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## SCIENTIFIC EDITORIAL

# Is the Thoratec<sup>®</sup> paracorporeal ventricular assist device a primary or secondary device to support patients with refractory cardiogenic shock?☆

L'assistance ventriculaire paracorporelle par Thoratec<sup>®</sup> est-elle indiquée en première ou en seconde intention chez les patients en choc cardiogénique réfractaire ?

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Extracorporeal membrane oxygenation

Temporary mechanical circulatory support should be considered for rescuing patients with refractory cardiogenic shock [1]. This technique has been used successfully as a bridge to myocardial recovery or cardiac transplantation in patients with various aetiologies of overt cardiac failure, e.g., acute myocardial infarction, end-stage dilated cardiomyopathy, viral or toxic myocarditis, complications of cardiac surgery and cardiac arrest [2–4]. The Thoratec<sup>®</sup> paracorporeal ventricular assist device (Thoratec<sup>®</sup> PVAD) can be used in these indications. It is a pulsatile-flow, univentricular or biventricular cardiac assist device (BiVAD).

In this issue of *Archives of Cardiovascular Diseases*, Kirsch et al. [5] present their single-centre experience between January 1996 and June 2008, in a retrospective study

**Abbreviations:** BiVAD, Biventricular assist device; PVAD, Paracorporeal biventricular assist device; ECMO, Extracorporeal membrane oxygenation.

☆ Single-centre experience with the Thoratec<sup>®</sup> paracorporeal ventricular assist device for patients with primary cardiac failure, Kirsch M., Vermes E., Damy T., Nakashima K., Sénéchal M., Boval B., Drouet L., Loisançe D., doi:10.1016/j.acvd.2009.03.010.

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**MOTS CLÉS**

Système d'assistance  
ventriculaire ;  
Choc cardiogénique ;  
L'assistance  
ventriculaire  
paracorporelle par  
Thoratec® ;  
Survie ;  
ECMO

assessing the outcomes of 84 patients with cardiogenic shock supported primarily by a Thoratec® PVAD. The reasons for using a ventricular assist device (VAD) were similar to those reported in other recent single- and multicentre studies [6–9], except for the exclusion of patients with postcardiotomy shock. In line with the literature, the initial gravity of this population was high, reflected by a low mean cardiac index before VAD implantation, the high percentage of patients on inotropic drugs and the high blood concentrations of creatinine, liver enzymes and total bilirubin at the time of Thoratec® PVAD implantation. Sixty-two (74%) patients received biventricular support, 20 (24%) received isolated left ventricular support and two (2%) received isolated right ventricular (RV) support (indications for BiVAD were at the discretion of the surgeon). The median duration of support was 42 (2.3 to 268). While the rates of adverse events were high, they were similar to those reported in other studies [10,11], and included surgical re-exploration due to bleeding or cardiac tamponade (36%), VAD cannulae infection (21%) and neurological infections (30%). Four patients with a left ventricular assist device (LVAD) presented RV dysfunction, reflecting the difficulties in evaluating RV function. Thirty-six (43%) patients died during mechanical assist device support. Forty-seven (56%) patients were bridged successfully to transplantation ( $n=42$ , 50%) or recovery ( $n=5$ , 6%). Actuarial survival estimates after transplantation were  $78.7 \pm 6.3\%$  at 1 year and  $62.6 \pm 8.3\%$  at 5 years. Survival to transplantation or recovery and actuarial survival estimates after transplantation were not statistically significantly different in LVAD and BiVAD patients.

Thus, the authors concluded that Thoratec® PVAD should be used as the primary device to support patients with refractory cardiogenic shock. Nevertheless, this approach involves a surgically aggressive procedure in critically ill patients and it cannot be implanted in all hospital centres. Short-term assist devices, such as venoarterial extracorporeal membrane oxygenation (ECMO), have proved as efficient as BiVAD [2,3,12]. They are less invasive, easier to implant and more cost-effective. ECMO provides a temporary, venoarterial, continuous-flow extracorporeal circulation that can support the left and right ventricles. A cannula implanted into the right atrium drains venous blood, which is reinjected into the aorta after oxygenation. Thus the heart is unloaded and the haemodynamic status is restored by a pump flow that can reach 8 L/min in central ECMO. It can be implanted by experienced surgeons working across hospital sites, allowing the transfer of unstable patients to specialist cardiac surgery centres

[13]. Kirsch et al. [5] state that ECMO is a continuous pump and provides incomplete left ventricular unloading.

Experimental studies have reported alterations in microvascular perfusion induced by continuous-flow VAD and a lower efficiency of continuous perfusion VAD compared with pulsatile perfusion VAD in the recovery of renal, hepatic and metabolic function [14,15]. However, most recent clinical studies report that continuous-flow VAD is as effective as pulsatile-flow VAD on left ventricular unloading, cardiac haemodynamics and end-organ function recovery [16–18]. Moreover, left ventricular unloading can be improved by a discharge in the pulmonary artery, averting some pulmonary oedema. ECMO also supports both the left and right ventricles, avoiding right ventricular dysfunction, which can appear with left VAD. The implantation of BiVAD increases the duration of surgery in critically ill patients. The assessment of right ventricular function remains difficult. Some authors have tried to identify LVAD-assisted patients who could go on to develop RV dysfunction, proposing clinical risk factors and biological scores [19,20], but no index currently exists in the literature that can evaluate RV function precisely.

While the benefits and efficacy of Thoratec® PVAD have been clearly demonstrated in the study by Kirsch et al., as well as in many other studies [1,5–9], a short-assist device such as ECMO should be considered as the first-line approach in patients with refractory cardiogenic shock and could be bridged by more invasive VAD such as Thoratec® PVAD in the case of incomplete left ventricular unloading or as final therapy.

## Conflicts of interests

None.

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