

## New concepts in Aortic Arch Repair. Are we Heading in the Right Way?

Carlos-A. Mestres, MD, PhD, FETCS\*, Miguel Josa, MD, Manuel Castellá, MD, PhD, Jaime Mulet MD, PhD

*Department of Cardiovascular Surgery, Hospital Clinico, University of Barcelona, Barcelona, Spain.*

*The standard approach for repair of type A aortic dissection includes repair or replacement of the aortic valve, the ascending aorta and the arch, alone or in combination with direct vision under hypothermic circulatory arrest. Although type A dissection usually extends into the distal thoracoabdominal aorta, the descending thoracic aorta is usually left alone. During the follow-up, surgeons will sequentially and periodically evaluate the patients looking for aneurysmal dilatation of the untreated aorta for an eventual late open surgical or endovascular repair.*

*Surgery of the aorta continues to be a surgical challenge. Aortic disease and surgery are dynamic as new ideas are continuously brought up in terms of surgical approach, extension of repair and characterization of patients. Technology also plays an important role nowadays. Since the early days of high-porosity vascular grafts, until today where vascular grafts are being coated with albumin or collagen, results have dramatically changed in terms of control of hemorrhage and related intraoperative death. The inception of endovascular therapy seems to change the perception of patients suffering from descending thoracic aortic aneurysms and chronic dissections.<sup>1</sup> Acute type B dissections are still a matter of concern regardless of the attempted therapy.*

*Type A dissection routinely involves the aortic arch. Operation-related morbidity and mortality is still high. Some questions are still unanswered; like the need of performing complex combined resections of the arch and how to treat the descending aorta. To save the patient first has always been our major surgical standard and we believe this must always be priority in the critical decision-making process.*

*Here we will have a quick look at evolving concepts, ideas and technologies, asking some questions for the near future.*

### **Where are we?**

As stated, the currently accepted gold standard for treatment of acute type a dissection is the radical management of the proximal tear regardless of its location. Most of the times, the tear is located in the supracoronary region of the ascending aorta. Due to a frequently associated tear in the arch or extended dissection to the arch or descending thoracic aorta, it is mandatory to explore the arch under hypothermic arrest. This carries significant technical difficulty and higher risk of mortality. All types of techniques have been evaluated including simple hypothermic arrest at 18-20C.<sup>2</sup> In recent years retrograde cerebral perfusion through the superior

vena cava and antegrade cerebral perfusion through the neck vessels has been advocated trying to reduce the incidence of neurological damage.<sup>3,4</sup>

However, surgical trauma and perioperative morbidity continues to be a major limiting factor for a complete single-stage repair when needed. Therefore, the classical strategy to approach the ascending aorta, arch and descending thoracic aorta still consists of a two-operation approach through median sternotomy and left lateral thoracotomy. There are also some additional limitations for a second operation, namely the increased age of surgical candidates

\*Corresponding Author: Carlos-A. Mestres, Consultant of Cardiovascular Surgery, Hospital Clinico, Villarroel 170, 08036 Barcelona, Spain. Tel: +34-93-2275749. Fax: +34-93-4514898. E-mail: cmestres@clinic.ub.es

after primary anterior repair and the associated comorbidity, especially of pulmonary origin. Not to be neglected is the still significant risk of paraplegia related to operations on the thoracoabdominal aorta regardless of the surgical approach and technique used. Mortalities in the range of 20-30% are common even in the best hands.<sup>5</sup>

### ***What can be offered today?***

This type of surgery is still a matter of controversy. Previous attempts to decrease risks and make operations simple are not new. An important modification of the surgical technique was the operation designed by Borst et al more than twenty years ago and well known today as the “elephant trunk” repair.<sup>6</sup> Even though there is an agreement that this technique performs well, its major drawback is the need for a second operation provided the descending thoracic aortic is left untouched or there are different levels of involvement. New applications are being explored with excellent results.<sup>7</sup>

As stated, a significant proportion of patients will eventually require additional procedures for acute or chronic dissections or atherosclerotic aneurysms. The advent of endovascular stent-grafting has actually modified our perception of the patient<sup>1</sup> and has greatly facilitated the approach to complex patients although we still lack sufficient follow-up to clearly define true indications and possible pitfalls. Actually only midterm results regarding descending endovascular retrograde repair of thoracic aneurysms have been reported.<sup>8</sup> Something important to consider are the continuous changes in the stent-graft technology. Acute aortic dissections will continue to be a challenge for a number of years due to its pathophysiology and characteristics.

New developments are on the horizon. All of them try to overcome the associated morbidity and mortality, to decrease the need for late reoperations and to facilitate single-stage repair of both dissections and aneurysms if feasible. Technological advances are looked as the eventual panacea and this has to be looked at with care. Recently, some modifications of the “elephant trunk” technique are seen as promising. Antegrade deployment of nitinol stent-grafts appear to be of interest. Initial reports using conventional stent-grafts for retrograde deployment<sup>9,10</sup> have led to the identification of some problems and the need to reapproach this issue with new stent-grafts especially designed for antegrade deployment.

Some new devices are currently available in the market like the Chavan-Haverich<sup>11</sup> and the E-Vita Open (Jotec, Hechingen, Germany) integrated stent-grafts, however global experience is still scanty.<sup>12-14</sup> These devices consist of stent-grafts with an integrated conventional Dacron graft that will be used to repair the arch and ascending aorta during surgical repair. A common fact seems to be the immediate thrombosis of the false lumen after surgery in the case of aortic dissection and this is regarded as a very positive issue.

Mid- and long-term results are needed to ascertain what will be the real role of these devices be.<sup>15</sup>

### ***Hybrids?***

This sounds like an attractive word. Some patients might benefit from a hybrid approach combining retrograde transfemoral deployment of stent-grafts in the treatment of chronic complex aortic disease, associated with arch debranching through median sternotomy.<sup>16</sup> Some suffering from more complex disease may benefit from procedures that involve the use of newer devices such as those integrated stent-grafts designed for antegrade deployment during circulatory arrest.<sup>12-14</sup> What will work better is yet to be defined. The key point will be an exhaustive collection of data, the use of judicious indications, avoiding biases in patient selection and lack of more favorable results to skew the balance in its favor. This has always been our surgical standard. And please, do not forget old techniques that still work.

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