Risk assessment of the patient with an abdominal aortic aneurysm

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It is self-evident that the extent of a therapeutic intervention should be proportional to the risk of the disease being addressed. This concept implies that the factors influencing clinical outcome are considered prior to treatment and that treatment is then tailored to an individual's need. Clinical outcome is therefore determined by:

- The risk of morbidity and mortality associated with a disease;
- The "fitness" of the affected patient;
- The quality of care provided, and;
- The durability of the treatment modality to be used.

The management of a patient presenting with an abdominal aortic aneurysm (AAA) is an excellent example of the importance of evaluating the above factors in order to maximise that patient's longevity and quality of life. In these patients, a small increase in the peri-procedural mortality can negate the survival benefit from procedures intended to prevent aneurysm rupture. It is also as a result of this very small margin of error inherent in the management of such patients that extensive information is available to aid in decision making in patients with AAAs.

While it is now clear that high-volume specialised units have unequivocally been demonstrated to have better outcomes when compared to less experienced units,[1] and while in the management of such AAAs endovascular methods of treatment have a greater need for subsequent interventions, and for this reason are less durable in the long term in comparison to open-operative repair,[2] this discussion will only concentrate on the direct patient factors that influence the outcome of AAA repair.

Risk of the disease

AAA is a feared disease, because rupture of an aneurysm is usually unexpected and usually fatal. The only effective method of preventing this from happening is by recognising that an individual has an AAA and repairing this prior to the lesion rupturing. Currently, the detection of an AAA is based on screening populations that are at risk. This has been demonstrated to be safe and effective and has resulted in improved survival in a number of studies.

Once identified, the subsequent risk of rupture of such an AAA is best predicted by the maximum diameter of the aneurysm (Table I). The data are robust when aneurysms are small, but since few studies have evaluated patients at very high risk of rupture, predicting the rupture risk for aneurysms much greater than 60 mm in diameter is often speculative. The former information is largely based on information obtained from a British small aneurysm trial in which 1 090 patients with AAA between 40-54 mm in diameter were randomised to an early elective repair group and a structure ultrasound surveillance group. In this study, which recently reported 12-year follow-up results, no survival advantage was noted for either strategy, but by six years of follow-up, approximately 75% of patients in the surveillance group had an aneurysm repaired.[3]

Other factors that have been demonstrated to increase the risk of rupture are the size of the aneurysm in relation to the native aorta, the shape of the aneurysm, the presence of emphysema and the patient's sex. Women have a higher rupture risk than men when comparing similar aneurysm diameters.

Table I: AAA risk of rupture predicted on the basis of the maximum aneurysm diameter (adapted from multiple sources, including Fa Lederle et al[4])

Diameter:	One-year risk of rupture:
< 40 mm	< 0.1%
40-50 mm	< 1%
40-55 mm	± 2%/year
55-70 mm	± 10%/year
> 70 mm	40% first year

Patient "fitness"

Multiple factors influence a patient's ability to withstand the physiological and psychological stresses associated with an operation. These factors also usually predict such a patient's longer term survival, and for this reason an attempt at quantifying these is essential in order to ensure maximal benefit when making clinical decisions. As most AAA are degenerative in nature, and occur usually in individuals in their seventh decade of life or later, such patients will have significant (mostly cardiac and respiratory) comorbidities. These will influence the eventual outcome. In some settings, it is easy to predict what influence these co-morbidities will have, particularly when patients have very severe associated disease.

Absolute predictors of short survival include:

- Uncorrected severe cardiac disease (congestive cardiac failure, severe cardiac valvular disease – particularly severe aortic stenosis, severe cardiac rhythm abnormalities and acute myocardial ischaemic syndromes).
- Severe renal failure.
- Untreated malignancy.
- Uncontrolled severe infections or severe inflammatory disease.
- Conditions associated with severe malnutrition or significant endocrine abnormalities.

This is obviously not an exhaustive list, but repair of an AAA in such a patient will generally have a perioperative mortality rate well in excess of 50%. These patients will also not survive for long from the underlying condition, unless it is reversed, even if they have large aneurysms.

In the majority of patients, predicting outcome is substantially more difficult, but has been made substantially easier by some recently published studies:

- The Decrease IV study[5] in which 770 intermediate-risk patients who were on beta blockers were randomly assigned to cardiac stress testing or no testing. Testing revealed some degree of myocardial ischaemia in 26% of patients, in whom further studies and additional therapeutic interventions were performed as deemed necessary. The primary endpoint – cardiac death or myocardial infarction – occurred in a similar number of patients in each arm. The only major predictor of outcome was a heart rate of < 65 beats/min (1.3% vs. 5.2%, OR 0.24, 95%CI 0.09-0.66).
- The Dutch AAA outcome study in which 3 457 patients undergoing AAA repair in 1997 and 2000 were evaluated for survival.[6] In this study, age, female sex, the presence of congestive cardiac failure and the presence pf diabetes mellitus, were significant predictors of 28-day, one- and five-year mortality.
- The New England outcome study.[7] In 748 patients undergoing open aneurysm repair in the period between 2003 and 2007, the one-year mortality was 5.8% in a multivariate analysis, predictors for outcome were age greater than 70 years, a creatinine greater than 160 µmol/L, the presence of COPD and the need for suprarenal aortic clamping. If none of these factors was present, the mortality was about 2%, if one was present about 4-5%, two present 10%, three present 20-30%, and, if all present, nearly 70%.

Additional interventions such as the use of beta blocker therapy, endovascular repair for patients with significant respiratory compromise and careful perioperative monitoring will also influence outcomes, but do not fall into the scope of this discussion.

Conclusion

Clinical predictions will never be accurate, but in some conditions have become more reliable as a result of substantial new evidence. In patients with AAA, both the risk of the disease, and the potential for an adverse operative outcome can now be predicted with reasonable accuracy. As a result, it is now clinically possible to select patients with this condition who are most likely to benefit from AAA repair.

References

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