

Circulatory system and neurosciences. Some perspectives in diagnosis and treatment

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Keywords: Hypoxia inducible factor

- Radial artery occlusion

- Fatigue - Vital exhaustion

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Received:

1 February 2019

Accepted:

1 March 2019

Abstract

This paper aims to describe how radial artery obstruction can support blood circulation in an ischemic area. A dramatic case is described. Furthermore aims to describe that fatigue, atherosclerosis and toxic substances like in alcoholism may reduce blood flow and energy supply in the cortex and other brain areas and thus unconsciously modify our usual civilized behavior. Intense mental and physical fatigue was described as: "vital exhaustion".

Hell J Nucl Med 2019; 22(1): 10-13

Epub ahead of print: 7 March 2019

Published online: 5 April 2019

Introduction

Diagnosis and treatment of heart and brain diseases are well known and quite effective. In this paper we try to describe some facts that may suggest or improve diagnosis and/or treatment related to heart and brain abnormal function.

Respiration, hypoxia inducible factor and heart function

We know that inspiration is energetic and offers oxygen. Expiration is mainly passive, normally lasts a little longer and exhales carbon dioxide (CO₂). Diaphragm, the respiratory muscles and the positive-negative pressure in the lungs, support the exchange of CO₂ for oxygen. In fatigue and/or in coronary insufficiency, deeper inspiration gives more oxygen to vital organs like the heart. "Lack of oxygen may soon induce hypoxia, anoxia and finally death of the organism as a whole" [1]. During sleep, longer and deeper inspirations induce better rest [2, 3].

Inspiration not only offers oxygen but also induces a negative endothoracic pressure, which also supports heart function. Oxidative metabolism yields 18 times more ATP per mol of glucose consumed, as compared to non-oxidative metabolism. Electrons are transferred to mitochondria and then to protein complexes in order to offer energy [1].

Stress and fatigue induce short breaths, while the lower pulmonary lobes remain hypo-ventilated.

To face myocardial ischemia by increasing angiogenesis in myocardium and possibly increasing coronary blood flow, we may consider the following: We know that under conditions of reduced oxygen, hypoxia-inducible factor-1 (HIF-1) regulates the expression of genes that mediate adaptive responses. Hypoxia-inducible factor-1 was first identified in human cells as a regulator of erythropoietin and of vascular endothelial growth factor (VEGF). The VEGF stimulates angiogenesis and glycolytic enzymes, which then adapt cells metabolism to hypoxic conditions [1-4] (Figure 1).

V. Kokkas and K. Papadopoulos 18 years ago reported that myocardial ischemia of short duration induces a favorable effect called "ischemic preconditioning" leading to "ischemia reperfusion of myocardial cells" [5]. Today we know the mechanism of this reperfusion: Angiogenesis is induced in hypoxic tissues via induction of several signaling pathways, for example the induction of VEGF or of basic fibroblast growth factor (bFGF). Moreover, alternative pathways in endothelia axis or regulation mechanisms for VEGF receptor (VEGFR) have been described to support VEGF [6].

Based on the above useful reactions in case of tissue ischemia, we have tried the following test: By using our right hand fingers, we occluded blood flow for about 25sec or more in the radial artery of the left hand of the patient, acting to a shear stress manner (Figures 2 and 3). This radial obstruction test causes ischemia to the hand because one of the two arteries that irrigate the hand is obstructed and especially ischemia appears to the first finger and part of the second finger of the left hand of the patient. This procedure may be repeated after 15sec, several times. It has been reported that coronary stenosis of $\geq 70\%$ after early myocardial infarction in men triggers HIF-1 as above and induces angio-arteriogenesis, thus protecting myocardial cells. It has been suggested in animals that the above capillary neo-genesis procedure through DNA genetic stimulus may even produce cardiomyocytes [7].

An additional favorable effect after obstructing radial artery could be that the blood flow pressure behind the obstruction point may slightly increase. Of course, this small hydrodynamic effect is mainly absorbed by the elasticity of the arteries and may not increase blood flow in the coronary arteries. Anyhow, this possible increase in blood flow could refer to a small extend to the coronary arteries. A related figure showing tap water pressure in Figure 4.

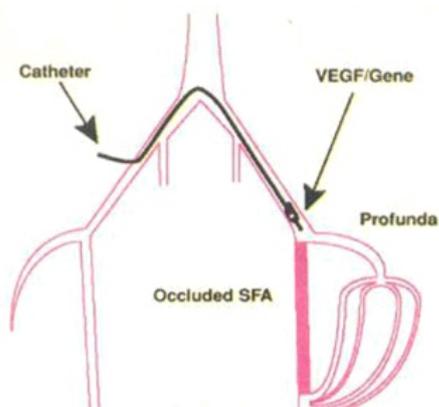


Figure 1. Angiogenesis after occlusion of an arteriole and the importance of VEGF gene.



Figure 2. Obstructing radial artery.

Hippocrates described: "Heart pain, if often occurring in the elderly announces sudden death" (Coacic Prognosis XV) [9].

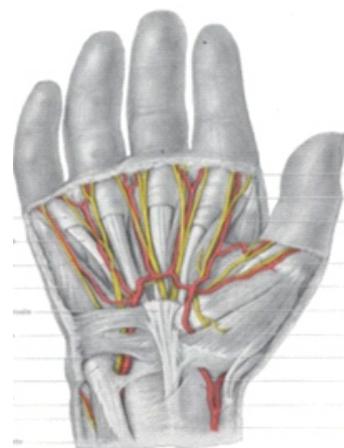


Figure 3. Occlusion of the radial artery (on the right) will cause hypo-perfusion and hypoxia at the corresponding area of the hand (mainly the thumb and the second finger) and induction of HIF-1 (from Grant's Anatomy) [8].



Figure 4. For example, after obstruction of the end of the hose, water pressure increases backwards and disconnects the hose from the faucet.

Dramatic experience of a case where the radial artery obstruction test was applied

About 8 years ago a lady of 74 years old by that time, had a partial colectomy. About 40cm of the ascending colon and the right colic curve were ablated. Six years ago she had a great physical stress after swimming in the sea. She was fatigued and was carried out of the water rather unconscious. There was no medical or pharmaceutical support around and no ambulance to take her to a medical centre. Her pulse was arrhythmic, irregular and very low, almost not existing. This is the pulse we detect before complete death. We tried to keep her as warm as possible. Realizing that no other help was available we practiced to her the procedure of "radial obstruction" as described before. In brief, we obstructed the blood flow of her left radial artery by the two, 2nd and 3rd fingers of our right hand. By doing so, we tried to induce some ischemia to the hand and especially to the first and partly the second fingers of her left hand aiming to increase circulation in the ischemic parts of her body, like the heart by the mechanism explained before. The lady was now conscious,

felt a little better but to our surprise soon started vomiting which deteriorated her condition dramatically. After we used the radial artery obstruction test, she felt better again but for the next six hours and every 20 minutes approximately she continued having small vomits which worsened her overall condition.

After about 6 hours, both the doctor and the patient realized that this situation was not bearable and was leading to nowhere. The doctor (author of this note) felt that only a miracle could save his patient. Disappointed but still willing to fight and help, he prayed to God with all his heart. Then something extraordinary happened. A drop of the vomiting liquid had been accidentally spilled near the doctor's lips. The doctor touched this drop with his tongue and felt that this drop was not acidic, as expected for a gastric vomit to be, but was alkaline. This meant that vomit was coming from the intestine. The doctor soon realized that after colectomy, the patient had a paralytic-spastic ileus with multiple vomiting episodes. As mentioned above, any other conservative or surgical treatment was not possible at that time [10]. He remembered from his anatomy lessons that related nerves that could possibly restore intestinal function were, the pelvic neural plexus lying on the (right) pelvic anonymous bone and partly the pelvic-inguinal and the pelvic-hypogastric nerves which partly run closely under the skin. He thought that if there was to be a miracle to save the patient's life, that would be to make the above nerves function normally again and so treat the intestinal disease. Almost disappointed but still willing to try, the doctor applied an intense massage on the patient's skin over these nerves area. The patient still hoping for her life, tried to help the doctor by massaging her belly herself. Soon after, a sound of enteric movements was heard and the vomit stopped! The pulse was much better and in a steady condition. God helped! Ileus was treated by stimulating the related nerves over the skin of the patient!

It was rather fortunate (!) that there was no ambulance to take the patient to a medical center, because the patient had "no steam" to keep her alive during this transfer. Furthermore, if general practitioners were present, they would most likely administer some gastric spasmolytic drugs, which could worsen the situation of the intestine!

Today, we are pleased to say that this lady eight years after the above incidence has a normal life with her 5 children and 10 grandchildren.

Fatigue

Since our brain is mainly influenced by fatigue and even more by exhaustion, it may be reasonable to say that fatigue is mainly related to Neurosciences.

Fatigue is characterized by profound lack of energy, muscles weakness, slow movements, slight mental decline and central nervous system slow reactions.

Baloyannis-Grammaticos syndrome

Fatigue, atherosclerosis and toxic substances like alcohol in cases of alcoholism can induce impairment of blood flow

and energy supply in the cortex of our brain hemispheres, as well as in hippocampus and the anterior thalamus, structures which are characterized by high metabolic activity and energy necessities (oxygen and glucose consumption) and thus may unconsciously modify our usual civilized social behavior. As an example, when being at a stage of severe fatigue we may express either an unusual, unreasonable and unexpected hyperthymic behavior or a depressive anxious and even offensive or aggressive reaction. At the same time most of the subcortical centers of our brain, which remain well energy supplied, since they have a lower necessity of oxygen and glucose consumption, in correlation with the cortex of the brain hemispheres, may express a rather primitive, uninhibited, uncontrolled, unexpected, unjustified, unconditional and even irrational behavior. This is so, considering that they are under an unstable or even poor control from the defected brain hemispheres. Of course if this behavior is exclusively due to fatigue it will be fully restored but if is due to atherosclerosis, alcoholism and any other addiction may easily reappear or become stable eventually. This syndrome has been specifically described by the honorable Professor Stavros Baloyannis supported by Philip Grammaticos and was suggested as: "Baloyannis-Grammaticos syndrome".

At the outer surface of the frontal, parietal, occipital and temporal lobes the human brain has developed and is continuously developing centres that manage our cognition, our speech fluency, our ability to remember words and increase our vocabulary, to view and recognize images or faces, to hear sounds and compose music, to paint and sculpt, to construct various structures, to read the Braille system and to have the ability to make judgments about things, persons and conditions. All these functions are mostly found in the "civilized man" and may be impaired in cases of intense fatigue, extreme anxiety, profound depression, permanent atherosclerosis, chronic alcoholism and drug addiction, as described in the previous paragraph [11-13].

More than fatigue. Vital exhaustion, a dangerous syndrome

Fatigue is in a way the opposite of rest. In fatigue we stress ourselves to a level above which is difficult to retain normal function of our body, especially of our brain, heart, respiration and muscles. In fatigue, inspiration lasts longer than expiration.

In a complete fatigue stage, it is obvious that we have no more physical reserves. If after this stage we stress ourselves to do more physical and mental work we shall enter to another stage which is the stage of vital exhaustion. This is a vital disorder in which our critical organs and principally the brain are unable to function properly. The brain and especially hypothalamus cannot give specific and well-targeted orders for retaining the homeostatic equilibrium and the other principal organs (heart and lungs) come to a point of abnormal-insufficient-irregular function. Many studies underlined the importance of mental health [14-16]. Sex is rather impossible and may be dangerous if attempted. At this point we may have an acute heart disease like angina and infarction, due to uncontrolled release of catecholamines and possibly other serious dysfunctions from the brain and/or

other organs.

This syndrome needs emergency treatment which is: complete bed rest for a few days, tranquility, many additional hours of sleep every day and easily digested meals, rich of proteins, vitamins and minerals (not more than 2-3 meals per day). The use of the radial artery obstruction test mentioned before may also be occasionally applied. Clear fresh air is very important.

All problems, mainly emotional ones must be avoided. After the first days or the first week, some physical morning exercise is advisable [17].

Due to the increased air pollution in our days, to increased number of working hours of many workers and to insufficient sleep we may have vital exhaustion and loss of homeostatic equilibrium even in younger people. This may be one reason that we currently see acute heart disease unexpectedly, in younger people.

In conclusion, by a longer inspiration we offer more oxygen to myocardium in cases of angina or fatigue. By temporary occlusion of the radial artery we induce ischemia which through the HIF-1 factor and through other related mechanisms may induce better blood supply to the ischemic area of the heart. Radial artery obstruction test and an attempt to stimulate some celiac nerves, supported treatment in a difficult life threatening situation.

Chronic fatigue, atherosclerosis and toxic substances like alcohol in cases of chronic alcoholism can induce impairment of blood flow and energy supply in the cortex of our brain hemispheres, as well as in hippocampus and the anterior thalamus, structures which are characterized by high metabolic activity and energy necessities (oxygen and glucose consumption) and thus may unconsciously modify our usual civilized social behavior. This syndrome has been specifically described by the honorable Professor Stavros Baloyannis supported by Philip Grammaticos and was suggested as: "Baloyannis-Grammaticos syndrome". It is suggested not to stress ourselves after fatigue in order to avoid a dangerous condition which may be called vital exhaustion.

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