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Electrocardiographic changes in ex-prisoners of war released from detention camps

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Abstract The aim of the study was to determine whether and to what extent changes in the electrocardiograms occurred in released prisoners of war (POWs) from Serbian detention camps and whether the frequency of occurrence differed from similar changes in a control group. An electrocardiogram was recorded and medical examinations conducted on 182 randomly selected ex-POWs. The subjects were male with a mean age of 35.8 ± 11.0 years, age range 18–65 years and the average length of imprisonment 164.5 ± 87.1 days. The electrocardiograms were analysed according to the Minnesota code. The following changes were frequently found: postinfarction Q-wave in 3.3%, control 1.1% (not significant), ST-segment depression horizontal or descendent in 14.3% (controls 3.8%, $P < 0.01$), particularly S-T segment depression of up to 0.5 mm in 12.1% (controls 2.2%, ($P < 0.01$), total negative T-wave in 7.1% (control group 3.3%, not significant), total arrhythmia 18.1% (controls 7.1%, $P < 0.01$), particularly ventricular premature beats in 2.2% (controls 0.5%, not significant), incomplete left bundle-branch block 2.2% (not registered in the control group), complete left bundle-branch block in 0.5% (not registered in the control group), sinus tachycardia in 12.1% (controls 6.6%, not significant), sinus bradycardia 3.3% (not registered in the control group) and microvoltage QRS complex in 11.5% (controls 0.5%, $P < 0.001$). The results of this study confirm that changes in the

electrocardiograms of the POWs released from Serbian detention camps were far more frequent than in the controls.

Key words Prisoners of war · Detention camps · Electrocardiogram

Introduction

The United Nations declaration on the protection of persons from being subjected to torture or degrading treatment offers the definition:

“1. For the purpose of this Declaration, torture means any act by which severe pain or suffering, whether physical or mental, is intentionally inflicted by or at the instigation of a public official on a person for such purposes as obtaining from him or a third person information or confession, punishing him for an act he has committed or is suspected of having committed, or intimidating him or other persons. It does not include pain or suffering arising only from – inherent in or incidental to – lawful sanctions to the extent consistent with the Standard Minimum Rules for the Treatment of Prisoners.

2. Torture constitutes an aggravated and deliberate form of cruel, inhuman or degrading treatment or punishment.”

During aggression on Croatia, the prisoners of war held in Serbian detention camps were subjected to mental and physical maltreatment, including hunger, extreme cold, lack of medication, beatings, forced to shower in cold water with environmental temperatures below zero and many other forms of maltreatment (Begovac et al. 1993; Beus 1993; Borčić et al. 1992; Duraković and Marinković 1993; Lončar 1993; Kozarić-Kovačić et al. 1993; Novotny 1992; Pavlović et al. 1993 a; Pavlović et al. 1993 b; Solar 1993 a; Solar 1993 b; Zavalic et al. 1993). The aim of the study was to investigate whether and to what extent changes occurred in the electrocardiograms of ex-prisoners of war (POWs) who had not had subjective disorders prior to imprisonment and maltreatment and to compare the results with electrocardiograms taken from a random sample of the gen-

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eral Croatian population (Čorović and Duraković 1997; Čorović et al. 1996).

Subjects and methods

From October 1991 to September 1992 medical examinations were carried out on 1458 ex-POWs comprising 1450 males and 8 females, immediately upon their release from Serbian detention camps in order to determine their health status. The majority of the ex-POWs had been captured in Eastern Slavonia (67%) and the average length of imprisonment was 154.2 days (range 12–474 days) in various camps (Manjača, Stajičevo, Begejci, Sremska Mitrovica, Stara Gradiška and others). The mean age was 32.8 years and the range 7–72 years (Begovac et al. 1993).

The medical examinations were organized in the University Hospital for Infectious Diseases “Dr. Fran Mihaljević” in Zagreb. The evaluation of the health status was carried out by a team of specialists in infectious diseases, psychiatrists, surgeons-traumatologists, psychologists, and specialists in occupational health. When necessary, other specialists were consulted, partic-

ularly neurologists, specialists in internal medicine and physiatrist.

The analyses presented here were carried out in the Department for Occupational Health, Institute for Medical Research and Occupational Health in Zagreb on a subgroup of 182 male ex-POWs, within 2 weeks of release. The subgroup (13%) was chosen at random from the total group and the mean age was 35.8 ± 11.0 years (range 18–65) and the average length of imprisonment 164.5 ± 87.1 days (range 22–333). During the imprisonment they had been subjected to various mental and physical maltreatment, malnutrition, hunger, cold, and unhygienic living conditions (Begovac et al. 1993; Lončar 1993; Novotny 1992; Solar 1993a; Solar 1993b). The control group was taken from a sample of the general population within the programme “Prevalence of Chronic Diseases in the Population of Croatia” undertaken during the period 1969–1982. The controls were pair-matched to the ex-POWs with regard to age, gender, region of residence and the season at the time of examination. After resting for 10 min in a lying position electrocardiograms were recorded on a three-channel apparatus (Siemens) with 12 leads, i.e. 3 standard leads (D1, D2, D3), 3 unipolar extremity leads (aVR, aVL, aVF), and 6 precordial leads (V_{1-6}), with a track speed of 25 mm/s. The electrocardiograms were analysed accord-

Table 1 Changes in the electrocardiogram of male ex-POWs from detention camps

Electrocardiogram		Ex-POWs age 35.8 ± 11.0 years $n = 182$		Control group age 35.9 ± 10.8 years $n = 182$		Statistical significance of the difference
Minnesota Symptom code		No.	%	No.	%	
1.1–1.3	Q-wave infarction	6	3.3	2	1.1	NS
2.1	Pathological left axis deviation	7	3.8	6	3.3	NS
2.2	Pathological right axis deviation	1	0.5	2	1.1	NS
3.1	High R-wave “left”	2	1.1	5	2.7	NS
3.2	High R-wave “right”	1	0.5	0	–	NS
4.1	ST-segment depression ≥ 1 mm	2	1.1	2	1.1	NS
4.2	horizontal or $0.5\text{--}0.9$ mm	2	1.1	1	0.5	NS
4.3	descendent < 0.5 mm	22	12.1	4	2.2	$P < 0.001$
4.4	ST-segment depression ascendent ≥ 1 mm	3	1.6	1	0.5	NS
Total 4.1–4.3		26	14.3	7	3.8	$P < 0.01$
5.1	T-wave inversion ≥ 5 mm	0	–	0	–	–
5.2	T-wave inversion 1–5 mm	3	1.6	3	1.6	NS
5.3	T-wave inversion 0–0.9 mm	9	4.9	3	1.6	NS
5.4	T/R ratio $< 1/20$	1	0.5	0	–	NS
Total 5.1–5.4		13	7.1	6	3.3	NS
6.5	Short PQ interval	6	3.3	1	0.5	NS
7.1	Complete left bundle branch block	1	0.5	0	–	NS
7.2	Complete right bundle branch block	0	–	1	0.5	NS
7.3	Incomplete right bundle branch block	1	0.5	6	3.3	NS
7.4	Intraventricular block	0	–	1	0.5	NS
7.5	$R_1 < R$ in V_1/V_2	7	3.8	7	3.8	NS
7.6	Incomplete left bundle branch block	4	2.2	0	–	NS
8.1	Ventricular premature beats	4	2.2	1	0.5	NS
8.7	Sinus tachycardia $> 100/\text{min}$	22	12.1	12	6.6	NS
8.8	Sinus bradycardia $< 50/\text{min}$	6	3.3	0	–	NS
8.9	Any other arrhythmias	1	0.5	0	–	NS
Total 8.1, 8.7, 8.8, 8.9		33	18.1	13	7.1	$P < 0.01$
9.1	Microvoltage of QRS complex	21	11.5	1	0.5	$P < 0.001$
9.2	ST-segment elevation	1	0.5	5	2.7	NS
9.5	High T-wave	4	2.2	8	4.4	NS

ing to the standardised criteria of the Minnesota code (Rose and Blackburn 1968) by two independent specialists in internal medicine. Their findings agreed in 95.5% of the cases and in cases of non-agreement a third specialist in internal medicine was consulted. The statistical significance of the differences between the two groups was assessed using the Poisson's test (Morton and Habel 1980).

Results

Table 1 shows the following changes in the electrocardiograms of ex-POWs in relation to the control group:

1. Q-wave infarction was detected in 3.3% of the ex-POWs, compared to only 1.1% in subjects in the control group but was statistically not significant (NS).
2. The total ST-segment depression of the horizontal or descending type was registered in 14.3% of the ex-POWs and in 3.8% controls. The difference was statistically significant ($P < 0.01$).
3. All T-wave inversions were more frequent in the ex-POWs than in the control group (7.1% vs 3.3%, NS).
4. The same was the case with arrhythmias: 18.1% and 7.1% for ex-POWs and controls respectively ($P < 0.01$). The most frequently registered arrhythmia was the sinus tachycardia, but the difference was not statistically significant. Ventricular premature beats occurred in 2.2% of the ex-POWs compared to 0.5% of subjects in the control group (NS).
5. Complete left bundle branch block occurred in 0.5% and incomplete left bundle branch block in 2.2% of the ex-POWs. No such changes were found in the electrocardiogram of the control subjects.
6. The increase in QRS microvoltage in ex-POWs was also statistically significant (11.5%, against 0.5% in the controls; $P < 0.001$).

Discussion

Numerous pathological changes were found in the ex-POWs such as posttraumatic stress disorder (De Zan 1993; Kozarić-Kovačić et al. 1993; The Centers for Disease Control Vietnam Veterans 1988), loss of body mass (Pavlović et al. 1993b) due to malnutrition, and physical maltreatment such as injuries to the soft tissue and bones, including the skull, spine, and pelvis (Begovac et al. 1993). Mental and physical maltreatment are presently the subject of several ongoing investigations and documents (Bobić et al. 1997; Cohen et al. 1997; Jacobsen and Vesti 1992; Pavlović et al. 1993b; Rasmussen 1990; Vrca 1996). This study was carried out within the framework of a multidisciplinary

study of the health status of Croatian ex-POWs released from Serbian detention camps, who had been captured during the war in the region of the Eastern Slavonia.

The electrocardiogram of ex-POWs showed an increase in signs of coronary disease, postinfarction Q-wave was found in 3.3%, which was more than 3 times the incidence in the control group. However, this occurred quite infrequently and was not significant. Furthermore, changes were found with regard to ST-segment depression in 14.3% ex-POWs, which was 4 times the control value and is characteristic of myocardial ischemia or injury. We have been unable to confirm any of the extracardial diseases for ST-segment depression by the clinical examination. Arrhythmias occurred in 18.1% of the ex-POWs, which was 2.5 times the control value.

The Minnesota code criteria for the microvoltage of the QRS complex were as follow: QRS complex wave less than 5 mm in each of the standard leads, or less than 10 mm in each of the precordial leads (V_1 – V_6), when not registered in other codes. Microvoltage of the QRS complex can be seen in diffuse coronary disease, cardiac failure (excluded), pericardial effusion (excluded), myxoedema (excluded), primary amyloidosis, emphysema (excluded), generalized oedema (excluded), obesity (excluded) and widespread myocardial damage. The occurrence of microvoltage QRS complex was 20 times higher in the ex-POWs, than in the control group. In another study on the health status of physically maltreated persons (Rasmussen 1990), 41% (out of 200) complained of cardiac or respiratory disorders, the majority of whom had previously been beaten on the chest but in this series many of these diseases could be excluded. Microvoltage of the QRS complex is still an open problem in these patients the question being if the coronary heart disease was due to conditions in the camps. As we were not able to find similar data on electrocardiogram analyses in ex-POWs, we were unable to make a comparison.

The results of this study suggest that particular attention should be paid to the cardiovascular status in ex-POWs. We believe that clinical electrocardiographic examinations should be included in the overall assessment of the health status of tortured individuals.

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