Abdominal Aortic Aneurysm: Awareness, monitoring and management.

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Abstract

Abdominal Aortic Aneursym (AAA) is an enlargement of the aorta. The aorta is the main artery that runs from the heart suppling oxygented blood to all the major organs. AAA tended only to be found by coincIndence when patients underwent some form of imaging, although in many cases AAA went undiagnosed until rupture occurred. The survival rate following rupture of AAA is only around 20%, meaning that for 80% of patients a rupture would be fatal, (Mureebe et al., 2008). To try and eliminate death from rupturing of AAA the National Abdominal Aortic Anneursym Screening Programme (NAAASP) was introduced in England in 2008, with the national roll out of the programme completed in 2012. Similar programmes were introduced across Wales, Scotland and Northern Ireland in 2013. Across the UK the NAAASP invites all men in their 65th year to attend screening for abdominal aortic aneursym. With the full implementation of NAAASP nurses working in primary care will come into contact with men invited for screening or patients undergoing regular surviellence of known AAA. This article aims to provide an update for practice based nurses reviewing knowledge and evidence base relating to the causes, management and treatment of patients with known AAA.

AAA – what is it?

An aneurysm is an area of localised enlargement or dilation of a blood vessel. The word aneurysm comes from the Greek work aneurysma which means 'a widening'. The aorta originates from the left ventricle of the heart and it extends through the chest down into the abdomen splitting at the level of the fourth lumbar vertebrae into the common iliac arteries. The aorta is classed in anatomical compartments: thoracic aorta (from the heart to the diaphragm), and abdominal aorta

(from the diaphragm to the aortic bifurcation). Enlargement in the diameter of the aorta can occur at any point, but is most commonly located in the abdominal aorta but can also be found in the thoracic aorta. The aorta is classed as aneurysmal if it exceeds 3cm in diameter, an increase of 50% in the normal size of approximately 2cm.

Incidence and symptoms

AAA formation is uncommon in patients below the age of 60, (Erbel and Eggebrecht, 2006). Over the age of 60 the prevalence in men is reported to be 5% and 1% in women, (Lederle et al., 2001). AAA tend to be asymptomatic until the aneurysm ruptures, which is uniformly fatal if left untreated, (Jacob et al., 2015). It is estimated that greater than 50% of patients whose AAA ruptures will die before reaching hospital and of those that do arrive at the hospital between 30-50% will not survive to discharge, (Mureebe et al., 2008). AAA are responsible for over 7,000 deaths per year across England and Wales, (Stather et al., 2013).

Risk factors for developing abdominal aortic aneurysms

The exact cause of most aneurysms is unknown, (Sakalihasan et al., 2005). However, in some specific cases the cause of the aneurysm can be identified. These include: trauma; acute infection (brucellosis, salmonellosis); chronic infection (tuberculosis); inflammatory diseases (Behçet and Takayasu disease) and connective tissue disorders, (Sakalihasan et al., 2005).

Using population based studies several risk factors have been identified which increase the risk of developing abdominal aortic aneurysm these include:

Smoking

Smoking is the major environmental risk factor for AAA, enhancing the chance of developing AAA as well as the risk of rupture, (Brady et al., 2004). The prevalence of AAA's in tobacco smokers is more than four times that of life-long non-smokers, (Sakalihasan et al., 2005). Interestingly, the prevalence of AAA diminished with the years of abstinence from smoking, (Kent et al., 2010).

Age and sex

In a seven year prospective trial monitoring the risk factors for developing AAA it was found that male sex and increasing age were strong risk factors for developing AAA, (Forsdahl et al., 2009). It has been shown in men that the incidence is approximately 25 per 100,000 at age 50 increasing to 78 per 100,000 in those older than 70 years, (Hay et al., 2009). In a 2001 study, the mean age of

patients undergoing repair for AAA in the United States was 72 years, (Huber et al., 2001). It has been demonstrated that the population prevalence of AAA is three times higher in men than in women, (Moll et al., 2011).

Family History

Familial clustering of the abdominal aortic aneurysm (AAA) is clear, 12–19% of AAA patients have one or more first-degree relatives with an aneurysm, (Van Vlijmen-van Keulen et al., 2002). Data from a Swedish population study demonstrated that a family history of AAA increased the risk of AAA about 2 fold, (Larsson et al., 2009). Although the benefits of screening for AAA in the presence of a family history of aneurysm has not been formally assessed, (Moll et al., 2011).

Ethnicity

A retrospective study from Leicester of men aged 65 years by Salem et al. (2009) demonstrated that patients who described themselves as Asian showed a prevalence rate of AAA of 0.45% compared to prevalence rate of 4.69% in Caucasian men. A study from America has also demonstrated a lower rate of AAA in Afro-Americans; Hispanic and Asians compared to Caucasian after adjusting for all other known risk factors, (Kent et al., 2010).

Hypertension, hypercholesterolemia and atherosclerotic disease

Studies have demonstrated significant association between AAA and hypertension, hypercholesterolemia, as well as pre-existing atherosclerotic occlusive disease in various vascular beds, (Kent et al., 2010). However, patients with diabetes appear to have a lower incidence of AAA, (De Rango et al., 2014), suggesting a differing pathophysiology to occlusive atherosclerotic disease, (Kent et al., 2010). The reason for the lower incidence of AAA in patients with diabetes is not fully understood, (De Rango et al., 2014).

AAA screening

Screening is performed to reduce the risk of future ill health in a defined group of people, (Raffle et al., 2007). In the case of AAA screening, this is systematically offered to the male population at the age of 65 who live in England, Wales, Scotland and Northern Ireland. Each country has an individualised screening programme but all follow the same operational standards, (Stather et al., 2013). AAA screening had been consistently demonstrated as a cost-effective intervention to reduce aneurysm related mortality, (Stather et al., 2013). This has most strongly been supported by the 10-

year MASS trial (Multicentre Aneurysm Screening Study), which was based on a population sample of 67,770 men aged between 65-74. The study identified that at the end of the 10-year period screening had reduced the number of deaths related to AAA's by 48%, (Thompson et al., 2009). Currently AAA screening is only offered to the male population as women are 6x less likely to develop an AAA and therefore screening is not economically viable, (Scott et al., 2002). Additionally AAA screening is not offered to men 64-years or under, as the prevalence of undiagnosed AAA falls dramatically under the age of 65, reported at being only 0.6% in men aged 55 – 64 years, (Brosnan, 2011).

Screening is organised through local programmes, each led by a vascular specialist. Men are invited by letter in the 65th year of their life and are supplied with a standard information leaflet regarding the scan. The ultrasound scans (USS) are undertaken by screening technicians trained to a national standard, (Davis et al., 2013). The scans are performed in clinics held in local venues such as community clinics, community hospitals, or primary care facilities, (Public Health England, 2015). The benefit of AAA screening is reliant upon achieving good attendance rates by men and screening will never eradicate all deaths related to AAA's, but in the long-term it should reduce the mortality rates related to AAA's in men aged 65 and over, (Thompson et al., 2009).

Monitoring

If the abdominal aorta is 3cm or greater, it is deemed as aneurysmal but at this size only requires surveillance to monitor growth. Treatment is only required if the aneurysm reaches a size of 5.5cm or above depending on patients' individualized risks. Although many small AAA (<5.5cm) are detected through the screening programme, a large majority of these patients may never require intervention as they remain less than the 5.5cm threshold. During 2013/14 the English screening programme detected nearly 3,700 aneurysms, which relates to a prevalence of 1.3%, of the 3,700 detected aneurysms of which only 491 required planned surgery during that period, (Public Health England, 2015). However, each aneurysm detected does require ongoing surveillance to assess growth and establish whether any intervention is required, imaging intervals are determined by aneurysm size. The table below describes the agreed timings for surveillance by the screening services across the UK, (Stather et al., 2013).

Size of Aorta	Considered to be Aneurysmal?	Frequency of Surveillance/Plan
<30mm	No	Discharged from screening programme.

≥30mm-44mm	Yes	Yearly surveillance scans by the screening service
≥45mm-54mm	Yes	3 monthly scans by the screening service
≥55mm	Yes	Referral to a Vascular Surgeon

Treatment

Managing patients general cardiovascular risk is important for improving overall outcomes associated with AAA, as cardiovascular disease is the main cause of death in people with AAA not rupture, (Sohrabi et al., 2014). Additionally the optimisation of cardio vascular risk will help overall outcomes associated with AAA repair given that about half of the patients with small (<0.5cm) AAA who are being monitored will eventually undergo AAA repair, (Lindholt et al., 2010). Anti-platelet therapy and statin treatment may be required if the patient is deemed at high cardiovascular risk but the most important modifiable risk is that of smoking, as there is strong evidence that links smoking to AAA expansion and rupture, therefore smoking cessation is key to effective management, (Lindholt et al., 2010).

Elective repair of the AAA is the most effective management to prevent rupture. However, elective aortic surgery is also associated with risk. Therefore elective AAA repair is not recommended until the risk of rupture exceeds the risks associated with the repair, (Dalman and Mell, 2015). The risk of rupture generally exceeds the surgical risks once the aneurysm measures 5.5cm. However, this is dependent on individual patient assessment to accurately determine when to proceed with elective repair.

There are two methods of treating abdominal aortic aneurysm: open repair or endovascular repair. Conventional (open) surgical repair involves making a large incision in the abdomen and inserting a prosthetic graft to replace the damaged section of the aorta, (Hay et al., 2009). Endovascular aneurysm repair (EVAR) is where a thin tube is passed via the blood vessels into the groin to the site of the AAA. Once in a correct position a device is introduced that relines the dilated aorta acting as an artificial blood vessel through which blood can flow bypassing the aneurysm, (Paravastu et al., 2014). EVAR has short-term advantages in reducing early mortality, length of hospital stay and improved quality of life, (Greenhalgh et al., 2005). However, the lower short term mortality

associated with EVAR does not persist to the intermediate and long term, (Paravastu et al., 2014). EVAR's require on-going imaging assessment, often on a yearly basis, to assess device location and ensure there is no evidence of late-occurring endoleaks, where the blood continues to flow through the aneurysm because of lack of graft seal. The decision as to which treatment is most appropriate is a complex one and should be made jointly by the patient and their clinician after assessment of a number of factors, (Hay et al., 2009). Including:

- *aneurysm size and morphology,*
- *patient age, general life expectancy and fitness for open surgery,*
- *the short and long-term benefits and risks of the procedures including aneurysm-related mortality and operative mortality.*

Conclusion

AAA is a common yet potentially lethal condition. Across the UK there is a screening programme for men aged 65 years old to help detection of AAA, allowing monitoring and timely intervention to help reduce the risk of rupture and death. The risk of AAA rupture is proportional to the size of the aneurysm, when the aneurysm reaches a size of greater than 5.5cm in diameter - in most patients the risk of rupture outweighs the surgical risks from repair. However, many patients will be detected as having an AAA but will not require surgical intervention. These patients will often remain under long term surveillance. It is vital that patients diagnosed with an AAA are provided with accurate information about their condition, have on-going surveillance and where possible interventions to aid reduction in their overall cardiovascular risk, with the ultimate aim of reducing mortality in this patient group.

References

DAVIS, M., HARRIS, M. & EARNSHAW, J. J. 2013. Implementation of the National Health Service Abdominal Aortic Aneurysm Screening Program in England. *Journal of Vascular Surgery*. 57 (5) 1440-1445

BRADY, A., THOMPSON, S., FOWKES, F., GREENHALGH, R. & POWELL, J. 2004. Abdominal aortic aneurysm expansion: risk factors and time intervals for surveillance. *Circulation,* 1101**,** 16-21.

BROSNAN, M. 2011. Is there a benefit to screening for abdominal aortic aneurysms in the Irish male population between the ages of 55 to 75 years? *Masters Thesis: Dublin Institite of Technology*.

DALMAN, R. L. & MELL, M. 2015. *Management of asymptomatic abdominal aortic aneursym* [Online]. Available: http://www.uptodate.com/contents/management-of-asymptomatic-abdominal-aortic-aneurysm.

DAVIS, M., HARRIS, M. & EARNSHAW, J. J. 2013. Implementation of the National Health Service Abdominal Aortic Aneurysm Screening Program in England. *Journal of Vascular Surgery,* 57**,** 1440-1445.

DE RANGO, P., FARCHIONI, L., FIORUCCI, B. & LENTI, M. 2014. Diabetes and Abdominal Aortic Aneurysms *European Journal of Vascular and Endovascular Surgery,* 47**,** 243-261.

ERBEL, R. & EGGEBRECHT, H. 2006. Aortic dimensions and the risk of dissection. *Heart,* 92**,** 137-142.

FORSDAHL, S., SINGH, K., SOLBERG, S. & JACOBSEN, B. 2009. Risk Factors for Abdominal Aortic Anurysm A 7- year Prospective study The Tromso study 1994-2001. *Circulation,* 119**,** 2202-2208.

GREENHALGH, R. M., BROWN, L. C., KWONG, G. P., POWELL, J. T. & THOMPSON, S. G. 2005. Comparison of endovascular aneurysm repair with open repair in patients with abdominal aortic aneurysm (EVAR trial 1), 30-day operative mortality results: randomised controlled trial. *Lancet,* 364**,** 843-8.

HAY, N., MCCRACKEN, F., RICHARDSON, J., GEORGE, E. & BARNETT, D. 2009. Endovascular stent-grafts for the treatment of abdominal aortic aneurysms: NICE technology appraisal guidance. *Heart,* 95**,** 1798-800.

HUBER, T., WANG, J., DERROW, A., DAME, D., OZAKI, C., ZELENOCK, G., FLYNN, T. & SEEGAR, J. 2001. Experience in the United States with intact abdominal aortic aneurysm repair. *Journal of Vascular Surgery,* 33**,** 304-10.

JACOB, A. D., BARKLEY, P. L., BROADBENT, K. C. & HUYNH, T. T. T. 2015. Abdominal Aortic Aneurysm Screening. *Seminars in Roentgenology,* 50**,** 118-126.

KENT, K., R., Z., EGOROVA, N., RILES, T., MANGANARO, A., MOSKOWITZ, A., GELIJNS, A. & GRECO, G. 2010 Anlaysis of risk factors for abdominal aortic aneurysm in a cohort of 3 million individuals. *Journal of Vascular Surgery,* 52**,** 539-548.

LARSSON, E., GRANATH, F., SWEDENBORG, J. & HULTGREN, R. 2009. A population based case-control study of the familial risk of abdominal aortic aneurysm. *Journal of Vascular Surgery,* 49**,** 47-50.

LEDERLE, F. A., JOHNSON, G. R. & WILSON, S. E. 2001. Aneurysm Detection and Management Veterans Affairs Cooperative Study Group: Abdominal aortic aneurysm in women. *J Vasc Surg,* 34**,** 122-126.

LINDHOLT, J. S., SØRENSEN, J., SØGAARD, R. & HENNEBERG, E. W. 2010. Long-term benefit and cost-effectiveness analysis of screening for abdominal aortic aneurysms from a randomized controlled trial.

AU. *Britsh Journal of Surgery,* 97**,** 826.

MOLL, F., POWELL, J., FRAEDRICH, G., VERZINI, F., HAULON, S., WALTHAM, M., VAN HERWAARDEN, J., HOLT, P., VAN KEULEN, J., RANTNER, B., SCHLOSSER, F., SETACCI, F. & RICCO, F. 2011. Management of Abdominal Aortic Aneurysm Clinical Practice Guidelines of the European Society of Vascular Surgery. *European Journal of Vascular Surgery,* 41**,** s1-s58.

MUREEBE, L. N., EGOROVA, J. K., GIACOVELLI, J. K., GELIJNS, A., KENT, C. & MCKINSEY, J. F. 2008. National trends in the repair of ruptured abdominal aortic aneurysms. *Journal Vascular Surgery,* 48**,** 1101-1107.

PARAVASTU, S., JAYARAJASINGAM, R., COTTAM, R., PALFREYMAN, S., MICHAELS, J. & THOMAS, S. 2014. *Endovascular repair of Aortic Aneurysm: The Cochrane Collaboration* [Online]. Available: http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004178.pub2/pdf [Accessed Accessed 29th of December 2015.

PUBLIC HEALTH ENGLAND 2015. NHS Screening Programmes in England 2013/2014. *In:* ENGLAND, P. H. (ed.).

RAFFLE, A. E., ARMSTRONG, J. & GRAY, M. 2007. *Screening: Evidence and Practice,* USA, Oxford University Press.

SAKALIHASAN, N., LIMET, R. & O., D. 2005. Abdominal Aortic Surgery. *The Lancet (British edition),* 365**,** 1577-89.

SALEM, M., RAYT, H., HUSSEY, G., RAFELT, S., NELSON, C., SAYERS, R., NAYLOR, R. & NASIM, A. 2009. Should Asian men be included in abdominal aortic aneurysm screening programmes? *European Journal of Vascular and Endovascular Surgery,* 38**,** 748-749.

SCOTT, R. A. P., BRIDGEWATER, S. G. & ASHTON, H. A. 2002. Randomized clinical trial of screening for abdominal aortic aneurysm in women. *British Journal of Surgery,* 89**,** 283-285.

SOHRABI, S., WHEATCROFT, S., BARTH, J. H., BAILEY, M. A., JOHNSON, A., BRIDGE, K., GRIFFIN, K., BAXTER, P. D. & SCOTT, D. J. A. 2014. Cardiovascular risk in patients with small and medium abdominal aortic aneurysms, and no history of cardiovascular disease. *British Journal of Surgery,* 101**,** 1238-1243.

STATHER, P. W., DATTANI, N., BOWN, M. J., EARNSHAW, J. J. & LEES, T. A. 2013. International variations in AAA screening. European Journal of Vascular and Endovascular Surgery. 453**,** 231-234.

THOMPSON, S. G., ASHTON, H. A., GAO, L. & SCOTT, R. A. P. 2009. Screening men for abdominal aortic aneurysm: 10 year mortality and cost effectiveness results from the randomised Multicentre Aneurysm Screening Study. *British Medical Journal,* 338**,** 1-6.

VAN VLIJMEN-VAN KEULEN, C., PALS, G. & RAUWERDA, J. 2002. Familial Abdominal Aortic Aneurysm: a systematic Review of a Genetic Background. *European Journal of Vascular and Endovascular Surgery,* 24.