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Elective Surgical Management of Aortic Abdominal Aneurysms – An Overview

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ABSTRACT

Abdominal aortic aneurysms (AAAs) represent a degenerative process of the abdominal aorta that is often attributed to atherosclerosis; however, the exact cause is not known. In American autopsy studies, the frequency rate of AAA ranges from 0.5-3.2%. The frequency of rupture is 6.9 cases per 100,000 persons in Sweden, 4.8 cases per 100,000 persons in Finland, and 13 cases per 100,000 persons in the United Kingdom. Importantly, patients have a high mortality if an aneurysm ruptures so elective surgical management is of vital importance for the long-term health of many patients.

Introduction

An aneurysm is a degenerative disease in which there is abnormal local dilation of the artery greater than 50% of its normal diameter. In the case of an abdominal aortic aneurysm (AAA), this would be a dilation more than 3cm as the normal diameter of the abdominal aorta is 2cm.[1] A study by Singh et al showed that men are 4 times more likely to suffer from AAA than women and it is more frequently seen in the elderly population.[2] 5-10% of men between the age of 65 and 79 years were reported to have AAA according to a Cochrane review.[3] It can be broadly classified as the 'true' variant in which all layers of the vessel are involved or as the 'false' variant in which an extravascular haematoma is formed instead. Another classification is by its location - most cases of AAA are infrarenal with the less common suprarenal AAA being more difficult to manage.[4] Sometimes, the shape of an aneurysm may be described with fusiform AAA being seen more frequently than saccular aneurysms.

The management of a patient with AAA depends on the disease presentation with patients presenting with a ruptured AAA requiring prompt resuscitation and immediate open repair. Patients with non-ruptured AAA require monitoring and appropriate surgical management further explored in this article.

Aetiology

While its exact aetiology is uncertain, atherosclerosis which involves plaque formation, destruction of the tunica media and loss of elastic recoil, plays a key role

in AAA development.[4] Less common associations are infection, trauma, arteritis and connective tissue diseases such as Marfan's syndrome and Ehlers-Danlos syndrome.[4] A positive family history, smoking and hypertension are some of the other risk factors identified.[5]

Clinical Presentation

AAA can present in a number of ways. A 'text-book' presentation familiar to many medical students is that of a ruptured aneurysm. This patient experiences severe abdominal pain that typically radiates to the back often associated with hypotension and eventual hypovolaemic shock. Patients with a complete AAA rupture are unlikely to survive long enough to reach hospital. However, the retroperitoneal structures in patients with a 'leaking' AAA exert a tamponade effect that acts to limit blood loss so that patient may reach hospital. Patients with an intact AAA may still have abdominal tenderness whilst a large non-ruptured AAA may compress local structures such as the ureters. Turbulent blood flow within the AAA may promote thrombus formation that may embolise to distal structures. For example, the patient could develop gangrene of the feet (also known as 'trash feet') as a result of distal embolisation. Despite the above, it should be noted that approximately 75% patients are asymptomatic at the initial diagnosis of the AAA with the majority of cases being identified incidentally as a result of imaging investigations.[6] Indeed, many patients remain untroubled by the condition for the rest of their lives.

Management

The aim of treatment for the intact AAA is to prevent aneurysmal expansion as this increases the risk of potentially life threatening rupture. The medical management of these patients, regardless of whether they are surgical candidates, must not be neglected. Cardiovascular risk factors should be assessed, as they often have a higher risk of peri-operative cardiovascular mortality. Correction of these risk factors also helps reduce operative mortality.[6] Cessation of smoking, good control of hypertension and the statin therapy are also likely to be beneficial.[6]

Elective Surgical Management

The risk of aneurysmal rupture and the potential mortality from the intervention must both be weighed carefully. In general, elective surgical intervention of AAA is indicated for a AAA with a diameter of 5.5cm or above, if the AAA increases in diameter by greater than 1cm every year or if the aneurysm becomes tender.[7] The indication based on the size if the AAA is particularly important due to the high number of incidental findings of AAA. The figure of 5.5cm or above has been adopted from the UK Small Aneurysm Trial (UKSAT) that involved 93 UK hospitals. This study in investigated whether early elective open surgery or regular ultrasound surveillance was more suitable for small AAA.[7] The study showed that aneurysms less than 5.5cm in diameter could be safely monitored, unless the diameter increased by greater than 1cm per year or they became tender.[7,8] However, as studies have also reported a higher risk of rupture in women, the threshold for surgery in female patients may be lower.[9]

Open repair versus endovascular aneurysm repair

The two main commonly used interventional approaches are open surgical repair or an endovascular aneurysm repair (EVAR). An open repair of the aorta is commonly adopted in an emergency setting. After laparotomy, the neck of the aneurysm is identified and the proximal affected aorta is clamped. This is followed by the incision of the AAA and the clearing out of thrombus from the aneurysm. A synthetic graft, usually Dacron (Fig 1), is stitched within the aorta while the outer wall of the aorta is then sutured up. The mortality rate for an elective open repair of the AAA is 5-7.8% in the UK compared to an approximates 50% mortality rate for an emergency repair.[1]

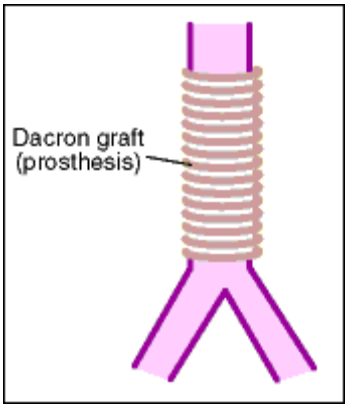

Fig. 1 Picture showing the use of Dacron graft to repair an AAA in open repair

(Image from Cambridge University Hospital. Abdominal Aortic Aneurysm (AAA), Vascular Surgery.)

The alternative EVAR procedure employs a stent-graft system to divert blood flow through its lumen and to allow aneurysm to thrombose (Fig. 2).[1] Many centres have seen the use of EVAR becoming more prominent than open repair and reports suggest that at least 65% of AAA patient are suitable for EVAR.[1] According to the British Heart Foundation, an adequate neck length of 1.2cm is needed for fixation of the stent.[1] The EVAR intervention is much less invasive, although follow-up visits with imaging such as ultrasound are necessary to ensure correct position of the stent.[10] In one study by Greenhalgh et al, the perioperative mortality for EVAR was 1.7% compared to 4.7% in those who underwent open AAA repair.[11] Hospital stay was also less for patients who had EVAR.[11] However, the United Kingdom EVAR trial reported subsequent rupture of aneurysm after its repair in patients who underwent EVAR such that further intervention became necessary: 23% who underwent EVAR required further intervention whilst only 9% needed another operation after an open repair.[12] The benefits of an open repair include the lack of requirement for long term follow-up after surgery and the absence of any potential stent-related complications, such as stent migration and stenosis, observed in patients after EVAR.[10, 12] In the same EVAR trial, the total mortality or aneurysm-related mortality after 4 years were reported to be very similar between these two techniques.[12]

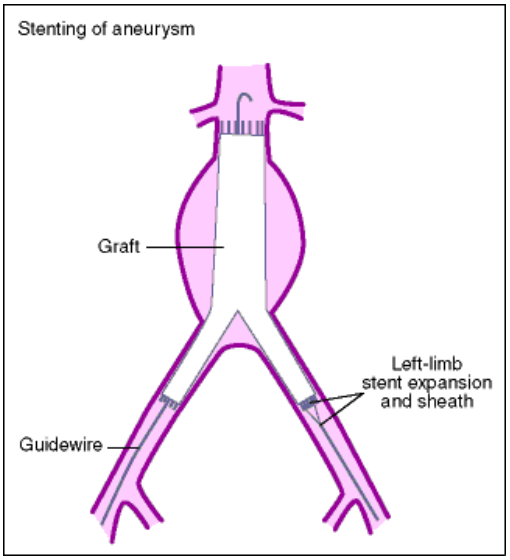

Fig. 2 Picture showing the use a stent-graft system in EVAR to direct blood flow

(Image from Cambridge University Hospital. Abdominal Aortic Aneurysm (AAA), Vascular Surgery.)

Conclusion

The decision on whether a patient is a candidate for repair of an intact aneurysm is complex. Numerous factors, including the risks and benefits of any proposed intervention and the consequence of a 'wait and see' approach have to be considered. The particular treatment adopted should be tailored to the specific disease presentation of each patient and take into account other patient factors such as age and comorbidities. While EVAR has become a more popular treatment choice, doubts regarding its effectiveness remain, mainly due to insufficient data on the long-term outcome of patients.[1] In order to provide the best care for patients with non-ruptured AAA, more controlled trials are still necessary, especially with regards to the long term prognosis of patients who have undergone these operations.

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