

# Aortic Aneurysm Probably Due to Isometric Type of Training Program in Military Personnel

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## ÖZET

**Askeri personelde olası izometrik tip eğitim programına bağlı gelişmiş aort anevrizması**

Aort anevrizması erken tanı konulmadığı ve yönlendirilmediği takdirde ölüm potansiyeli olan bir klinik durumdur. Yarışmalı sporlarda gençlerde ani ölüm riski artışı ile birliktedir. Dolayısıyla özellikle profesyonel atletlerde kapsamlı bir tıbbi değerlendirme önerilmektedir. Ancak bazı askeri personel en az profesyonel atletler kadar veya daha ağır fiziki şartlara ve güç gerektiren eğitimlere maruz kalmaktadırlar.

Burada aortanın sinüs valsava düzeyinde dev anevrizması olan bir ve asendan aort anevrizması olan iki vakayı sunduk. İlk hasta cerrahi olarak tedavi edilirken diğer iki vaka tıbbi olarak takip edildi. İzometrik egzersiz ve eğitim faaliyetleri bu bireylerde aort anevrizmalarının başlaması ve ilerlemesi için tetikleyici bir faktör olabilir.

Ekokardiyografi oldukça yaygındır ve aort anevrizmasının tespitinde ve belirli askeri birliklere katılış taramalarında kullanılabilir seçkin bir testtir. Ayrıca askeri personele birkaç yıllık periyotlarda düzenli kardiyak muayene yapılması bu hastaların tespit edilmesine imkan sağlar.

**Anahtar kelimeler:** Aort anevrizması, ani ölüm, spor, askeri, ekokardiyografi

## SUMMARY

Aortic aneurysm is potentially a lethal clinical condition unless it was diagnosed and managed earlier. It is associated with increased risk for sudden death among young subjects in competitive sports. So a complete medical evaluation is recommended especially for official athletes. However certain military personnel in Army are absolutely exposed to strenuous physical conditions and strengthening exercises as well as or harder than the athletes do.

We presented three patients; one with giant aortic aneurysm at level of Valsava sinus of aorta and two with aortic aneurysm at ascending aorta. First patient underwent surgical treatment whereas other two patients were followed medically. Isometric type of exercise and training activities were probably the main triggering factor for initiation and progression of aortic aneurysm in those subjects.

Echocardiography is widely available and is the choice of method in pre-participation screening of certain military forces and diagnosing of aortic aneurysm. Also routine cardiac examination of military personnel in Army at a few years' periods may allow detection of those patients.

**Key words:** aortic aneurysm, sudden death, sports, military, echocardiography

## Introduction

Sudden cardiac death in athletes and individuals who are active in sport is a legal and medical issue which currently gains an increasing public interest (1). It is also a current problem for military people e.g officer, cadets, privates, etc. Therefore screening echocardiography and electrocardiography could aid the identification of any cardiac abnormalities potentially lethal (2). Below the ages of 30-35, congenital cardiovascular disease are responsible for the majority of sudden deaths whereas over the ages older than 35 years atherosclerotic coronary artery disease is the leading cause of sudden cardiac death (3). However rupture of aortic aneurysm is not uncommon with an approximately 5% rate in both age groups. Since the aortic root dilatation and subsequent aortic dissection could be a devastating clinical condition screening of athletes by echocardiography is recommended for men taller than six feet and women taller than five feet or who have a family history of Marfan's syndrome (3).

We aimed to present three cases that were randomly detected by a routine echocardiographic examination performed during a periodical examination of military personnel from the Special Forces of Army. Also we aimed to alert the physicians to be highly suspicious about the presence of any aortic aneurysm and to perform routine echocardiographic examination and chest X-ray to those patients that suffer hard and tremendous levels of isometric type of exercise as a part of military profession.

## Case 1

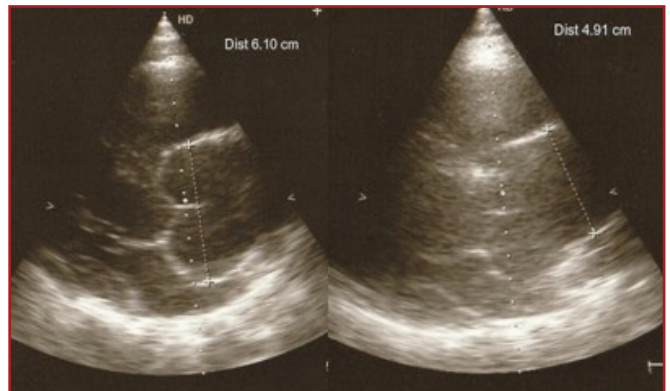


Figure 1: A

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Date submitted: Feb 22, 2012 • Data accepted: Mar 18, 2012 • Online publication date: Sep 27, 2014

Patient was a 40 years old male without any complaint. Findings on physical examination were 140/70 mmHg blood pressure, grade 1 diastolic murmur of aortic auscultation, and normal chest auscultation. Laboratory results were completely normal. Right contour of cardiac silhouette indicating enlargement of aortic root and ascending part was there on chest X-ray. Thereafter an echocardiographic examination was performed and diameters of aortic root and ascending aorta were measured 61 and 49 mm, respectively (Figure 1).

Additionally moderate degree of aortic insufficiency with a slight eccentric hypertrophy of left ventricle was observed. Patient was performed aortic angiography by multi-slice computerized tomography in order to evaluate thoracic and abdominal aorta (Figure 2). Then the patient was consulted by cardiovascular surgeons due to critical diameter of aorta and underwent surgical treatment.



Figure 2: A

## Case 2

Patient was a 42 years old male without any significant medical history. On his physical examination, blood pressure was 140/85 mmHg, cardiac and chest auscultation was normal. The ECG was normal. On his echocardiographic examination from parasternal long and suprasternal view, diameters of aortic root and ascending aorta were measured 44,5 mm, and 46 mm, respectively. Internal diameters of left ventricle at diastole and systole were 49 and 34 mm, respectively and left ventricular ejection fraction was normal without any finding of left ventricular hypertrophy and valvular regurgitation. Aortic angiography by Multi-slice CT revealed the same measurements of aortic diameters without any dissection or additional aneurysm on thoracic and abdominal aorta. The patient was initiated beta blocker therapy and scheduled for control echocardiography and aortic angiography by CT at six months period, initially. Retirement procedures were initiated to protect the patient from suffering hard military training program.

## Case 3

Patient was a 37 years old male. His blood pressure was 135/80 mmHg. Cardiac auscultation was normal. Aortic diameters were 40 mm, 46.5 mm and 38 mm at levels of root, ascending and arch of aorta, respectively on parasternal long and suprasternal imaging by echocardiography. Aortic valve was tricuspid without any sequela of rheumatic valvular disease. Aortic angiography by CT revealed those measurements of 41x40 mm at level of sinus of valsalva, 46x45 mm at ascending part of aorta, and 37 mm at aortic arch. Patient was initiated beta blocker therapy and recommended cardiovascular consultation. He was also scheduled for control echocardiography and aortic angiography by CT at six months period, initially. He was recommended to strictly avoid any form of isometric exercise and weight lifting or training.

## Discussion

Sudden cardiac death due to variable cardiac and coronary abnormalities during participation of endurance, strengthening and weight training is a current public health issue with growing medical and legal responsibilities in athletes, subjects or military people (1). Aortic aneurysm is one of those causes which could easily be detected and prevented by a proper screening and selection programs or periodical examinations (4,5). Periodical examination will certainly be effective and life saving in subjects at high risk for aortic aneurysm as well as in our cases.

Common features of our three patients were as follows; they have been military troops of Special Forces of army for at least 8 to 10 years period and suffering very hard exercise and entrainment activities daily. Content of their daily program was mainly composed of isometric exercise such as doing crunches, push-up, pull-up, gallows, trekking, climb, and jump, and etc. They had no sign or symptom of chest pain or Marfanoid body habitus, no history of chest trauma, hypertension, chronic inflammatory disease and no family history of sudden death etc. Moreover aortic root dilatation accompanied with the dilatation of ascending aorta differently from the bicuspid aortic valve with near normal aortic root and post-stenotic dilatation of ascending part in saccular type. They have been diagnosed by cardiac evaluation and echocardiographic examination procedure, which was newly inserted to routine periodical examination protocol.

Cardiac output raises with a positive linear relationship e.g. up to 30-40 lt/min in highly trained subjects as the intensity of the exercise increase (6). Mild and highest levels of aerobic exercise may respectively produce modest (140-160 mmHg) and highest (180-220 mmHg) rise in arterial blood pressure whereas weight training, bench press, extreme strength and etc. produces acute rises in blood pressure to over 300 mmHg (7). Extremely acute rise in blood pressure will certainly increase the susceptibility to aortic dissection or rupture in subjects with aortic aneurysm. Also repetitive increase of blood pressure during isometric exercise training in years as a result of their job may cause a deterioration of mechanical properties of aorta which will be represented by expansion of aortic root or ascending aorta as well as in our cases. Thus selection

and disqualifying of the subjects with an aortic diameter at upper limit of normal ranges, probable defective collagen tissue e.g. mitral valve prolapse, Marfanoid body habitus, bicuspid aortic valve, gain importance in order to prevent development of aortic aneurysm (8, 9). Changes in direction or velocity of aortic jet flow exert unilaterally abnormal pressure on aortic wall especially the ascending part of aorta as well as bicuspid aortic valve disease (9). Post-stenotic dilatation of aorta accompanying with bicuspid aortic valve or fibrotic rheumatic aortic valve could be demonstrative findings on echocardiographic examination.

Those patients with aortic dissection may present with chest pain varying from atypical to serious character other than related to myocardial ischemia. Vague symptoms may misleadingly be ignored and potentially lethal as well as the case of a young athlete died following a sharp chest pain and ascending aortic dissection during bench press training that was reported by Mayerick et al.(7). In previous studies it was reported that type A aortic dissection was observed in individuals that appears healthy and with ages varying 30 to 50 years especially immediately following an intense physical exertion, e.g. heavy weightlifting or high intensity non-lifting exercise (10). Imaging studies revealed that abnormally enlarged aorta ranging 4 to 5 cm was preexisted in cases of aortic dissection. Patients may be presented with complaints of chest pain, back pain, abdominal pain, hypotension, altered level of conscious, and rarely lower and upper extremity pain, etc. and also clinical scene of sudden cardiac death, myocardial infarction, syncope etc (7). Unawareness of the clinical condition such a preexisting aortic aneurysm and lack of immediate medical attention contributes the fatality of aortic dissection.

Detection of vulnerable subjects with any preexisting aortic aneurysm or an aorta with high normal diameter gains importance. Thus pre-participation screening of professional athletes for hypertrophic cardiomyopathy, arrhythmogenic right ventricular dysplasia, long QT syndrome, and etc. and disqualification of those individuals could effectively prevent any probable fatal events (11). We concluded aneurysm of aorta was one of the clinical issues that should clinically be sought due to its probable dramatic results. Individuals who are candidates or members of military profession, especially Special Forces of Army should be evaluated medically since they may be at risk for development or rupture of aortic aneurysm. Medically evaluation procedures could be performed at certain period of times such as 3 to 5 years and our patients were diagnosed during such a periodical examination performed at the tenth year of their profession. However echocardiographic examination was recently included to the periodical examination for the last few years.

Physical examination, electrocardiography, and echocardiography are the tools for a physician that evaluating for any possible cause of sudden cardiac death or any structural heart disease among athletes (2-4). In a patient who has a negative history and physical examination, echocardiographic screening is of low yield and high cost (12). However in certain professions such military, weight lifting and endurance sports, etc. appliance of echocardiographic examination may be life-

saving. Also detection of bicuspid aortic valve with slightly enlarged aorta or aorta with upper diameter of normal ranges etc. may aid the physician to guide the patients to take the measures to prevent further enlargement, rupture or dissecting of aortic aneurysm. Modifying life style, avoidance isometric exertion e.g. weight training, bench press etc. therapy for or control of hypertension, usage of beta blocker drugs if not contraindicated, disqualifying from some sports or military professions were all effective and life saving measurements which could aid not only prevent fatal complications but also progression of the disease (13). So we claim that aneurysm of aortic root or ascending aorta is a modifiable cause of sudden cardiac death among young athletes or military troops except hypertrophic cardiomyopathy, arrhythmogenic right ventricular dysplasia, Brugada syndrome, long QT syndrome, anomalous origin of coronary arteries etc. which could not be modified (14). Cigarette smoking should be also prohibited for patients with aortic aneurysm in order to lower the mortality risk since death due to aortic aneurysm was reported to be two times higher among those smokers compared to ex-smokers (15).

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