# Managing an abdominal aortic aneurysm

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**An abdominal aortic aneurysm is an abnormal swelling of the major artery in the abdomen. Once the vessel has started to enlarge it will continue to do so until it either leaks or is repaired. Ruptured abdominal aortic aneurysms are the 10th most common cause of death in men aged over 65 years in the Western world. Repair should be considered when the risk of rupture exceeds the operative risks.**

The first description of an abdominal aortic aneurysm (AAA) was recorded in the 16th century by the anatomist Vesalius. Until the early 1950s, treatment for the condition was rarely successful. However, with the introduction of open Dacron inlay grafts, and, more recently, the development of endovascular techniques and the beginning of screening in the 1990s, there has been a dramatic change in prognosis.

## Prevalence

An aneurysm is defined as a permanent dilatation of an artery with an increase greater than 1.5 times its normal diameter. It has been estimated that AAAs account for 10,000 deaths each year in the UK[1]. The prevalence in men is five to seven times higher than in women[2]. AAAs are most common in men over 60 years of age and their incidence is increasing[3]. The normal diameter of an artery depends on several factors, including age, sex and blood pressure. The mean size of a healthy infrarenal aorta is approximately 22mm in men and 19mm in women.

The apparent increasing prevalence of AAA has been observed in a number of Western countries, and may be more than a reflection of the increasing age of the population and improved diagnostic capabilities.

## Aetiology

The aetiology of AAAs is multifactorial and is thought to be predominantly a combination of degenerative and atherosclerotic processes. AAAs are associated with atherosclerotic occlusive disease in 25% of patients. Lifestyle factors thought to increase the risk of development of an AAA are similar to the risk factors for coronary and peripheral vascular disease and include, in particular, smoking, uncontrolled hypertension and hypercholesterolaemia[4].

There is strong evidence to suggest a genetic susceptibility to AAAs. Patients with an aneurysm have a 20% chance of having a male first-degree relative who is affected[5]. More rarely, AAAs may be caused by other disease processes, including dissection, mycotic infection, cystic medial necrosis and connective tissue disorders such as Ehlers-Danlos syndrome or Marfan's syndrome

## Clinical presentation

The majority of AAAs are asymptomatic and are only discovered during a routine physical examination or unrelated ultrasound investigations. However, even large AAAs can be difficult to palpate in obese individuals. Continued growth of the AAA will eventually lead to symptoms either as a result of rupture, localised pressure on adjacent structures, embolisation or thrombosis. The most commonly reported symptom is any type of abdominal, flank or back pain, sometimes mimicking ureteric colic.

The sudden onset of severe, constant pain in the abdomen, back or flank which is unrelieved by the patient

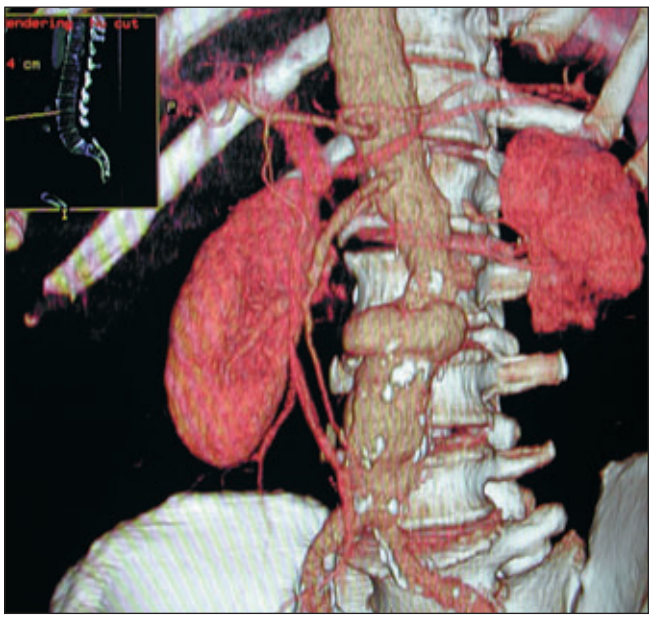

**Fig 1.** CT scan of abdominal aortic aneurysm

altering position is characteristic of expansion, leaking or free rupture of the aneurysm. The course of subsequent events depends upon which of the three processes is involved. In the expanding aneurysm the patient will remain relatively stable and expeditious investigations such as ultrasound or CT are possible (Fig 1). In the leaking aneurysm there is often a small tear in the aortic wall with an associated contained haematoma within the retroperitoneum. In this scenario the time course is variable. Occasionally the contained leak temporarily settles, affording a short period of apparent stability. However, the situation is misleading and may at any stage deteriorate. Urgent surgical intervention is required. Imaging is potentially dangerous and is not recommended. Free rupture of an AAA into the peritoneal cavity is a catastrophic event associated with severe pain, which is rapidly followed by cardiovascular collapse and death. A high index of suspicion is required, and the presence of abdominal pain, backache and cardiovascular instability in a patient over 60 years of age needs to treated as a leaking AAA in the first instance.

## Management options

### *Risks and benefits of surgery*

The larger the aneurysm, the greater is the risk of rupture. The annual risk of rupture of an abdominal aneurysm 5.0–5.7cm in diameter is 6–7%, rising to 20% if the diameter is 7cm. There is a marked increase in risk as the aneurysm grows above 6cm. The mortality from a ruptured AAA is estimated to be 75–90%, whereas elective surgical repair still carries a mortality of 3–7%. Patients who undergo elective repair of abdominal aneurysms have an average five-year survival rate of about 60%. Ischaemic heart disease remains the leading cause of death following repair of abdominal aneurysms.

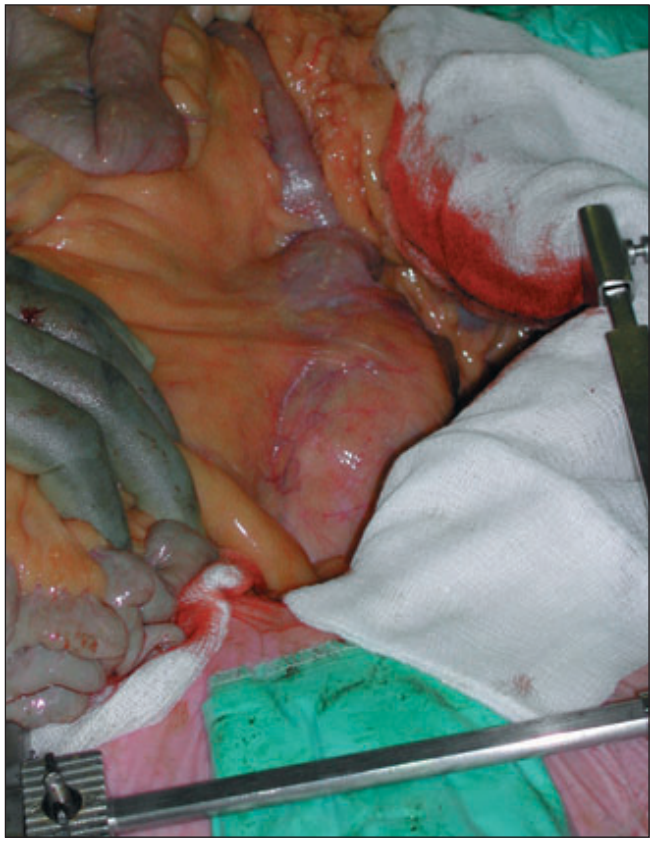

**Fig 2.** Open surgery for a 7cm abdominal aortic aneurysm

#### Pre-operative co morbid assessment

Aortic surgery is a major operative undertaking and it is important to understand the risks and benefits of intervention. Significant comorbidities need to be borne in mind and the patient should have a reasonable quality of life and life expectancy if the aneurysm were to be successfully treated.

#### Cardiorespiratory assessments

Coronary artery disease is the most common cause of serious perioperative morbidity and mortality. The incidence of fatal myocardial infarction following elective surgical repair of abdominal aneurysms is reported to be as high as 4.7%, and non-fatal myocardial infarction occurs in up to 16% of patients. Detailed preoperative cardiac assessment is a prerequisite to safe elective surgery. Clinical assessment, ECG, exercise stress testing, echocardiography, dipyridamole-thallium scanning, Holter monitoring and coronary angiography may be used individually or in combination to more accurately assess the cardiac status of the patient.

In major non-cardiac surgery, the inability to climb two flights of stairs has a positive predictive value of 82% for postoperative cardiac or pulmonary complications or death within 30 days of surgery. More recently, there has been growing interest in the use of cardiopulmonary exercise testing as a predictor of likely outcomes for non-cardiac surgery[6].

### *Open or endovascular repair*

Abdominal aortic aneurysms can be repaired using open surgery, a technique first described in the 1950s. Alternatively, an endovascular approach devised in the early 1990s may be used.

#### Open repair of AAA

The procedure is performed under general anaesthesia, often using an epidural for intra- and postoperative analgesia. Either a midline or transverse abdominal incision is made (Fig 2). The neck and distal extent of the aneurysm are exposed. Heparin is given and the vessels are temporarily clamped. An inlay tube graft or bifurcating graft of Dacron is sewn into position and the flow restored. The aneurysm sac is closed around the graft. Once satisfactory haemostasis is achieved the abdomen is closed. The patient is returned to a high-dependency unit for close postoperative monitoring and analgesia for 24–72 hours. The patient usually goes home at 8–14 days and gradually returns to normal activities over the next 6–12 weeks.

#### Endovascular repair of AAA

Endovascular repair of an AAA is now possible. The technique involves the placement of a composite stent graft,


**Fig 3.** Abdominal aortic aneurysm with stent graft *in situ*

consisting of a metal framework and a Dacron cover, into the aorta bridging the abnormal aortic vessel. Small cuts are made in each groin accessing the common femoral arteries and the stent graft is deployed in the abdomen (Fig 3).

Endovascular repair can be performed under loco-regional anaesthesia or general anaesthesia, usually with an interventional radiologist and a vascular surgeon working as a team. It has the advantage of being considerably less invasive and patients make a more rapid recovery, often going home on the third to fifth postoperative day. However, there are a number of drawbacks. Only certain aneurysms have suitable anatomical configurations, the stent costs approximately £5,000–£7,500, and it often has to be custom-made in advance. There also appears to be a relatively high incidence of secondary interventions required in subsequent years.

### *Complications of surgery*

Myocardial infarction, respiratory failure and death occur infrequently during elective surgical repair of AAAs, but are the most common causes of perioperative problems. Other, more rare complications include haemorrhage, renal failure, injury to the bowel or ureter, postoperative ileus and bowel obstruction, ischaemic colitis, spinal cord ischaemia, lower extremity ischaemia or embolisation, and finally graft infection. Although complications may occur, most patients undergo successful elective repair and have an uneventful recovery. Detailed audits of an individual surgeon's and a unit's results are an important component in maintaining satisfactory standards.

## Screening

There is a growing evidence base supporting screening for AAAs in men aged 65–75 years. A number of prospective randomised trials have demonstrated that screening a selected population with a single abdominal ultrasound scan can reduce the long-term mortality from aneurysms. The greatest impact is amongst smokers. The evidence supporting a screening programme has been available for some time, but there remains a significant delay in its widespread implementation the UK[7,8].

When an AAA is found on screening but is too small for surgical intervention (<5.5cm), regular ultrasound examinations should be performed to measure the growth of the aneurysm and to determine the appropriate time for intervention. Rapid enlargement (>0.5cm in six months) warrants closer surveillance or intervention.

## Conclusion

An abdominal aortic aneurysm is an abnormal swelling of a major artery and, if left alone, it will continue to grow. Eventually the enlarged weakened vessel is at risk of rupture and when that occurs there is an associated high morbidity and mortality. Timely open or endovascular intervention significantly improves the prognosis and so a surgical opinion should be considered for most patients with an abdominal aortic aneurysm.

### Key points

- Aneurysms are abnormal swellings within arteries
- Left alone, they continue to grow
- A ruptured abdominal aortic aneurysm has a 90% mortality rate
- Open or endovascular surgical repair caries a 3–7% major complication rate
- Repair should be considered when the risks of surgery are less than the risk of rupture (usually 5.5cm)
- Ultrasound screening of the population may have an important role in reducing mortality from this condition

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