Versatility of the endoventricular patch technique in repair of postinfarction left ventricular rupture

Sartipy U, Albåge A

ABSTRACT
Surgical ventricular restoration by the endoventricular patch technique (Dor procedure) is a surgical option designed to restore left ventricular shape and volume in patients with ischaemic heart disease and heart failure. Surgical ventricular restoration includes complete revascularisation, left ventricular reconstruction to restore near-normal shape and volume, and when necessary, mitral valve repair and surgery for ventricular tachycardia. However, the endoventricular patch technique is versatile and can also be used in other cases. We report the successful use of this technique in two emergent postinfarction cases, one with left ventricular free-wall rupture and one with ventricular septal defect. The aim of these case reports is to illustrate the flexibility of the endoventricular patch technique.

Keywords: Dor procedure, endoventricular patch plasty, left ventricular rupture, postinfarction ventricular septal defect

Singapore Med J 2008; 49(5): e134-e136

INTRODUCTION
The endoventricular patch plasty (Dor procedure) was introduced in 1989 by Dor for the repair of postinfarction anterior left ventricular (LV) aneurysms.[1] This technique reduces LV size by aneurysm exclusion, and reshapes the remaining LV cavity by the use of an endoventricular patch. In addition, the procedure includes coronary artery bypass grafting (CABG), mitral repair and ventricular arrhythmia surgery; these are employed as and when the need arises. The Dor procedure has subsequently been applied by many surgical centres, including our own institution, with good results.[2,3] Lately, it has been increasingly used in patients with a large dilated akinetic LV due to ischaemic cardiomyopathy.[4,5] Thus, the technique of using an endoventricular patch to "seal off" the significant pathological area of the LV is versatile, and can be applied in situations other than clear-cut LV aneurysms. We describe the successful use of this technique to repair a postinfarction LV rupture in one patient, and an apical ventricular septal defect (VSD) in another patient.

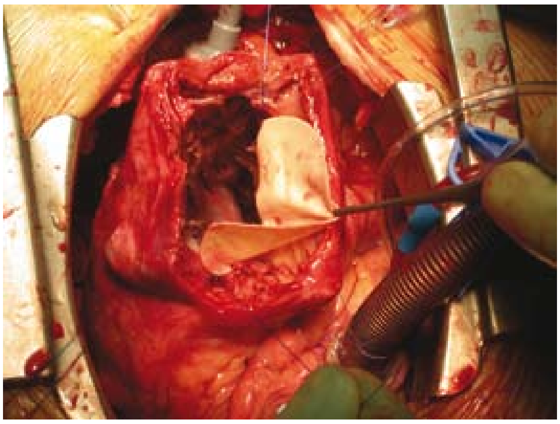

Fig. 1 Case 1. Operative photograph shows repair of post-infarction apical free wall rupture of the left ventricle using the endoventricular patch technique.

CASE REPORTS
Case 1
A 66-year-old male smoker with a previous history of acute myocardial infarction (AMI) was admitted with an ST-elevation AMI and brought to the angiography laboratory for emergency intervention. The left anterior descending artery was found to be occluded, and only partial reperfusion could be accomplished by stenting. In addition, angiography revealed triple vessel disease and a LV ejection fraction of 15%. The patient declined early surgical intervention and was treated medically. Two weeks later, the patient was stable but experienced shortness of breath upon mild exertion and accepted surgery. Echocardiography showed a dilated spherical LV with LV ejection fraction of 10% and no mitral insufficiency.

The patient was operated through a median sternotomy. The left internal thoracic artery was harvested, and the heart was cannulated in routine fashion. After starting cardiopulmonary bypass, while carefully dividing some soft adhesions around the LV, the anteroapical LV wall ruptured spontaneously. The wall region was paper-thin, necrotic and signs of fibrosis were absent. The resulting wall defect was approximately 5 cm × 5 cm, and it was assumed that the patient initially had a contained free-wall rupture (Fig. 1). A purse-string 2-0 polypropylene suture was placed around the ventricular cavity at the midventricular level, where the tissue was

Department of Cardiothoracic Surgery and Anesthesiology, Karolinska University Hospital, SE-17176 Stockholm, Sweden

Sartipy U, MD, PhD
Staff Surgeon

Albåge A, MD, PhD
Consultant

Correspondence to:
Dr Ulrik Sartipy
Tel: (46) 8517 700 00
Fax: (46) 833 19 31
Email: ulrik.sartipy@karolinska.se

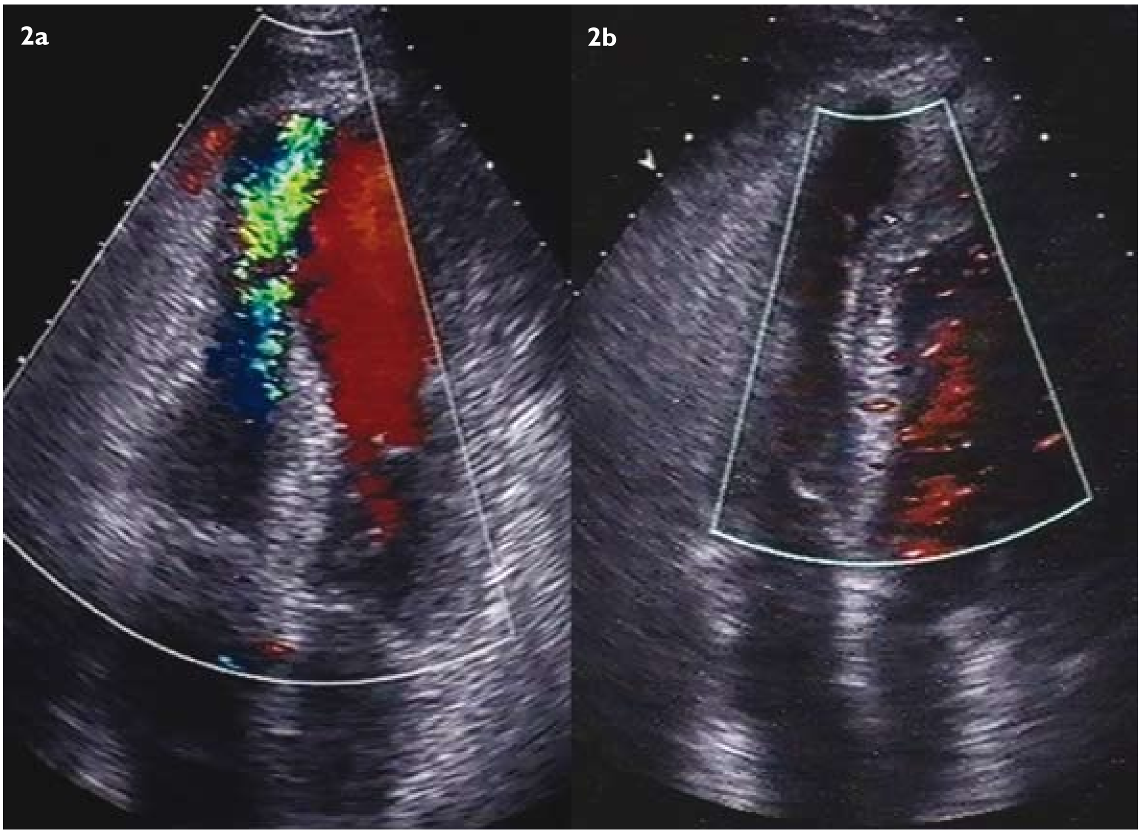

Fig. 2 Case 2. (a) Preoperative transthoracic echocardiogram shows an apical postinfarction VSD with significant shunting to the right ventricle. (b) Postoperative transthoracic echocardiogram shows no residual VSD or shunting after endoventricular patch repair.

semi-infarcted but deemed intact. This anchoring stitch could then serve as reinforcement for a bovine pericardial patch, subsequently inserted endoventricularly by a running suture. The patch suture line was reinforced by BioGlue® (CryoLife International Inc, Kennesaw, GA, USA) application. The remaining necrotic anterior wall was approximated outside of the patch by a running suture and felt pledgets, and CABG with four distal anastomoses was subsequently performed.

The postoperative course was long and complicated, with use of intraaortic balloon pumping and full medical treatment for low cardiac output syndrome and recurrent ventricular arrhythmias. An implantable cardioverter-defibrillator (ICD) was implanted three weeks postoperatively, and the patient could be discharged after six weeks. Eight months after the operation, the patient had no angina, no signs of heart failure and analysis of ICD function revealed no episodes of firing. Unfortunately, the patient died from lung cancer 20 months postoperatively.

Case 2

A 75-year-old man with hypertension was admitted due to dyspnoea and dry cough for three weeks. A murmur was noted and echocardiography showed an LV aneurysm with an apical thrombus and a right ventricular systolic pressure of 75 mmHg. A second echocardiography, some days later, revealed an apical VSD (Fig. 2a). The LV was akinetic in the apical region but had reasonable contractility in the basal portions. There was no significant mitral insufficiency. Upon admittance for emergent surgery, the patient was in obvious cardiac failure with distinct orthopnoea and systolic blood pressure of 80 mmHg, but still with an adequate urine output. Coronary angiography revealed triple vessel disease with an occluded left anterior descending artery. A preoperative intraaortic balloon pump was inserted, clearly improving the status of the patient.

After median sternotomy, the heart was cannulated with separate caval cannulas. The aorta was clamped, and anterograde and retrograde cold blood cardioplegia was administered. The LV was incised 2 cm laterally and parallel to the left anterior descending artery, and a slit-like VSD was found to be located from the mid-septum towards the apex. Although the tissue in the immediate vicinity of the VSD was necrotic and fragile, the more basal portions of the septum were intact. A 2-0 polypropylene purse-string suture was placed obliquely from this area, encircling the interior of the LV wall, extending more distally on the noninfarcted lateral wall. This suture was tied loosely. A bovine pericardial patch was then sutured endoventricularly to the ridge formed by the anchoring stitch, and the suture line was reinforced with BioGlue®. The patch was tailored to fit loosely to allow for both exclusion of the VSD from the LV cavity, and preserve an adequate LV end-diastolic volume. The remaining excluded anteroseptal wall of the LV was approximated over the patch. Bypass grafting with two distal anastomoses was subsequently performed. The patient could be discharged 13 days postoperatively and there were no signs of residual VSD on echocardiography (Fig. 2b). At follow-up six months postoperatively, he was asymptomatic and taking daily walks of 5–6 km. Echocardiography showed no residual VSD, no mitral insufficiency and a LV ejection fraction of 40%.

DISCUSSION

These cases represent two infrequent, but serious, complications of anterior transmural AMI. The fact that anterior LV pathology can be addressed surgically with the endoventricular patch technique is certainly not a new revelation. Special credit should be given to Dor and other colleagues who have developed this type of surgery for LV aneurysms,[1,5] as well as David et al for introducing a similar concept in treatment of postinfarction VSD.[6] These two cases illustrate that one established and reproducible surgical technique used in elective surgical ventricular restoration (SVR) also can be applied in acute situations with either septal or free-wall ruptures. Some modification of the Dor concept had to be made in the current cases. Normally during SVR, we use a sizing device (TRISVR™, Chase Medical, Richardson, TX, USA) to better estimate the postoperative LV end-diastolic volume and shape, as well as to guide patch location. This device was not used in the present cases, as the placement of the anchoring stitch and the patch was dictated by the tissue quality in the septum and remaining LV wall. The technique used in our patient in Case 2 was essentially the same as that reported by David et al,[6] although we used the anchoring stitch to guide and reinforce patch insertion. We believe this surgical detail will further strengthen a repair of this kind. Also, a VSD repair may require a much larger patch as compared to a normal Dor procedure, in order to exclude all pathological tissue in the septum and leave behind an adequate LV end-diastolic volume.

Normally, a prerequisite for success in repairing the anteroapical region of the LV is an acceptable myocardial contractility in the remaining basal portions of the LV, as seen in the patient in Case 2. However, the patient in Case 1 had a more extensive infarct with a severely reduced global LV function, which in part, explained the complicated postoperative course. Other key factors in saving these ventricles are graftable coronary vessels and concomitant treatment of mitral insufficiency. In conclusion, LV reconstruction by an endoventricular patch is a reproducible and versatile surgical technique which can be used not solely in elective LV aneurysm repair or ischaemic cardiomyopathy, but also in emergent cases of postinfarction apical VSD and LV free-wall rupture.

REFERENCES

1. Dor V, Saab M, Coste P, Kornaszewska M, Montiglio F. Left ventricular aneurysm: a new surgical approach. Thorac Cardiovasc Surg 1989; 37:11-9.
2. Dor V, Sabatier M, Di Donato M, et al. Late hemodynamic results after left ventricular patch repair associated with coronary grafting in patients with postinfarction akinetic or dyskinetic aneurysm of the left ventricle. J Thorac Cardiovasc Surg 1995; 110:1291-9.
3. Sartipy U, Albåge A, Lindblom D. The Dor procedure for left ventricular reconstruction. Ten-year clinical experience. Eur J Cardiothorac Surg 2005; 27:1005-10.
4. Athanasuleas CL, Buckberg GD, Stanley AW, et al. Surgical ventricular restoration in the treatment of congestive heart failure due to post-infarction ventricular dilation. J Am Coll Cardiol 2004; 44:1439-45.
5. Menicanti L, Di Donato M. The Dor procedure: what has changed after fifteen years of clinical practice? J Thorac Cardiovasc Surg 2002; 124:886-90.
6. David TE, Dale L, Sun Z. Postinfarction ventricular septal rupture: repair by endocardial patch with infarct exclusion. J Thorac Cardiovasc Surg 1995; 110:1315-22.