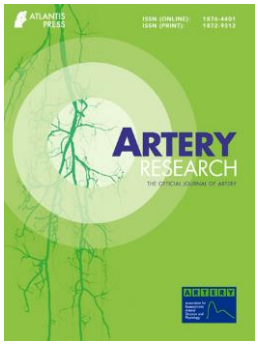

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5.6: PULSE PRESSURE AND AGE

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5.5
ANDROGEN DEFICIENCY: A CRITICAL DETERMINANT OF AORTIC STIFFNESS IN MEN

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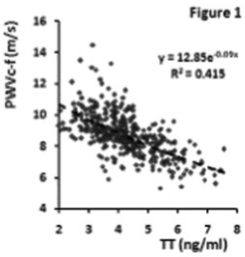
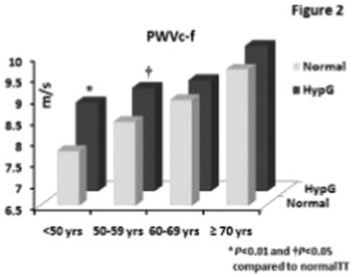
Background: Low testosterone levels and increased aortic stiffness are predictive markers for those at high risk of cardiovascular disease. The influence of androgen level on the age/aortic stiffness relationship is unknown.
Methods: Total testosterone (TT) levels were measured in 382 men with no evidence of clinical atherosclerosis. Carotid-femoral Pulse Wave Velocity (PWVc-f) was measured as an index of aortic stiffness.
Results: Figure 1 illustrates the exponential increase in PWVc-f values with linearly decreasing total testosterone concentration. The inverse correlation between PWVc-f values and TT remained significant in multivariate analysis after adjustment for confounders (β=-0.170, P<0.001). Subjects were then categorized by age decade and further subdivided according to presence/absence of hypogonadism (TT<3.4 ng/ml). PWVc-f values of each age/testosterone category after adjustment for confounders are shown in figure 2. In the first two age categories, patients with hypogonadism (HypG) had higher adjusted PWVc-f (by 0.80 m/s, P<0.01 and 0.45 m/s, P<0.05, respectively) compared to subjects with TT concentration above the cut off level for biochemical definition of HypG. On the contrary, in older age categories, PWVc-f between patients with HypG and men with normal levels did not differ. It can be noted also that young men (<50 yrs and 50-59 yrs) with HypG had already elevated PWVc-f as compared to older men (50-59 and 60-69 yrs, respectively) with normal TT levels.
Conclusion: TT levels are independently associated with aortic stiffening. The effect of low testosterone concentration on aortic stiffness is emphasized in young men. These findings underline the important role of testosterone as a marker of arterial damage.





5.6
PULSE PRESSURE AND AGE

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We investigated individual and combined effects of increased aortic stiffness and resistance on (pulse, PP) pressure with aging. Wave travel and reflection determine the contribution of the arterial system to pressure wave shape and magnitude. Reflections occur at all branch points, and these local reflections cause amplification (distal pressure equal forward *plus* backward pressure). We used an anatomically accurate model of the human systemic arterial tree in this analysis. We found that ascending aorta pressure wave shape and Reflection Magnitude ($PP_{forw}/(PP_{backw}+PP_{forw})$) are not changed with changes in peripheral resistance. This suggests that pressure wave shape depends on multiple local reflections, i.e., large artery (aortic) geometry and stiffness. Mean pressure depends on resistance only. Over the physiologic range changes in geometry have little effect, but stiffness does. Using aortic PWV and area as function of age (20—80 years, PWV 4—10m/s) we calculated aortic stiffness. For constant resistance systolic pressure increased and diastolic pressure decreased with age (stiffness). An increase in peripheral resistance of 20% and decrease in CO of 5% between 20 and 80 yrs, increased both systolic and diastolic pressures but left PP unaltered. Both effects together let systolic and mean pressure increase (106—161 and 93—108mmHg, resp.) and diastolic pressure decrease (81—71mmHg).
We conclude that increased pulse pressure results from increased aortic stiffening not from increased vascular resistance. Increased mean pressure results from increased resistance. Both effects together causes increased systolic pressure and may cause a decrease in diastolic pressure, depending on the resistance change.