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ФІЗІОЛОГІЯ – МЕДИЦИНІ, ФАРМАЦІЇ ТА ПЕДАГОГІЦІ: АКТУАЛЬНІ ПРОБЛЕМИ ТА СУЧАСНІ ДОСЯГНЕННЯ

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Відповідальність за достовірність даних, наведених у наукових публікаціях, несуть автори

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pressure is well established. Baroreflex -mediated changes insympathetic nerve activity to the heart and peripheral vasculature counter short-term fluctuations in arterial pressure. While baroreflex -mediated changes in sympathetic nerve activity to the kidney may influence the renin-angiontensinaldosterone system and therefore may mediate more longterm changes in mean arterial pressure. However, it has been suggested that resetting of the baroreflex in the direction of acute and chronic pressure changes, and the observed effect of sinoaortic denervation on baroreflex indicates that the baroreflex may not be critical for setting the long-term “set point” of arterial pressure.

Blood pressure is affected by baroreflex (BR)-mediated changes in efferent autonomic nerve activity to the heart, kidneys, and other vascular beds. Mechanosensitive baroreceptor neurons constitute the afferent signal of the “BR arc” which consists primarily of arterial, cardiopulmonary, and carotid sinus baroreceptors. While BR control of the cardiovascular system is necessary to regulate blood pressure, heart rate, and sympathetic nerve activity, BR resetting may contribute to the maintenance of hypertensive states. Inappropriate regulation of blood pressure and sympathetic nerve activity is associated with structural and hormonal changes that contribute to the development and progression of cardiovascular disease and leads to further dysregulation of BP and SNA. In discussing the function and dysfunction of the BR it is useful to define its operating parameters and alterations that occur in response to BP changes.

Definitions:

• Resetting: refers to the phenomenon whereby the baroreflex operating range and pressure threshold shifts in the direction of the arterial pressure change.
• Central resetting: refers to functional and/or anatomic changes in the CNS that occur in BR resetting associated with sustained changes in BP; may be quantified using the ratio of baroreceptor input to the amount of efferent SNA.
• Efferent resetting: refers to the relative amount of change in efferent SNA as mediated by the CNS in response to reset BR signaling.
• Pressure threshold: the arterial pressure at which baroreceptors begin to fire.
• Resting point: the mean arterial pressure at which the baroreflex maintains its buffering capacity, pressures above this result in reflex inhibition of heart rate and sympathetic nerve activity, pressures below this level result in disinhibition.
• Baroreflex Gain or Sensitivity: refers to the capacity of the baroreflex to buffer changes in arterial pressure; often depicted graphically as the slope of the relationship between mean arterial pressure and heart rate, sympathetic nerve activity, R-R interval or baroreceptor firing.
• Adaptation: whereby baroreceptors activity initially increases with a sustained increase in blood pressure but declines (or adapts) over time as the elevated pressure is maintained.
• Postexcitatory depression: the suppression, or refractory period, of baroreceptor activity following a period of acute hypertension.

Conclusions. The potential for normalizing BR sensitivity and restoring the BR pressure threshold is an exciting prospect for individuals with compromised BR function (e.g., hypertension, aging, obstructive sleep apnea, and atherosclerosis). These individuals could potentially improve BP control using novel therapeutics that improves BR function through the alteration of humoral factors and molecular mechanisms responsible for baroreceptor signaling and CNS regulation of efferent SNA.

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APPLICATION OF CARDIOPLEGIC SOLUTION IN CLINICAL PRACTICE

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Background. Cardioplegic solutions (CPS) are chemical solutions designed to stop the heart and reduce its energy demands during cardiac surgery. They are used by most surgeons worldwide to protect the heart from damage when its blood supply must be interrupted while the cardiac condition is corrected surgically. Most common types of heart surgeries that require cardiac arrest are coronary artery bypass graft (CABG), heart transplantation, heart valve replacement, heart congenital effects etc. The number of those surgeries carried out in the world annually increases the interest to CPS and theirs effects.

When the patient is placed on cardiopulmonary bypass (heart-lung machine), the heart is isolated from the rest of the blood circulation by means of an occlusive cross-clamp placed on the ascending aorta proximal to the innominate artery. During this period of heart isolation, the heart is not receiving any blood flow, thus no oxygen for metabolism, therefore, it needs to be protected from ischemia and necrosis, that is achieved by administration of CPS. As CPS is distributed to the entire myocardium, the ECG will change and eventually asystole will ensue. CPS lowers the metabolic rate of the heart muscle, thereby preventing cell death during the ischemic period of time.

There are 2 main types of CPS – intracellular type (Bretschneider solution) and extracellular type (St. Thomas, Buckberg solution). Intracellular are used predominantly for preservation of the heart and abdominal organs. Extracellular type is used for cardiac surgeries. According to chemical composition, CPS are divided into pure crystalloid and blood-based solutions.

Most CPS have high potassium concentration that decreases the membrane resting potential of cardiac cells. The normal resting potential of ventricular myocytes is about -90 mV. When extracellular cardioplegia displaces blood surrounding myocytes, the membrane voltage becomes less negative and the cell depolarizes more readily. The depolarization causes contraction, intracellular calcium is sequestered by the sarcoplasmic reticulum via ATP-dependent Ca^{2+} pumps, and the cell relaxes (diastole). However, the high potassium concentration of CPS prevents further repolarization. Raising the K^+ concentration to 16.2 mmol/l raises the resting potential to −60 mV, a level at which muscle fibers are inexcitable to ordinary stimuli. When the resting potential approaches −50 mV, sodium channels are inactivated, resulting in a diastolic arrest of cardiac activity.

The use of two other cations, Na^+ and Ca^{2+}, also can be used to arrest the heart. By removing extracellular Na^+ from perfusate, the heart will not beat because the action potential is dependent upon extracellular Na^+ ions. However, the removal of Na^+ does not alter the resting membrane potential of the cell. Likewise, removal of extracellular Ca^{2+} results in a decreased contractile force, and eventual arrest in diastole. An example of a low K^+ and low Na^+ solution is histidine-tryptophan-ketoglutarate.

Hypothermia is the other key component of most cardioplegic strategies. It is employed as another means to further lower myocardial metabolism during periods of ischemia. The Vant Hoff equation allows calculation that oxygen consumption will drop by 50 % for every 10°C reduction in temperature. Results of various studies showed that in case of normothermic cardiac arrest (37°C) oxygen demand of cardio-myocytes equals about 1.00 mL/100g/min and reduction of myocardial oxygen consumption is about 90 %. In case of hypothermic arrest at 22°C oxygen demand is 0.30 mL/100g/min, consumption lowers by 97 %, and in case of hypothermic arrest at 10°C demand becomes 0.14 mL/100g/min and consumption ~ 97 %.

Blood-based CPS have some advantages in comparison to crystalloid CPS. According to research data, after application of blood-based CPS left ventricle (LV) stroke work index improve after ischemic 2 hr, and in case of usage of crystalloid only, LV stroke work index improve after ischemic 24 hr. Advantages of blood-based CPS include improvement of oxygen carrying capacity and delivery, enhanced myocardial oxygen consumption, substrate preserved high-energy phosphate stores, buffering changes in pH and provision of appropriate osmotic environment for myocardial cells and lessening the myocardial edema. However, they cost more, lead to high hematocrit and low temperature, inducing a sludge effect, and cause the operating field becoming less clear.

Conclusion. The use of CPS has substantially increased the safety of cardiac surgery. It protects the myocardium by inducing a rapid and complete diastolic arrest, minimizing myocardial energy requirements and preventing ischemic damage during the arrest phase and minimizing or preventing reperfusion injury once coronary blood flow is restored. Chemical components added to CPS, such as potassium and glucose, are largely responsible for its protective effect. Crystalloid solutions have traditionally been used, however, blood-based CPS demonstrate more favorable effects. Even though first CPS was developed in the early 1970's, it's necessary to continue to develop and improve them, aiming for further decrease of myocardial ischemia consequences.

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COMPARATIVE ANALYSIS OF THE EFFICIENCY OF DIAGNOSTIC AND TREATMENT MEASURES BY WOMEN WITH ECTOPIC PREGNANCY

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Topicality. Ectopic pregnancy (EP) is a life-threatening gynecological emergency, and a significant cause of maternal morbidity and mortality in Ukraine. Ectopic pregnancy occurs at a rate of about 1-2% of pregnancies and can occur in any sexually active woman of reproductive age. Ectopic pregnancy is the most common cause of pregnancy-related deaths in the first trimester of pregnancy, and one of the main causes of future tubal-peritoneal infertility and fetal wastage.

The aim. The aim of this work is to determine and evaluate the incidence, risk factors, complaints and clinical presentation, the most informative diagnostic criteria of EP, and therefore to improve the algorithm of diagnostic and treatment measures. On this background, this is a possibility to reduce the frequency of infringements of reproductive function by the women with EP in anamnesis.

Methods and materials. This was a retrospective, descriptive analysis of medical histories of 55 women managed for ectopic pregnancies, who were on treatment in City Clinical Maternity in Ivano-Frankivsk during years 2014–2016, divided in 2 groups: I – 25 women with EP, who were examined and treated due to general clinical recommendations. II – 30 women, with EP, examined and treated, using the supplemented algorithm.