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The unexpected relationship between electrocardiogram and neurological diseases

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Abstract

The relationship between Neurology and Cardiology, as well as Neurocardiology Term is, nowadays, more often promoted. The purpose of this paper was to find an objective connection between these two fields of Medicine. Between January 2015 and April 2015, we hospitalized in the Neurology Department 416 patients. We have considered the demographic data, the neurological diagnosis and paraclinic data (minimum two ECGs, one of the moment of admission and the other later). We studied 416 patients, 213 males and 203 females (51,2 % vs 48,8%). We divided the two groups into other ten groups according to the pathology. The mean group was the Acute Stroke Group (111 males vs. 109 females; 52,13 % vs. 53,69 %). For each group we analyzed the Electrocardiograms. In the males group the *Acute Stroke* is associated with tachycardia, atrial fibrillation, left axis deviation, flattened T waves, amputated R waves, left ventricle hypertrophy; *Chronic Stroke* (37 males; 17,37 %) with tachycardia, intermediate axis, flattened T waves, amputated R waves, left ventricle hypertrophy; *Intracerebral Acute Hemorrhages* (18 males; 8,45 %) with tachycardia, horizontal axis, negative T waves, left ventricle hypertrophy, extrasistolia; *TIA* (16 males; 7,51 %) with left axis deviation, flattened T waves, amputated R waves, left anterior hemiblock; %) with tachycardia, left axis deviation, flattened T waves. The differences in the females group are: the *Acute Stroke* is associated with horizontal axis; *Chronic Stroke* (31 females; 15,27%) with horizontal axis; *Dementia* (22 females; 10,84 %) with tachycardia, left axis deviation; *TIA Dementia* (12 males; 5,63 %) with bradycardia, horizontal axis, flattened T waves, amputated R waves; *Epilepsy* (9 males; 4,22 %) with intermediate axis, negative T waves; *Parkinson Disease* (6 males; 2,81 %) with flattened T waves;Conclusions: Neurology is strong connected with Cardiology. There are some differences between males and females, but Electrocardiogram shows in cases rhythmus, axis, T and R waves abnormalities and left ventricle hypertrophy.

Keywords: Electrocardiogram, left ventricle hypertrophy, neurology, T waves.

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1. Introduction

The relationship between Neurology and Cardiology, as well as Neurocardiology Term is, nowadays, more often promoted.

Neurocardiology is the study of the neurophysiological, neurological and neuroanatomical aspects of Cardiology (Natelson, 1985). The effects of stress on the heart are studied in terms of the heart's interactions with both the peripheral nervous system and the central nervous system.

The complicated link between the brain and the heart can be mapped out from the complex of higher nervous system influences descending down to the heart. This complex innervates key autonomic structures from the brain's cortex to the heart along the neurocardiac axis. The heart is both the source of life and a source of cardiac arrhythmias and complications.

The information originates in the brain's cortex and descends down to the hypothalamus. The neural signals are then transferred to the brainstem, followed by the spinal cord, which is the location where the heart receives all its signals from. In further detail, the heart receives its neural input through parasympathetic and sympathetic ganglia and intermediolateral gray column of the spinal cord (Davis,1993). The neurocardiac axis links the cardiovascular and nervous systems to physiological problems such as; arrhythmias, epilepsy, and stroke.

Clinical issues in neurocardiology include hypoxic-ischemic brain injury, neurogenic stress cardiomyopathy, cerebral embolism, encephalopathy, neurologic sequelae of cardiac surgery and cardiac interventions, and cardiovascular findings in patients with primary neurological disease (Caplan, Hurst & Chimowitz, 1999).

The purpose of this paper was to find an objective connection between these two fields of Medicine. So an Electrocardiogram, a usual and a simple method of investigation, performed in all neurological patients, can offer important information regarding the correlation between cardiac and neurological disorders. Discovered 150 years ago, electrocardiogram remained a very useful method of investigation. Nowadays, it can be performed at the patient's bed with complex equipment.

2. Methods

Between January 2015 and April 2015, we hospitalized in the Neurology Department 416 patients. We have considered the demographic data, the neurological diagnosis (cerebral CT and MRI) and paraclinic data (minimum two ECGs, one of the moment of admission and the other later).

The ECGs were performed with a Nihon Kohden Japony Electrocardiograph.

3. Results

We studied 416 patients, 213 males and 203 females (51,2 % vs. 48,8%). We divided the two groups into other ten groups (A to J) according to the pathology for each group we analyzed the Electrocardiograms.

A. The mean group was the Acute Stroke Group (111 males vs. 109 females; 53,69 % vs. 52,13 %)

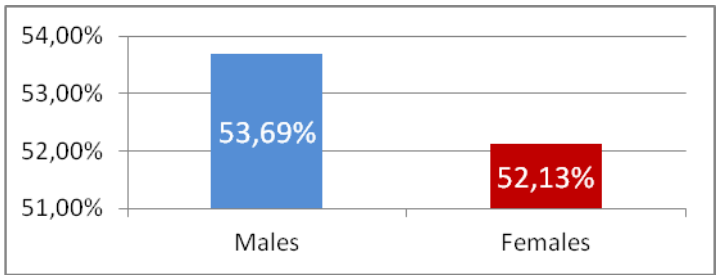

Figure 1. Acute Stroke Group Distribution

In the males group the *Acute Stroke* is associated with tachycardia, atrial fibrillation, left axis deviation, flattened T waves, amputated R waves, left ventricle hypertrophy.

In the females group there is only one difference: horizontal axis.

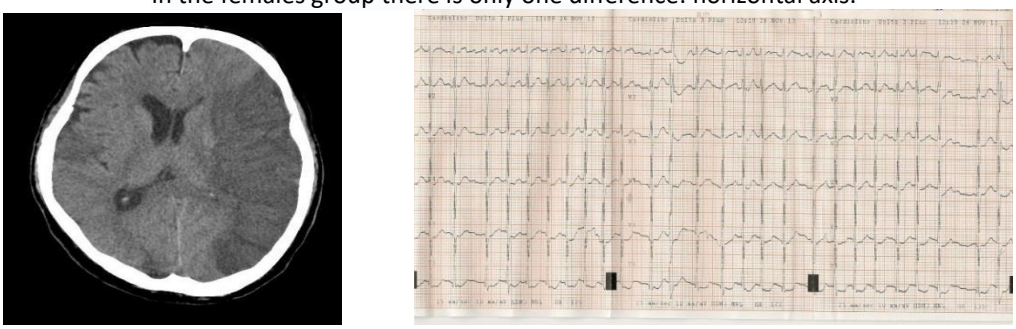

Figure 2. Acute Stroke and ECG

B. The *Chronic Stroke* Group consists of 37 males vs. 31 females; 17,37 % vs. 15,27 %. (Figure 3)

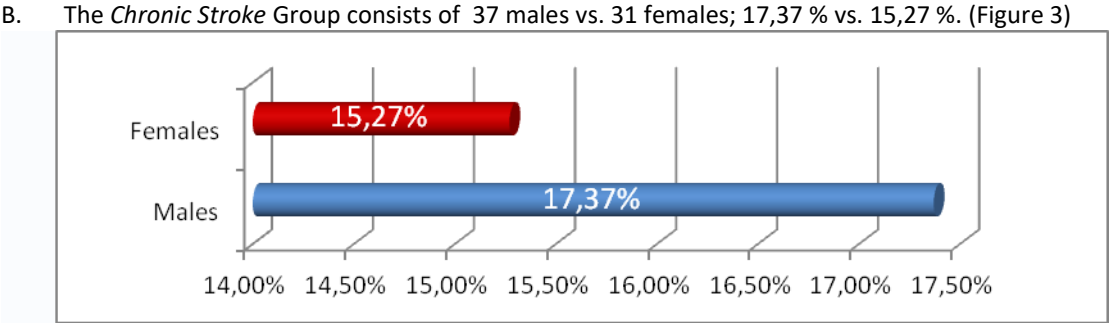

Figure 3. Chronic Stroke Group distribution

The males group is associated with tachycardia, intermediate axis, flattened T waves, amputated R waves, left ventricle hypertrophy.

In the females group there is only one difference: Horizontal axis.

Figure 4. Chronic Stroke and ECG

C. *Intracerebral Acute Hemorrhages* Group consists of 18 males vs. 10 females; 8,45 % vs. 4,93 %.

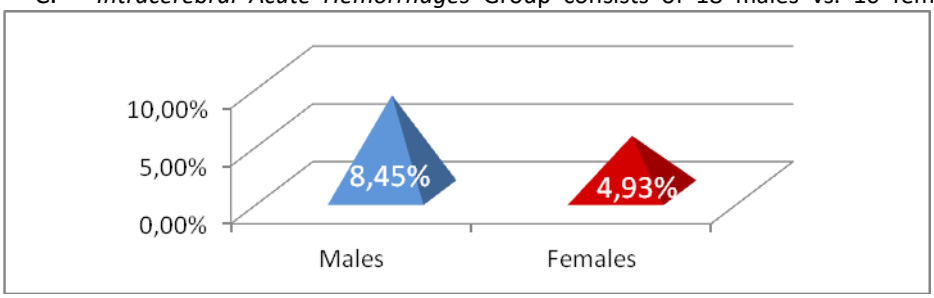

Figure 5. Intracerebral Acute Hemorrhages Group Distribution

The males group is associated with tachycardia, horizontal axis, negative T waves, left ventricle hypertrophy, extrasistolia.

The females group is associated with atrial fibrillation, left axis deviation.

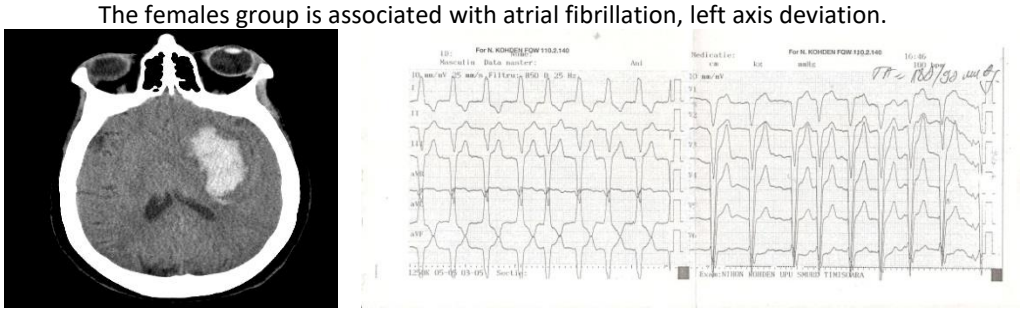

Figure 6. Intracerebral Acute Hemorrhage and ECG

D. *Transient ischemic attack (TIA)* Group consists of 16 males vs. 12 females; 7,51 % vs. 5,91 %.

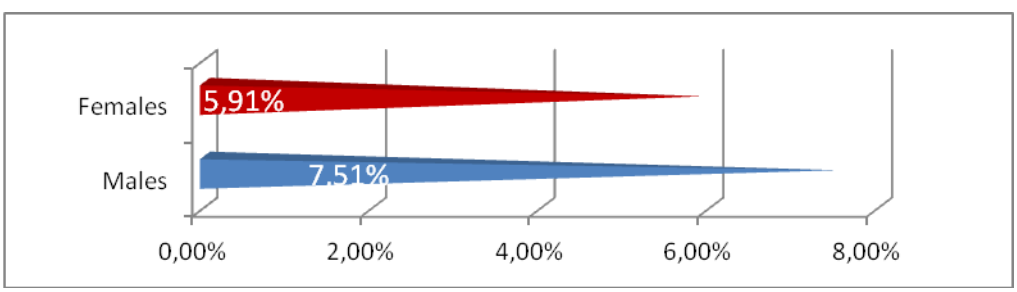

Figure 7. TIA Group Distribution

The males group is associated with left axis deviation, flattened T waves, amputated R waves, left anterior hemiblock.

The females group is associated with tachycardia, horizontal axis, negative T waves.

E. *Dementia* Group consists of 12 males vs. 22 females; 5,63 % vs. 10,84 %.

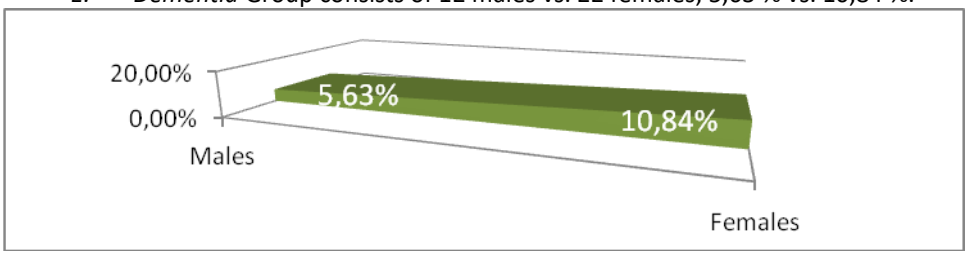

Figure 8. Dementia Group Distribution

The males group is associated with bradycardia, horizontal axis, flattened T waves, amputated R waves.

The females group is associated with tachycardia, left axis deviation.

F. *Epilepsy* Group consists of 9 males vs. 6 females; 4,22 % vs. 2,95 %.

The males group is associated with intermediate axis, negative T waves.

In the females group there is only one difference*:* horizontal axis.

G. *Parkinson Disease* Group consists of 6 males vs. 7 females; 2,81 % vs. 3,45 %.

The males group is associated with flattened T waves.

The females group is associated with left axis deviation.

H. *Hypertensive Encephalopathy* Group consists of 3 males vs. 5 females; 1,41 % vs. 2,47 %.

The males group is associated with T waves abnormalities and left ventricle hypertrophy.

The females group is associated with left axis deviation and flattened T waves.

I. *Gravis Miastenia* Group consists of 1 male; 0,47 % with tachycardia, left axis deviation, flattened T waves.

J. *Multiple Sclerosis* Group consists of 1 female; 0,49 % with vertical axis, peaked T waves, short PR segment.

4. Discussions

For the optimal patient management a close cooperation between neurologists and cardiologists is necessary. Thus, a new future medical subspecialization may emerge: neurocardiology or cardioneurology (Widimsky & Stetkarova, 2015).

Neurocardiology refers to the pathophysiological interplays of the nervous and cardiovascular systems (Van der Wall & Van Gilst, 2012). It is an emerging field in medicine over the last decade. The constant communication between the heart and the brain has proved invaluable to interdisciplinary fields of neurological and cardiac diseases (Carrero, 2011).

The fundamental understanding of the communication between the heart and the brain via the nervous system has led scientists into understanding its elaborate circuitry (Madurasinghe, 2013). The brain emits neurological signals of oscillating frequencies. The neural rhythms provide information on steady state conditions of healthy individuals. Variations in the neural rhythms provide evidence that a problem is present regarding physiologic regulation and help physicians determine the underlying condition quicker based on the given symptoms (Fallen, 2000).

5. Conclusions

Neurology is strong connected with Cardiology. There are some differences between males and females, but Electrocardiogram shows in cases rhythmus, axis, T and R waves abnormalities and left ventricle hypertrophy. Cerebrovascular dysfunction leads to electrocardiographic disorders and cardiac rhythm disturbances.

Based on the result that no neurological patient with a normal Electrocardiogram was found, we can conclude that all neurological diseases are associated with cardiac disorders.

The literature in the field of neurocardiology has accrued tremendously over the last decade, and the area has been considered a fertile ground for a collaborative effort in both clinical studies and basic research.

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