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Biological age of body and organs

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Biological age (BA) is the definition which reflects the degree of real morphological and physiological development of the organism [5]. Introduction of the term BA due to the fact that the calendar (passport, chronological) age is not a sufficient criterion for the state of human health and working ability [4]. Problems of accurate quantification of BA are associated with 4 aging patterns [10].

Heterochronicity – the difference in time of aging onset of certain tissues, organs, systems. The start of organs aging [11]: after 20 years – cerebral organs; after 30 years – kidneys, spleen; after 40 years – skeleton, heart; after 50 years – liver, gastrointestinal tract, lungs, muscles. Thymus gland atrophy in humans begins between 13-15 years, sex glands – in menopause (48-52 years for women), and some pituitary functions remain on high level until old age. **Heterotopy** – unequal intensity of the aging process in various organs and structures of the same organ. **Heterocatephtenicity** – multidirection of age-related changes associated with, for example, suppression of some and enhancing of other vital processes in the ageing organism. **Heterokineticity** – development of age-related changes at different rates. In some tissues they arise early, slowly and progress relatively smoothly; in other – develop later, but rapidly.

Purpose – to demonstrate the promising area of diagnostic radiology – BA identification.

Known methods for the determination of BA according to physical health (in the range of 7-89 years), to mental health (20-89 years), to physical and mental health (20-89 years), to anthropometry (7-89 years), to bioelectric cerebral activity (20-89 years), to echocardiography (20-89 years), according to electrocardiography, to blood analysis (20-89 years), to spirography (20-89 years), according to stabilography (20-89 years), to Cattell test (20-89 years), to skeletal asymmetry (4-17 years), according to laboratory data of pregnant women (20-39 years old) [3, 4].

Pregnancy as the test that detects the functional reserves of organs and systems. Definition of BA during this period allows us to study its effect on the rate of age-related changes, evaluating the functional and reserve possibilities of the organism of pregnant in dynamics [9].

Biological age control. All components of lifestyle affect the biological age. Its reduction, stabilization or retardation – is the retardation of aging. It is important to know the contribution of individual factors in this process. Determinant, apparently, is the psychological factor – desire to spend the energy, time and personal material resources.

The concept of heart and vessels age identification. The new concept of cardiovascular risk evaluation, which is based on the calculation of heart and blood vessels age of the given patient with tables, taking into account the generally accepted risk factors, was proposed. The concept was developed on the basis of epidemiological data of the American population, but it can be successfully applied in other world regions, such as Europe [14]. Such calculation of the heart and blood vessels age more is more obvious and comprehensive for patients than the absolute risk indicators, and should contribute to awareness of the problem of personal cardiovascular health and to more active involvement of the patients in the preventive and therapeutic measures. The implementation of the concept started in Ukraine as well .... [8].

Ultrasound determination of the common carotid artery intima-media thickness is sensitive, objective method for the evaluation of the vascular component contribution in the cardiovascular system BA [2, 16].

Patent RU 2518347. Method of human BA definition by determining echocardiography parameters **in women of 20-96 years** by the formula: BA = -76,726 + (1,311LA) + (3,596IVST) + (1,712 RV), where LA – left atrium size, mm; IVST – interventricular septum thickness, in millimeters; RV – right ventricular size, mm; **in men 20 to 90 years**, according to the formula: BA = -156,066 + (1.52Ad) + (2,041LA) +

(7,709IVST), where Ad – aortic diameter in mm.

The ultrasonic evaluation of aorta stiffness with the measurement of aortic pulse wave velocity [1]. Age proper values: less than 30 years – 5,9 m/s, 30-39 – 6,6 m/s, 40-49 – 7,0 m/s, 50-59 – 8,0 m/s, 60-69 – 10,3 m/s, over 70 years – 11,4 m/s.

CT. Among many body constants pCa^{+2} is one of the most rigorous: the range of changes of H+ ions concentrations in the blood under physiological conditions is about 100 times wider than the "allowed" pCa^{+2} changes. Calcium plays the central role in the initiation of cell response as participates in all known cell effector systems. The only difference is in the share contribution of Ca^{+2} – effector system – and in the source of calcium mobilization. Being absolutely essential for any cell, the calcium becomes to be cellular toxin at its high concentrations. Excessive increase of calcium concentration in cytoplasm leads to dysfunction and cell death [7]. Calcium "cemeteries" are observed practically in all organs and tissues [6]: gallstones, kidney, prostate, salivary glands stones, calcifications of brain, heart valves, carotid and coronary arteries, lungs, heterotopic idiopathic ossificates of muscles, tendons, ligaments, joint capsules, enteroliths, coproliths, rinoliths. Classical semiotics of epiphysis calcification (sometimes observed in childhood): hyperdensed homogeneous structure of irregular shape with sharp contours. Calcification X-ray density is maximum in the central portion (+935 HU) and decreases as approaches to its borders (+130 HU). Correlation of calcification X-ray density with BA is quite obvious [6].

MRI. Cerebral investigation 885 people at the age from 3 to 20 years was conducted to identify 231 biomarkers in the anatomical structure of the brain, the combination of which can estimate BA of the person with the accuracy of > 92 % [13]. The method of BA estimation applying MRI image of the male left wrist was suggested [15]. BA identification is possible by measuring the linear dimensions of the corpus callosum using MRI [12].

Conclusion. BA identification according to routine CT, MRI, US data significantly enhances the informativeness and attractiveness of radiological examinations for patients and healthy persons.

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BIOLOGICAL AGE OF BODY AND ORGANS

N.N. Kolotilov

Purpose – to show promising area of diagnostic radiology: identification of biological age (BA).

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БІОЛОГІЧНИЙ ВІК ОРГАНІЗМУ ТА ОРГАНІВ

М.М. Колотілов

Ціль – показати перспективне направлення діагностичної радіології: ідентифікація біологічного віку (БВ).

Висновок. Визначення БВ за рутинними даними технологій КТ, МРТ, ехографії значно розширює інформативність та привабливість радіологічних обстежень для хворих та здорових

БИОЛОГИЧЕСКИЙ ВОЗРАСТ ОРГАНИЗМА И ОРГАНОВ

Н.Н. Колотилов

Цель − показать перспективное направление диагностической радиологии: идентификация биологического возраста (БВ).

Вывод. Определение БВ по рутинным данным технологий КТ, МРТ, эхографии значительно расширяет информативность и привлекательность радиологических обследований для больных и здоровых.

Патенти

СПОСОБ ЛУЧЕВОЙ ТЕРАПИИ РЕЦИДИВОВ РАКА ПРЕДСТАТЕЛЬНОЙ ЖЕЛЕЗЫ ПОСЛЕ РАДИКАЛЬНОЙ ПРОСТАТЭКТОМИИ. БЫКОВА Ю.Б., БУЛЫЧКИН П.В., ТКАЧЕВ С. И., БЕРДНИК А.В.
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Формула изобретения
Способ лучевой терапии рецидивов рака предстательной железы после радикальной простатэктомии, включающий облучение зон регионарного метастазирования, ложа удаленной предстательной железы и зоны рецидива, отличающийся тем, что облучение проводили в режиме гипофракционирования с использованием лучевой терапии с модуляцией интенсивности динамическими арками по принципу «симультантного интегрированного буста», одновременно на зоны регионарного метастазирования РОД 1,8 Гр, ложе удаленной предстательной железы РОД 2,35 Гр и зоны рецидива РОД 2,5 Гр, 5 раз в неделю, в количестве 26 фракций.