

CARDIOVASCULAR DISEASE IN THE ACTIVE MILITARY POPULATION

M. FLOREA¹, D. ZDRENGHEA²

¹Emergency Military Hospital Cluj-Napoca, ²Rehabilitation Hospital-Cardiology Cluj-Napoca

Keywords:
cardiovascular
diseases, active military
population,
cardiovascular risk
factors

Abstract: The active military population has some peculiarities regarding cardiovascular diseases, in the sense that a good cardiovascular health state is one of the basic requirements for the maintenance of the active military status. Given the peculiarities of the profession and especially the fact that this involves a multitude of risk factors and cardiovascular risk behaviors, we considered useful the evaluation of cardiovascular pathology in this professional category. The study included a number of 920 active armed forces, in whom cardiovascular diseases and cardiovascular risk factors were analyzed. The prevalence of cardiovascular diseases in the studied group was low, complaints being predominantly functional. Thus, sinus bradycardia was present in 5.65% of the military population, and sinus tachycardia had a prevalence of 4.02%. Ventricular and supraventricular extrasystolic arrhythmias, without an organic substrate, were present in 1.63% of the studied group ($p=0.46$). Intermittent Wolf-Parkinson-White syndrome was identified in an asymptomatic, young male subject. Minor right bundle branch block was detected in 5.98% of the subjects, but major right bundle branch block had a prevalence of only 0.21%. Major left bundle branch block was detected in only one male subject. The prevalence of ischemic heart disease was 1.85%, most of the subjects being asymptomatic. Hypertension was present in 14 women (26.92%) and 177 men (20.39%), i.e. 191 subjects (20.76% of the whole group). There was an association between the prevalence of hypertension and that of ischemic heart disease. In hypertensive subjects, the prevalence of ischemic heart disease was 3.14%, in subjects with "normal high" blood pressure, 1.54%, and in normotensive subjects, 1.49% ($p=0.05$). Mitral valve prolapse was clinically and echocardiographically diagnosed in 4 subjects. One case with minimal mitral insufficiency was also detected. Peripheral arterial disease had a prevalence of 0.65%, the subjects being smokers, dyslipidemic and hypertensive.

Cuvinte cheie:
patologie
cardiovasculară,
populație militară
activă, factori de risc
cardiovascular

Rezumat: Populația militară activă prezintă unele particularități în ceea ce privește patologia cardiovasculară, în sensul că o bună stare de sănătate cardiovasculară reprezintă una din condițiile de bază ale păstrării calității de militar activ, orice afecțiune cardiacă, medie sau severă fiind incompatibilă cu aceasta. Ținând cont de particularitățile profesiei și în special de faptul că ea implică o multitudine de factori de risc și de comportamente cu risc cardiovascular, am considerat utilă evaluarea patologiei cardiovasculare la această categorie profesională, prin prisma riscului cardiovascular global. S-au luat în studiu un număr de 920 de militari activi, la care s-au analizat patologia cardiovasculară și factorii de risc cardiovascular comparativ cu datele din literatură. Prevalența patologiei cardiovasculare la grupul de studiu este scăzută, acuzele fiind predominant funcționale. Astfel, bradicardia sinusală a fost prezentă la 5,65% din populația militară, iar tahicardia sinusală a avut o prevalență de 4,02%. Aritmia extrasistolică ventriculară și supraventriculară benignă, fără substrat organic a fost prezentă la 1,63% din lotul de studiu ($p=0,46$). Sindromul Wolf-Parkinson-White intermitent a fost identificat la un subiect de sex masculin, tânăr, asimptomatic. Blocul minor de ramură dreaptă a fost decelat la 5,98% dintre membrii grupului de studiu, iar blocul major de ramură dreaptă a avut o prevalență de 0,21%. Blocul major de ramură stângă a fost decelat la un singur caz de sex masculin. Prevalența cardiopatiei ischemice a fost de 1,85%, majoritatea subiecților fiind asimptomatici și cu factori de risc asociați. HTA a fost prezentă la 14 femei (26,92%) și la 177 de bărbați (20,39%), respectiv la 191 de subiecți (20,76% din întregul lot). Există o asocierie între prevalența HTA și cea a cardiopatiei ischemice. La hipertensivi prevalența cardiopatiei ischemice este de 3,14%, la cei cu TA „normal înaltă” de 1,54%, iar la normotensivi de 1,49% ($p=0,05$). Prolapsul de valvă mitrală a fost diagnosticat clinic și echocardiografic la un număr de 4 subiecți. A fost decelat și un caz de insuficiență mitrală minimă. Arteriopatia obliterantă a membrilor inferioare a avut prevalența de 0,65%, subiecții fiind fumători, dislipidemici și hipertensivi.

INTRODUCTION

A real danger of the past decades, degenerative cardiovascular diseases, particularly atherosclerotic disease, are

through their extremely high morbidity and mortality a serious problem of national health systems. Classic major cardiovascular risk factors, along with genetic and socio-

¹Corresponding Author: M. Florea, Emergency Military Hospital „Dr. Constantin Papilian” Cluj-Napoca, 22, G-ral Traian Mosoiu street, Cluj-Napoca, Romania; e-mail: mikeflorea07@yahoo.com; tel +4- (0264) - 598381

Article received on 01.03.2010 and accepted for publication on 08.03.2010

ACTA MEDICA TRANSILVANICA June 2010; 2(2)187-191

CLINICAL ASPECTS

environmental risk factors, represent the main causes of cardiovascular diseases (1). Population groups considered until recently protected to a certain extent are today severely exposed to atherosclerotic cardiovascular disease.

Because of the increased prevalence of AHT, dyslipidemia, abnormal glucose metabolism, occupational stress, heavy smoking and even a sedentary lifestyle, the active military population is currently considered at risk for atherosclerotic cardiovascular pathology. The fact that the pathology found is relatively poor is due to the following reasons: the young age of this professional category, the systematic periodical medical examinations, and the exclusion from this profession of subjects with moderate or severe pathology.

MATERIAL AND METHOD

A group of 920 active armed forces of various specialties was studied, in whom the prevalence of the main cardiovascular risk factors as well as the cardiovascular diseases found were determined. The results obtained were compared to those of the literature. Laboratory investigations were performed in the Military Hospital Cluj. The diagnosis of the cardiovascular disorders was established based on the correlation of clinical examination and previous medical documents with the laboratory investigations adapted to the type of pathology found (ECG, ambulatory Holter electrocardiographic monitoring, exercise stress test, echocardiography, coronarography, peripheral arteriography).

RESULTS

The types of cardiovascular diseases found, as well as their distribution in relation to the whole study group and depending on sex, are shown in Table 1.

Table no. 1. The prevalence of cardiovascular diseases in the active military population in relation to gender

Disease	Whole group	Men	Women	
Arterial hypertension	20,76%	20,39%	26,92%	
Upper normal limit of blood pressure	28,26%	28,92%	17,31%	
Arrhythmias	Sinus bradycardia	5,65%	5,76%	3,85%
	Sinus tachycardia	4,02%	3,80%	7,69%
	Extrasystolic arrhythmia	1,63%	1,5%	3,85%
	Minor RBB	5,98%	5,99%	5,76%
	Major RBB	0,21%	0,23%	–
	Major LBB	0,10%	0,11%	–
	WPW syndrome	0,10%	0,11%	–
	Early repolarization	3,91%	4,03%	1,92%
Ischemic heart disease	1,85%	1,72%	3,84%	
Mitral valve prolapse	0,43%	0,23%	3,84%	
Mitral insufficiency	0,10%	–	1,92%	
Obstructive artery disease of the lower limbs	0,65%	0,57%	1,92%	

The prevalence of cardiovascular pathology in the study group was generally low, functional adaptive disorders being dominant. However, some pathological aspects were found, as follows:

The prevalence of arterial hypertension in the military population was 20.76%, a high prevalence for this age and professional group. The following peculiarities should be noted:

- The higher prevalence of hypertension in the female group (26.92% of women).
- The presence of a representative group of subjects ranging

within the “normal high” blood pressure category. The 260 subjects (28.26% of the whole group), of which 9 women (17.31%) and 251 men (28.92%) are included here.

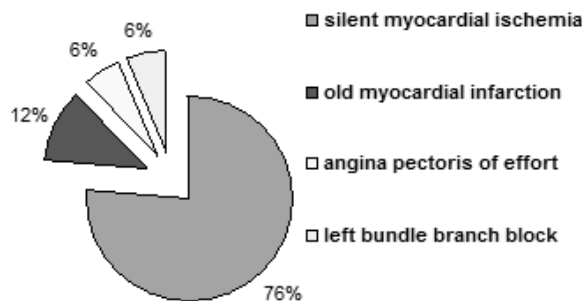
- The prevalence of high blood pressure values starts at young ages, with a subsequent increase proportional to the age group.

Arrhythmias were the following:

- **Sinus bradycardia** was present in a proportion of 5.65%, representing 52 subjects, of which 2 females (3.85%) and 50 males (5.76%).
- **Sinus tachycardia** was registered in 4.02% of all cases, representing 37 subjects.
- **The prevalence of extrasystolic arrhythmia** was 1.63%, which represents 15 subjects, of which 2 women (3.85% of the female group) and 13 men (1.5% of the male group). Of the 15 cases of extrasystolic arrhythmia, 6 subjects had **supraventricular extrasystolic arrhythmia** (40%), and 9 subjects (60%) had **ventricular extrasystolic arrhythmia**.
- **Minor right bundle branch block** was detected in 5.98% of the studied subjects, who were asymptomatic, without cardiovascular disease, but smokers in a proportion of 60%, and **major right bundle branch block** had a prevalence of 0.21%, being asymptomatic.
- **Major left bundle branch block** was found in a smoking, dyslipidemic, obese man with “high normal” blood pressure, revealing an ischemic substrate.
- **Intermittent Wolf-Parkinson-White syndrome** was identified in an asymptomatic male patient.
- **Early repolarization**, an aspect generally considered physiological, was present in 3.91% of the subjects of the group (35 men aged between 20 and 39 years, i.e. 4.03% of the male group, and one woman, i.e. 1.92% of the female group).

The prevalence of ischemic heart disease was 1.85%, the majority of the subjects being asymptomatic, with associated risk factors. As shown in Figure 1, the forms of ischemic heart disease found in the military group were the following: old myocardial infarction (12% of cases with ischemic heart disease), stable effort angina pectoris (6% of cases), major left bundle branch block (6% of cases) and silent ischemia, which represents most of the cases of ischemic heart disease found, i.e. 76% (13 subjects).

Figure no. 1. The types of ischemic heart disease in our study group



The valvular disorders present in the study group were the following:

- **Mitral valve prolapse**, present in 0.43% of the group, of which 2 asymptomatic men and two women.
- **One case of minimal mitral insufficiency** (first ultrasonographic degree) in a young woman who also had mitral valve prolapse.

Peripheral arterial disease was present in 0.65% (6

subjects) of the study group, the stages of the disorder being I and IIA Fontaine.

DISCUSSION

The high prevalence of major cardiovascular risk factors in the active military population, correlated with a type of activity in which the degree of stress is extremely high, associated with intense physical exercise, frequently changing climate and time zone conditions, the sense of imminent danger, sleep deprivation and a frequently unbalanced diet, causes an increased risk for cardiovascular diseases in this population group.

Certain pathological peculiarities in the armed forces are interpretable, depending on the clinical context and the degree of effort required.

Minor functionally compensated valvulopathies occurring in young people should be assessed in a clinical and echocardiographic context, with the subsequent making of the medico-military decision.

Osswald S.S. et al. published in 2007 a study on mitral valve prolapse in American military pilots and found that, although this disorder generally requires to stop flying, the decision is depending on each individual case. 404 military pilots aged between 21 and 64 years were evaluated over a mean period of 8.6 years. They underwent echocardiography, ECG Holter monitoring, myocardial scintigraphy, chest X-Ray. Throughout the monitoring period, 0.32% sudden cardiac events (sudden death, syncope, presyncope, transient cerebral attack) were recorded per year. The authors conclude that mitral valve prolapse is associated with rare but statistically significant aeromedical incapacity events. The predictive elements for the occurrence of adverse cardiac events were: left ventricular hypertrophy, left atrial hypertrophy, clinical cardiovascular symptoms and signs, significantly thickened mitral valves. The direct evaluation of coronary arteries was not indicated in any case (2).

In 1995, Gray G.W. et al. published a study on a group of young Canadian military pilots (1476 subjects), as well as young aspirants to this profession, and based on 2D and Doppler echocardiography, they concluded that 7.8% of these were medically unfit for this profession, the most frequent disorder being mitral valve prolapse with a prevalence of 4.8% (3).

Landau D.A. et al. performed in Israel in 2008 a study on candidates to the military pilot profession aged between 18 and 20 years, and they clinically, electrocardiographically and echocardiographically detected 18% mitral valve lesions, the majority of which being minor mitral insufficiencies, of which only 0.5% were declared incompatible with the military pilot profession (4). In the subjects of the study group, we found 4 cases (0.43%) with mitral valve prolapse and one case of minimal mitral insufficiency. The literature shows the importance of echocardiographic examination for the detection and evaluation of cardiac diseases other than valvulopathies.

Thus, in 2001, Saary M.J. et al. found in a group of Canadian armed forces that 25% of these had patent foramen ovale, without indicating a prevalence of complications. The authors insist on the need for systematic monitoring of carriers of this abnormality, particularly due to the possibility of appearance of two types of complications. The first of them would be the predisposition to type II decompression sickness in diving and altitude exposure, both under hypobaric and hyperbaric conditions, due to the possibility of the passage of gas emboli through the intermittent right-to-left shunt that may occur. Another possible complication is "cryptogenic" stroke in young persons (5).

In 2006, Rasmussen F. et al. performed in Sweden a

longitudinal study on risk factors for obesity and cardiovascular diseases in young male twins, part of which were armed forces and part of which belonged to the civilian population. The study was carried out in 1783 pairs of twins, born between 1973 and 1979. Similarities between body size, blood pressure values, birth weight, the genetic and environmental contribution to diet behavior, physical activity and the relationship between diet and the pattern of physical and mental activity were identified (6).

Finnegan T.P. et al. compared in 1988 the major causes of death in British armed forces and a civilian population matched for age. As expected, traumatic lesions were the most frequently found, followed by cardiovascular disorders whose incidence was 13%, which was similar to the situation found in the civilians, the value of SMR (Standardized Mortality Ratio) being 92 both for the armed forces and the civilian population (7). Hoiberg A. et al. published in USA in 1986 a longitudinal study on cardiovascular disease in American marine pilots. The follow-up period was between 1972 and 1979, during which one death, one recurrent myocardial infarction and 32 hospitalizations or military discharges for cardiovascular diseases were recorded. It should be mentioned that the majority of secondary cardiac events occurred within 12 months after the acute event (8).

Similarly to the armed forces of other states, a relatively low prevalence of cardiovascular diseases was found in our study, functional pathology being dominant, but without the exclusion of severe pathology, even if this had a low prevalence. Thus, among rhythm disorders, we detected a prevalence of 5.65% for sinus bradycardia, 4.02% for sinus tachycardia, and 1.63% for benign supraventricular and ventricular extrasystolic arrhythmia. No organic lesions were found in any of the 3 conditions.

Conduction disorders were represented by minor right bundle branch block with a prevalence of 5.98%, occurring in asymptomatic subjects of which 60% were smokers, 2 cases of major right bundle branch block, and one case of major left bundle branch block.

Johnson C.C. et al. demonstrated in 1993 that life style was the main determining factor of cardiovascular health in the American military personnel (9).

For the representatives of the military group, we found a prevalence of 1.85% of ischemic heart disease (old myocardial infarction, exertional angina pectoris, major right bundle branch block and silent myocardial ischemia).

In the study group, the prevalence of arterial hypertension was 20.76%.

A comparative study performed in 2006 by Biggeri A. et al. in a representative group of military and civilian population found a significantly higher prevalence of cardiovascular and pulmonary diseases in Sardinia compared to the rest of Italy and explained this phenomenon by the much more increased air pollution index in Sardinia (10).

In 2001, Neath A.T. et al. compared morbidity in Australian Defence Forces to that of the general population, reaching the conclusion that the military population had a much higher prevalence of cardiovascular disease (11).

In 2005, Sakuta H. published a study on the differentiation of atherosclerotic risk depending on the military rank in the Japanese army, and concluded that smoking, stress, alcohol use and type 2 diabetes mellitus were more frequent in lower military ranks (12).

Abo-Zenah H. et al. showed in 2008 that the presence of microalbuminuria in young Saudi soldiers was associated with type 2 diabetes mellitus, hypertension, obesity, male sex and hypercholesterolemia (13).

In 2003, He Y. et al. demonstrated in a group of

Chinese armed forces aged over 55 years that systolic blood pressure, BMI, a personal history of coronary disease and hyperlipidemia were independent risk factors for the incidence of vascular accidents and general mortality. However, the incidence of stroke and mortality were lower than in the general population matched for age, and the monitoring of BMI and blood pressure are important factors for the prevention of stroke in the elderly (14).

In 2001, Parker P.E. et al. published the results of a study on morbidity in American military pilots, concluding that in 25% of the cases, cardiovascular disorders determined the temporary or the permanent exclusion of pilots from flying (15).

Regarding thromboembolic diseases, Viera A.J. et al. show in a study published in USA in 1997 that young armed forces have a risk for Paget-Schroetter syndrome (primary deep vein thrombosis of the upper extremities), a disorder affecting active young healthy people, and emphasize the fact that the therapeutic approach of the disease is multiple (16).

Kark M. et al. performed in 2007 a study on a group of Swedish military and former military personnel, with moderately increased blood pressure values since a young age, and concluded that hypertensive subjects had significantly more extensive lesions of the target organs compared to non-hypertensive subjects, the difference being statistically significant (17).

In 2004, Amital H. et al. demonstrated that sudden death occurring in young Israeli armed forces had in 47% of cases cardiac causes of dysrhythmic origin. Of these, only 34% were preceded by predictive symptoms (syncope, palpitations, chest pain) (18).

Gray J. et al. published in 1987 an article on mortality from ischemic heart disease in British armed forces. Military men aged less than 55 years were studied, the follow-up period being 1973-1984. During the study period, a decrease in cardiovascular mortality was found in the army. However, among the armed forces, mortality from ischemic heart disease was reported particularly in the officers, being higher than in other military categories, but lower than in the civilian population. An interesting element is the fact that the highest mortality risk in the armed forces was found in young age groups, i.e. between 25-39 years. The authors conclude that the differences in mortality from ischemic heart disease between officers and other military categories, as well as between armed forces and civilians, can be explained by the different social conditions and the degree of social responsibility, which is certainly higher in officers (19).

In our study, the prevalence of peripheral arterial disease was 0.65% in the military group, being largely related to the higher incidence of smoking and dyslipidemia in the military population.

Over the past years, an increasing tendency of cardiovascular risk factors and ischemic coronary disease has been described in both the general population and the active military population. This is supported by the conclusions of the American authors McGraw LK, Turner BS et al., who in August 2008 showed that the same trend of increase in the prevalence of major cardiovascular risk factors and ischemic coronary disease was present at young ages in both the civilians and the armed forces, with a higher degree of stress in the latter (20). In 2007, Grosz A. also performed a study in a group of young Hungarian military pilots, finding a variety of risk factors and cardiovascular diseases. Thus, 25% of the subjects had a family history of cardiovascular disease, 40.8% were obese, 31.7% were smokers, 23.9% reported to be sedentary, 14.7% hypertensive, 53.9% had hypercholesterolemia, and 1.3% had pathological ECG abnormalities (21).

Engstrom G. et al. demonstrated in May 2009, in a group of Swedish military and civilian population, the presence of a relationship between leukocytosis and the incidence of hospitalizations for heart failure, in middle aged men. The authors monitored for 23 years a representative group of men with a mean age of 44 years, without a history of myocardial infarction or stroke, and statistically demonstrated that there was a direct correlation between the greater number of leukocytes and the long-term increase of hospitalizations for heart failure (22). Another study conducted by Engstrom G. and co-workers in Sweden in February 2009, in a group of military and civilian population, demonstrates a statistically significant correlation between the high levels of some plasma markers of inflammation (fibrinogen, ceruloplasmin, haptoglobin, orosomucoid, and alpha-1-antitrypsin) and the increased long-term incidence of hospitalizations for heart failure in middle aged men (23).

CONCLUSIONS

1. Cardiovascular pathology in the active military population is generally low, functional disorders being dominant.
2. Organic disorders have a low prevalence, but include all the spectrum of cardiovascular diseases and occur at a younger age than in general population.
3. Hypertension and particularly "normal high" BP has a high prevalence in active armed forces.
4. The prevalence of ischemic heart disease and peripheral arterial disease of limbs is low, but not negligible, and may determine the professional reorientation of the subjects concerned.
5. The prevalence of arrhythmias is relatively high, requiring accurate diagnostic evaluation, for the determination of arrhythmogenic and occupational risk of the subjects.
6. The active military population has an increased cardiovascular risk, due to the presence of specific risk factors that can result in the early onset of cardiovascular diseases.

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