

# Complex Aortic Surgery and Endovascular Program



## Women and Infrarenal Abdominal Aortic Aneurysms

Written by Angela Vouyouka, M.D.

Increases in the human life span over the course of the 20th century have caused significant changes in demographic characteristics of the U.S. population. In 1900 only 39 percent of persons survived to age 65; in 2000, in contrast, 86 percent of individuals survive to age 65, and 58% survive to age 80.

The majority of these elderly

individuals are expected to be women. Despite historical biases, vascular disease whether be occlusive or aneurysmal does affect elderly women. Its treatment is associated with significant challenges compared to men since there are significant differences in anatomic, physiologic and sociologic aspects of the disease.



A significant difference between women and men is the size of the infrarenal aorta; the diameter is smaller in women than men (23mm in men vs. 19mm in women). Therefore a uniform definition of aneurysmal disease across genders with such size disparity in normal aortas will lead to underestimation of

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## LONG-TERM SURVIVAL AFTER OPEN SURGERY AT MOUNT SINAI FOR CHRONIC AORTIC DISSECTION

Written by Gabriele Di Luozzo, M.D.

Patients who sustain an aortic dissection are prone to aneurysmal formation after the initial event. The majority of aneurysms will develop in the first two years. If the patient is cared for during the acute aortic dissection at Mount Sinai, the patient

is followed every 6 months. In conjunction with the medical team, their blood pressure and heart rate are monitored closely. In addition, patients are vigilantly monitored for complications related to the aortic dissection and aneurysm. Patients are

### WOMEN AND INFRA-RENAL ABDOMINAL AORTIC ANEURYSMS (CONT.)

the prevalence of aortic aneurysmal disease in women. For both women and men, the aortic diameter enlarges with age while aortic compliance decreases; however, these changes occur later in women - usually become more pronounced during the 6<sup>th</sup> and 7<sup>th</sup> decade.

The principal associations of abdominal aortic aneurysms with smoking and family history are all similar in women compared to men. Few reports also indicate a stronger association of cerebrovascular disease, black race and cancer with AAA in women compared to men but these observations certainly need further validation.

The role of estrogen on the physiology and mechanical properties of the aortic wall is probably significant: the presence of estrogen during the reproductive years confer protection against atherosclerotic disease in premenopausal women. Postmenopausal women lose this protection and

### CHRONIC AORTIC DISSECTION (CONT.)

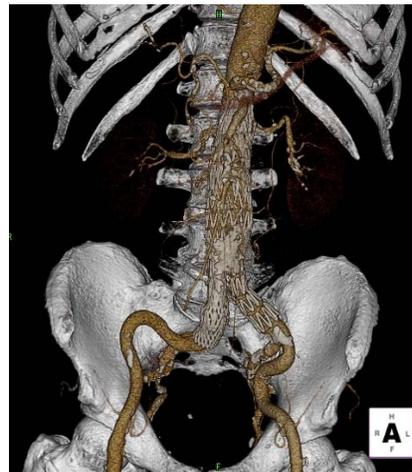
followed with serial imaging with MRA or CTA and complete physical examination every 6 months. Patients are offered repair when the descending thoracic aortic diameter is above 5 cm, diameter expansion >0.5cm/6months, pain, or signs of malperfusion. Natural history studies performed at Mount Sinai found a hinged point in medical management at a diameter of the descending thoracic aorta of 6.0 cm in patients with chronic aortic dissection with an exponential risk of an aortic complication.

We examined 104 patients who underwent open repair of a descending or thoracoabdominal aneurysm with chronic dissection as the etiology. The mean age was 60.9 years and the mean aortic diameter was 6.9 cm. Forty-seven percent of the patient had previous cardio-aortic surgery and 22% of patient underwent urgent/emergent surgery. Extensive thoracoabdominal aortic repair represented over 50% of the operations. Only

during these years there is an acceleration of atherosclerotic process and therefore atherosclerosis in elderly women is as prevalent as it is in men despite historical biases suggesting the opposite.

Probably sex hormones play equally major role on aortic wall compliance by regulating the collagen/elastin ratio and matrix metalloproteinase (MMP) activity. This role changes dramatically during menopause. This has been suggested so far by studies in rat models. Female sex hormones increase the elastin/collagen ratio and decrease of MMP-9 activity.

MMP-9 is one of the main metalloproteinase that are strongly associated with aneurysmal formation and it increases up to three to fourfold in patients with abdominal aortic aneurysm (AAA), in fact, female mice demonstrate lower MMP-9 levels



The image depicts a three-dimensional CT scan reconstruction of the abdominal aorta following an endovascular AAA repair.

and resistance to experimental AAA formation by inhibiting MMP-9 activity. Estrogen absence reverses the metalloproteinase effect and elastin to collagen ratio even in female rat aortas transplanted in male rodents. Although all this needs further validation in human subjects, these findings in part, explain why women who undergo intervention for aortic aneurysms are well into their postmenopausal years and older than men by at least 4 to 5 years.

## WOMEN AND INFRA-RENAL ABDOMINAL AORTIC ANEURYSMS (CONT.)

The prevalence of AAA in women is lower than the observed in men. In a community based screening study of the older population the prevalence of AA in women was 1.3% as compared to 7.6% found in men.. Men to women prevalence ratio range from 3.6: 2.23 in autopsy studies to 4:1 in large clinical studies such as ADAM trial, UK small aneurysm trial, to 5:1 in many surgical studies that include only AAA intended to treat). There is an overall 2-3 fold increase in the incidence of AAA in women with family history, cardiovascular disease and older age.

Focusing on clinical data, despite a lower incidence of AAA, the rupture rate is at least three times higher for women, compared with men, and occurs at smaller aneurysm size. For instance, in the UKSAT study, the mean diameter of the ruptured aneurysms in women was 5 cm; in men it was 6cm. The reasons are unclear but many hypotheses have been made. Lack of estrogens in postmenopausal women decreases dramatically the aortic wall compliance and thus the aortic wall in women is more prone to rupture than dilation as wall tension increases. Also female aortas are starting with smaller diameters when normal and therefore is reasonable to assume that once aneurysmal are prone to rupture at smaller sizes

compared to men.

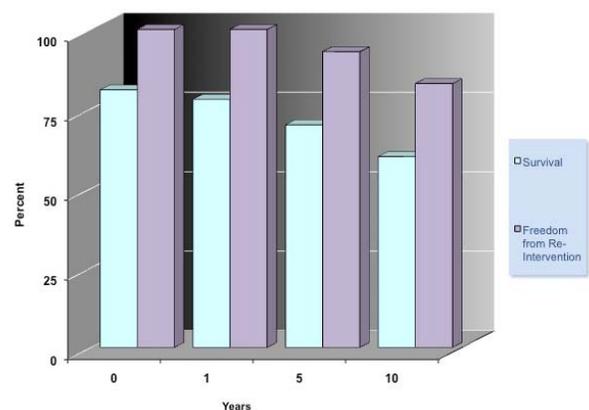
Elective repair of AAA was historically associated with higher mortality in women. For example during the decade of 1980, peri-operative mortality in women after elective open repair was as high as 10.6% as compared to 6.8 % in men. The introduction of endovascular procedures in aortic intervention has dramatically decreased mortality in general population. Because of challenging anatomy there is limited device availability in women and therefore endovascular treatment is less frequently offered in women compared to men. However as technique continues to develop more and more endovascular devices fit well the female anatomy and, once the endograft is implanted women appear to have more rapid shrinkage of the aneurysmal sac as compared to men. More importantly endovascular aortic repair has dramatically decreased perioperative female mortality to 3.1-2.6% vs. 5-6.4% in open repair in current reports. In a recent analysis, of Medicare inpatient data from 1995 to 2005 this initial survival benefit after endovascular aortic over open repair in women persisted up to 6 years after the initial aortic procedure while in men dissipated in 2 years. In fact for first time we have seen that initial survival advantage of men vs. women undergoing elective

## CHRONIC AORTIC DISSECTION (CONT.)

25% of patients had a thrombosed false lumen. The operative mortality was 9%. The presence of atheroma was a predictor of adverse outcome. Survivors after first year of surgery (78%) had a normal long-term survival comparable to a NYS age-sex matched population. Freedom from re-intervention was 93% at 5-years and 83% at 10-years.

In brief, open repair of chronic aortic dissection offers a durable repair and excellent long-term survival. Thrombosis of false lumen in the descending thoracic aorta, the goal of numerous

therapies, does not eliminate the possibility of long- term aneurysm formation.



**WOMEN AND INFRA-RENAL ABDOMINAL AORTIC ANEURYSMS (CONT.)**

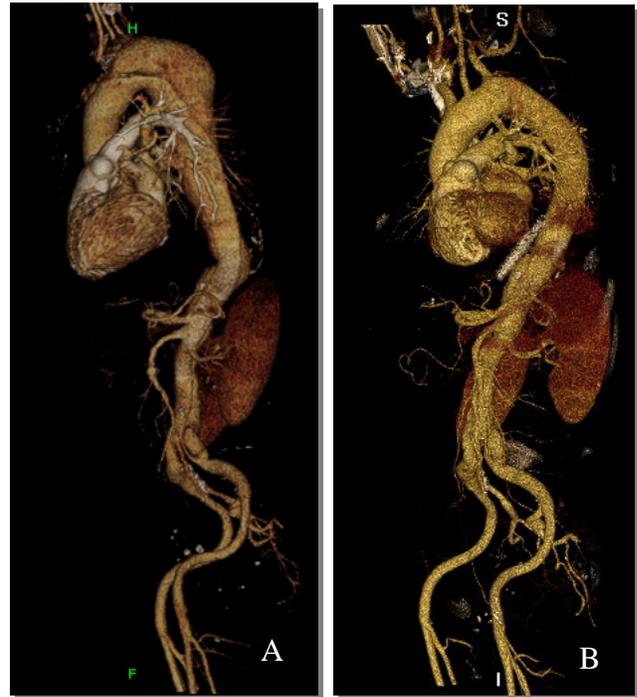
AAA repair disappeared in 2 years when the repair was conducted with endovascular means.

Although women have been excluded from the recent screening recommendations the society of vascular surgery and vascular biology after analyzing certain high risk groups have revised the screening recommendations for AAA to include women 65-80 years of age with cardiovascular history or related family history.

Fig A.) Pre-op CT scan of a chronic Type B dissection with an aneurysm.

Fig B.) Post-op CT following descending thoracic aortic replacement.

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