5. Indications for Intra-aortic Balloon Pumping

E. Wolner

The applications of the intra-aortic balloon pump (IABP) in various forms of left heart insufficiency has gained more significance in the last 10 years. Due to its main effects, decompression of the left ventricle and increase of the coronary pressure, IABP is indicated in all situations in which an inadequacy between cardiac output (CO) demand and necessary coronary circulation might occur. Based on this functional concept, the IABP was introduced especially for the various complications of coronary diseases, postoperative heart failure after cardiosurgical procedures, and, in selected cases, heart failure from primary extracardial causes [5, 8, 12, 16, 19]. In 1969 after experimental evaluation in dogs we began using IABP clinically. On the basis of our experience as well as that of other groups, the present concept of IABP is described.

The control and driving unit developed in our clinic has the shape of a suitcase with self-contained power and can be carried with the patient. This makes it possible to move the patient between the intensive care unit (ICU), the angiography, and the operation ward with a working pump (Fig. 5.1).

Diastolic augmentation (Table 5.1) results in improvement of coronary circulation, reduction of the infarction area, increased CO, reduction of the regurgitation in a postinfarctional mitral insufficiency, and reduction of the shunt volume in a postinfarctional defect of the ventricular septum [14, 18].

The three indications in cardiosurgical procedures (Table 5.2) for the balloon pump are the following:

1) as prophylactic in the high-risk patient,

![Fig. 5.1. A portable control and drive unit for IABP devised by Thoma](image-url)
Table 5.1 Effects of the IABP

A. Deflation of the balloon (systole)
   1. Reduction of the left ventricular pressure
   2. Reduction of the myocardial oxygen consumption
   3. Reduction of systolic blood pressure

B. Inflation of the balloon (diastole)
   1. Diastolic pressure-increase
   2. Improvement of the coronary circulation (especially in cardiogenic shock)
      a) Increase of myocardial contractility (MAP increase)
      b) Improvement of the coronary collateral circulation at coronary occlusion
      c) Reduction of the infarct area
      d) Reduction of the shunt volumes in VSD
      e) Reduction of the regurgitation volumes in mitral insufficiency

Table 5.2. Indications for the application of the IABP

1. Postoperative cardiac failure (cardiosurgery)
2. Complications in coronary heart diseases
   a) Unstable angina with disturbed function of the ventricle
   b) Impending reinfarction
   c) Uncontrollable tachyarrhythmia after myocardial infarction
   d) Cardiogenic shock
   e) High-risk patient in coronary surgical interventions
3. Cardial high-risk patients in general surgical interventions

2) in postoperative heart failure presenting difficulties in weaning the patient from the heart-lung machine,
3) in heart failure in the subsequent postoperative period.

The prophylactic use of the IABP is indicated especially in coronary surgery risk patients as well as in patients with aortic stenosis with gradients over 100 mmHg. Booloki [3] proved in an extensive study that mortality can be significantly decreased in such patients. Also in our patients we saw a significant lowering of mortality.

The IABP is also indicated in weaning patients from extracorporeal circulation who have left atrial pressures increasing above 25 mmHg and cardiac indexes under 2 ml/min (Fig. 5.2). It became obvious that the early application of the pump in these patients results in a greater survival chance. With IABP an improvement of the coronary circulation in the deeper parts of the myocardium, especially in a hypertrophic heart, and thus a quicker reversion of an eventual subendocardial ischemia can be observed, expressed as endocardial viability ratio (EVR) [11]. This is a reliable indirect measure which yields significant prognostic evidence, especially as regards switching off the IABP.

The main indication was originally cardiogenic shock [8, 12, 19]. Use of the balloon pump in a patient in shock results after a few hours typically in improvement of the whole hemodynamic situation, maximally after 24–48 h.