The "Elephant Trunk" Technique Made Easier

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In patients with diffuse aneurysmal disease, the "elephant trunk" technique, which uses surplus intravascular graft length to facilitate subsequent operations on the downstream aorta, is an accepted method of treatment. Nevertheless, in the presence of large aneurysms without a definite neck beyond the left subclavian artery, there is an increased risk of rupture at the level of the distal anastomosis. My colleagues and I herein describe a modified elephant trunk technique performed with a new prosthesis, which was conceived to overcome the difficulties and the risks inherent in a large aneurysmal neck.

Operations on the descending thoracic aorta in patients with diffuse aneurysmal disease are further facilitated by the "elephant trunk" technique first described by Borel and associates [1]. This technique has been shown to greatly facilitate and reduce the risk of multiple-stage aortic replacement [2]. Nevertheless, when the distal aortic arch exceeds 5 to 6 cm, there is an increased tension at the level of the distal anastomosis because of the mismatch between the graft and the aorta; this can potentially precipitate aneurysm rupture before the second-stage repair. Under these conditions various approaches have been proposed, such as performing the anastomosis between the left common carotid and the left subclavian arteries [3] or trimming the aorta at the level of the distal anastomosis [4]. To circumvent this problem we have developed a newly designed prosthesis, named the Dumbo graft by virtue of its peculiar aspect and of its use, conceived to facilitate the elephant trunk technique (Fig 1).

Technique

The aortic arch is exposed through a median sternotomy. Cardiopulmonary bypass is initiated with arterial perfusion through the right axillary artery and single venous drainage with a 2-staged cannula in the right atrium, and then the patient is cooled to less than 25°C bladder temperature and 23°C nasopharyngeal temperature. The brachiocephalic trunk, the left common carotid artery, and the left subclavian artery are clamped for selective cerebral perfusion; according to our protocol the infusion rate is reduced to 10 to 15 ml.kg⁻¹.min⁻¹, with perfusion pressures not exceeding 80 mm Hg. Perfusion temperatures are maintained at less than 12°C. The aortic arch is then opened, and additional selective perfusion of the left common carotid artery is initiated if inadequate bihemispheric perfusion is assessed by transcranial Doppler flowmetry [5]. Cold blood cardioplegia (10 mL/kg) is administered antegrade through the coronary ostia; additional doses are repeated every 20 minutes. During systemic circulatory arrest the aorta, the site of the distal anastomosis, and the button containing the ostia of the supraarch grafts are prepared (Fig 2). The Dumbo graft (Vascutek, Inchinnan, UK) is then inserted inside the aortic lumen, and the "sewing disk" is trimmed to fit the aortic diameter (Fig 3). In the case of chronic dissection, to perfuse both distal channels, the intimal flap is opened longitudinally for an adequate length. The graft is sutured with a 3-0 polypropylene running suture and polytetrafluoroethylene felt strip reinforcement on the adventitial side of the aorta. A second arterial catheter is connected to a predisposed branch of the graft for distal perfusion. Then, with a clamp proximal to the side branch, the button containing the arch vessels is anastomosed to the graft. After de-

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Accepted for publication Nov 7, 2003.

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airing of the supraaortic trunks and of the graft, full rewarming is begun. Brachiocephalic perfusion is stopped, and whole arterial blood return is switched to the side-branch cannula. The procedure is then completed with the proximal aortic repair. This technique has been used since May 2002 in 4 patients, aged 59, 63, 66, and 79 years; all aneurysms involved the ascending aorta and the aortic arch and extended distally beyond the distal two thirds of the descending aorta. A thoracoabdominal aneurysm (Crawford type I) was present in 2 patients. Aortic pathology included degenerative aneurysms in 3 cases and chronic dissection in 1; none had Marfan's syndrome. The average circulatory arrest time was 27.9 minutes (range, 18 to 46 minutes); the supraaortic branches were separately reimplanted into the graft in 1 case and with use of an en bloc technique in 3. Second-stage treatment was surgical in 3 patients and endovascular in 1; in this case we used an Endofit (Endomed Inc, Phoenix, AZ) thoracic stent graft implanted between the distal end of the Dumbo graft and the distal aneurysm neck. One patient died of intestinal infarction 2 weeks after second-stage repair.

Comment
The proposed technique enables 2-stage repair of complex aortic lesions that involve both the aortic arch and descending aorta, even in the presence of a mismatch between the graft and the aorta at the level of the distal anastomosis of the elephant trunk operation. The prosthetic sewing ring covers the gap between the aorta and the graft, thus reducing tension on the sutures, and avoids the need for trimming the fragile tissues of the diseased aorta.

Although the primary indication for the Dumbo graft is the repair of extensive aortic lesions (megaoarte syndrome), we also appreciated the presence of the external sewing ring for the repair of aortas with near-normal sized distal necks. In particular, this simplifies the distal anastomosis of 4-branched grafts, which are generally very complex to invaginate and retrieve; at the same time it facilitates the distal anastomosis when the invagination technique is not advisable, such as in cases of acute dissection or in the presence of a fragile aortic wall.

Marking the distal end of the graft with metal clips makes its identification easier on plain chest roentgenograms or other radiographic modes, such as computed tomographic scanning. Knowledge of this level is essential when the next operative stage is planned.

The Dumbo graft was developed in collaboration with Seron Medical Technologies (Rome, Italy) and Vasuteck (Inchinnan, UK). We thank Dr. Sergio Morosco, Domenico Ferrise (Seron Medical Technologies), and Dr. Tim Ashton (Vasuteck).

References