Endovascular Abdominal Aortic Aneurysm Repair: Update

Essay

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Ramy Essam El-Kady

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Abbreviations

AAA	Abdominal Aortic Aneurysm
ASA	American Society Of Anesthesia Classification
CAD	Coronary Artery Disease
CEUS	Contrast Enhanced Ultra Sound
CFA	Common Femoral Artery
CM	Contrast Media
CT	Compued Tomography
ECM	Extra Celluar Matrix
EL	Endoleak
EVAR	Endovascular Abdominal Aortic Aneurysm Repair
FEVAR	Fenestrated Endovascular Aortic Aneurysm Repair
GI	Gastrointestinal
IMA	Inferior Mesenteric Artery
IVC	Inferior Vena Cava
MMPS	Matrix Metalloproteinases
MRA	Magnetic Resonance Angiogram
PEVAR	Percutanous Endovascular Aortic Aneurysm Repair
PTFE	Polytetrafluoroethylene
REVAR	Ruptured Endovascular Aortic Aneurysm Repair
r-AAA	Ruptured Abdominal Aortic Aneurysm
TIMPS	Tissue Inhibitor of Metalloprotinase
US	Ultra Sonography
VSMCS	Vascular Smooth Muscle Cells

EPIDEMIOLOGY

Abdominal aortic aneurysms are generally a disease of elderly white males. AAAs increase steadily in frequency after age 50 years , are 5 times more common in men than in women, and are 3.5 times more common in white than in African American men ***(Brady et al., 2000).***

In the year 2000 approximately 34 million people age 65 and over lived in the United States, constituting 12.6% of the population.1 By 2050, the number is expected to grow to almost 79 million and represent 20% of the population.***(Day JC, 1996)***

With the ‘‘baby boom’’ generation reaching age 65 starting in 2011, patients of advanced age represent one the fastest growing populations and will drive growth in the demand for surgical services. ***(Etzioni DA et al., 2003)***

As life expectancies rise, more octogenarians with abdominal aortic aneurysms (AAA) are expected. Although morbidity and mortality rates for elderly patients (80 years) undergoing AAA repair remain greater than in younger patients ,data supports elective repair compared with emergent surgical management which is associated with dramatically greater mortality rates. ***(Giles KA et al., 2009)***

Aneurysms of infrarenal aorta are by far the most common arterial aneurysms encountered in clinical practice. They occur 2–6 times more frequently than do thoracic aneurysms. Other aneurysms are frequently associated in patients with aortic aneurysm including common or internal iliac aneurysms in 41% and femoropopliteal aneurysms in 15% of patients. Popliteal aneurysms, are markers of AAA as AAA can be found in about 8% of patients who presented with unilateral popliteal aneurysm and in 30% of patients who have bilateral popliteal aneurysm.In patient with carotid atherosclerosis there was 10% incidence of AAA, in other group of patient with tortorus internal carotid artery, 40% incidence of AAA was found . In men AAAs begin to occur at about age 50 years while in women incidence near age of 60 years. ***(Melton et al., 2004).***

Overall, the age adjusted incidence is 4 to 6 folds higher in men than in women for both asymptomatic and ruptured AAAs . A significant increase in the incidence of asymptomatic AAAs has been noted during the 1990s, in part because of increased case finding due to more frequent use of ultrasonography and other abdominal imaging modalities. ***(Wilmink et al., 2000).***

For patients over age 50 years, the incidence of AAA rupture is much higher because the risk of rupture increases dramatically with age with an incidence of 76 per 100,000 person-years for men and 11 per 100,000 person-years for women over 50 years of age, giving a male- female ratio of 4.8 : 1 ***(Wilmink et al., 2000).***

The median age at rupture was 76 years for men and 81 years for women. The median AAA size at rupture was 8 cm, but 4.5% of the ruptured AAAs were less than 5 cm in diameter (measured at autopsy or during operation). The overall mortality rate from rupture was 78%, and three fourths of these deaths occurred outside the hospital. Interestingly, most from ruptured AAAs, like those from coronary artery disease, occur in winter months ***(sterpetti et al., 2005).***

Prevalence of AAAs in a given population depends on risk factors that are associated with AAAs, including older age, male gender, white race, positive family history, smoking, hypertension, hypercholesterolemia, peripheral vascular occlusive disease, and coronary artery disease ***(Alcorn et al., 2006).***

Although these risk factors are associated with increased AAA prevalence, they may not be independent predictors and may be markers rather than causes of AAA disease. Of these risk factors, however, age, gender, and smoking have the largest impact on AAA prevalence ***(Lee et al., 2007).***

Table (1): Association of gender, race, and smoking states with the prevalence of small and medium-sized AAAs among 73, 451 US military veterans aged 50 to 79 years. ***(Lederle et al., 2004)***

Race	**Sex**	**Smoking status**	**Prevalence of pretest probability (%)**	
			>3 cm	**>4 cm**
White	Male	Smoker Nonsmoker	5.9 1.9	1.9 0.04
White	Female	Smoker Nonsmoker	1.9 0.6	0.3 0
Black	Male	Smoker Nonsmoker	3.2 1.4	0.8 0.1
Black	Female	Smoker Non smoker	1.3 0.3	0.2 0

Table (2): risk factors for detection of an unknown abdominal aortic aneurysm 4 cm in diameter or less during ultrasound screening ***(Lederle et al., 2004)***

Risk factor	Odds ratio
Increased risk	
Smoking history	5.6
Family history of AAA	2.0
Older age (per 7-year interval)	1.7
Coronary artery disease	1.6
High cholesterol level	1.5
COPD	1.3
Height (per 7-cm interval)	1.2
Decreased risk	
Abdominal imaging within 5 years	0.8
Deep vein thrombosis	0.7
Diabetes mellitus	0.5
Black race	0.5
Female gender	0.2

- **Odds ratio:** indicates relative risk compared to patients without that risk factor.
- **COPD:** chronic obstructive pulmonary disease. ***(Lederle et al., 2004) .***

Of patients undergoing AAA repair, 15% to 25% have a first-degree relative with a clinically apparent AAA compared with only 2% to 3% of age-matched control patients without AAAs ***(Verloes et al., 2006).***

Conversely, and more clinically relevant, approximately 7% of siblings of patients with AAAs have a clinically apparent AAA ***(Blanchard, 2002).***

- **Incidence of ruptured aneurysms:**

Elective repair is currently recommended for most AAA larger than 4.5 to 5.0 cm diameter while small, asymptomatic AAA carry substantially lower risk of rupture (i.e. approximately 2% to 5% for those <4.0 cm diameter), at least 75% of these lesions continue gradually to expand. Currently, more than 45,000 elective operations are performed for AAA each year in United State alone, and 15.000 persons die unexpectedly from ruptured AAA ***(Hollier et al., 2002).***

- **Incidence of mortality:**

The overall mortality rate for ruptured aneurysms is still over 90%, and despite many advances in surgery and critical care, operative mortality rates range from 50% to 70%. While the aneurysm repair, has operative mortality rates below 5% when performed under elective conditions ***(Zarins and Harris 2007).***