Difficulties in Beating-Heart Totally Endoscopic Coronary Artery Bypass Grafting: How to Handle the Problem Endoscopically

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ABSTRACT

We describe 2 cases of successful conversion from beating-heart (BH) to arrested-heart (AH) totally endoscopic coronary artery bypass surgery (TECAB). The preoperative computed tomographic (CT) scan of the first patient showed significant artherosclerosis of the femoral vessels in both groins. Therefore we tried to avoid inguinal cannulation by performing an off-pump BH-TECAB. But the target vessel was strongly fissured, and bleedings from the surrounding tissue made anastomotic suturing impossible. Therefore we cannulated the groin cautiously and endoclamped the aorta. The preoperative CT scan of the second patient showed a soft plaque in the ascending aorta. Therefore we tried to perform an on-pump BH-TECAB to avoid clamping of the aorta. Even though we snared the target vessel, significant backbbleeding occurred. Therefore we performed endoclamping of the aorta distal to the aortic plaque. In both cases the following AH-TECAB procedure was performed successfully without any problems.

BACKGROUND

Since the introduction of computer-enhanced robotic instrumentation systems in the 1990s, several successful cardiac surgery procedures have been performed, including arrested-heart (AH) and beating-heart (BH) totally endoscopic coronary artery bypass (TECAB) [Loulmet 1999; Kappert 2001; Bonatti 2004]. BH-TE coronary surgery with the aid of the Da Vinci surgical system (Intuitive; Sunnyvale, CA, USA) is a challenging procedure including difficult exposure and stabilization of the target vessel, coronary artery backflow, and bleeding from the surrounding tissue. Nevertheless, the BH procedure has advantages: no clamping of the aorta, and no need of cardiopulmonary bypass. Traditionally problems during BH-TECAB have led to a conversion to thoracotomy or sternotomy. Herein we describe 2 cases of BH-TECAB that were converted to an AH-TECAB procedure.

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CASE REPORTS

The first case occurred in a 53-year-old man with a stenosis of the left anterior descending artery (LAD), who was admitted for a left internal mammary artery to left anterior descending artery TECAB surgery. Because the preoperative CT scan showed considerable atherosclerosis of the femoral vessels, we decided to avoid cannulation and to perform an off-pump BH-TECAB (Figure 1). We used an endostabilizer for target-vessel exposure and snared the LAD to avoid backflow. After the arteriotomy, the target vessel presented as locally dissected and there was prolonged bleeding from the surrounding tissue. This made a safe suturing of the anastomosis impossible. Therefore we decided to cannulate the groin and endoclamp the aorta [Schachner 2005]. When the heart was arrested, the target vessel exposure was perfect, and the anastomosis was sutured without technical problems. The postoperative course of the patient was uneventful: after 12 hours of mechanical ventilation extubation was successful and

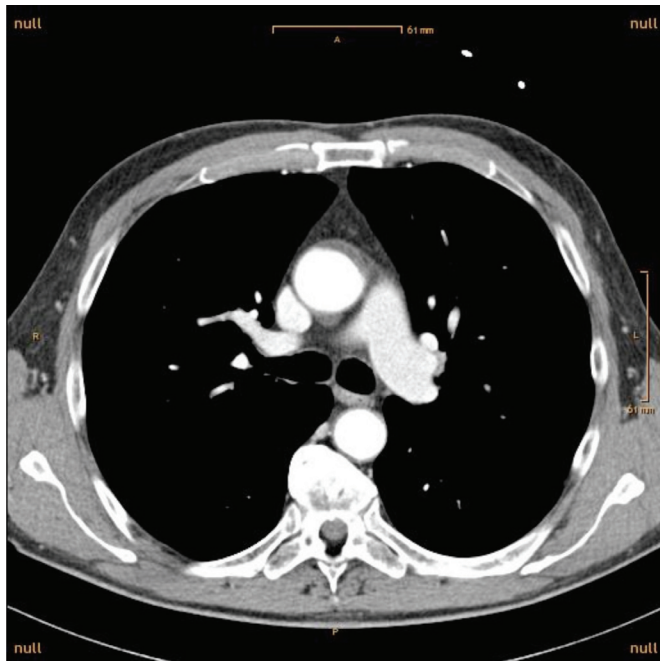Figure 1. Artherosclerosis in left and right femoral arteries.

Figure 2. Soft plaque in the ascending aorta.

there was no requirement for blood products. The patient was transferred from the intensive care unit to the cardiac surgery ward on the first postoperative day and could be discharged without any problem 6 days after surgery.

The second case was a 70-year-old man who also had a stenosis of the LAD and was admitted for a LIMA-to-LAD TECAB procedure. On his preoperative CT a soft plaque in the ascending aorta was found (Figure 2). To avoid endoocclusion of the aorta, an on-pump BH-TECAB was intended. Because of insufficiency of the vessel loops, significant bleeding after arteriotomy of the LAD occurred. We were therefore forced to occlude the aorta. We positioned the endoclamp balloon rather distally to avoid plaque rupture. When the heart was arrested, the target vessel exposure was perfect again, so that the AH-TECAB procedure was performed without any complications. The operation took 300 minutes and 2 units of packed red blood cells were transfused intraoperatively. The postoperative course of this patient was uneventful. No significant bleeding occurred. The patient could be weaned from mechanical ventilation after 14 hours. On the second postoperative day the patient could be transferred from the intensive-care unit to the cardiac surgery ward and was discharged on day 6 after surgery.

DISCUSSION

The 2 presented cases show that failure of the BH-TECAB procedure doesn't inevitably mean a failure of the endoscopic procedure. The first case shows that cannulation of an atherosclerotic femoral vessel is possible. This procedure must be performed with caution, however, and requires experience by the team that applies remote-access perfusion. In the second case we decided to continue with the endoscopic

procedure and to endoclamp the aorta instead of cross-clamping, because we thought that the mechanical trauma to the aorta would be the same. Both cases show the importance of a preoperative CT scan: in the first case we explored the atherosclerotic femoral vessels, and in the second the plaque in the ascending aorta [Feuchtner 2007]. Even though we ultimately performed femoral vessel cannulation and endoocclusion of the aorta in both cases, we were aware of the problems. In the second case we placed the endoocclusion balloon distal to the plaque to avoid mechanical irritation of the plaque. Apart from that, it was rather interesting to see the difference between BH-TECAB and AH-TECAB in these cases. The BH-TECAB procedure was associated with technical difficulties such as the locally dissected target vessel, bleeding from the surrounding tissue, and strong backflow from the LAD. In contrast, after switching to the AH procedure, the vessel was perfectly exposed, and suturing of the anastomosis was quite easy.

On the basis on our comparison of the BH procedure with the AH procedure, we would recommend AH-TECAB for standard cases because of the better exposure of the target vessel and the higher safety net of the procedure. Nevertheless, BH-TECAB is an alternative approach when inguinal cannulation or aortic endoocclusion are contraindicated. These cases also show that the preoperative CT scan is an important tool for identification of lesions of the aorta. In summary, we demonstrated that conversion from BH-TECAB to AH-TECAB can be an alternative when BH-TECAB is not feasible.

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