Simplifying management strategies in contemporary practice of endovascular abdominal aortic aneurysm repair

VALORISATION

VALORISATION

Introduction

An abdominal aortic aneurysm (AAA) is a focal dilatation of the aorta to at least 1.5 times its normal diameter. The normal diameter of the infrarenal aorta is approximately 20mm, therefore an aortic diameter of 30mm or larger is considered being aneurysmatic. AAAs are a significant health challenge with an estimated incidence of 20 – 40 cases per 100,000 population per year. Its more commonly seen in men than in women, with a prevalence of 1.3% to 8.9% in males and 1.0% tot 2.2% in females. The prevalence of AAA in The Netherlands is approximately 90.000 among people older than 55 years of age. Important risk factors for the occurrence of AAA are gender, age and smoking habits.

An AAA is a progressive disease, which if left untreated eventually leads to rupture of the aneurysm with massive bleeding and consequently death. To date, AAAs are responsible for 1.3% of all deaths among men aged between 65-85 years in developed countries. In The Netherlands, each year approximately 850 persons die of a ruptured aneurysm. Since AAAs generally exists without symptoms, the AAA related mortality is probably underestimated.

The risk of rupture increases with the aneurysm diameter. Initial treatment of an AAA is aimed at preventing rupture. Because treatment itself also comes with a risk of mortality and morbidity, a selected treatment policy is constructed. A preventative aneurysm repair is indicated when the threshold diameter is reached (55mm in men and 52mm in women), if rapid aneurysm growth is observed (>5mm per 6 months in AAAs >40mm) or if the aneurysm becomes symptomatic (abdominal or back pain). AAAs are responsible for approximately 7.000 hospital admissions yearly in The Netherlands.

Two modalities of AAA treatment are available; conventional open surgical repair or minimally invasive endovascular repair (EVAR). In open repair the aneurysmatic aorta is replaced by a synthetic graft. This treatment requires laparotomy, clamping of the aorta and is accompanied by substantial blood loss, and is consequently associated with a perioperative mortality of 2% to 5% and significant morbidity. In EVAR treatment a synthetic

stentgraft is fed from femoral artery access in the groin through the aorta up to the AAA neck and subsequently unfolded, excluding the aneurysm sac from blood flow and pressure. Initially, EVAR was considered to be an alternative treatment for those AAA patients not suitable for open repair due to severe morbidities. Meanwhile, EVAR has proven to be a feasible and safe technique, showing decreased mortality and morbidity rates compared to conventional open treatment. EVAR now has become the treatment of preference for patients with infrarenal AAA.

Despite the promising results of EVAR perioperatively and in the short-term, complications unique for endovascular treatment cause EVAR to be less beneficial in the longer term. Also, a substantial proportion (40%) of AAA patients that require repair fall outside stringent anatomic criteria that make treatment with commercially available stentgrafts suitable. Improvement of EVAR treatment is necessary to enhance outcomes of AAA patients. The technology of EVAR is a dynamic ever-changing endeavour. The challenge is to decrease complications and reinterventions, while safely treating more complex anatomy, especially those cases unfit for open repair. In the mean time hold dear to resource-effective strategies that do not include technically complex and costly interventions when they are not necessary. Both patients and society as a whole benefit from simply applicable and affordable techniques for AAA repair. Well-designed registries that closely monitor the performance of new graft designs and new endovascular techniques are therefore crucial in making balanced judgement about the optimal management of abdominal aortic aneurysms.

Relevance of the scientific results in this thesis

This thesis consists of three main parts. Part one focuses on the perioperative outcome of patients included in the ENGAGE registry. It describes the outcomes of a contemporary stent graft devices in current practice, and compares feasibility and outcome of EVAR with different anaesthetic modalities and outcome of EVAR in more urgent cases.

With the fast changing stentgraft designs it is important to keep hold on the performance of contemporary EVAR devices and put these results in perspective to older generations of devices en conventional open surgical AAA treatment. **Chapter 2** describes the performance

of the Endurant Stent Graft. Within the real-world ENGAGE Registry perioperative and one-year results are promising. Complication and reintervention rates compare beneficial with those reported in the landmark EVAR-1, DREAM and OVER trails. This strengthens the evidence for the preferential use of EVAR over conventional open surgical repair whenever AAA treatment is indicated. **Chapter 3** represents the largest comparative analyses between EVAR outcome in symptomatic and asymptomatic AAA patients. It shows that with the use of contemporary devices and technical proficiency of EVAR, the outcome of urgent EVAR in symptomatic cases is not different from the outcome of elective EVAR. Feasibility of EVAR under regional or local anaesthesia has been proven 20 years ago, however there is still no consensus on which type of anaesthesia is most suitable. **Chapter 4** strengthens the evidence in favour of a strategy based on preferential use of locoregional anaesthesia for EVAR. It shows that type of anaesthesia used for EVAR has no influence on technical success and perioperative mortality and morbidity, but that the use of local or regional anaesthesia appears to be beneficial concerning procedural time, ICU admission, postoperative hospital stay and recovery.

The focus in part two of this thesis is on the handling of the ostium of the internal iliac artery (IIA) whenever coverage is indicated. It questions if treatment with more complex solutions is really necessary or if iliac stenting with the omission of coil embolisation is also safe to perform. A review of literature in **Chapter 5** shows that so-feared IIA-related endoleaks following IIA stentgraft coverage without prior coil embolisation are rarely reported. Suggested pre-emptive coil embolisation as a preventative measure related-endoleaks may therefore be unnecessary. Furthermore, results from a strategy in which stent coverage of the IIA was routinely performed without prior coil embolisation show that this strategy in EVAR treatment of aorto-iliac and iliac aneurysms is safe and effective, and may reduce complications. **Chapter 6** confirms these conclusions in a comparative analysis from the ENGAGE Registry that shows that the omission of coil embolisation in case of IIA coverage does not increase the incidence of endoleaks or related secondary interventions. Since this is the largest comparative study on the topic, and therefore the strongest evidence to date it may imply abandoning of pre-emptive coil embolisation as a standard regimen.

In part three of this thesis an overview is given on the current management and prevention of complications that are unique for EVAR. **Chapter 7** describes the evolution of occurrence and treatment options of all types of endoleaks, device migration, stent fractures, graft detoriation, or even persistent aneurysm growth that EVAR patients may experience. Advanced stent graft designs and increased understanding of management of these technical complications are declining the incidence rate for the necessity of secondary interventions, which is considered the down-side of EVAR and matter of great concern in the landmark trials that compare EVAR with open repair. Furthermore, in **Chapter 8** a study design is presented to give more insight in the outcome of EVAR with contemporary devices in patients with challenging AAA morphology.

Innovation and future

Randomized controlled trials (RCTs) are considered the gold standard in the hierarchy of research designs for evaluating the efficacy and safety of a treatment intervention. Results of RCTs, however, may not reflect 'real world' since patient inclusion is subject to strict criteria, and can therefore have limited applicability to individual patients in clinical setting. Moreover, one must question if RCT design is feasible in qualifying outcome of EVAR in view of the contemporary preference for EVAR and the swift evolution in stent graft designs. Large high-quality, well-designed observational studies are increasingly believed to provide complementary evidence to RCTs. They can assess treatment effectiveness in patients encountered in day-to-day clinical practice because of the use of larger and more heterogeneous populations with common comorbidities and longer follow-up periods. A mandatory registry on AAA-treatment that is globally supported by doctors and is financially supported governments and industries might be the solution for creating a benchmark for future treatment and qualifying performance of new devices.

This thesis and future research contributes to the understanding of AAA treatment and the development of national and international guidelines that give guidance to the optimal treatment of abdominal aortic aneurysms. Above all making AAA disease a less lethal and more bearable disease.