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38.1 Introduction

Cardiovascular disease is the leading cause of death in most Western societies and is increasing steadily in many developing countries. Longer life expectancy, hypertension and the proliferation of modern noninvasive imaging modalities have contributed to the growing awareness of acute and chronic aortic syndromes. Despite recent developments in epidemiology, diagnostic and therapeutic modalities, there is still a lot of progress to be made to understand the spectrum of aortic syndromes and to define an optimal approach to managing aortic diseases.

In the 1990s, endovascular stent-graft treatment emerged as a new and less invasive method to treat abdominal aortic aneurysm. It soon led to the use of stent grafts in the treatment of thoracic aortic diseases, but their exact role remains approximate.

Although only midterm study results are now available, they indicate a better outcome compared with conventional surgery, especially in elderly patients with significant comorbidities such as pulmonary and renal insufficiency, coronary heart disease, hypertension and diabetes mellitus, where morbidity and mortality rates after an open surgical repair are as high as 50%. However, despite the good published results, endoluminal stent grafts are not risk-free: endoleaks, prosthesis dislocations, neurological complications, acute or late rupture of the aorta and side branch occlusions are described leading to therapy failure. Owing to the actual restrained number of patients treated by endovascular repair, the blur in the indications and the different types of devices used, it is nearly impossible to identify if the complications are device-, procedure- or patient-related and the exact place of this new therapy.

Nevertheless, we will attempt, in this chapter, to discuss the ongoing studies and the need for future studies to better understand and treat the various thoracic aortic pathologies.

38.2 Descending Thoracic Aortic Aneurysms

Aneurysms of the thoracic aorta represent a potentially life-threatening situation. Surgical resection and interposition with a vascular prosthesis have long been considered the standard treatment despite the substantial risks of the procedure. The use of an endovascular stent graft to treat thoracic aortic aneurysms emerged a decade ago propelled by the desire to reduce surgical risks and induce remodeling of the diseased aorta by initiating a natural healing process after exclusion and de-pressurization of the aneurismal sac.

So far, all prospective studies and registers have shown that the stent-graft technique has better immediate results compared with classic open surgery, with lower 30-day morbidity–mortality and paraplegia rates. In midterm studies, the complication rates are, however, not negligible and habitually consist of secondary leaks which can mostly be treated intravascularly [1, 2, 3]. Compared with stent-graft abdominal aortic aneurysm repair, complications of thoracic treatment differ considerably. Abdominal complications mostly relate to changes in aneurysmal volume after successful exclusion, which result in device distortions, kinks or modular disconnections. At the thoracic level, as only one tubular device is needed in most patients, the risks of type III leaks, kinks, disconnections or thromboses are
either eliminated or greatly reduced. Furthermore, the diameter reduction after complete aneurysm exclusion is probably less than in the abdomen combined with the use of an oversized device (at least 10% more than the normal aortic diameter) and this reduces risks even more. Nevertheless, the most frequent thoracic complications are type I endoleaks that occur at aortic and graft junctions allowing the aneurysmal sac to remain pressurized. They are more frequent because degenerative thoracic aortic disease is usually more diffuse than abdominal disease; thus, progression of the malady at attachment sites is more likely. To avoid this problem, we recommend the placement of longer stent grafts covering healthy aorta up to the visceral arteries. Type II endoleaks, except from the left subclavian artery, are rare. If two or more grafts are used, type III endoleaks can arise at junctions, requiring insertion of another stent-graft segment. This complication is greatly reduced when we systematically overlap a long segment of the grafts. Finally, pseudoaneurysms and intimal perforations at distal implantation sites have been reported secondary to stent-graft erosions [4]. Complete long-standing studies are still needed to determine the incidence of these complications and their long-term effects.

The question of intentional exclusion of the left subclavian artery is still unanswered. In patients with a very short neck between the left subclavian artery and the aneurysm requiring coverage of the former, different treatment attitudes have been described; left subclavian transposition or bypass either systematically before stent-graft insertion or only if the patient has ischemic neurological or left arm symptoms after occlusion. Left subclavian artery coverage is routinely done without complication in many centers [5, 6]. Nevertheless, it should be kept in mind that it is crucial to evaluate the vertebral arteries before occluding the left subclavian artery to prevent ischemic symptoms in cases of stenotic vertebral arteries or absence of collateral pathways between the two as observed in up to 6% of cases.

As devices improve, better results should be observed in the future. Therefore, requests to place endografts in patients with small lesions, in which the risk of rupture is extremely low, should be more frequent. It will be important to resist these demands until further data prove otherwise. So, as far as we are concerned, we recommend that endograft use should be limited to patients who truly exhibit surgical indications.

### 38.3 Dissection

Despite the frequency of acute aortic dissection, there are few large series published on the outcomes of dissections and most are long retrospective multicenter studies confounded by inconsistent methods of treatment and data collection. The IRAD study, a prospective multicenter registry has now been created to address some of these concerns. This study [7, 8] provides better understanding of the clinical profile and outcomes of patients with acute type B aortic dissection, helping clinicians in early risk stratification and decision-making. Unfortunately, there is an inherent selection bias because the study results are mainly based on data from tertiary referral centers that may not necessarily be extrapolated to the general population. Even though the IRAD study is a step forward, to better evaluate survival predictors, prospective studies are still needed mainly because the actual registry does not re-group homogeneous patients with similar risk factors whose outcomes could be rigorously compared nor does it take into consideration factors such as nonfatal morbidity, quality of life and cost effectiveness.

Actual consensus exists regarding the need for emergency surgical treatment of patients with acute Stanford type A aortic dissection. The optimal treatment strategy for Stanford type B dissection remains controversial [9-12]. Most groups today reserve the surgical replacement of the descending aorta for patients with aortic rupture, organ ischemia, refractory pain, uncontrolled hypertension, false lumen dilatation or other life-threatening conditions. Other teams have advocated early surgery for young and good operative candidates irrespective of the presence of complications [13], arguing that if the surgery is successful, these individuals would be at lower risk of late dissection-related aortic complications. Finally, percutaneous interventional techniques, i.e., fenestration and stent-graft repair to correct ischemic complications related to thoraco-abdominal malperfusion, have become a valuable adjunct to both medical and surgical therapy, but their role is still debated.

For type B dissections with complications, percutaneous stent-graft placement seems to be superior to surgery on short-term follow-up [14-19]. Recently, it was shown that percutaneous stent-graft treatment has an early mortality rate of 16% among patients with acute Stanford type B aortic dissections associated with life-threatening complications [16]. If treated surgically, i.e., an emergency thoracotomy, these patients would be facing an early mortality risk of 40%. The rate was said to be 60-70% if treated medically [11, 14, 15] The effectiveness of stent-graft treatment in patients with complicated acute type B aortic dissections must however still be confirmed by long-term prospective randomized trials. Such a study was started in early 2003 but regrettably had to be stopped after the intentional retrieval of the Gore device after cases of nitinol wire fractures.

In cases of acute type B dissection without complications, medical treatment was long the only accepted treatment until stent grafts were used successfully [17], complicating the decision-making process. The INSTEAD study was started in Europe in 2002 to compare medical and stent-graft treatment in patients with un-