Proposition for bail-out procedures - Aortic and aneurysmal
Improved derivation for uncontrolled bleeding in aortic root and arch surgery

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Abstract
Uncontrolled bleeding post root, ascending aorta and aortic arch operations can occur. Various techniques for getting bleeding under control have already been published in the literature. This life-threatening complication happens especially during acute aortic dissection and acute endocarditis operations, the former sometimes requiring complex mobilization of the aortic arch and the use of branched prosthetic grafts. In this report we describe the simple innovation of the technique which creates a relatively small space surrounding the aortic graft by its wrapping with use of the pericardium. Decompression of this space is maintained to a low-pressure system.

Keywords: Aortic arch; Aortic root; Aortic dissection; Pericardium; Surgery complications

1. Introduction
Immediate postoperative bleeding, which does not allow the closing of the sternotomy without the risk of a subsequent reoperation, can occur. It is observed most often in post acute dissection and endocarditis operations. Getting bleeding under control is more difficult when the aortic arch and innominate vein are fully mobilized and the arch replaced by a branched prosthetic graft. Techniques of various types of blood derivation by wrapping of prosthetic graft have already been described [1–4]. In the case when a diseased aorta is removed (cannot be used for wrapping), we can use the method described by Posacioglu et al. [5], but with possible leaks behind the prosthetic graft and between the graft and innominate vein. Using biological glue may help, but rising pressure in the derivation space could lead to failure of reconstruction in poorly accessible places. The fixing of surrounding tissues directly to the prosthetic graft may result in increased bleeding from prosthetic holes. We will describe a very simple technique to divide the periprosthetic space into halves and to create a small sealed space from which the blood cannot escape surrounding the lower or upper part of the ascending aorta.

2. Technique
The first step in root derivation is the obliteration of the transverse sinus as proposed by Posacioglu et al. [5]. It consists of tightening of the sinus by resorbable foam and fibrin or formaldehyde glue. For construction of the barrier, a harvested autologous pericardium is needed (for its pliability). A circular hole smaller than the prosthetic graft is made in the center of the pericardial patch, and an incision is performed on the upper aspect. This preparation allows the creation of the blood-sealed collar surrounding the prosthesis (Fig. 1a). The running suture then closes the collar, and the conjunction of the pericardium with the prosthetic graft is secured with glue. The pericardium is then fixed to the upper aspect of the left pulmonary artery and the pericardium is turned cranially or caudally depending on the type of derivation required. In the case of a root derivation, the pericardial patch suture continues to the pulmonary trunk, epicardium of the right ventricle, right atrium and medial part of the superior vena cava. In the case of an arch derivation, the patch is fixed to the cranial pericardium and surrounding jugular muscles. An extension of another piece of pericardium (autologous or bovine) is used when needed. To secure suture lines in poorly accessible places, glue is also used. Before closing the space, a purse-string suture surrounding the large hole in the low-pressure system (right atrium–root and innominate vein–arch derivation) is created, and sutures pass through the patch and are temporarily tightened using a tourniquet. The next step consists of testing the seal by simultaneous monitoring of pressure in the derivation space and low-pressure system after closing the derivation space. Throughout testing, no bleeding should be present outside the derivation. When the pressure in the former exceeds that in the latter, we simply release the purse-string suture, communication is then opened with a drop in derivation pressure and the procedure can be finished. If the pressure

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in the former does not exceed that in the latter for a further 15 min, then we simply tighten the suture and finish the operation without creating a link between both systems.

3. Comment

From November 2006 until January 2008, out of 112 aortic root and arch operations operated on in our department, ten patients required various postoperative bleeding derivations. Six patients were operated due to acute dissection, one for chronic dissection, one for acute endocarditis, and there were two ascending aorta aneurysms requiring a modified Bentall procedure. In the first eight cases, we used the technique described by Posacioglu et al. [5]. The innovations used in the last two cases enabled us to reduce the derivation volume to the minimum (Fig. 1b) and simultaneous pressure monitoring enabled us to decide, whether to open the communication between derivation space and low pressure system or not. Postoperative CT-scan showed pericardium surrounding the thrombosis of the periprosthetic space (Fig. 2).

The new procedure described above can be summarized in three steps.

1. Creating a derivation by using the technique described above.
2. Testing pressure in the derivation and low-pressure system after temporary closure of the derivation.
3. If the former pressure exceeds the latter, then communication between both systems is opened.

The technique described is simple and reproducible; it minimizes derivation space and enables safe construction of a derivation in cases of whole arch replacement using branched graft with mobilization of the thoracic aorta.

References


