Repair of coronary artery ostium with a ring-shaped bovine pericardial patch

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Abstract

As an approach to coronary artery (CA) ostial injury in type A aortic dissection (TAAD) and infective endocarditis, we describe a technique of coronary ostial repair using a ring-shaped bovine pericardial patch. The inner and outer rims of the patch were sutured to the involved coronary ostium (to close the ostial tear) and to the aortic wall (to cover the sinus), respectively. Four patients were successfully managed and computed tomographic coronary arteriogram at follow-up showed patent coronary ostia and arteries. The favorable preliminary results imply that this technique is a simple, safe, and effective approach to coronary ostial repair in patients with TAAD or infective endocarditis.

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ABSTRACT

As an approach to coronary artery (CA) ostial injury in type A aortic dissection (TAAD) and infective endocarditis, we describe a technique of coronary ostial repair using a ring-shaped bovine pericardial patch.

The inner and outer rims of the patch were sutured to the involved coronary ostium (to close the ostial tear) and to the aortic wall (to cover the sinus), respectively. Four patients were successfully managed and computed tomographic coronary arteriogram at follow-up showed patent coronary ostia and arteries. The favorable preliminary results imply that this technique is a simple, safe, and effective approach to coronary ostial repair in patients with TAAD or infective endocarditis.

Introduction

Coronary artery (CA) ostial injury is usually seen in type A aortic dissection (TAAD) and infective endocarditis. Once the ostial injury progresses to coronary malperfusion, the mortality risk may be increased by 7-fold in patients with TAAD.[1] Currently available approaches to repair of coronary ostial injury in such patients include direct repair with continuous suture, percutaneous coronary intervention (PCI), and coronary artery bypass grafting (CABG). In our practice, we have developed a different technique for coronary ostial injury by using of a ring-shaped bovine pericardial patch. The report seeks to describe this technique and evaluate the preliminary outcomes in four patients.

Patients and methods

From August 2020 to January 2022, we treated 4 patients with coronary ostial injury by using a ring-shaped bovine pericardial patch. Mean age was 37 ± 11.4 years (range 26-53). The etiology was TAAD in 3 patients and infective endocarditis in 1. TAAD involved the left coronary ostium in 2 patients and the right coronary ostium in 1. Preoperatively, transthoracic echocardiogram (TTE) and aortic computed tomographic angiogram (CTA) did not identify any injury to the coronary ostium, nor did ECG show any signs of myocardial ischemia.

After the ascending aorta was opened, the intima of the coronary ostium was found to be split into long fissures in all four patients; and the patient with infective endocarditis sustained a concomitant intimal intussusception involving the proximal segment of the left main CA.

In all four patients, a piece of bovine pericardium (Beijing Balance Medical, Beijing, China) was carefully trimmed into a ring-shape patch; the inner and outer diameters were approximately 5 and 20 mm, respectively, so that the patch could cover the involved coronary sinus (**Figure 1**). The inner rim of the bovine pericardial patch was continuously sutured to the coronary ostium with 7-0 prolene. To avoid deterioration of ostial dissection and minimize the risk of postoperative coronary occlusion, 7-0 prolene suture was used in the first stitch, which was sutured slantly on both sides of the ostial tear, and covers the torn ostium with bovine pericardium (**Figure 2**). In the case of infective endocarditis, to address the inner cylinder intussusception of left main CA, the inner rim of the ring-shaped patch, coronary intima and the aortic adventitia were continuously sutured with 6-0 prolene in a sandwich manner. Due to the fragility of tissue in TAAD and endocarditis, a full-thickness bite was taken to transverse the aortic wall to strengthen repair. The outer rim of the bovine pericardial patch was continuously sewn to the aortic wall with 6-0 prolene suture. No pledgets were placed outside the aortic adventitia.

Results

The procedure was successful in all four patients. The coronary ostial repair lasted for 10-15 minutes. The heart resumed beating automatically after the cross-clamp was removed. Neither mortality nor morbidity occurred, and all patients were discharged in good condition.

Clinical and imaging follow-up was complete in 100% for a mean duration of 1.3 ± 0.7 years (range 0.3-1.7). All patients were doing well and without symptoms at the latest follow-up. ECG did not reveal any signs of myocardial ischemia. In all patients, coronary CTA showed a normal and patent coronary ostium, unobstructed distal blood flow to left coronary artery, with no signs of coronary ostial stenosis or dissection (**Figure 3**).

Discussion

Coronary malperfusion occurs in approximately 7% of patients with acute TAAD and surgical strategies depend on the severity of the coronary artery dissection. According to lesions of coronary malperfusion, Neri classified the coronary artery dissection into three subtypes: ostial dissection, dissection with a coronary false channel, and circumferential detachment with an inner cylinder intussusception.[2] The latter two subtypes are usually managed with CABG or PCI,[3] while the optimal approach to ostial dissection remains unclear. Although direct suture with 7-0 prolene is widely used, the anastomosis is often under high tension and at risk of anastomotic breakage or leak. The preliminary results in our patients suggest that ostial repair with a ring-shaped bovine pericardial patch is a feasible approach to coronary ostial injury in type A aortic dissection or infective endocarditis.

Barbero and associates reported a somewhat similar technique for catheter-induced left main coronary dissection with subsequent retrograde progression into the ascending aortic wall. The left coronary ostium was repaired with an autologous ring-shaped aortic patch, which achieved unobstructed blood flow in left coronary artery postoperatively.[4] The biggest advantage of an autologous aortic patch lies in its smooth surface that reduces the risk of thrombosis. It offers more strength in buttressing the coronary ostium and sinuses compared to direct suture repair, which effectively avoids progression of the ostial injury caused by blood flow, and aggravation of myocardial ischemia, thereby eliminating the need for CABG or Bentall-type operation. In contrast, a ring-shaped bovine pericardial patch offers more advantages than autologous aortic or pericardial patch. It is thinner and less likely to cause ostial and proximal coronary stenosis, especially when the intima of coronary ostium is involved in the repair. Bovine pericardial patch is pliable and strong, and holds the stitches more reliably compared to autologous aortic patch, which is often brittle and edematous in acute dissection or infective endocarditis. Autologous pericardium is not as strong as bovine pericardial patch and takes longer time to suture. However, the bovine pericardial patch may calcify over time, which needs to be closely monitored.

Although the favorable results in our patients suggest that the ring-shaped bovine pericardium repair is safe and effective for coronary ostial injury in acute dissection or infective endocarditis, further studies in more patients for longer duration are warranted to evaluate its long-term efficacy and durability.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest

ETHICS STATEMENT

The Ethics Committee of Luoyang Central Hospital approved this retrospective study and waived the need for informed patient consent.

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Figure Legends

Figure 1 . Diagram of coronary ostial repair with a ring-shaped bovine pericardial patch. The red circle and yellow ring stand for the coronary ostium and the bovine pericardial patch, respectively

Figure 2 . Operative view of right coronary ostial repair with a ring-shaped bovine pericardial patch in a 35-year-old male with type A aortic dissection involving the right coronary ostia. The arrowheads point to the inner rim of the patch that was sutured in place to the right coronary ostium

Figure 3 . Follow-up coronary CT arteriogram of the same patient in Figure 2. A. Volume-rendered CT images showed a well visualized right coronary artery with patent lumen; B. Endoscopic images of the aortic root showed a patent right coronary ostium (arrow)

Figures

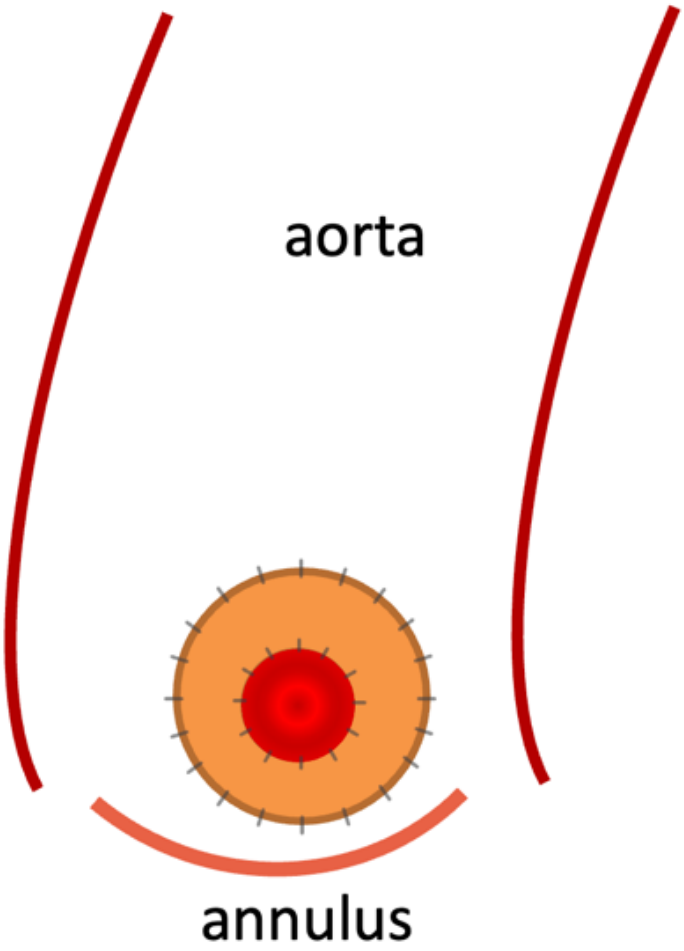

Figure 1

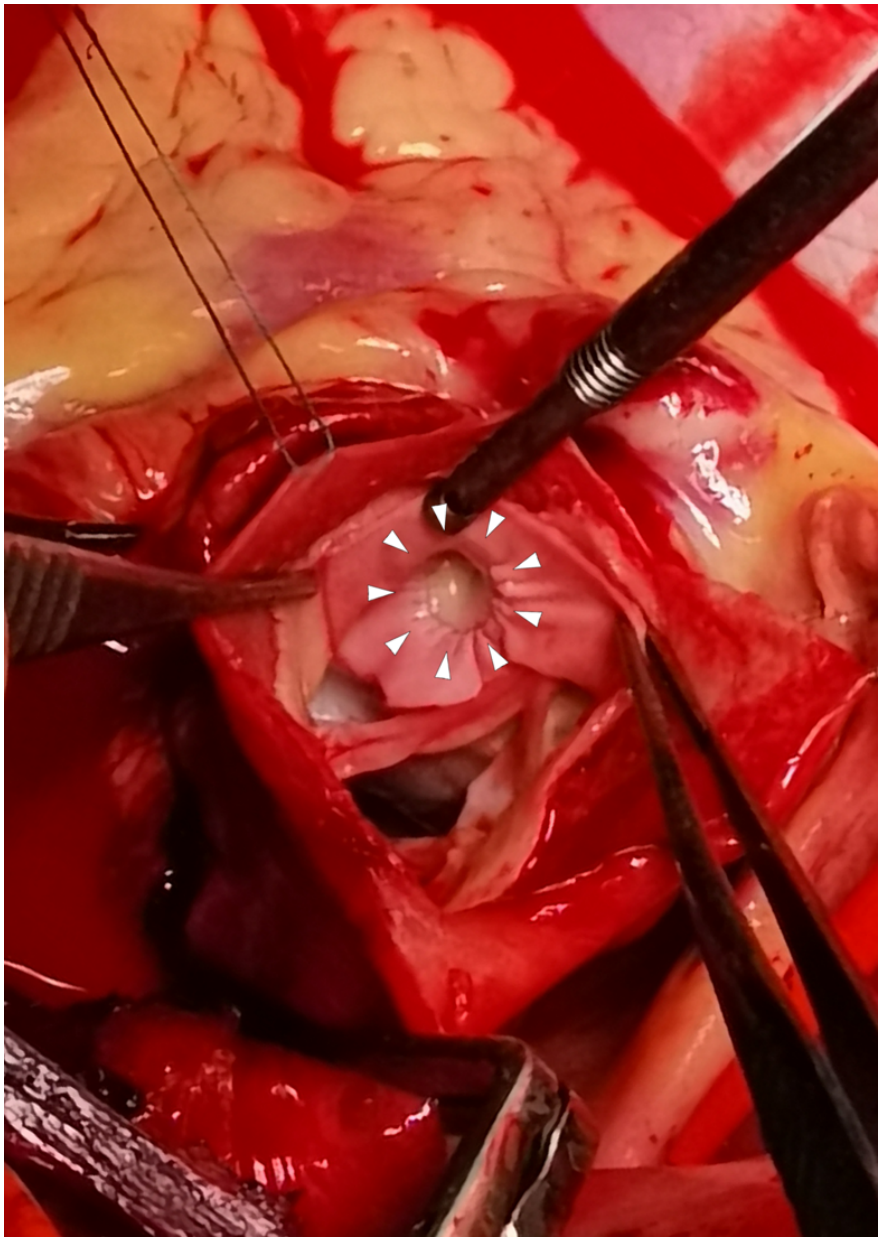

Figure 2

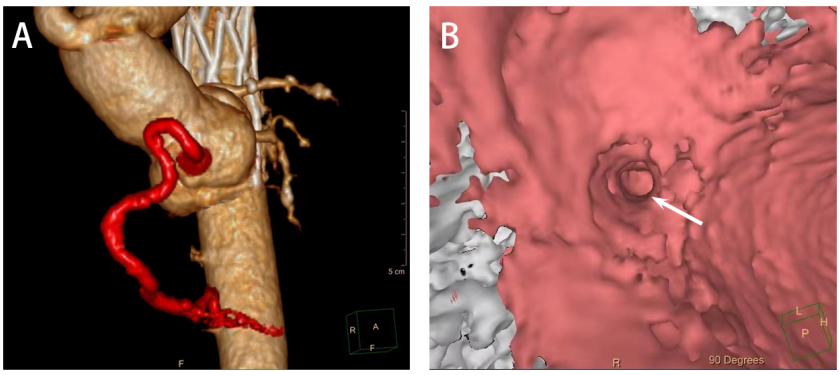

Figure 3