Intensive care after minimally invasive and conventional coronary surgery: a prospective comparison

Abstract  Objective: The purpose of this study was to compare the intensive care course of patients after minimally invasive coronary surgery to conventional coronary artery by-pass grafting.  Design: Prospective observational study.  Setting: Intensive care unit of a university hospital.  Patients and participants: One hundred and five patients with two-vessel disease consecutively scheduled for elective coronary bypass surgery were enrolled.  Interventions: Two techniques of revascularization were performed: the Octopus procedure via median sternotomy without cardiopulmonary bypass (n = 52) and conventional coronary artery bypass grafting CABG (n = 53).  Measurements and results: Three major categories describing the patients’ postoperative course were defined: (1) clinical and laboratory findings, i.e., transfusion rate, catecholamine support, duration of ventilation, Simplified Acute Physiology Score II (SAPS II), serum levels of cardiac enzymes and lactic acid; (2) postoperative complications, i.e., incidence of myocardial infarction (MI), atrial fibrillation (AF), and neurological deficits; (3) this category was defined as “the extent of care” as represented by the Therapeutic Intervention Scoring System (TISS), and the length of stay in the ICU and in the hospital. In the Octopus group significantly lower figures were noted for duration of ventilation [6.1(5.5/9.5) vs 10.2(8.2/11.8) h], cardiac enzymes [CK-MB-Mass [5.1(2.0/8.3) vs 31.3(21.4/39.3) ng/ml], and lactic acid [2.0(1.5/3.3) vs 3.2(2.2/6.5) mmol/l]], incidence of AF (2/52 vs 9/53), and neurological deficits (0/52 vs 4/53), TISS score [72(44/83) vs 84(73/93)], LOS in the ICU [2(1/2) vs 2(2/2) days], and in the hospital [6(5/9) vs 9(8/12) days].  Catecholamine support, SAPS II scores, and incidence of MI of each group did not differ significantly.  Conclusions: Off-pump coronary surgery via the Octopus technique was superior to conventional CABG regarding the course of patients in the early postoperative period. This implies benefits for the patients and the entire healthcare system.  Key words  Minimally invasive coronary surgery (MICS) · Octopus · Coronary artery bypass grafting (CABG) · Postoperative period · Outcomes
Introduction

Since its invention in the early 1980s, minimally invasive coronary surgery (MICS) gained noticeable importance [1]. A main advantage of MICS is the avoidance of cardiopulmonary bypass (CPB) with its implications and side effects, i.e., systemic heparinization, cannulation and clamping of the aorta, cardiac arrest with cardioplegia, and derangement of the hemostatic system [2]. There are two major types of MICS currently being performed: the minimally invasive direct coronary artery bypass (MIDCAB) through a small left thoracotomy, and the off-pump coronary artery bypass through a median sternotomy (OPCAB) carried out particularly with the Octopus stabilizing system. The MIDCAB approach is predominantly used to serve patients with one-vessel disease especially in the case of a proximal stenosis of the LAD. The Octopus technique is used in patients who need two or more grafts, as median sternotomy offers a more feasible surgical approach to the RCA and the RCX.

For all that, CABG, the “gold standard” of surgical coronary revascularization, is a procedure that provides excellent surgical results and is associated with a low mortality rate [3]. Thus, it is obviously difficult for novel approaches to compete with this standard technique [4]. The new procedures, therefore, should obtain similar surgical results, a lower incidence of complications, and an equivalent long-term outcome.

Diegeler et al. demonstrated that the patency rate of the grafts implanted by means of the minimally invasive techniques was comparable to the one after CABG in early postoperative angiographies [5]. To elucidate the role and the potential benefits of the new surgical techniques to the patients and the health care system, the evaluation of data from the early postoperative period is of utmost importance.

The aim of this prospective study was to compare the influence of MICS using the Octopus technique on the postoperative ICU course of patients with two-vessel disease to conventional CABG.

‘Postoperative course’ after coronary revascularization is obviously not a well-defined term. Thus, we chose three major features that are commonly accepted to be descriptive for this early phase of recovery:

First, we gathered a series of important clinical findings including the need for transfusions and circulatory and ventilatory support, augmented by three diagnostic parameters, i.e., postoperative Simplified Acute Physiology Score II (SAPS II), and serum levels of cardiac enzymes and lactic acid.

Second, we compared the incidence of postoperative complications such as postoperative myocardial infarction (MI), atrial fibrillation (AF), and neurological deficits.

Third, the extent of care was evaluated by means of the Therapeutic Intervention Scoring System (TISS), the length of stay (LOS) in the ICU, and the LOS in the hospital.

Materials and methods

Subjects

After institutional review board approval and written informed consent, 105 consecutive patients scheduled for elective coronary surgery for two-vessel disease were enrolled in this prospective observational study between April 1998 and January 2000. The diagnosis was established by a cardiologist according to standard coronary angiography. Treatment with percutaneous transluminal coronary angioplasty (PTCA) was not feasible or was unsuccessful.

The patients were allocated to the two different procedures by the unanimous decision of a team consisting of two equally highly experienced senior physicians (surgeons 1 and 2) of the department of cardiac surgery, who performed all the operations for this study. Two procedures were performed: the Octopus system [6] (n = 52), and conventional CABG (n = 53). Patients assigned for Octopus had to meet the following criteria: no combined valvular and coronary artery disease, coronary artery not less than 1.5 mm in diameter and not calcified at the proposed anastomosis site. Left main disease was an exclusion criterion for the Octopus procedure. Reduced ejection fraction was not an exclusion criterion nor were associated systemic diseases (e.g., diabetes mellitus, dialysis). To create a comparable cohort for the CABG group, only patients with two-vessel disease were prospectively identified. In addition, the patients in the CABG group had to meet the same criteria as those in the Octopus group except for the absence of left main disease. Patients with preexisting AF, which is still considered a relative contraindication for minimally invasive procedures [7], were excluded from the study.

Surgery

Octopus: without CPB, performed through a median sternotomy using a suction device (Octopus Tissue Stabilizer Medtronic, Minneapolis, Minn., USA) for local immobilization of the myocardium, surrounding the anastomosis site. Interruption of the native coronary blood flow by clamping of the referring coronary artery was used [6].

CABG: with CPB, accomplished in mild hypothermia (31 ± 2 °C). During CPB a mean arterial pressure of >60 mmHg was maintained by a minimal flow rate of 2.4 l/m² body surface area by means of the pump flows. Myocardial protection was provided by use of cold hyperkalemic cardioplegic solution (Brettschneider).

Anesthesia

For premedication, patients received midazolam 0.1 mg/kg BW (body weight) 1 h before anesthesia. Induction was performed with midazolam (0.15–0.25 mg/kg BW), sufentanil (1–3 μg/kg BW), and pancuronium (0.1 mg/kg BW), and maintenance with sufentanil (1–2 μg/kg per hour) and with 0.3–1.0 vol% isoflurane. Management of postoperative pain was performed in all patients with continuous infusion of metamizol i.v. (200 mg/h) and boli of the opioid piritramide i.v. (2–5 mg) every 4–6 h if needed. For inotropic support epinephrine was used as the preferred drug.