wound Dehiscence

after Cardiac Surgery in a Neonate

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Management of sternal wound dehiscence in newborns after cardiac operations can be a slow and lengthy process, during which the risk of progression to deep sternal wound infection and mediastinitis remains a concern. We report the case of a neonate born with single-ventricle physiology who underwent a Damus-Kaye-Stansel procedure as first-stage palliation toward creating Fontan circulation. The postoperative period was characterized by sterile wound dehiscence of the subcutaneous layers. We used a CorMatrix extracellular matrix patch as an adjunct to repair the wound defect. After 7 weeks, the wound had healed with excellent results. To our knowledge, this is the first report of extracellular matrix patch implantation for sternal wound reconstruction in a neonate. (Tex Heart Inst J 2018;45(3):176-8)

Delayed sternal wound closure is a recognized practice after pediatric cardiac surgery; it provides time to optimize hemodynamic status and to enable resolution of inflammation and myocardial edema. However, delayed closure is associated with higher rates of wound infection, so closing wounds at the earliest opportunity is important.¹

Topical negative-pressure vacuum dressings have been used successfully to treat wound dehiscence, but they do not always resolve superficial wound gaps.² The use of submucosal porcine extracellular matrix (ECM) may overcome this problem by providing a bioscaffold that promotes native cell growth and proliferation, enabling the repair of damaged tissue. CorMatrix[®] ECM (CorMatrix Cardiovascular, Inc., acquired by Aziyo Biologics, Inc.),³ licensed for clinical use by the United States Food and Drug Administration in 2005, is composed of decellularized porcine small-intestinal submucosal ECM, and we have used it successfully to repair congenital heart defects. Therefore, when one of our neonate patients developed sterile wound dehiscence, we implanted an ECM patch to repair the wound.

Key words: Cardiac surgical procedures/methods; extracellular matrix/transplantation; heart defects, congenital/surgery; infant, newborn; pericardium/surgery; treatment outcome; wound healing

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Case Report

In May 2014, a male neonate with an antenatal diagnosis of double-inlet left ventricle and transposition of the great arteries with hypoplastic aortic arch was referred to our center. After birth, his clinical condition was stabilized with prostaglandin infusions. At 3 days of age, the patient underwent aortic arch enlargement and pulmonary artery banding through a median sternotomy. After he was transferred to the intensive care unit, the ventricular septal defect became restrictive, so we performed a Damus-Kaye-Stansel (DKS) procedure and a modified Blalock-Taussig shunt procedure with chest closure. Three weeks later, an existing stenosis at the DKS level was refashioned, after which the patient's chest was left open with a silastic membrane sutured over the sternal gap. The patient recovered well, and the sternotomy was closed 2 days later. However, one week later, he developed superficial wound dehiscence involving the skin and the soft-tissue layers.

At the lower third of the wound, the dehiscence was deeper, and part of the sternum was exposed. We thoroughly débrided the wound and found no evidence of infection. After 2 weeks of negative-pressure dressing, the wound looked healthier, with granulation tissue growing from the deepest layers. However, a 1.5-cm gap remained

between the edges of the skin, along the entire length of the wound (Fig. 1A).

To facilitate wound healing, we decided to use CorMatrix® ECM to cover the skin gap and to create a barrier between the skin and the deeper granulating layers. We trimmed an ECM patch and sutured it to the skin edges, using continuous absorbable suture (Fig. 1B). We then dressed the wound with Mepore® (Mölnlycke Health Care). Four weeks after patch implantation, a dry scab formed over the wound and, just after 6 weeks, it spontaneously fell off (Fig. 1C). The wound had healed well, and the gap between the edges had been macroscopically replaced with skin (Fig. 1D). Seven weeks later, the wound looked healthy and showed no evidence of dehiscence or infection. Finally, 3 months after hospital discharge, the patient was seen in the clinic, and the wound still looked healthy.

Discussion

We have used ECM since 2011 to repair congenital heart defects. Having seen its regenerative properties in those operations, we decided to use an ECM patch on a neonate patient in whom wound dehiscence developed after sternotomy. To our knowledge, no other reports of sternal closure with ECM have appeared in the medical literature.

Results of an experimental study reported in 2012 showed that ECM enabled native cells to regenerate,⁴ and these results were confirmed in clinical reports. Stelly and colleagues⁵ used ECM for pericardial reconstruction in a patient who underwent coronary artery bypass grafting; after repeat surgery 5 years later, analysis of pathologic specimens showed that the bioscaffold had remodeled into viable cellularized tissue similar to native pericardium. This new biomaterial proved promising in short-term clinical studies and case reports for a range of applications, including repair of valvular, septal, and vascular defects in congenital and adult cardiac and vascular surgery.^{6,7}

The most likely cause of sterile wound dehiscence in our patient was a mechanical breakdown of the suture line. After débriding the wound, we applied a negative-pressure dressing to promote growth of the deep tissue layers and to maintain sterility. When the wound looked healthy enough to discontinue negative-pressure therapy, we had to consider options for closing it. Primary wound closure was excluded because the skin edges were too far apart for tensionless suturing, and skin grafting in a neonate would have been difficult. Therefore, because the wound was sterile and relatively shallow, we decided to use an ECM patch to promote tissue regeneration.

Our patient's case supports the findings of previous studies in which ECM provided a bioscaffold for wound healing. Macroscopically, the ECM patch was replaced

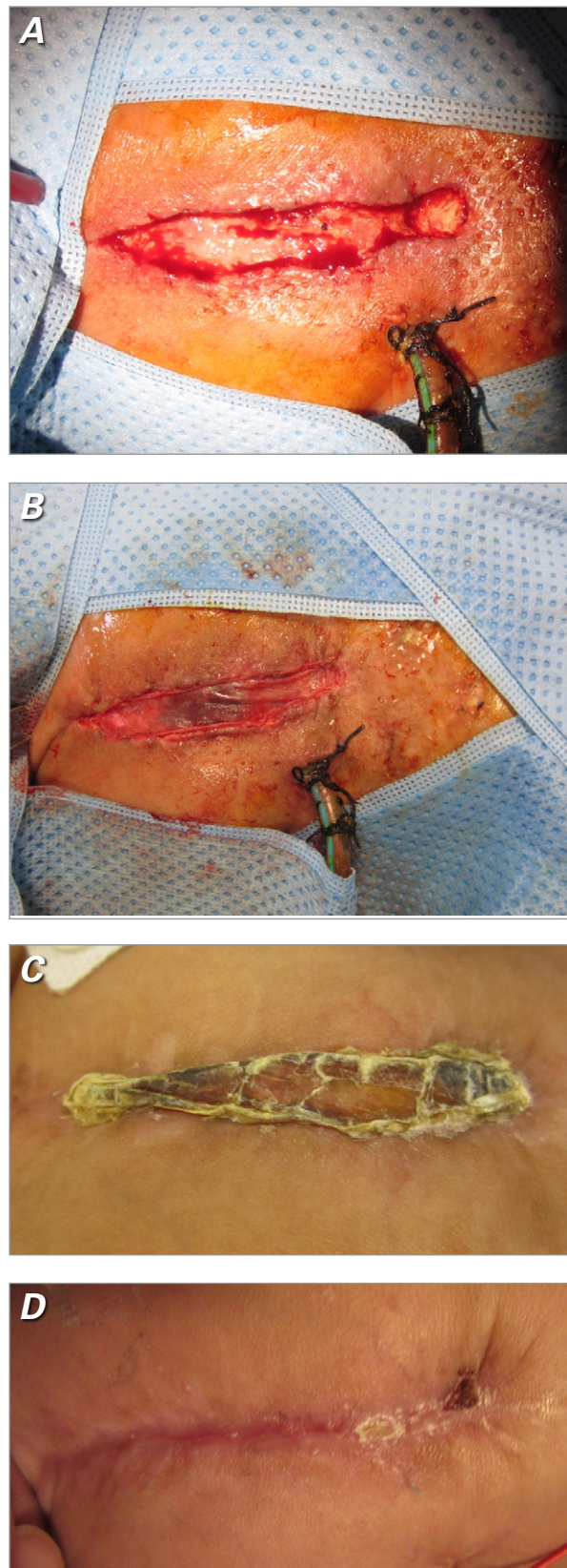


Fig. 1 Photographs show **A)** sternal wound dehiscence, **B)** extracellular matrix patch implantation, **C)** scab formation 6 weeks after implantation, and **D)** skin and subcutaneous tissue remodeling and healing 7 weeks after implantation.

by skin, and the wound healed well. The regenerative characteristics of ECM may lead to its extended use in managing more complex cases of sterile wound dehiscence that are not suitable for conventional treatment.

Addendum

In 2017, Aziyo Biologics acquired CorMatrix Cardiovascular, Inc. An ECM developed by Aziyo, Tyke[®], is approved for pericardial repair in neonates and infants.³

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