

# **Mechanical circulatory support in patients with severe heart failure**

Akademisk avhandling

som för avläggande av medicine doktorsexamen vid Sahlgrenska akademien vid  
Göteborgs Universitet kommer att offentligt försvaras i sal  
hjärtats aula, Blå stråket 5, Sahlgrenska Universitetssjukhuset, Göteborg.  
Fredagen den 30 april 2010, klockan 09:00

Av

**Hans Lidén**

**Leg. Läkare**

Fakultetsopponent: Docent Arnt Fiane  
Thoraxkirurgiska kliniken, Rikshospitalet, Oslo

Avhandlingen baseras på följande delarbeten:

- I. Lidén H, Karason K, Bergh CH, Nilsson F, Koul B, Wiklund L.  
**The feasibility of left ventricular mechanical support as a bridge to cardiac recovery**  
Eur J Heart Fail. 2007 May;9(5):525-530.
- II. Lidén H, Haraldsson Å, Ricksten SE, Kjellman U, Wiklund L.  
**Does pretransplant left ventricular assist device therapy improve results after heart transplantation in patients with elevated pulmonary vascular resistance?**  
Eur J Cardiothorac Surg. 2009 Jun;35(6):1029-34.
- III. Lidén H, Wiklund L, Haraldsson Å, Berglin E, Hultman J, Dellgren G.  
**Temporary circulatory support with extra corporeal membrane oxygenation in adults with refractory cardiogenic shock**  
Scand Cardiovasc J. 2009 Aug;43(4):226-32
- IV. Lidén H, Kolsrud O, Dellgren G, Haraldsson Å, Kjellman U, Wiklund L.  
**Results of short-term mechanical circulatory assist as a bridge to urgent cardiac transplantation**  
Manuscript

# **Mechanical circulatory support in patients with severe heart failure**

Hans Lidén

Severe heart failure has a poor prognosis. Mechanical circulatory support (MCS) is capable of assisting the circulation in selected patients to bridge them to heart transplantation or recovery of heart function. MCS is manufactured in short-term or long-term designs. Short-term MCS can be coupled to an oxygenator to supply oxygen to the blood, and in that case also assist the lungs. Short-term MCS is most often extra-corporeal, with the pump situated outside the patient's body and capable of assisting circulation for up to a few weeks. Long-term MCS is usually implantable, has batteries to run the pump, and allows the patient to be ambulatory. We have investigated different types of circulatory support and its influence on survival, possibility for recovery, and ameliorating effects on co-morbidities.

## **Methods and results**

In the first paper we prospectively studied the possibility of avoiding the need for heart transplantation by allowing the hearts of transplant eligible patients to recover function during support with a long-term MCS. Eighteen patients were enrolled in the study and each had a battery driven long-term MCS implanted into the chest. They were then evaluated for the recovery of heart function. Three patients showed signs of recovery and had their long-term MCS explanted. Only one of these patients remained well. We conclude that this strategy is not applicable to heart transplant candidates in general.

In the second paper, we retrospectively investigated short-term MCS used for the emergency treatment of patients in refractory cardiogenic shock. Fifty-two patients with cardiogenic shock were included in the study and were split into two groups: those without previous surgery (n=19), and those treated after surgery (n=33). We noted a fairly good survival rate (63%) in the group without previous surgery. Patients that had undergone surgery fared less well, however, with a 33% survival rate. We believe that most patients would have succumbed to circulatory collapse, and from that perspective, the results are encouraging.

The third paper dealt with the problem of pulmonary hypertension (PH) in heart transplantation. Patients with PH treated with or without a long-term MCS implanted before heart transplantation were retrospectively reviewed regarding survival and reduction of PH. PH was effectively reduced, but no significant difference was seen in survival after heart transplantation.

The final paper is in manuscript. Here, we investigated the results of bridging patients in refractory cardiogenic shock to cardiac transplantation with short-term MCS. This strategy has been considered to result in inferior survival and is somewhat controversial. Twelve patients on short-term assist devices were accepted for transplantation, and transplanted without mortality. This is discussed and compared with the bridge-to-bridge concept where patients on short-term MCS are implanted with a long-term MCS, and then transplanted.

## **Conclusion**

The results of treatment with mechanical circulatory support in patients with severe heart failure are encouraging. Mechanical circulatory support can be life saving but demands large resources and should be applied to carefully selected patients that could benefit from the treatment.