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HOW TO DO IT

Sutureless repair with Hydrofit® and bovine pericardial patch for oozing-type postinfarction cardiac rupture

Shintaro Takago[1] · Satoru Nishida[1] · Kazunori Koyama[1] · Susumu Fujino[2] · Takayasu Tada[2]

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Abstract

Left ventricular free wall rupture is a fatal complication of myocardial infarction for which infarctectomy and reconstruction of the left ventricle using a prosthetic patch under cardiopulmonary bypass are performed. However, these surgical treatments remain challenging. Left ventricular free wall rupture secondary to acute myocardial infarction was diagnosed in an 86-year-old man. We performed sutureless repair of the left ventricular free wall rupture without cardiopulmonary bypass. During the operation, a pre-gluing bovine pericardial patch with Hydrofit® was placed twice on the ruptured site and manually pressed to provide complete hemostasis. The postoperative course was uneventful. This sutureless technique has the benefit of avoiding sutures in the fragile infarcted myocardium and might be effective for left ventricular free wall rupture treatment.

Keywords Left ventricular rupture · Sutureless repair · Surgical sealant

Abbreviations

LVFWR	Left ventricular free wall rupture
CPB	Cardiopulmonary bypass

Introduction

Left ventricular free wall rupture (LVFWR) is a fatal complication of myocardial infarction. The conventional surgical technique for LVFWR involves infarctectomy, including the ruptured site, and reconstruction of the left ventricle by directly suturing the prosthetic patch to the myocardium [1]. However, this technique requires manipulation of fragile tissue after myocardial infarction with cardiopulmonary bypass under systemic heparinization. To avoid these problems, the efficacy of sutureless repair using various surgical sealants has been reported for LVFWR [1–6]. Most of these sutureless repair techniques use a fibrin tissue-adhesive collagen fleece, TachoSil® (CSL Behring, Tokyo, Japan) or TachoComb® (Torii Pharmaceutical, Tokyo, Japan). However, this technique may cause pseudo-aneurysms and re-ruptures [4, 5]. Furthermore, these surgical adhesives are not effective in moisturized fields, such as the bleeding site [3, 7, 8]. To solve these problems, we adopted sutureless repair for LVFWR using Hydrofit® (Sanyo Chemical Industries, Kyoto, Japan), a surgical sealant that comprises a urethane-based polymer.

Technique

An 86-year-old man received 10 mg of prednisone and 100 mg of cyclosporine daily for interstitial pneumonia. He was referred to our hospital because of severe dyspnea and acute shock 3 days after the onset of chest pain. His electrocardiogram demonstrated normal sinus rhythm with ST-segment elevation and deep Q waves in II, III, and aVF. Transthoracic echocardiography revealed massive pericardial effusion around the heart. Enhanced computed tomography revealed massive fluid in the whole pericardial circumference and a poorly enhanced area in the posterolateral left ventricular wall and papillary muscle (Fig. 1a). An emergency coronary angiogram revealed 100% stenosis of the left circumflex coronary artery (Fig. 1b). He was urgently taken to the operating room with suspected LVFWR because of a 3-day-old acute myocardial infarction.

During the operation, the pericardium was promptly opened through standard median sternotomy. A large amount of blood and pericardial hematoma were removed (Fig. 2a).

✉ Shintaro Takago
shintaro-takago@live.jp

[1] Department of Cardiovascular Surgery, Fukui Prefectural Hospital, 2-8-1 Yotsui, Fukui, Fukui 910-8526, Japan

[2] Department of Cardiology, Fukui Prefectural Hospital, Fukui, Japan

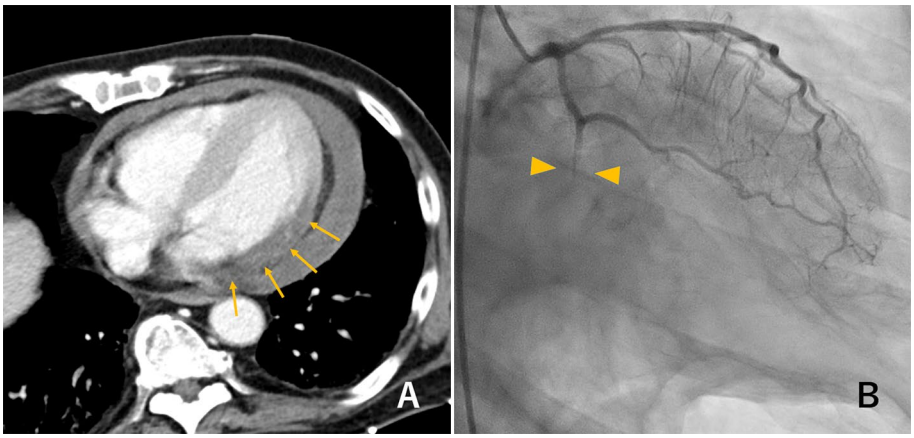

Fig. 1 **a** Chest computed tomography scan demonstrating massive pericardial effusion and poorly enhanced area in the posterolateral left ventricular wall (arrow). **b** Coronary angiogram revealed 100% stenosis of the left circumflex coronary artery (arrowhead)

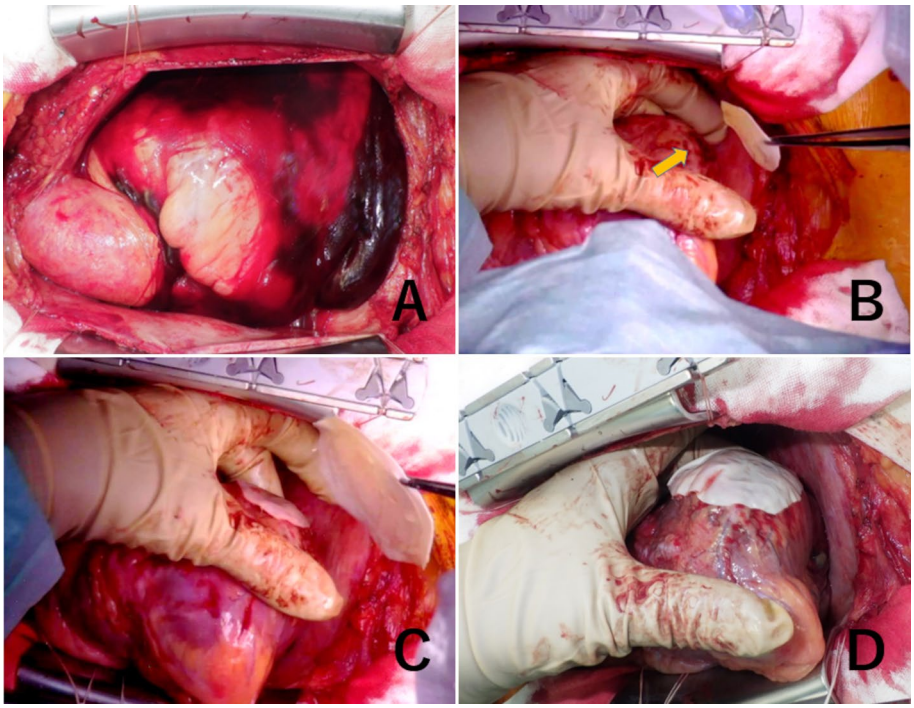

Fig. 2 Intraoperative findings of sutureless repair with Hydrofit®. **a** A large amount of blood and hematoma were revealed after the pericardium was opened. **b** Left ventricular wall rupture (arrow) can be observed. The bovine pericardial patch pre-glued with Hydrofit® as the first patch was tailored to overlap the rupture site. **c** Then, we applied a second patch, which was larger than the first patch; it completely covered the necrotic tissue and slightly covered the healthy epicardium. **d** Hemostasis in the oozing area was achieved after the application of a pre-gluing bovine pericardial patch with Hydrofit®

We detected an epicardial hematoma in the posterolateral left ventricular wall and oozing-type bleeding site. The site of the infarcted myocardium with bleeding was carefully identified, and the size was visually estimated. An oval bovine pericardial patch (the first patch), with major and minor diameters of approximately 4–6 cm, was tailored to overlap the infarcted myocardium site (Fig. 2b). Hydrofit® was directly applied to the bovine pericardial patch and placed over the bleeding point and surrounding area of the fragile necrotic tissue. To spread Hydrofit® evenly and thinly, we first applied it around the bovine pericardial patch and then applied several rows inside the circle. Next, we spread it with a spatula. The first patch was then manually pressed onto the bleeding site. After 3 min of compression, complete hemostasis was achieved. Subsequently, we applied a second patch with major and minor diameters of approximately 6–8 cm to completely cover the first patch and slightly cover the healthy epicardium (Fig. 2c, d). Using the first patch as a guide, we could easily apply the second patch at the center of the oozing site. Approximately 1.5 mL (0.5 and 1.0 mL for the first and the second patch, respectively) of Hydrofit® was used to apply the two patches. The chest was closed and drained in the usual manner. Cardiopulmonary bypass (CPB) was not performed. The operating time was 75 min. The postoperative course was uneventful, and the patient was discharged on postoperative day 14. At the 2-month follow-up, he resumed his daily life activities without any limitations. Postoperative computed tomography and transthoracic echocardiography revealed no left ventricular aneurysm or pericardial effusion.

Comment

LVFWR reportedly occurs in 2–6.2% of acute myocardial infarctions. It is the second most common cause of death after acute myocardial infarction following pump failure [1]. For post-infarction LVFWR, myocardiectomy of necrotic myocardial tissue and suture repair with a prosthetic patch are conventional surgical procedures [1]. However, problems with the surgical technique exist, such as the necessity of suturing fragile tissue after myocardial infarction using cardiopulmonary arrest with cardiopulmonary bypass [1–4, 6]. Systemic heparinization is essential for cardiopulmonary bypass. Moreover, suturing along the non-ischemic myocardium of the left ventricle can lead to future deterioration of left ventricular function [2]. In addition, recent myocardial infarction decreases the heart's tolerance to subsequent global ischemia even when protected by hypothermic cardioplegia [6]. In severe conditions, avoiding CPB is expected to decrease post-CPB cytokine release and result in better recovery [4]. Therefore, sutureless repair without CPB has been reported for oozing-type LVFWR after myocardial infarction [1–6]. Most of these sutureless repair techniques use a fibrin tissue-adhesive collagen fleece as a bio-absorbable hemostatic sponge, but this technique may cause future complications, such as pseudo-aneurysms and re-ruptures [4, 5]. A surgical procedure using a combination of Teflon felt and cyanoacrylate monomer agent has also been reported [2]. However, cyanoacrylate monomer agent may cause tissue thermal injury of coronary artery [2].

We used Hydrofit® and bovine pericardial patch. The use of Hydrofit® is reportedly successful in sutureless repair for LVFWR in combination with a hemostatic cellulose sheet [3]. Hydrofit® is a surgical sealant that consists of a urethane-based polymer applied to an attached silicone sheet. Hydrofit® adheres tightly to target tissues and is less likely to cause tissue injury [8]. Additionally, it is easier to use in a moisturized field than other surgical adhesives, such as fibrin glue and bovine serum albumin–glutaraldehyde glue, because it absorbs water [3, 7, 8]. Moreover, owing to its moderate viscosity, Hydrofit® is easy to apply to the target tissue.

As the bovine pericardial patch is strong and non-absorbable, a left ventricular pseudo-aneurysm may not occur when using it, compared with using absorbable materials. Another advantage is that using a bovine pericardium patch eliminates the need for a silicone sheet. If a silicone sheet is used, it cannot be left in the body, and peeling it off often causes re-bleeding [7]. Furthermore, bovine pericardium can be easily processed to any size and is easy to handle.

In conclusion, we believe that the sutureless patch technique using a pre-gluing bovine pericardial patch with Hydrofit® may be a reasonable option to treat oozing-type LVFWRs due to myocardial infarction.

Declarations

Conflict of interest None declared.

Ethical approval The Institutional Review Board approved the use of Hydrofit® for this case. The patient was informed concerning the off-label use of Hydrofit® and consent was obtained for publication of this article.

References

1. Matteucci M, Fina D, Jiritano F, Blankesteijn WM, Raffa GM, Kowalewski M, et al. Sutured and sutureless repair of postinfarction left ventricular free-wall rupture: a systematic review. Eur J Cardiothorac Surg. 2019;56:840–8.
2. Lachapelle K, Varennes B, Ergina PL, Cecere R. Sutureless patch technique for postinfarction left ventricular rupture. Ann Thorac Surg. 2002;74:96–101.
3. Ishii H, Endo H, Tsuchiya H, Inaba Y, Terakawa K, Kubota H. Off-pump hemostasis for left ventricular rupture after myocardial infarction with Hydrofit® and Surgicel®. Gen Thorac Cardiovasc Surg. 2018;66:753–5.
4. Okamura H, Kimura N, Mieno M, Matsumoto H, Yuri K, Yamaguchi A. Sutureless repair for postinfarction left ventricular free wall rupture. J Thorac Cardiovasc Surg. 2019;158:771–7.
5. Fukushima S, Kobayashi J, Tagusari O, Sasako Y. A huge pseudoaneurysm of the left ventricle after simple gluing of an oozing-type postinfarction rupture. Interact Cardiovasc Thorac Surg. 2003;2:94–6.
6. Yamaguchi H, Nakao T, Tokunaga N, Nakamura H, Takagaki M. Off-pump suture repair of left ventricular rupture utilizing TachoComb® sheet: a case report and literature review. World J Emerg Surg. 2013;8:29.
7. Kawashima T, Hatori K, Mizoguchi T, Oda, Arakura M, Hagiwara N, et al. In vitro evaluation of the hemostatic effect of method involving the combined use of Hydrofit® and Spongel®. Gen Thorac Cardiovasc Surg. 2020;68:932–7.
8. Nakae M, Toda K, Yoshioka D, Miyagawa S, Kainuma S, Kawamura T, et al. Sutureless patch repair with a novel adhesive for postinfarction ventricular septal rupture. Ann Thorac Surg. 2022;113:e33–6.