

## CASE REPORT

# Right ventricular failure due to late embolic RV infarction during continuous flow LVAD support

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## SUMMARY

This report describes a 63-year-old man with a dilated cardiomyopathy, who was supported with a continuous flow left ventricular assist device (LVAD), and on the waiting list for heart transplantation. After a long period of stability, he presented with recurrent ventricular tachycardia and rapidly developed progressive right ventricular (RV) failure. He required implantation of a temporary RV assist device to regain stability and subsequently underwent urgent heart transplantation. The explanted heart showed multiple areas of ischaemic damage to the RV myocardium, but there was no significant underlying coronary artery disease. It appears that the ventricular arrhythmias and subsequent RV failure were due to an embolic event in the territory of the right coronary artery. The case highlights that coronary embolism is a rare cause of RV failure during LVAD support and demonstrates the utility of temporary RV assist device support as a bridge to heart transplantation.

## BACKGROUND

We report a case of ventricular tachycardia (VT) and progressive right ventricular (RV) failure during left ventricular assist device (LVAD) support. The case highlights that coronary embolism is a rare cause of RV failure during LVAD support and demonstrates the utility of temporary RV assist device (RVAD) support as a bridge to heart transplantation.

## CASE PRESENTATION

A 63-year-old man with idiopathic dilated cardiomyopathy received a HeartWare LVAD as a bridge to transplantation. There were no problems with right heart failure after LVAD implantation and he had a low diuretic requirement during LVAD support. RV performance was adequate, as evidenced by low right atrial pressure. Full details of right heart catheterisation during LVAD support are described (figure 1). The demand placed on the RV was low due to low pulmonary vascular resistance and effective mechanical off-loading of the left ventricle. However, echocardiography showed severe RV dilation and systolic dysfunction, with a fractional area change of 12% and a tricuspid annular plane systolic excursion of 9 mm.

After 18 months of uneventful LVAD support, the patient presented to the emergency department, following an episode of syncope, and was found to be in sustained VT. There was no history of VT and the patient did not have an implantable cardioverter defibrillator. He underwent electrical

cardioversion. His international normalised ratio was 2.3 and had been in the therapeutic range prior to presentation. The patient deteriorated over the subsequent 4 h with recurrent ventricular arrhythmias that required multiple external shocks. He developed signs of RV failure and it became difficult to maintain adequate LVAD flow despite escalating inotropic and vasopressor support. There were no features of LVAD pump thrombosis such as increased power consumption.

During periods of sinus rhythm, no obvious ST-segment changes were noted, although subtle changes cannot be excluded because LVADs cause electrical interference on the isoelectric line. Of note, cardiac troponin-I was elevated at >40 000 ng/L. At this stage, transoesophageal echocardiography showed extreme RV systolic dysfunction, absence of aortic valve opening and spontaneous contrast in ventricles and aortic root. The cause of the RV failure was uncertain, but the differential diagnosis included RV infarction and recurrent VT.

## TREATMENT

A temporary RVAD (CentriMag; Thoratec Corporation, California, USA) was implanted. The patient recovered from RVAD implantation and was listed for urgent heart transplantation. He underwent heart transplantation after 50 days, made a full recovery and remains well 1.5 years later.

## OUTCOME AND FOLLOW-UP

Histological examination of the explanted heart is shown (figure 2). There was diffuse interstitial fibrosis and myocyte hypertrophy of left and right ventricles in keeping with the known diagnosis of dilated cardiomyopathy. Additionally, the RV showed multiple discrete areas of myocyte loss with replacement fibrosis, in keeping with ischaemic infarction. These areas of RV infarction appeared to be similar in age. The coronary arteries only showed minor atheroma.

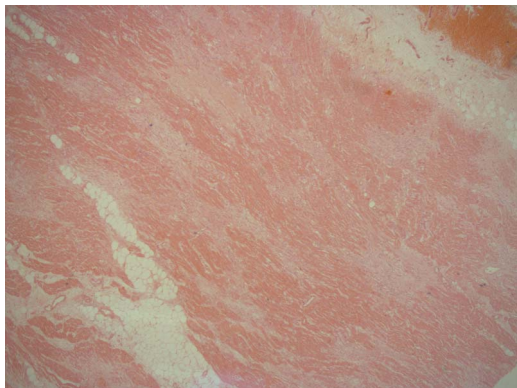
Mean right atrial pressure	3 mmHg
Mean pulmonary artery pressure	14 mmHg
Mean pulmonary capillary wedge pressure	5 mmHg
Trans-pulmonary pressure gradient	9 mmHg
Cardiac output	3.3 L/min
Pulmonary vascular resistance	2.7 Wood units
Right ventricular stroke work index	216 mmHg·ml/m <sup>2</sup>

**Figure 1** Details of right heart catheterisation during left ventricular assist device support.



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**Figure 2** Pathological appearance of right ventricular myocardium in explanted heart, showing multiple discrete areas of myocyte loss with replacement fibrosis, in keeping with ischaemic infarction (×25 magnification).

## DISCUSSION

We describe a case of late RV failure due to RV infarction during LVAD support. We believe this was due to a microembolic shower in the territory of the right coronary artery. The source of the embolism was uncertain, but possibilities include thrombus associated with the left ventricle, LVAD inflow cannula, aortic valve or aortic root. It is possible that oxygen supply–demand mismatch during VT and use of vasopressors may have contributed to the process of RV infarction.

Regardless of cause, this case demonstrates the utility of temporary RVAD support to facilitate recovery or bridging to urgent heart transplantation. Measurement of cardiac troponin may help diagnose RV infarction in LVAD-supported patients.

## Learning points

- ▶ Sustained ventricular arrhythmias can lead to right ventricular failure in patients supported with a left ventricular assist device (LVAD) and should be treated in the conventional fashion.
- ▶ Measurement of cardiac troponin may help with identification of acute right ventricular infarction in patients with an LVAD.
- ▶ Temporary right ventricular assist devices may be used in patients with an LVAD and severe right heart failure, in order to bridge them to urgent heart transplantation.

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