

Mechanics for helping the failing heart
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Failure of heart function is the cause of heart failure. In the most advanced forms, it can be compensated by a mechanical device that takes over or replaces the function of one or both ventricles. First conceived in the 1960s, circulatory assistance and the artificial heart have undergone considerable technological development.

Three types of devices are currently available and commonly used:

- a) Emergency assistance devices, of short duration (days), ensuring extracorporeal blood circulation and which can even, in case of a great emergency, be set up outside the hospital environment and percutaneously, to ensure a correct oxygenation of the various organs, in particular the brain.
- b) Ventricular assistance devices surgically implanted as a bypass of the native ventricle(s), and allowing survival for months, sometimes years, with an appreciable quality of life, while awaiting recovery of cardiac function or heart transplant.
- c) Heart replacement devices (artificial heart), which are surgically implanted, the patient currently still awaiting a heart transplant.

Several possibilities may be considered:

a) The activity of rescue assistance is rapidly spreading within the multipurpose existing resuscitation units and its exhaustive listing should be possible. Its results depend on the clinical context in which it is implemented. Inter-hospital transfers of a patient placed under such an assistance are possible.

(b or c) Analysis of the French experience with implantable devices is possible thanks to the Francemacs Register, supplied by the hospital teams, but with incomplete patient follow-up data. This register shows the availability of these devices in almost all of the 23 French heart transplant centers, but with often a low level of activity per center (less than 5 cases per year). In contrast as always in those with a regular and complex technical activity, patients benefit from better outcomes. On a national scale, this register reveals a low use of these devices in France (4 per million inhabitants (mh)) compared to Germany (9/mh) or the United States (more than 50,000 patients, i.e. 16/mh).

In France, the one-year survival rate after mechanical cardiac assistance (67%) is lower than that reported in the United States (85%, for the most recent cases) and in the international Intermacs registry (82%) (1). This difference can be explained by the greater severity of the diseases at the time of their treatment, priority being given, in France, to the most severe of them, but also by the strategy adopted in terms of allocation of heart transplants (2).

The French experience is also characterized by the wealth of technological research: development of an innovative cardiac assistance system providing additional ejection in the event of an insufficient ventricular systole or based on the action of an undulating membrane and aiming for better tolerance; development of an artificial heart, original by its self-regulation system and the use of materials of biological origin (3). The latter obtained CE marking in

December 2020 and saw the start of its implementation in France in December 2022 as part of the Efficas medico-economic study, in patients awaiting transplant.

Given the recent technological progress observed (3) in the management of patients with advanced heart failure, the National Academy of Medicine recommends to:

- better inform the public, general practitioners and cardiologists on the progress of assistance and mechanical replacement of failing heart function, so that patients are not sent to the surgeon at a too advanced stage of the disease;
- create multidisciplinary “heart failure” reference centers (cardiologists, surgeons, anaesthetists and resuscitators, biomedical technicians and engineers, and nursing staff, in particular dedicated to the monitoring of implanted patients living at home (“VAD coordinators”)), authorized for heart transplantation and all types of cardiac assistance/mechanical support, distributed throughout the national territory but able to have a sufficient volume of activity;
- help clinical research, by allocating the means that would enable the Francemacs register to become exhaustive, and technological research conducted by young French companies, by supporting them in their approach to transferring to humans the progress made and evaluated in animal.

References

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