How to do it

A new method for coronary occlusion and local stabilization during minimally invasive LIMA-to-LAD-bypass

Friedrich-Christian Riess*, Niels Bleese, Andreas G. Riess

Department of Cardiac Surgery, Abteilung für Herzchirurgie, Albertinen-Krankenhaus, Suentelstrasse 11 a, 22457 Hamburg, Germany

Received 28 September 1998; received in revised form 23 November 1998; accepted 1 December 1998

Abstract

The minimally invasive direct coronary occlusion and stabilizing technique (midCOAST)-system, a new device for coronary occlusion and local stabilization during minimally invasive LIMA-to-LAD-bypass is presented. A closed platform with an oval opening in its center provides optimal immobilization together with platform-fixed vessel-loops, which are used for LAD-occlusion. Clinical results in 72 consecutive patients indicate that the midCOAST-device can be safely and effectively used for minimally invasive LIMA-to-LAD-procedure, even in patients with impaired left ventricular function. Due to the optimal immobilization of the target area the quality of the LIMA-to-LAD-anastomosis, documented by post-operative angiography (62/72), was excellent in all cases. © 1999 Elsevier Science B.V. All rights reserved.

Keywords: Minimally invasive coronary surgery; Beating heart surgery; Local stabilization; Stabilizer; Minimally invasive direct coronary occlusion and stabilizing technique

1. Operative technique

Minimally invasive coronary artery bypass surgery without use of cardiopulmonary bypass (CPB) has been proved to be an important alternative technique for cardiovascular patients [1–3]. Promising results were reported in patients undergoing minimally invasive coronary surgery based on retractor-mounted pressure fixation [4] or suction fixation [5,6]. We report on a new device for local stabilization during minimally invasive LIMA-to-LAD-bypass, the so called midCOAST-system, which stands for minimally invasive direct coronary occlusion and stabilizing technique (AES-CULAP, Tuttlingen, Germany). It consists of a multifunctional retractor with a special pair of blades for preparation of the LIMA and a stabilizer for local immobilization of the anastomosis-area (Fig. 1a). The midCOAST-device provides optimal stabilization of the target area by moderate pressure using a closed platform with an oval opening in its center in combination with platform-fixed vessel-loops, which are used for LAD-occlusion.

After mini-sternotomy [7] up to the left 3rd intercostal space LIMA is harvested up to the 2nd intercostal space under direct vision using special blades (Fig. 1b). Then the retractor is re-equipped with a second pair of blades and reinserted. After pericardiotomy the heart is displaced by traction sutures at the pericardium and pads placed underneath the heart. For vascular occlusion the LAD is snared twice using elastic hollow vessel-loops with a blunt needle (Ethiloop, Ethicon, Norderstedt, Germany) together with the stabilizer (Fig. 2). An intravenous bolus of 10,000 units of heparin is administered. The column is screwed to the retractor. It has several alternative sides for optimal positioning. The column supports the extension arm, the joint of which receives the stem of the actual
stabilizer (Fig. 1a). The vessel-loops are threaded through suitable wholes in four groups of three. By utilizing the various degrees of freedom of the stabilizer, the platform is lowered tangentially on the anastomosis-area. By careful tensioning and fixation of the vessel-loops under the four knobs, the anastomosis region is centered in the oval opening of the platform (Fig. 2). If required, the tension on the vessel-loops can be rapidly re-adjusted. After 5 min of LAD-occlusion followed by another 5 min of reperfusion, the LAD is occluded again and anastomosis between LIMA and LAD is performed with a running 8-0 monophilic suture. After completing the anastomosis the vessel-loops are removed, the platform is opened (Fig. 1c) by pressing down the stamp, and the stabilizer is taken off.

2. Clinical results

From 1/97 till 11/98 a total number of 72 consecutive patients (61 male/ 11 female), mean age 64 ± 7 (37–86) years with coronary 1-vessel (n = 30), 2-vessel (n = 14) and 3-vessel (n = 28) disease were treated by a minimally invasive LIMA-to-LAD-bypass alone (n = 48) or in combination with a balloon angioplasty (‘hybrid-procedure’) (n = 24) including six patients with left main stenosis within a clinical study approved by the institutional ethics committee on human research. Informed consent was obtained in all patients. In all cases the midCOAST-device was used, which provided excellent stabilization during LIMA-to-LAD-bypass. No visible traumatization of the fatty tissue,
myocardium, or coronary vessels was observed in the area of immobilization. All patients remained hemodynamically stable without the use of catecholamines during a mean LAD-occlusion time of 18 ± 7 min, even in the case of impaired left ventricular function (LVEF < 40%, n = 7). 54/72 patients were extubated in the operation room. No increase of myocardial band creatinine kinase was observed and no red cell transfusion was necessary in any patient. No intra- or post-operative complications occurred except post-operative sternal bleeding in two patients and a dissection of the LIMA in another one, probably induced by preparation, which was stented successfully. All patients with angiograms performed within the first 3 post-operative days (62/72) and 6–12 month later (n = 30) demonstrated a patent LIMA-graft except the dissected LIMA-bypass, which showed to be occluded 6 months after surgery. The quality of anastomosis was good in all cases and there were no signs of endothelial damages or stenoses of the LAD in the area of snaring until now.

3. Discussion

The midCOAST-device provides optimal stabilization of the target area due to a closed platform, which ensures atraumatic force distribution to the entire surface. Only the anastomosis-region is visible in the center of the platform. Outside the area fixed by vessel-loops the heart can continue its movement freely underneath the stabilizer. The platform of the midCOAST-system meets the anterior wall almost in its middle position, namely half between systole and diastole, reducing excessive vessel tension due to left ventricular wall motion. This also may explain the fact that, so far, no hemodynamic impairment has been observed using the midCOAST-device.

These clinical results indicate, that the midCOAST-stabilizer can be safely and effectively used for minimally invasive LIMA-to-LAD-procedure in selected patients with single- and multi-vessel disease, even in patients with impaired left ventricular function. Due to its special features the atraumatic and excellent stabilization enables the cardiac surgeon to achieve optimal results of LIMA-to-LAD-anastomosis.

References