Linköping University Medical Dissertations

No. 677

Management of patients treated with left ventricular assist devices
A clinical and experimental study

Bengt Peterzén MD

Akademisk avhandling som för avläggande av medicine doktorsexamen offentligen försvaras i Berzeliussalen, Hälsouniversitetet, Linköping onsdagen den 23 maj 2001, kl 13.00

Fakultetsopponent: Docent Lars Wiklund

Avhandlingen baseras på följande delarbeten:

I. Postoperative management of patients with Hemopump support after coronary artery bypass grafting.
Peterzén B, Lönn U, Babi´c A, Granfeldt H, Casimir-Ahn H, Rutberg H.
Ann Thorac Surg 1996;62:495-500.

II. Anesthetic management of patients undergoing coronary artery bypass grafting with the use of an axial flow pump and a short-acting β-blocker.
Peterzén B, Lönn U, Babi´c A Carnstam B, Rutberg H, Casimir-Ahn H.
J Cardiothorac Vasc Anesth 1999;13:431-436.

III. Management of patients with end-stage heart disease treated with an implantable left ventricular assist device in a non-transplanting center.
Peterzén B, Granfeldt H, Lönn U, Carnstam B, Nylander E, Dahlström U, Rutberg H, Casimir-Ahn H.
J Cardiothorac Vasc Anesth 2000;14:438-443.

IV. Long term follow-up of patients treated with an implantable left ventricular assist device as an extended bridge to heart transplantation.
Peterzén B, Lönn U, Jansson K, Rutberg H, Casimir-Ahn H, Nylander E.
Submitted for publication.

V. Hemodynamic evaluation of the Jarvik 2000 Heart during heart failure in a calf model.
Peterzén B, Gregoric ID, Myers TJ, Lönn U, Träff S, Hubbert L, Lindström L, Wårdell K, Frazier OH, Jarvik RK, Casimir-Ahn H.
Accepted for publication, Ann Thorac Surg.

Department of Cardiovascular Surgery and Anaesthesia, Linköping Heart Center, Institution of Medicine and Care, Faculty of Health Sciences, SE-581 85 Linköping, Sweden.

Linköping 2001

ABSTRACT

This thesis describes the management of patients treated with mechanical circulatory support devices for short- or long-term use. Twenty-four patients suffering from postcardiotomy heart failure were treated with a minimally invasive axial flow pump. The device was effective in unloading the failing left ventricle and in maintaining an adequate systemic circulation. The principles of perioperative monitoring, and pharmacological therapy are outlined. The pump was also used as an alternative to the heart-lung machine in conjunction with coronary artery bypass surgery. Together with a short-acting β-blocker, esmolol, the heart was decompressed and heart motion was reduced, facilitating bypass surgery on the beating heart. The anesthesiological considerations using this method are described.

An implantable left ventricular assist device was used as a bridge to heart transplantation in 10 patients. We were interested in assessing the possibility to establish such a treatment program at a nontransplanting center. A multidisciplinary approach was enabled thanks to the organization of our Heart Center and due the close collaboration with our transplant center at Lund University. As one of the first centers in Europe, we established a well-functioning program with good results. Nine out of 10 of the bridge patients, with treatment times varying between 56 to 873 days, survived pump treatment and were eventually transplanted. The device proved to be powerful enough to support the failing heart and enable rehabilitation of the patients. Outpatient management became simpler when using the electrical device with belt-worn batteries. The uncertain durability and the high risk of device-related complications are shortcomings that limit its potential for more permanent treatment of heart failure.

A new generation of small implantable axial blood flow pumps has therefore been developed. The principles of these pumps are based on the first generation axial flow pumps evaluated in this thesis. After several years of basic research and experimental studies, the first human implants have been performed. In the thesis, the hemodynamic effects of such a novel axial flow pump have been evaluated in an acute heart failure model. This technology holds great promise, both as a bridge to heart transplantation, and as a permanent circulatory support system.

ISBN 91-7219-969-5
ISSN 0345-0082

Printed by Unitryck, Linköping 2001