

## Assisted Circulation

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# Assisted Circulation 4

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Edited by Felix Unger

With 172 Figures and 58 Tables



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## Preface

It is always a great pleasure editing a book, especially this fourth volume of *Assisted Circulation*. In the last 5 years there has been a dramatic change in the status of assisted circulation and in our understanding of it. The previous volume on assisted circulation was published in 1989. Since then several hundred clinical implantations of pneumatically driven assist blood pumps have been clinically performed, and the technique of bridging has truly become a clinical reality. These results allow a good discussion of long-term device implantation to take place. The first long-term implants (over 200 days) demonstrated the fundamental feasibility of this approach. I am convinced that the next issue of this book in 5 years will contain the first real long-term review of experiences over 1–2 years. The early clinical experience shows dramatically that in certain cardiomyopathies a patient's heart can indeed recover. Verification of this will have a great impact on the whole discussion of heart replacement. The total artificial heart is at present no longer an object of discussion, but further clinical studies on long-term assistance of circulation by means of artificial ventricles will indicate if the artificial heart has a chance for reconsideration.

A great deal of help is necessary in editing such a book, and I want to thank especially my associates R. Schistek and R. Baier as well my secretary C. Stutz. Special thanks go to the Gesellschaft zur Förderung der Herzchirurgie in Salzburg and the Kurt-Polzer-Foundation for support. Heartly thanks also go to Dr. Wiczorek, Dr. Gebhardt, Frau Fingerhuth, and the staff of Springer-Verlag, who have given this fourth volume an attractive format and ensured its accuracy, as usual.

This fourth volume in the series *Assisted Circulation* concentrates on the clinical experience gained in the use of cardiac assist devices, providing both clinical data and experimental ideas. The main unresolved problems in assisted circulation still remain, such as biocompatibility, energy sources, and the driving monitoring components. I would like to express my hopes that the discus-

sion of long-term implantations continues, so that in the fifth edition we can speak about new long-term devices with clinical applications.

Salzburg, January 1995

FELIX UNGER

# Contents

|                                               |   |
|-----------------------------------------------|---|
| Questions and Predictions<br>W.J. KOLFF ..... | 1 |
|-----------------------------------------------|---|

## Part I. Counterpulsation

|                                                                                                                                                                                                                                                 |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Introduction: Intra-aortic Balloon Pumping<br>as an Established Clinical Method<br>F. UNGER .....                                                                                                                                               | 9  |
| Intra-aortic Balloon Pumping for Assisted Circulation:<br>New Techniques and New Prospects<br>A. KANTROWITZ, B. BRIDGEWATER, and J. AU .....                                                                                                    | 12 |
| Large-volume Counterpulsation<br>S.D. Mouloupoulos .....                                                                                                                                                                                        | 36 |
| Optimal Conditions of Biventricular Balloon Pumping<br>During Ventricular Fibrillation in the Experimental Animal<br>S. STAMATELOPOULOS, N. ZAKOPOULOS, N. SARIDAKIS,<br>J. KANAKAKIS, S. STEFANOU, A. GOUGOULAKIS,<br>and S. MOULOPOULOS ..... | 42 |

## Part II. Ventricular Assist Devices

|                                                                                                                                                                                                                                                                                                              |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Introduction: Clinical Reality<br>F. UNGER .....                                                                                                                                                                                                                                                             | 55 |
| Mechanical Circulatory Support at Henri Mondor Hospital:<br>Indications for the Use of Different Devices<br>D. LOISANCE, P.H. DELEUZE, J.P. MAZZUCOTELLI,<br>and M.L. HILLION .....                                                                                                                          | 59 |
| Use of the Novacor Left Ventricular Assist System<br>as a Bridge to Cardiac Transplantation: First Experience<br>with Long-Term Patients on the Wearable System<br>H.O. VETTER, H.G. KAULBACK, M. HALLER, T. HUMMEL,<br>C. SCHMITZ, O. DWVALD, P. BREUNER, E. KREUZER,<br>P. ÜBERFAHR, and B. REICHART ..... | 65 |

|                                                                                                                                                                                                                                          |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Clinical Results of the HeartMate Implantable Blood Pump<br>V. POIRIER and K. DASSE . . . . .                                                                                                                                            | 76  |
| The Abiomed BVS 5000 for Treatment<br>of Postcardiotomy Cardiogenic Shock<br>P.A.M. EVERTS, J.P.A.M. SCHÖNBERGER, and C.H. PEELS . . .                                                                                                   | 87  |
| The Development of Low-Cost Temporary<br>and Permanent Circulatory Assist Devices<br>R.L. WHALEN . . . . .                                                                                                                               | 101 |
| Progress Toward a Completely Implantable left Ventricular<br>Assist Device at the Pennsylvania State University<br>W.J. WEISS, G. ROSENBERG, A.J. SNYDER, J.H. DONACHY,<br>G. FELDER, J.S. SAPIRSTEIN, W.E. PAE, and W.S. PIERCE . . . . | 124 |

### **Part III. Nonpulsatile Blood Pumps**

|                                                                                                   |     |
|---------------------------------------------------------------------------------------------------|-----|
| Introduction<br>F. UNGER . . . . .                                                                | 141 |
| Centrifugal Pumps – Now and the Future<br>L.A.R. GOLDING and W.A. SMITH . . . . .                 | 142 |
| The Hemopump: Clinical Results and Future Applications<br>W. ABOUL-HOSN and R. WAMPLER . . . . .  | 152 |
| Considerations in the Development of Mini-Spindle Pump<br>J. HAGER and F. BRANDSTAETTER . . . . . | 166 |
| New Progress with Impeller Pumps in Taiwan<br>K.X. QIAN . . . . .                                 | 172 |

### **Part IV. Biologic Assistance and Energy Sources**

|                                                                                                                     |     |
|---------------------------------------------------------------------------------------------------------------------|-----|
| Introduction<br>F. UNGER . . . . .                                                                                  | 191 |
| Skeletal Muscle Ventricles for Biologic Cardiac Assistance<br>H. LU, R.L. HAMMOND, G.A. THOMAS, and L.M. STEPHENSON | 192 |
| Chronic Heart Assist System<br>D. LIOTTA and C.B. ALVAREZ<br>and CONICET-PROCOAR Investigators . . . . .            | 217 |

### **Part V. Total Artificial Heart**

|                                    |     |
|------------------------------------|-----|
| Introduction<br>F. UNGER . . . . . | 235 |
|------------------------------------|-----|



|                                                                                                                                                                 |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| In Vivo Testing of a Clinical-Size Totally Implantable Artificial Heart<br>G. ROSENBERG, A.J. SNYDER, W.J. WEISS, J.S. SAPIRSTEIN,<br>and W.S. PIERCE . . . . . | 236 |
| Total Artificial Heart with High-efficiency Motor-Gear Unit<br>R. KAUFMANN, H. REUL, and G. RAU . . . . .                                                       | 249 |

## **Part VI. Cardiac Transplantation**

|                                                                                                                                                                                                                                     |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Introduction<br>F. UNGER . . . . .                                                                                                                                                                                                  | 267 |
| Heart Transplantation: Current Experience at La Pitié, Paris<br>P. NATAF, I. GANDJBAKHCH, A. PAVIE, V. BORS, R. DORENT,<br>M. DESRUENNES, P. LEGAR, E. VAISSIER, J.P. LEVASSEUR,<br>A. CABROL, J. SZEFLNER, and C. CABROL . . . . . | 268 |
| The Efficacy of Calcium Channel Blockers<br>in Pulmonary Reperfusion<br>A. HAVERICH and M. KARCK . . . . .                                                                                                                          | 278 |
| Cardiac Xenotransplantation<br>D.K.C. COOPER . . . . .                                                                                                                                                                              | 286 |

## **Part VII. Extracorporeal Respiratory Support**

|                                                                                                                                                                                                                                        |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Introduction<br>F. UNGER . . . . .                                                                                                                                                                                                     | 299 |
| Extracorporeal Respiratory Support<br>in Acute Respiratory Failure<br>L. GATTINONI, L. BRAZZI, P. PELOSI, and A. PESENTI . . . . .                                                                                                     | 300 |
| Extracorporeal Membrane Oxygenation in Children<br>G.A. PEARSON and R.K. FIRMIN . . . . .                                                                                                                                              | 310 |
| Intravascular Membrane Oxygenation and Carbon Dioxide<br>Removal with Permissive Hypercapnia –<br>New Concepts in the Management of Respiratory Failure<br>J.B. ZWISCHENBERGER, W. TAO, V.J. CARDENAS, JR.,<br>and A. BIDANI . . . . . | 336 |

## **Part VIII. Horizons and Future Trends**

|                                |     |
|--------------------------------|-----|
| Horizons<br>F. UNGER . . . . . | 355 |
|--------------------------------|-----|

|                                                                                      |            |
|--------------------------------------------------------------------------------------|------------|
| Horizons                                                                             |            |
| D.A. COOLEY . . . . .                                                                | 356        |
| Horizons for Cardiac Prostheses                                                      |            |
| Y. ORIME and Y. NOSÉ . . . . .                                                       | 359        |
| Horizons                                                                             |            |
| J.T. WATSON . . . . .                                                                | 368        |
| Horizons                                                                             |            |
| J. OCHSNER . . . . .                                                                 | 372        |
| Horizons                                                                             |            |
| V.O. BJÖRK . . . . .                                                                 | 375        |
| Horizons                                                                             |            |
| J. WADA and W.R. ADE . . . . .                                                       | 377        |
| Future Directions in Assisted Circulation                                            |            |
| R.S. LITWAK and R.M. KOFFSHY . . . . .                                               | 380        |
| Further Development of Extracorporeal Life Support                                   |            |
| C.N. STEIMLE and R.H. BARTLETT . . . . .                                             | 383        |
| Recent Progress Using the Anstadt Cup<br>for Direct Mechanical Ventricular Actuation |            |
| M.P. ANSTADT, R. ANTHONY PEREZ-TAMAYO, J.E. LOWE,<br>and G.L. ANSTADT . . . . .      | 394        |
| <b>Subject Index</b> . . . . .                                                       | <b>409</b> |

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## **Introduction: The Present Status of Assisted Circulation**

It is now 15 years ago that, with the generous help of the publisher, we started the series *Assisted Circulation*. Twenty years ago, experimental research in this field was very intensive and focussed on the total artificial heart, for which Cooley had showed in 1969 the principle feasibility and capability of maintaining normal circulation. In the 25 years since then a great deal of clinical experience has been accumulated, demonstrating today that there are clear indications for assisted circulation using different devices available:

1. There are clear indications for intraaortic balloon pumping.
2. Cardiopulmonary bypass devices in the form of roller pumps or nonpulsatile blood pumps of different shapes are available for patients with cardiac failure. They have been frequently employed throughout the whole world. Nevertheless, practically no literature is available for this group because acute assist devices are implanted in a catastrophic situation.
3. Bridging devices such as left ventricle assist devices are established tools used for heart transplantation. These devices can be considered an indispensable standard in a transplant program.

Based on experience to date, long-term implantation can be considered a possibility, yet it might have an affect on the biological cardiac replacement. Assisted circulation is always indicated when a heart is failing and pharmacological treatment is limited to providing adjunctive support. A number of devices available for assisted circulation have demonstrated their utility for specific purposes:

1. Counterpulsation: intraaortic balloon pumping.
2. Functional heart replacement: ventricular assist devices by means of nonpulsatile or pulsatile blood pumps for partial heart replacement. The pulsatile pumps are driven pneumatically or electromechanically and designed for long-term support. They are used as bridges for heart transplantation. Nonpulsatile blood pumps with open impellers or roller pumps are designed for

- weaning off in acute heart failure, such as after open heart surgery, acute myocardial infarction, and shock after PTCA.
3. Cardiomyoplasty: the Latissimus dorsi is used for long-term assistance.
  4. Heart replacement: biologic heart replacement by means of transplantation.

To repair or replace a heart is an ancient dream that has come true in part during the past 30 years, with excellent and reliable results. The overall quantity of cardiac surgery has grown enormously, especially due to direct cardiac interventions in acute myocardial infarction. This is reflected by an increasing number of open heart operations worldwide. In 1993 nearly 250 000 open heart operations were performed in Europe, of which 60% were coronary cases, 23% valves, 10% congenital problems, 1% cardiac replacement, and 2% aortic aneurysms. This means that in Europe there were 484 operations per million population, as opposed to 300 cases per million population in coronary artery surgery and 343 cases for PTCA.

*Assisted Circulation 4* documents the fantastic progress that has been made in this area over the last 20 years, as was also well illustrated by the volumes 2 and 3. There has been a great transition from an experimental status to clinical routine, providing assisted circulation a clearly defined position in the treatment of heart insufficiency. This volume has eight parts, six of which focus on different forms of assisted circulation: counterpulsation, ventricular assist devices in the clinical use, nonpulsatile blood pumps, biologic assistance, the total artificial heart, and heart transplantation. A new issue, extracorporeal respiratory support, which is clearly related to cardiac assistance, is the focus in another part. In the last part, "Horizons and Future Trends," important investigators attempt to provide a prognosis of future developments. It is always difficult to make a prognosis for a longer time period, especially in such a complex theme as cardiac assistance. Yet in addition to all the small steps, we also have to observe other techniques, such as genetechnology. As doctors we need visions and dreams that are realistic yet optimistic goals of our endeavors.

F. UNGER

### *Previous Volumes*

F. Unger (ed) Assisted circulation. Springer, Berlin Heidelberg New York, 1979

F. Unger (ed) Assisted circulation 2. Springer, Berlin Heidelberg New York, 1984

F. Unger (ed) Assisted circulation 3. Springer, Berlin Heidelberg New York, 1989