

2nd International Symposium: Frontiers in Anatomy and Physiology Research and Education

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ABSTRACT

The aim of the special issue is to expand knowledge on the recent achievements in Anatomy, Physiology and related basic, preclinical, and clinical sciences of the participants of the 2nd International Symposium: Frontiers in Anatomy and Physiology Research and Education, conducted by the Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, in collaboration with the international partners on December 13-14, 2023, to strengthen international collaboration between Malaysian and overseas universities and to help all the readers of the journal to identify their own niche in research and international partnership. It is also aimed at motivation of young researchers to participate in the research competitions and win, to upgrade their own research and participate in the scientific networking. The scope of the publications in the Special Issue covers but is not limited to the scientific data obtained from research in clinical anatomy, histology, embryology, systemic physiology and pathophysiology, molecular medicine, physiology of cell membrane and single cells, histophysiology, animal studies, drug discovery, immunology and infectious diseases, inflammation and cancer, neurosciences and medical education. The keynote and the invited speakers are world-renowned scientists and physicians known for cutting-edge research and clinical practice. The papers and abstracts were peer-reviewed and selected for publication by the scientific committee of the Symposium formed by Malaysian and international researchers.

Keywords: *Anatomy; physiology; education; research and conference*

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ABSTRACTS

All presented abstracts are listed from Page 4 to 89.

Topographic assessment of the kinetics of remote bioeffects of depleted uranium on various adrenal regions

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Abstract

Taking into account the nature of adrenal origin, their participation in compensatory-adaptive reactions, it is important to consider the neuro-endocrine response to depleted uranium exposure in remote periods. The model experiment consisted of six groups: three experimental groups of 45 rats each and three control groups of 10 rats each. Experimental rats received aqueous solution of depleted uranium instead of water at a dose of 0.1 mg per 100 g once. Histological material was taken one, three and six months after the beginning of the experiment together with the control groups. Histochemical reactions in the adrenal glands were performed on cryosections in Herxheimer staining to evaluate steroidogenesis in the adrenal cortex. For this purpose, the preparations were stained according to the Balosh method: red staining corresponded to heterochromatic nuclei of inactive cells; blue staining corresponded to euchromatic nuclei of active cells. The nuclear test served as an indicator of the activity of adrenal medullary chromaffinocytes. After a single DU incorporation, a change in the width of all zones was observed, which determined the kinetics of adrenal cortex thickness according to the experimental conditions. The redistribution of lipid density suggested a predominance of hormone formation over hormone consumption. After six months, dark cells with granular cytoplasm were predominant against islets of light-coloured cells. Occasionally, trabecular or diffuse metaplasia of brain matter cells into reticular or fascicular zones was observed. The nuclear test revealed a decrease in the functional activity of the medulla due to an increase in the number of chromaffinocytes with heterochromatic nuclei. The adrenal reaction had a prolonged character, apparently, caused by radiotoxicity.

Keywords: Depleted uranium; trachea and adrenal gland

Hepatoprotective effect of *Polygonum minus* flavonoid-rich-fraction (Pm-FRF) against cisplatin-induced hepatotoxicity: A physiological, biochemical, macroscopic and microscopic studies

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Abstract

Cisplatin (CP) is a widely used anticancer drug that is successfully used in the treatment of a variety of tumours, while its usage is limited due to its side effects including hepatotoxicity. In order to combat its side effects, natural products have been extensively explored against CP-induced toxicities because of their safety and traditional use. Thus, *Polygonum minus*, Pm ('Kesum'), a traditional plant that possesses various medicinal properties has been chosen for this study. This study was carried out to observe the effectiveness of Pm-flavonoid rich fraction (Pm-FRF) against hepatotoxicity via its physiological parameters, liver biomarkers, macroscopic and microscopic changes. Forty rats were divided into 5 groups: Group A and B were administered with distilled water, Group C was given quercetin, and Group D and E were administered with Pm-FRF 100mg/kg and 300mg/kg respectively for 14 days. Group A was injected with normal saline whereas other groups were administered with CP at day 15. All rats were sacrificed on Day 18. The findings demonstrated that Pm-FRF were able to preserve the physiological parameters. Pm-FRF groups protected the liver by decreasing the ALT and AST levels compared to CP group. This is due to the antioxidant effect of the plant that may reduce the free radical-induced oxidative damage in liver caused by CP. Liver histology showed that Pm-FRF 100mg/kg was able to preserve the histological changes. Pm-FRF 300mg/kg showed slight macroscopic changes. Therefore, our findings suggested that Pm-FRF may have protective effects against CP-induced hepatotoxicity by improving all the physiological, biochemical and histological parameters.

Keywords: Cisplatin-induced hepatotoxicity; *polygonum minus* and flavonoid

Multifractal analysis as a method of assessing the geometry of the cerebral arteries

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Abstract

Fractal analysis is an example of an objective method for assessing the adequacy of blood supply to a particular organ, which means that it can serve as a marker of morphofunctional deviations from the arterial bed, including the brain. An important issue for further research is the study of normal indicators of the fractal index of various departments of the cerebral hemispheres superficial arterial bed in males and females, which could serve as a standard and be used to assess the adequacy of blood supply to a particular area of the hemispheres convexital surface. The purpose of the study was to compare the quantitative characteristics of the superficial arterial network of the convexital surface of the cerebral hemispheres by fractal analysis in males and females. In accordance with the purpose of the work, the superficial arterial bed of the upper lateral surface of the frontal, parietal, occipital, and temporal lobes of 56 people of both sexes was studied, of whom 28 were men and 28 were women. To calculate the fractal index, the box counting method was used. During statistical processing of the obtained results, no significant differences were found between the values of the fractal index characterizing the superficial arterial bed of the frontal, parietal, occipital, and temporal lobes in men and women, which means that one reference value of the fractal index can be used in people of both sexes. Modern medical science requires the use of new progressive research methods. Moreover, to obtain objective results, it is rational to use methods that allow to obtain quantitative characteristics. One such method is fractal analysis.

Keywords: *Fractal analysis; fractal index; arterial bed and cerebral hemispheres*

Morphogenesis of the joint ligament attachment zone

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Abstract

The attachment zone, or enthesis, is the most sensitive to injuries and diseases in the ligaments of the joints. In this regard, a study of the structural features of the enthesis of the hip, knee, and ankle joints in 200 fetal corpses and 12 newborns was conducted. Macro and microscopic methods of investigation were used. It was established that the progressive stage of morphogenesis in the ligament, five zones are sequentially distinguished from the place of origin (cartilaginous basis of the proximal bone forming the joint) to the place of attachment (in the cartilaginous epiphysis of the distal bone). These zones are the proximal attachment zone, the proximal growth zone, the loading zone, the distal growth zone, and the distal attachment zone. The histological basis of enthesis is embryonic fibrocartilage. Its chondroblasts resemble morphologically the chondroblasts of the hyaline cartilage located nearby. Nevertheless, they are more rounded and have a special mutual arrangement: several elements are tightly lined up, forming so-called "cell columns" on the specimens. Bundles of collagen fibers of the first order are located between the rows of chondroblasts. The morphological features of these bundles allow us to distinguish two sites in the attachment zone: a section of organized and unorganized bundles. The area of the organized bundles is characterized by a uniform color, clear contours, and a constant diameter of the bundles of the first order, separated by cellular elements. This site is located on the border of the attachment and growth zones and the growth zone. The section of unorganized bundles of the attachment zone is heterogeneous, their diameter varies throughout, and their contours are indistinct. Morphological signs of the disunion of bundles into separate collagen fibers are revealed, which abruptly cut off at the border with hyaline cartilage, forming a well-defined ligament and embryonic bone border.

Keywords: Ligaments of joints; fetuses; newborns; attachment zone and enthesis

Parasitic diseases from clinical practice

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Abstract

The incidence of parasitic diseases is a serious problem in recent years, especially in large cities. Two parasitic infections has high frequency of manifestation in the different countries with different geographic location, climate and economic development: toxocariasis and paragonimiasis. Insufficient alertness of physicians in relation of these infections and development atypical forms of affections lead to incomplete examination of patients and diagnostic errors. The purpose is to deliver cases of indicated parasitic diseases from our clinical experience. Toxocariasis is a parasitic disease from the group of nematodoses, the causative agents of which are *Toxocara canis*. Invasion occurs when helminth's eggs are ingested with contaminated food, water, accidental geophagy, and direct contact with an infected animal. In the human gut, the larva releases from the egg and migrates, causing a general parasitic infestation. *Toxocara* settles in various organs (lungs, spleen, liver, eyes, brain), which causes the local inflammatory and allergic reactions. An ocular form of toxocariasis may manifest as granulomatous choroiditis, chorioretinitis and parsplanitis with the formation of peripheral granulomas and vasculitis. Sometimes in adults impairment of retina and choroid are hidden due to manifestation with unusual features, e.g. posterior vitreous detachment and hemophthalmos. Paragonimiasis is a parasitic disease from the group of trematodoses, the causative agent of which is *Paragonimus westermani*. A person is infected by eating raw and poorly cooked crayfish and crabs with live larvae of the parasite, which penetrate through the intestinal wall into the abdominal cavity, and from there through the diaphragm - into the pleura and lungs. Mechanical impact of helminths on tissues is the main pathological effect in the pathogenesis of paragonimiasis. During the migration of larvae into the lungs, haemorrhages and necroses are found in them. Later, fibrous cysts of 0.1 to 10 cm in size are formed around the parasites. The area of paragonimiasis distribution is South-East Asia. In Russia, limited foci of paragonimiasis are known in the Far East. The registration of paragonimiasis cases in areas that are not traditional foci of this helminthiasis determines the importance of preventive work with the population and the need for doctors to be vigilant when diagnosing pulmonary pathology.

Keywords: Parasitic diseases; toxocariasis and paragonimiasis

Knowledge on intrauterine device as a family planning method among antenatal mothers

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Abstract

Family planning allows people to attain their desired number of children and it is achieved through use of contraceptive methods (World Health Organization, 2022). Intrauterine Device (IUCD) is one of the modern contraceptive methods besides barrier, hormonal, and permanent methods. The Ministry of Health (MOH) Malaysia provides easily accessible contraceptive methods, however the use of contraceptive methods is still lower. Therefore, this study aimed to determine the knowledge level on IUCD and associated factors between knowledge level on IUCD and socio-demographic variables among antenatal mothers. A quantitative, cross-sectional approach with a convenient sampling method was conducted. A total of 247 antenatal mothers from Hospital Ampang were recruited using the Questionnaire. Descriptive Statistics, Chi-Square test and ANOVA test was used to analyze the collected data. This study revealed that the majority of antenatal mothers scored a moderate level of knowledge on IUCD. Age, gestation, occupation, and wished number of children were significantly associated with the knowledge level of the respondents ($p < 0.005$). This current study showed that the knowledge level of IUCD among antenatal mothers in Hospital Ampang was average. The factors that influenced antenatal mothers' family planning knowledge are multifaceted and challenging.

Keywords: Knowledge; IUCD; family planning and antenatal mothers

Assessment of the dependence of morphometric characteristics of vertebral arteries and veins on the nature of the course according to ultrasound data

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Abstract

The human neck has a pronounced anatomical variability, which is important in assessing the complex influence and predicting dynamics with changes in cerebral hemodynamics in clinical practice and is a prerequisite for developing new surgical approaches in neurosurgical practice. The aim is to evaluate the influence of the nature of the vertebral arteries' course on the morphometry results during ultrasound Dopplerography. The survey was carried out by evaluating the surveys of 325 volunteers, among them were 221 women and 104 men aged 19 to 86 years. The studies used SonoAce R7 with a linear transducer. The analysis of the vessels was carried out without considering the visualization side. Thus, 650 formations were evaluated because of the examination. All analyzed data had signs of normal distribution. When calculating the student's single-sample t-test for all values of $P < 0.05$, the presented data show a slightly larger diameter of the vertebral arteries among men and some higher indicators of diastolic blood flow velocity and higher values of venous hemodynamics in the group of women. We found larger diameters of the vertebral arteries with their non-rectilinear course and higher indicators of venous hemodynamics in the rectilinear course of vessels. There are no significant changes in the vertebral artery wall with a different nature of the course of the vessels. Some changes in the non-straightness of the course of the vessels were noted at the level of the vertebral veins, which had sufficient statistical significance for the differences in indicators. The data obtained by us are an important step in developing and improving personalized approach methods for the comprehensive assessment of hemodynamics in patients in outpatient settings.

Keywords: Anatomical variation; neck arteries and veins

Topographic Features of Heterogeneous Organs in Reactions to Depleted Uranium

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Abstract

The depleted uranium is used in many industries for military purposes and enter the human body by interacting with tissues. Many researchers are interested in human organs that are united by topographic proximity, experiencing a combination of primary and secondary effects of the depleted uranium exposure. The trachea and thyroid gland were chosen as the object of the study. The experiment was performed on 110 male laboratory rats aged from four to seven months. The rats were divided into two control groups of ten and two experimental groups of 45 individuals exposed to an aqueous solution of depleted uranium oxides at 0.1 mg per 100 g of mass. After one and three months from the beginning of the experiment, the rats were killed by decapitation and the organocomplex was extracted. One and three months after the incorporation of the depleted uranium, the destructive nature of changes in the epithelium lining the mucous membrane of the trachea was revealed. Violations of multi-rowedness, a decrease in the height of ciliated cells and cilia relative to the control indicators were noted. Enterocytus caliciformes contained little mucus. Acinuses were hypertrophied. The severity of the signs prevailed after three months with the formation of lymphoid nodules in the tracheal's wall. There was a significant decrease in hormone production in the thyroid gland and, three months later, a decrease in the height of the thyroid's epithelium in the follicle wall up to flat. The effect of a single exposure to the depleted uranium using general histological and histochemical methods of staining micro-preparations showed irreversible changes. Thus, a prolonged effect of destructive changes in organs was noted, regardless of their heterogeneous nature and the timing of observation, which allows us to state the cumulative radiotoxic nature of the depleted uranium exposure after its single incorporation

Keywords: Depleted uranium; trachea and thyroid gland

Ultrastructural study of small intestine in adolescent rats during chronic ingestion of cadmium and lead salts

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Abstract

The intestinal mucosa is an entry gateway for many xenobiotics with direct and indirect effects on the epithelium, specialized for digestion and absorption through the intestinal microbiota. Reynolds electron microscopy of small intestine tissue slices. The number of light enterocytes increases in all experimental groups, but the number of dark cells decreases. Cadmium application leads to a significant increase in the relative area of plasmocytes ($p=0.0027$) and fibroblasts ($p=0.001$). Lead induces an increase in the number of lymphocytes ($p=0.001$) and mast cells ($p=0.0001$). Combined exposure to metals induces an increase in fibroblasts ($p=0.013$) and lymphocytes ($p=0.001$). The lowest number of goblet cells was observed in lead monoexposure relative to the other groups. The lowest number of mucus-producing cells was observed in lead monoexposure, but this was compensated by the increase in cell area revealed by the electron microscopic study. A significant rearrangement of cytoarchitecture of both the epithelial layer and stromal elements is also noted.

Keywords: Cadmium; lead; small intestine and electron microscopic

Variability of accessory canals and foramina of the mandible

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Abstract

Superior parasymphysial canals open by the sides of the mental symphysis close to the alveolar ridge. We encountered these formations in 11 (16.6%) out of 56 examined jaw. The canals were not found in any of the female jaws. In the male jaws the frequency of detection of the parasymphysial canals was 72% (75% on both sides, 12.5% - only on the right or left side each). In undefined jaws the canals were discovered in 28% of cases (33% - only on the left side, 67% on both sides). The distance from the symphysis was on average 4.9 mm on the left (minimum 3 mm, maximum 8 mm), and 3.8 mm on the right (minimum 2, maximum 8) in men, in undefined jaws - 3 mm on the left (minimum 2, maximum 4), and 2.5 mm on the right (minimum 2, maximum 3). The average diameter of the canals was 1 mm. The study of cone beam computed tomography (CBCT) images has shown that the canals open into the periodontal fissure of the alveolus of the corresponding teeth, usually, medial and lateral incisors. The canals contained a neurovascular bundle with fibers of the lingual nerve and branches of the hypoglossal artery. This explains the fact that even bilateral mandibular anesthesia does not provide a complete anaesthetic effect for the frontal group of teeth; comprising 66% for anesthesia the central incisor and 74% for the lateral incisor. If this formation is damaged during surgical manipulation, bleeding and loss of tooth sensitivity may occur.

Keywords: Parasymphysial canal; mandible and anaesthesia

The influence of metabolic syndrome on morphological changes in the myocardium in rats

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Abstract

In the modern world, the problem of overweight in childhood is acute. Obesity in most cases is accompanied by the development of cardiovascular complications (atherosclerosis, arterial hypertension, etc.) among children of preschool and school age, which in the future may lead to their disability. Modeling of metabolic syndrome was carried out on adult male rats adolescent Wistar for 3 months in two groups. The control group received standard feed and water. The experimental group received, in addition to the standard feed, lard, a 20% sucrose solution, alternating with water with a difference of 1 day. Both groups had free access to food and liquids. In the conditions of modeling the metabolic syndrome with a high-fat and high-carbohydrate diet, the concentration of lipids and carbohydrates in the blood increases, which leads to a violation of tissue trophic and homeostasis inhibition. To maintain optimal conditions for the functioning of the cardiovascular system, it is necessary to remove their excess content from the bloodstream. The main way of removing lipids from the blood is their deposition in the form of inclusions directly in the myocardium and adventitia of the vascular wall (aorta, pulmonary trunk). The above correlates with the obtained experimental results. In contrast to the control group, in the experimental group, there is a shift in the nuclear-cytoplasmic ratio in the form of an increase in the size and remodulation of cardiomyocytes and their nuclei due to degenerative processes in the heart towards hypertrophy, which leads to a decrease in the volume of cytoplasm and interstitium. The number of adipocytes, together with leukocyte cells, increases sharply against the background of removal of lipids from the bloodstream and deposition in the tissue. The process of angiogenesis is observed as a compensatory reaction to normalize the trophic organ.

Keywords: Metabolic syndrome; cardiomyocytes and obesity

Clinical manifestations of skull patterns

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Abstract

By X-ray or computer diagnostics, without knowing the necessary anatomical parameters, it is difficult to determine one or another pattern. The definition of skull patterns is necessary: in dentistry - to reduce the risks of complications when correcting the position of the dentition, to understand the optimal occlusion of the maxillary system. In traumatology and orthopedics to identify the risks of the formation of idiopathic scoliosis at early stages. The purpose of the study is to determine the main topographic landmarks when conducting studies of skull patterns - rotation and rotation with a lateral slope. To determine the main lines of investigation of the patterns of the skull base. To determine the main lines of investigation of the patterns of the cranial vault. 17 skulls were examined. The angles were measured in the frontal, sagittal and horizontal planes. The purpose of the study was to determine the main topographic landmarks when conducting studies of skull patterns - rotation and rotation with lateral inclination, flexion and extension. 17 skulls were examined. To assess the degree of change in the positions of the skull bones, measurements of angles in the frontal, sagittal and horizontal planes were carried out. As a conclusion, the bones of the base of the skull in more distal structures are subject to the greatest change in symmetry than the bones of the cranial vault by 24%. In general, the degree of asymmetry of the skull bones is more pronounced (by 16%) with lateral tilt and rotation than with the rotation pattern. Accordingly, with the first pattern, the degree of tension of the TMO will be greater, which may affect the risks of clinical manifestations during decompensation of adaptive processes.

Keywords: Skull patterns; anatomy and dura mater

Quantitative characteristics of rats bronchial ciliated epithelium in postnatal development

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Abstract

The work is devoted to the study of the functional morphology of the epithelial lining of the bronchial tubes in postnatal ontogenesis. With the help of a technique of ex vivo study of the cilia beat frequency (high-speed video filming with the subsequent computer processing of digital files) in combination with light and electron microscopy methods, the ciliated epithelium of large (LB), average (AB) and small (SB) bronchial tubes of lungs from 70 Wistar rats from birth to old age (24 months) was investigated. The differentiation of ciliated cells (CC) population most intensively develops over the first month: during this period the frequency of this cell type increases from 20-22% to 52% in LB and to 72% in SB. At reproductive age (6-18 months) the content of CC is 58-64% in LB and 69-71% in AB and SB. In old animals (24 months), the maintenance of ciliated elements reaches 71-73 % in all types of bronchi, but the number of CC with morphological signs of cell hypertrophy and death increases. Cilia beat frequency reaches the greatest values in newborn animals (25-25,9 Hz), decreases to 15,1-15,9 Hz at monthly rats and is stabilized at this level for all subsequent age groups. In each cycle of ciliary beating the duration of the effective phase is minimal in newborn rats (16.4-16.7 msec), starting from the 14th day and for all subsequent periods, this parameter is 27-31 msec. The respiratory epithelium of bronchial tubes develops as a uniform tissue system, and at the same time the highest rates of structural differentiation of the population of ciliated cells are characteristic for small bronchi. A high level of structural organization and functional activity of the epithelial layer is maintained throughout the life of animals until old age.

Keywords: Respiratory epithelium; bronchial tubes; cilia beat frequency and postnatal ontogenesis

Age-related morpho-biochemical changes in the structures of the pyramidal tract

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Abstract

The brain and spinal cord specimen obtained by autopsy of 164 corpses of people of both sexes, aged between 21 and 92 years served as the object of the research. Neurons and glial cells of the cortex (V layer) of the Brodmann's area 6 and the anterior horn of the spinal cord (AHSC) (segments C5-C6) were detected by staining with cresyl violet stain (Nissl stain). Biochemical investigation included spectrophotometric determination of the level of primary, secondary, and final products of lipid peroxidation (LPO) and antioxidant enzymes (AOE): Cu-Zn-superoxide dismutases (SOD) and catalase. Aging was accompanied by unidirectional morpho-biochemical changes in the parts of the pyramidal tract: precentral gyrus (area 6) and the AHSC. Ontogenetic quantitative changes of neuro-glia interactions in the premotor cortex in the area of the hand were more distinct than in AHSC. It is highly likely that these changes are based on aged-related shifts of biochemical parameters of the LPO-AOE system. It is manifested by the increase of the LPO processes, SOD activity decrease and the compensatory increase of catalase activity. A less distinct age-related decrease in the number of neurons in the AHSC directly correlated with higher indicators of SOD activity in the spinal cord and less ontogenetic shifts of the latter. Obtained results should be taken into account during studies on various forms of motor neuron disease (amyotrophic lateral sclerosis, ALS). It is known that the idiopathic form of ALS is connected with mutations in the gene of Cu-Zn-dependent SOD, in which degeneration of neurons in the III and V of the precentral gyrus, the adjacent parts of the frontal lobe, and the anterior horns of the spinal cord with simultaneous degeneration of the corticospinal pathways throughout their entire length take place.

Keywords: *Pyramidal tract; neuron; glia; lipid peroxidation and antioxidant protection*

Danio rerio (zebrafish) as an object of experimental morphological studies

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Abstract

The biomedical model of the tropical fish *Danio rerio* (Zebrafish) is gaining popularity in modern preclinical trials. Embryogenesis described in detail: an important feature of this biological model can be considered transparent embryos, which allow studying the teratogenesis of various substances. Rapid stages of development - in 3 days after fertilization the cardiovascular system, nervous system begin to function, and on the 4th day a sexually mature fry capable of feeding and movement is formed. Embryos and mature individuals of *Danio rerio* are used to study acute toxicity. In the study of acute toxicity on fish of this species, only the concentration of the substance in water is considered, and the exact amount of absorbed compound is not determined, the following feature of the use of this biomodality in toxicology as a priority, the authors call zebrafish embryos absorb toxic compounds from water through the skin and gills, and after 7 days of development absorption occurs through the mouth. The absorption, distribution, metabolism and excretion of substances are just beginning to be studied in detail. The zebrafish biomodel has been widely used for drug research and development. The study of toxicity and carcinogenesis in this biological model can be considered a priority. In the study, the lethal concentration for 50% of the population (LC50) was determined for toxic substances. It turned out that zebrafish embryos are more sensitive to toxic effects than mammals. To date, the *Danio rerio* biomodel allows the use of zebrafish as an inexpensive research alternative instead of rodents and other laboratory animals. Quite a lot of knowledge has been accumulated on the development of the fish, its genome and approaches to experimental modeling of various pathological conditions.

Keywords: *Danio rerio*; zebrafish; fish; experiment and morphology

Morphological features of the heart in conditions of hypoxia and ischemia

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Abstract

The purpose of the study is to study the processes of inflammation, fibrogenesis and cardiosclerosis in the myocardium of sexually mature rats. The work was carried out on 20 mature male Wistar rats weighing 220 - 310 g. The control group was represented by 5 intact animals. A solution of cobalt chloride to simulate histoxic hypoxia was administered through an atraumatic probe into the stomach at a dose of 4 mg/kg, daily, once a day for 30 days. Changes occurred in myocardium, which could be classified as types of toxic cardiomyopathies. Hydropic degeneration was observed in the cytoplasm of cardiomyocytes, and foci of myocytolysis appeared. Masson staining revealed an excess amount of collagen fibers in the interstitium, and perivascular space, which, apparently, further hampered the transport of substrates and entry from the bloodstream to the cells under hypoxic conditions. Intensely stained macrophages and fibroblasts appear perivascularly and in the interstitium. Myocardial remodeling during hypoxic injury is accompanied by restructuring of the connective tissue stroma. Enzymatic strengthening of pre-existing connective tissue fibers and de novo synthesis of interstitial substances in accordance with new conditions of mechanical connections were developed. The leading role in this process is assigned to enzymes of the group of metalloproteinases. The expression of metalloproteinase MMP-9 was characterized as weakly positive (+) and positive (++) in certain areas of the myocardium. An increase in MMP-9 expression indicated the activation of a systemic inflammatory response during myocardial damage. The leading trigger mechanism for fibrogenesis processes is necrosis of cardiomyocytes, leading to the launch of biochemical intracellular signaling processes that initiate a partial change in reparative processes. It is obvious that the development of interstitial fibrogenesis plays a decisive role in the pathophysiology of myocardial remodeling under hypoxic conditions and may contribute to the progression of its dysfunction.

Keywords: Myocardium; rats; fibrogenesis and hypoxia

3-dimensional modeling of the variant anatomy for finding new safe surgical approach to the buccal region

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Abstract

Three-dimensional modeling is regularly used in the planning of surgical interventions and the creation of new surgical approaches. In our study, were selected 97 heads of both sexes. Vessels been filled with silicone compound according to the M. Landof method. Topographic and anatomical study of the buccal region was performed by layer-by-layer dissection on each side, so the total number of observations was 194. The purpose was to determine all the options for the relationship of the buccal region anatomical structures for investigating of a new safe surgical access to them. As a result of the study, multiple variants of the relationship between the parotid duct, the transverse facial artery, the facial artery, the facial vein, the branches of the facial nerve and the buccal fat pad were found. Each of the obtained variants was visualized using GEOGEBRA software in the form of a three-dimensional graphical model. Analysis of these graphical model allowed us to establish a zone on the surface of the oral mucosa that does not cross with any of the obtained variants of the course of the buccal region anatomical structures. Thus, a safe zone was established and a new option for safe intraoral surgical approach to the space of the buccal region was offered.

Keywords: *Buccal region; buccal fat pad; parotid duct; transverse artery and surgical approach*

Fascies and adipose spaces of the neck

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Abstract

The topographic anatomy of the fascia and cellular spaces of the neck is an important section and a detailed study of structural features allows us to expand our knowledge of possible ways of spreading infections. The aim was to identify patterns of structure and interrelation of cellular-fascial formations. In the course of our work, we conducted research on 14 corpses on the basis of the S.I. Georgievsky Medical Institute, Department of Topographic Anatomy and Operative Surgery. During the study, it was studied that N.I. Pirogov isolated 1 fascia of the neck, V.N. Shevkunenko isolated 5 fascia of the neck, according to the international anatomical classification, 3 fascia of the neck are distinguished. According to modern data, there are 5 neck fascies that we studied. The first fascia (fascia colli superficialis); The second fascia, or the superficial leaf of the neck fascia proper (lamina superficialis fasciae colli propriae; The third fascia, or the deep leaf of the neck fascia proper (lamina profunda fasciae colli propriae, otherwise - aponeurosis omoclavicularis); The fourth fascia - the intra-cervical fascia of the neck (fascia endocervicalis); The fifth fascia (fascia prevertebralis); Adipose spaces of the neck: Non-closed (non-communicating) adipose spaces are subdivided, they include: 1) Supraorbital interaponeurotic (interfacial) adipose space; 2) Epigastric space; 3) The vagina of the nodding muscle; 4) The space of the submandibular gland; 5) Thyroid gland space; 6) The prevertebral adipose space; Open (communicating) adipose spaces, which include 1) Previsceral space; 2) Retrovisceral space; 3) Fiber of the main neurovascular bundle; 4) The fiber of the outer triangle of the. The obtained data can be extrapolated for patients with a cosmetological profile, as well as in the production of cosmetic operations in patients with burn disease, multiple injuries, etc.

Keywords: Neck; fascia; adipose spaces; open and closed

Fascies and adipose spaces of the upper extremities

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Abstract

This work was devoted on the question of fascies, adipose spaces and the level of their communications. The studies were carried out on 12 human corpses at the S.I. Georgievsky Medical Institute. Subclavian region includes superficial fascia, proper fascia, thoracic proper fascia and also the subpectoral and adipose space of the axillary which communicates with axilla. Scapular region includes superficial fascia, proper fascia of the superficial scapular muscles and proper fascia of the deep muscles of the scapular. Supraspinous, podoseal, subscapular and posterior scapular adipose spaces. Axillary region includes superficial, proper fascies, adipose space of the axillary fossa and communicated with subpectoral space, posterior fascial compartment of the shoulder, subdeltoid adipose space. The shoulder region includes superficial, proper and deep fascia. Anterior and external adipose fissure. Communications: with the external adipose fissure of the ulnar fossa, axilla. The elbow region is divided into the proper fascia, the anterior, medial, deep and external adipose fissure. The deep fissure communicates with the elbow joint, medial and external fissure. External fissure communicates with the external forearm compartment. The forearm has a superficial, proper fascia and the Parona-Pyrogov adipose space. The fascial fissures are connected with each other and with the adipose of the ulnar region. In the wrist there is the proper fascia, which is an extension of the fascia of the forearm and still the anterior, middle and posterior adipose spaces. In the palm and fingers, there are proper, palmar interosseous and deep fascia which communicates with the Pirogov's space, external fascial compartment of the palm.

Keywords: *Fascia; adipose spaces and upper extremity*

Adipose spaces of the lower limb, topographic and anatomical connections of adipose spaces

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Abstract

The topographic anatomy of the adipose spaces of the lower limb is an important section, and a detailed study of their structural features allows to expand our knowledge about possible ways of spreading infections, to develop effective methods of surgical intervention and prevention of complications. The aim is to conduct a deep anatomical analysis of the adipose spaces of the lower limb using cadaver dissection methods. The study included dissection of 12 corpses on the basis of the S. I. Georgievsky Medical Institute, followed by macroscopic analysis of adipose spaces. The study revealed complex anatomical connections of adipose spaces in the lower limb, each of which has unique anatomical features and connections. Adipose spaces of the gluteal region include: interfascial adipose space of the gluteal region, deep interfascial adipose space of the gluteal region. There are three cellular slits in the hip joint area. The adipose spaces of the thigh include: superficial and deep paraosseal adipose space of the thigh. The adipose spaces of the knee joint area include: the adipose space of the popliteal fossa and the adipose spaces of the lower leg, which are represented by: the tibial canal (cruropopliteus Gruberi), the upper muscular-fibular canal, the lower muscular-peroneal channels. The adipose spaces of the ankle joint area include: lateral ankle and tarsal tunnel. Adipose spaces of the foot include on the dorsal: subcutaneous and subfascial adipose space of the back of the foot. On the sole: subaponeurotic cellular fissura, superficial cellular fissura, deep cellular fissura. The study expands the understanding of the topographic anatomy of the adipose spaces of the lower limb, providing valuable data for surgeons, anatomists, and other medical professionals. The obtained results can be used to optimize surgical interventions, increase the effectiveness of treatment and improve results in the field of lower limb surgery.

Keywords: *Zinc Adipose spaces of the lower limb and connections*

Fascies and adipose spaces of the head

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Abstract

In this study, much attention is paid to the fascies and adipose spaces of the head. Fascies of the head have a different structure depending on their function, are very important in the field of surgery, cosmetology, plastic surgery, maxillofacial surgery. The density of the fascies of the head varies enormously. In some cases, they have the character of aponeurosis, in others — thin, transparent, or adipose formations. Due to their anatomical structure, they can cause both limited and widespread inflammatory effusion or hematoma. The structure of the adipose filling the interfascial spaces of the head is also related to its function. The aim of the work was to study the fascies and adipose spaces of the head. The work was carried out on 12 corpses on the basis of the Department of Topographic Anatomy and Operative Surgery of the S.I. Georgievsky Medical Institute. During the study, all fascies and adipose spaces of the head areas were studied. In the fronto-parieto-occipital region are superficial fascia, adipose spaces: subaponeurotic space, subcostal space, subcutaneous space. In the temporal region are superficial fascia, proper fascia (fascia temporalis propria), adipose spaces: superficial temporal space, deep temporal space, infratemporal space. In the mastoid region are superficial fascia, proper fascia. In the eye socket region are superficial fascia, proper fascia (septum orbitale), adipose spaces: preseptal space, pretarsal space, adipose space in the retrobulbar department. In the eyeball region are fascial sheath of eyeball (Tenon's capsule), muscular fascia of the eyeball. In the lateral region of the face are superficial fascia, proper fasci, fascia parotideomasseterica, fascia buccopharyngeal, adipose spaces: canine, buccal, parotid, masseteric, submasseteric, pterygomandibular, and temporal spaces. According to the results of the study, scientific literature, medical articles were studied, and 12 corpses were dissected, fascies and adipose spaces of the head were studied.

Keywords: *Fascies; adipose spaces of the head and region of the head*

Fascies and adipose spaces of the thorax

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Abstract

The topographic anatomy of the fascia and adipose spaces of the thorax is an important section and a detailed study of structural features allows us to expand our knowledge about possible ways of spreading infections. The aim of the work was to study the mutual location of the fascia of the thorax in connection with adipose spaces and their interrelationships. The work was carried out on 14 corpses on the basis of the Department of Topographic Anatomy and Operative Surgery of the S.I. Georgievsky Medical Institute. During the study, 3 groups of fascia were identified: superficial fascia, pectoral fascia, endothoracic fascia. The superficial fascia - poorly developed. It surrounds the bundles of platysma under the collarbone, below it forms a capsule of the mammary gland. The pectoral fascia consists of three deep lamina - the superficial, deep and the thoracic proper. Endothoracic fascia lines the inner surface of the thorax, covering Endothoracic fascia lines the inner surface of the thorax, covering mm. intercostales interni, mm. subcostales, and mm. transversus thoracis. The gland is mobile, because between the deep leaf of the superficial fascia and the breast's own fascia there is fatty tissue (cellulosum adiposum) - retromammary fiber. During the study and dissection, we discovered the adipose spaces of the thorax region: retromammary, superficial subpectoral and deep subpectoral adiposes spaces The lower border of the near-tracheal adipose space is formed by the fascial case of the aortic arch and the root of the lung. Adipose space of the posterior mediastinum- perinesophageal adipose space. According to the results of the study, the data obtained can be extrapolated in relation to patients with thorax pathology, cosmetic, traumatic and cosmetological aspects.

Keywords: *Fascia of the thorax; adipose spaces of the thorax and mediastinum*

Fascies and Canals of the Lower Limb

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Abstract

Knowledge of the topography of the fascia and canals of the lower limb, as well as their communication with each other, is an important part of the work of transplantologists, neurosurgeons, oncologists, vascular surgeons. The topic of this study is devoted to this issue. The aim of the study is to identify patterns in the structure of fascia and canals of the lower limb, as well as their messages. The research was carried out on 11 corpses on the basis of the Department of Topographic Anatomy and Operative Surgery of CFU. As a result of the work carried out, it was found out that the gluteal region includes the superficial, as well as the gluteal fascia. At the bottom, the gluteal fascia continues into the wide fascia of the thigh. In the thigh area there are superficial, as well as wide fascia. Also in the thigh area there are femoral, obturator and driving canals. The femoral canal is located between the superficial and deep leaves of the deep fascia and contains two holes: shallow and deep. The obturator canal is a furrow on the lower surface of the pubic bone. The adductor canal is a continuation of the anterior furrow of the femur at the border of the middle and lower third. The popliteal region includes the superficial and proper popliteal fascia. There are superficial and deep fascia in the thigh area. There are 3 canals in the thigh area: the ankle-popliteal canal, upper and lower muscular-peroneal canals. In the foot area there is a rear fascia of the foot and a fascia of the sole. There are 2 canals in the foot area: ankle and heel.

Keywords: *Fascia; canals and lower extremity*

Glycation: Pathogenesis, regulation, treatment

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Abstract

The extracellular matrix's (ECM) physiological roles include facilitating intercellular interactions, cell migration, and providing structural function. Glycation, a mechanism of natural aging and a component of late diabetic complications, disrupts these functions. This disruption is due to the formation of toxic advanced glycation end-products (AGEs), cross-linking, ECM protein turnover disruption, and ECM micro-topology changes. This study aims to investigate the contributions and mechanisms of glycation modulators, such as inducers like methylglyoxal and inhibitors like alagebrium, to the resulting intensity of glycation. We established *in vitro*, *in cellulo* and *in vivo* models to reproduce the individual stages and overall mechanism of glycation as a pathogenic factor. *In vivo* experiments modelled diseases that serve as accelerated aging of the ECM or long-term complications of diabetes mellitus, caused by glycation. It was confirmed that glycation could be intensively isolated in an integrated organism through animal intoxication with glycation agents, without involving other pathogenic components. We discovered/designed new glycation-modulating compounds (novel chemically synthesized and extractives) that can suppress glycation in molecular biological conditions and in model organisms. As expected, these agents are able to protect against the development of encephalopathy, nephropathy, retinopathy, and cardiomyopathy in diabetic conditions and mitigate diseases associated with aging. In conclusion, these compounds hold promising potential for developing new geroprotectors and antidiabetic agents.

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Keywords: Glycation; AGEs; diabetes and aging

Neuropeptide: Correction of stress-associated caspase-dependent apoptosis

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Abstract

Stress causes dysfunction in many body systems, and stress factors contribute to the formation of endocrine, immune, antioxidant, metabolic and other types of disorders leading to disruption of homeostasis and the development of molecular cell apoptosis. In recent years the assessment of apoptotic processes has often been carried out by determining the activity of caspases, both initiator and effector. Against this background the problem of pharmacological regulation and correction of these changes becomes more and more urgent. Neuropeptide compounds that play the role of regulatory molecules that are produced by almost all body systems, which determines their broad pharmacological activity, are of great interest in this direction. It has been established that neuropeptides are capable of exerting metabolic and antioxidant activity, as well as participating in the processes of induction of various trophic factors and cytokines, regulation of apoptotic processes. The aim of this research is to study the effect of neuropeptides on the level of initiating and effector caspases in the blood serum of white rats under conditions of experimental social stress. The model of experimentally induced social stress is based on the formation of sensory contact with the subsequent determination of aggressive and submissive types of behavior. The effector caspase-3 and initiating caspase-8 are actively studied as targets for various pathological conditions, in which the processes of programmed cell death are triggered. Expression of caspases -3 and -8 is an indicator of the cytotoxicity of an apoptotic stimulus, which makes these markers an important part of research on apoptotic processes. These molecules-markers of the external and internal pathways of apoptosis can serve as targets for the action of stress-protective drugs of neuropeptide structure. The study established the presence of neuropeptides under stressful effects of anti-apoptotic action due to inhibition of the caspase-dependent cascade of apoptosis reactions.

Keywords: *Experimental social stress; neuropeptides; apoptosis and caspases*

The study of surfactant protein a in children with allergic bronchial asthma

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Abstract

Surfactant protein A (spA) activates the innate immune system, regulates apoptosis, and prevents the development of IgE-mediated allergic inflammation. Changes in the surfactant protein concentration in various biological materials have been studied mainly in adult patients with BA. Several studies demonstrate a negative correlation between the spA level and disease severity. The study of spA in the pediatric population is important. There are no studies on predicting the severity of bronchial asthma in children based on pulmonary surfactant indicators. The most sensitive method is the determination of surfactant proteins in induced sputum. This study aimed to evaluate the levels of surfactant protein A in induced sputum in children with different allergic bronchial asthma severity. Children aged 5 to 12 years diagnosed with bronchial asthma participated in the study. Patients were divided into groups: mild BA (n=26), moderate BA (n=48) and severe BA (n=24). The control group consisted of 20 healthy children. Obtaining and processing of induced sputum was conducted according to the standard methods. The surfactant protein A concentration was measured in induced sputum by enzyme-linked immunosorbent assay (ELISA) and expressed in pg/ml. The study of spA in induced sputum in children with different BA severity was conducted for the first time. The surfactant protein A level statistically significantly differed in patients with different BA severity in comparison with each other ($p < 0.05$) and with the control group ($p < 0.05$). A significant positive correlation was revealed between spA production and the BA severity ($r = 0.74$, $p < 0.05$). Protein A reflects the airway inflammation level in children with BA. Surfactant protein A can be used as a marker of inflammation and a predictor of disease severity in children with BA. These data can be used for choosing the dose of inhaled baseline drugs for treating BA in children.

Keywords: children; bronchial asthma; sputum and surfactant.

Interleukin 31 and 33 levels in atopic dermatitis during pregnancy

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Abstract

The wide prevalence of atopic dermatitis and the increase in the number of severe forms determine its high medical and social problem. IL-31 and IL-33 are involved in the development of skin inflammatory process. Purpose of the study: To evaluate the levels of interleukins IL-31 and IL-33 in the blood serum of pregnant women with exacerbation of AD. Research methods: The study included 76 pregnant women with exacerbation of AD, 23 non-pregnant women with AD, 20 pregnant and 20 non-pregnant women without AD. The diagnosis of AD was made based on criteria according to clinical guidelines. The level of IL-31 and IL-33 in blood serum was assessed by ELISA. The study revealed that during pregnancy the level of IL-31 is statistically significantly higher than in other groups. IL-33 levels in the exacerbation groups did not differ statistically significantly. There is a strong correlation between the levels of IL-31 and IL-33.

Keywords: Atopic dermatitis; pregnancy; interleukin 31 and interleukin 33

The content of malondialdehyde, cortisol in the blood and lipids in the membranes of erythrocytes in patient with covid-19

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Abstract

Inflammatory processes and metabolic disorders may persist for a long time after COVID-19 infection. Significant markers of post-COVID changes are required. The aim of the study was to evaluate the validity of a comprehensive assessment including blood cortisol levels and cell membrane lipid peroxidation as assessed by changes in malonic dialdehyde (MDA) and red blood cell membrane lipid composition. The study included an experimental group of 31 individuals who had been diagnosed with COVID-19 four months prior to the start of the study and a control group of 13 individuals. Plasma MDA concentration was determined by the photoelectrocolorimetric method. Erythrocyte membrane lipids were determined by thin-layer chromatography and cortisol concentration by enzyme-linked immunosorbent assay. Within the group of COVID-19 survivors, two subgroups were identified using the method of joining tree clustering. Within one of these subgroups (comprising 16 individuals), a significant increase in MDA, cortisol and non-esterified fatty acids (NEFA) was observed, together with a decrease in the proportion of phospholipids (FL). This suggests the persistence of inflammatory signs typical of the acute phase of the disease. In the second group of 15 people, the parameters observed were indistinguishable from those of the control group, which could be an indication of complete recovery. Therefore, MDA and cortisol concentrations and erythrocyte membrane FL and NEFA levels are useful biochemical indicators for assessing the development of the post-COVID syndrome.

Keywords: Covid-19; malondialdehyde (MDA); lipids of erythrocyte membranes and plasma cortisol

Amplifying GABA B receptor signalling for remyelination in experimental autoimmune encephalitis model of multiple sclerosis

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Abstract

Multiple sclerosis (MS) is a persistent inflammatory condition affecting the central nervous system, marked by the loss of the myelin sheath. Remyelination is an essential process capable of reinstating the functionality of damaged axons and enhancing the clinical well-being of individuals with MS. We would like to explore the potential of GABA B receptor modulation, focusing on remyelination. The Sprague Dawley rats aged 4–8 weeks were immunized with MOG35-55 suspended in complete Freund's adjuvant (CFA) and pertussis toxin. The animal groups were divided into healthy, normal saline, CGP-55845, Baclofen and CGP-55845+Baclofen. The clinical symptoms (EAE score) and changes in body weight were assessed daily for 35 days. To examine whether the treatments could affect the level of proliferation in spinal cord slices, the thymidine analogue 5-Ethynyl-2'-deoxyuridine (EdU) was added to the tissue. The daily weights and clinical scores in all groups are statistically significantly different ($p < 0.05$) for each group. *Luxol* fast blue stains the white matter myelin and reveals the zone of demyelination. The Edu-positive cells were different between the CGP-55845 and baclofen groups. The treatment by the GABA B receptor antagonist initiates the proliferation of new cells which can indicate remyelination. This process may involve the generation of new myelin-forming cells, such as oligodendrocytes, to replace damaged myelin. Our findings suggest that GABA B receptor signaling was able to amplify remyelination in the EAE rat model.

Keywords: Multiple sclerosis; remyelination; GABA_B receptor; EAE score and experimental autoimmune encephalitis (EAE)

Comparison of computer-based ishihara test versus online d-15 dichotomous test in colour vision screening

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Abstract

Colour vision is important in one's daily life, especially in certain professions such as health care. Most online colour vision tests have varying degrees of quality and are variations of Ishihara test. The test should be quick and accurate in colour vision screening. Objective of this study is to compare the results of *computer-based Ishihara test* to that of *online D-15 dichotomous test*. A total of 302 participants were involved in this study. The **results** showed that 295 (97.7%) were normal, and 7 (2.3%) showed colour vision defect in Ishihara test while 292 (96.7%) were normal, and 10 (3.3%) showed colour defect in the online test. Furthermore, there is strong agreement between the two tests results (*Kappa:0.82). In conclusion, our study showed that online colour test can determine type and severity of colour vision defect.

Keywords: Colour vision screening test; computer-based Ishihara test and online D-15 dichotomous test

Characteristics of bioelectrical brain activity in people recovering from COVID-19

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Abstract

In COVID-19, two thirds of hospitalised patients have neurological complications. Therefore, the aim of the study was to evaluate EEG parameters in COVID-19 survivors who were not hospitalised. Fifteen critically ill and 20 conditionally healthy subjects were studied. The EEG was recorded on 21 leads, with an analysis epoch of 20 seconds. Electrodes were placed in a 10-20% pattern. Multivariate analysis of variance (MANOVA) was used for comparisons. Visual analysis of the EEG activity in the group of overtreated patients showed no gross disturbances in the neurophysiological activity of the brain. However, an increased amplitude of the θ rhythm was found in the group of overtreated patients, indicating a high level of activity in subcortical structures. There is also an increased amplitude of α_1 and α_2 rhythms, most pronounced in the parieto-occipital regions. The increased amplitude of the β_1 rhythm compared to the control is of particular interest, which may indicate an increased level of functional activity in the cerebral cortex. The localisation of the changes in the right hemisphere gives reason to consider them as a sign of increased unproductive emotional tension. Such changes may create conditions for the development of a specific syndrome in the form of stress and anxiety.

Keywords: EEG and COVID-19

The kidney mobile ar application: A supplementary learning aid for medical and health sciences students

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Abstract

The term "augmented reality" (AR) refers to a three-dimensional (3D) interactive experience that combines a view of the real world with computer-generated elements. The Kidney Mobile AR Application (The Kidney) is a prototype, mainly serving as a supplementary learning aid in the teaching and learning process of the human urinary system (HUS), especially for medical and health sciences students. The Kidney has already obtained an approved copyright (CRLY2022W6625). The Kidney consists of kidneys' functions, the kidneys' anatomical structure; AR of the kidney; a video on histology structure and urine formation, and quizzes. The AR feature in The Kidney will increase the attention span in learning, thus understanding the basic anatomical and physiology of the HUS. The benefit of AR is that the user can visibly observe the kidney and its position through a 3D model instead of 3D on paper. Compared to the non-immersive traditional teaching method, The Kidney enables the students to augment the learning process via online self-learning due to its accessibility. The user acceptance testing (UAT) (total n= 58) revealed that 70.7% of respondents thought AR would aid in learning and improve the understanding of the HUS. Most (98.3%) agreed AR helps them gain more interest in learning and the video provided assisted their further understanding. Moreover, most of the respondents could identify the kidneys' structures. They agreed that The Kidney is an important tool in gaining learning interest and assisting them to comprehend the HUS more effectively. The respondents hope that The Kidney will be more user-friendly and that adding more multimedia elements will facilitate a better understanding of the HUS. In conclusion, most respondents were satisfied with The Kidney. Thus, it can be used as a supplementary learning aid of the HUS.

Keywords: *Augmented reality; The Kidney; mobile application; learning aid; human urinary system*

Simulation appendectomy using an animal biomaterial model

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Abstract

Today, appendectomy training involves surgical simulators. However, existing simulators do not provide full anatomical similarity and tactile sensations reliability during operation. This makes it difficult operational skills acquiring. That is why the most optimal simulator search is important. Aim of research is the model development for simulating open and laparoscopic appendectomy. Requirements: visual and manual simulation reliability, ensuring the standard nature of simulations, resemblance to real appendectomy stages by the simulator, variability of simulation modeling, mass training possibility, economic profitability. Assessing model's prospects for a simulation training course. The invented model was compared with alternative appendectomy simulators described in research articles and in the FIPS database. The comparisons were made with a latex glove model, silicone and virtual simulators, and surgery on laboratory animal. Due to its facture from animal biomaterial, the proposed model has high visual and manual reliability. It is universal for simulating both open and laparoscopic appendectomy. When using a mannequin trunk or laparoscopic box, it is additionally possible to simulate the surgical access and operative completion. The manufacturing parameters allow the standard simulations. There is may be the simulation of different morphologies and topographic positions of the appendix. The model is simple and cheap to facture, which ensures mass production and training. Due to the indicated advantages, this model is promising as part of simulation training course for student programs, residency and advanced training programs. The model has broad training prospects. The prospects for a simulation course using the proposed model are: increasing specialist's training level, improving the quality of emergency surgical care, expanding the range of care due to the popularization of laparoscopy.

Keywords: *Simulation; appendectomy and patent invention*

Evolution of basic medical science education approach among Malaysian practitioners of Malay medicine

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Abstract

Traditional Malay Health & Medical Practice (Perubatan & Penjagaan Kesihatan Warisan Melayu, PWM) is a deeply rooted tradition which draws its knowledge from local Malay wisdom. The knowledge was passed down through generations, with mentors and old manuscripts as its 'primary sources'. To enhance its effectiveness, modernization efforts have been worked out by the government such as Act 775, which attempt to integrate Basic Medical Science (BMS) such as anatomy & physiology into practice of PWM. Although in the literature there are many studies on BMS education for Traditional & Complementary Medicine (T&CM), however there is no study on the teaching of BMS in PWM. Objective of this study is to review the teaching & learning approaches of BMS amongst practitioners of PWM. The methodology used was narrative review comparing two eras namely pre-enactment of Act 775 and post-enactment of Act 775. The results showed the evolution of BMS teaching & learning approach in PWM from sage- in-stage to student-facilitator and independent student style such as the use of Problem Based Learning (PBL). In conclusion, this study suggests trend of increasing maturity amongst PWM practitioners in reinforcing the body of knowledge in this field parallel to the contemporary needs. This can be interpreted as increasing readiness amongst those practitioners to expand the body of knowledge in this field.

Keywords: Education; anatomy and physiology; basic medical science; traditional medicine and Malay

Perception of the anatomy education environment and its association with psychological distress and learning approaches among preclinical medical students in USM

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Abstract

Declining of anatomy knowledge among medical students and graduates may be associated with elements of educational environment which have implications on the students' psychological well-being and affect the adoption of learning approaches. The purpose of this study was to measure the medical students' perception of anatomy education environment and determine its association with their psychological well-being and learning approaches. A cross-sectional study involved the USM Year 1 and 2 medical students (academic session 2019/2020). The Anatomy Education Environment Measurement Inventory (AEEMI) measured the students' perception of anatomy education environment. The students' psychological well-being was measured by the Depression, Anxiety, and Stress Scale 21 (DASS-21). Adoption of learning approaches was determined by the Approaches and Study Skills Inventory for Students (ASSIST). A total of 235 out of 300 students participated in this study with 99.6% response rate. Majority of the participants were females, 20 years of age, Malay race, Year 1 students. Most of the students perceived the factors in anatomy education environment positively. However, anatomy learning resources and histology practical facilities were perceived as area for improvement (33.8%) and concern (65.0%) respectively. In terms of the psychological well-being, 63.2% of students was affected with anxiety (65.5% of first-year and 61.0% of second-year students were affected) and the predominant learning approach adopted by the participants was deep learning approach (52.5%). There was no significant association between students' perception of all factors in anatomy education environment with their psychological well-being ($p > 0.05$). No significant association was observed between the factors in anatomy education environment and learning approaches, except for intrinsic interest in learning anatomy ($p = 0.032$). The anatomy education environment in USM is positive and conducive for the students. Despite the non-association between students' perception of anatomy education environment with their psychological well-being, the percentage of participants affected by anxiety is relatively high.

Keywords: *Anatomy education environment; psychological distress and learning approaches*

My Smart Skeletal (MySS) applications for anatomy learning

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Abstract

Musculoskeletal (MSK) problems are leading source of pain and disability in our society. Those limitations had been used as indicators of ill health and disability. Basic knowledge of our own skeletal become a need for everyone. Electronic learning is one the most significant recent breakthroughs in the information system(e-learning). The use of augmented reality (AR)technology in educational settings is now looking promising. We built three mobile AR applications(apps) for complete human skeletal system (MySS); Skeletal System Mobile AR (skull and thorax), Uppelimbify (upper limb) and AR-LEARN (spine and lower limb) not only for medical and health sciences students but also for school children. It will encourage students to self-study and increase student involvement in their classes, resulting in improved national higher education quality. We added computed tomography (CT) scan images, videos and AR quizzes to help people better grasp the anatomy of the human skeleton. This e-learning technology, which can be assessed at any time and from any location is thought to overcome challenges faced by medical and health sciences students during hybrid education. We randomly assigned 50 medical students to these apps and conducted a user acceptance test (UAT). We discovered that every single student strongly recommend the apps. The users enjoy interacting with the mobile applications to have a better understanding and help retain their knowledge of the human skeletal system. In conclusion, this AR approach is one of the promising tools to introduce anatomy knowledge of our body to the public and medical-related students.

Keywords: *Anatomy; MySS apps and musculoskeletal system*

A technology-based approach to teaching anatomy – a case report from VinUniversity

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Abstract

Integrated curriculum has been demonstrated to promote the retention of knowledge and break down barriers between basic and clinical courses, especially for teaching Anatomy. At VinUniversity, Human Body block incorporates clinical anatomy and related basic medical sciences. To ensure the accomplishment of the learning outcomes, systematic technology innovations have been deployed across the block which enhance the teaching and learning experiences, which are essential to promote active learning for the students of this generation. The use of Pirogov Anatomy Table in conjunction with other software including Pathcore Flow for pathology, Lecturio for lecture-based videos, and especially plastinated cadavers for hands-on experience is identified to facilitate delivering the course. Overall learning flow is driven by the robust use of Canvas, a trusted learning management system. Technology application might be inevitable at the moment. However, not only an enormous investment is required, but also the necessity for human resources and efforts to maintain and effectively integrate these technologies in designing curriculum is highly imperative. It is also important to be mindful of the infrastructure required to successfully implement educational technology in teaching anatomy. The lessons learnt from VinUniversity can benefit other institutions in considering both limitations and advantages of applying technology in teaching anatomy and related basic medical sciences.

Keywords: Anatomy; education; integrated curriculum; technology and innovation

Modern anatomy teaching environment - expanding borders

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Abstract

It is well known fact that global and local concept of anatomy teaching has been changed lately. Modern anatomy teacher workflow and academic targets, volume of new scientific information appearing yearly as well as students' way of thinking and Z-generation's habits require not a single instrument but a birth and creation of supportive atmosphere of the anatomy teaching environment. That requires a strategic look on its coherent design and simplicity of its application both for UG and PG high medical school and universities, students and teachers. Purpose of the research is to enhance the quality of human anatomy teaching of students at the Reaviz Medical University using the Pirogov 3D Anatomy Table and application. Two hundred students of the Faculty of Medicine at the Reaviz Medical University were used as a representative group for the research, Interactive Anatomy Table "Pirogov", Pirogov Anatomy App for teachers' and students' personal devices, summary of test results, student survey. During Semester I, students were divided into two groups. In group I, when teaching anatomy, the Interactive Anatomy Table "Pirogov" and Pirogov Anatomy App for teachers' and students' personal devices were used. In Group II, only classical methods of teaching anatomy were used. According to the results of the study, students from group I showed on average a 15-20% higher level of knowledge in anatomy during assessment, and a 20% higher level of satisfaction with the educational process. Thus, application of Pirogov Anatomy table showed a higher level of knowledge and students' satisfaction compared to traditional methods of Anatomy teaching.

Keywords: *Anatomy, teaching Pirogov Anatomy table and Pirogov Anatomy App*

International school of surgeons: How to motivate students and increase the prestige of the clinical anatomy department

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Abstract

On December 9-10, 2022, Sechenov University (SU), I.I. Mechnikov North-Western State Medical University (NWMU), and Belarusian State Medical University (BSMU) launched a new scientific and educational project – the International School of Surgeons (ISS). ISS was created as an international platform in English for the exchange of experience, for students of different levels of training. The goals of ISS was increasing the level of theoretical and practical training of future surgeons. The objectives were to introduce the ISS in the educational process; introduce the Interactive Anatomy Table “Pirogov” and Pirogov Anatomy App into the guidelines for ISS, and develop the principles and methodology for organizing the work of ISS for the best academic and educational results. Mode of work: online and face-to-face meetings in the participating university. During online meetings, the participating teams exchange experience in developing manual skills, and present their results of scientific or practical work that was carried out between meetings. Participants use the Zoom platform, and the Pirogov Anatomy App for the presentations in Power Point. At past meetings, foreign students of the NWMU and SU from India, Egypt, Brazil, South Africa, Algeria, China, Yemen, Nigeria, Bahrain, Sri Lanka, Borneo and Iraq participated in the competitions: “Vascular Anastomosis”; “Intestinal Anastomosis”, Knitting Surgical Knots”, “Desmurgy” and “Maxillofacial (periodontal) Surgery”. An important stage of work is preoperative training. The educational trajectory using the “Pirogov” Interactive Anatomy Table allows not only to develop the skills of digital dissection of a human body, but also learn how to plan operational accesses, taking into account individual characteristics and the layered structure of the body. After proper theoretical training, students begin independently planning scientific and/or practical activities. At all stages, students have the opportunity to compare the individual anatomy of a real cadaver with the normal anatomy by using the Pirogov Anatomy App.

Keywords: *International school of surgeons and Pirogov Anatomy table*

Terminologia Anatomica (TA2), Terminologia Neuroanatomica (TNA) and Terminologia Oroanatomica (TOA) with Russian equivalents

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Abstract

International Federation of Anatomical Associations (IFAA) executive committee authorized the translation, adaptation and publication of the Anatomical Terminology (TA2) [followed the official list of 7,113 Latin terms by FIPAT], and Neuroanatomical Terminology (TNA) [followed the official list of 4,399 Latin terms by FIPAT] at the initiative of the President of Russian Anatomical Society (SMSAHE) Prof. Dr. Dmitriy B. Nikityuk, and Vice-President of SMSAHE, Prof. Dr. Sergei S. Dydykin. Oroanatomical Terminology (TOA) was also issued with Russian equivalents and proved to be the 1st edition of the TOA in the world. It includes 2,294 terms related to the head and neck. The Russian anatomical terminologies are not a simple translation of Latin terms, but a historically established system of terms that reflects the contribution of Russian scientists to anatomy. Due to the widespread use of anatomical terminology in the international scientific literature, TA2, TNA and also TOA were published in four languages: Latin, Russian and English (UK [Great Britain] and US [United States]). While original version of terminologies includes 7 columns [the first column - the serial number of the term to which all footnotes are referred; six columns {2–7} contain the official Latin term {2}, Latin synonyms {3}, English terms (UK {4} and US {5} and English synonyms (if necessary) {6}. The last column includes related terms, eponyms, and links to endnotes {7}]. In the Russian version another 3 columns are added: {8} - Russian equivalent, {9} - Russian synonym, {10} - Russian eponym. Footnotes are placed in a separate section at the end of each chapter. Terms indicating the location of body parts and organs were described in relation to the anatomical position. Each organ was generally designated by one term, except in cases where a variant of the main term was used to form clinical terms.

Keywords: Terminologia Anatomica, Terminologia Neuroanatomica, Terminologia Oroanatomica and Russian equivalents

Organocomplex as a target in realizing the bioeffects of depleted uranium

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Abstract

Currently, there is an obvious need to assess the morphofunctional state of the parotid salivary glands and deep parotid lymph nodes as target organs after the incorporation of an aqueous solution of depleted uranium oxides, which have not previously been studied in aggregate. The experiment used 117 outbred mature male rats, divided into three experimental and age-equivalent three control groups. Using histochemical and immunohistochemical methods, a study of the organocomplex of the parotid salivary glands and deep lymphatic parotid nodes was carried out in the long term after a single dose of an aqueous solution of depleted uranium oxides instead of drinking water at a dose of 0.1 mg per 100 g of rat weight. Histochemical reactions were carried out on cryosections using standard methods to identify the optical density of the distribution of enzymes (lactate and succinate dehydrogenases) characterizing anaerobic and aerobic oxidation processes at the level of acini and striated excretory ducts using the ImageJ 1.53S program on serial sections of each of both parotid glands. General recommendations for medical and biological research were followed. An immunohistochemical (IHC) reaction performed to detect mast cell tryptase in deep parotid lymph nodes is an informative clinical and laboratory marker in diagnosing their functionality as a sensitive test. A prolonged bioeffect of changes in the organocomplex of the parotid glands and deep lymph nodes is shown. The data obtained are a reflection of uranium-induced destructive changes in the components of the organocomplex depending on the remoteness of the study period against the background of atypical regeneration of the striated excretory ducts of the parotid glands, as well as the dynamism and variability of the mast cell population of deep lymph nodes according to morphofunctional types, integratively modifying the bioeffects of depleted uranium.

Keywords: *Parotid gland; parotid lymph nodes; mast cells; tryptase and depleted uranium*

Anthracycline induced cardiomyopathy in pediatric patients

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Abstract

Anthracycline is a potent chemotherapy with significant efficacy that prolong the five-year survival rate of children with leukaemia and lymphoma from 30% in the 1960s to over 80% at present. Unfortunately, cardiotoxicity is a well-recognized side effect that affect survival and quality of life. It can be presented as acute, subacute and chronic cardiomyopathy. The exact mechanism of anthracycline-induced cardiotoxicity is still not fully understood despite extensive research. The most probable mechanism is the production of reactive oxygen species which lead to oxidative stress. The histological pathophysiology is characterized by myocardial damage due to proteolysis, necrosis, apoptosis, and fibrosis. A proper, early diagnosis and management of cardiotoxicity induced by anthracyclines is very much needed. Effective strategies are required for the screening and early detection of anthracycline induced cardiotoxicity focusing particularly in detection of deterioration of myocardial contractility before there is obvious reduction in left ventricular ejection fraction (LVEF). Measurement of myocardial deformation using speckle tracking enables more detailed assessment of myocardial contractility. The objective of this review was to study the published articles on anthracycline-induced cardiomyopathy among pediatric malignancies, its method of detection and duration of follow-up. An extensive literature search using key word 'anthracycline induced cardiomyopathy in pediatric' was carried out on PubMed, Google Scholar, and Cochrane review. Almost all studies utilized traditional 2D echocardiography to detect cardiomyopathy and patients were follow-up up to two years duration. Studies were also limited by number of patients due to lack of registry. With the advancement of modern technology, speckle tracking with strain imaging should be used to detect early asymptomatic cardiotoxicity as it can detect cardiomyopathy before changes in left ventricular ejection fraction takes place. This is to prevent the delay of initiating cardioprotective treatment and hence to improve the overall outcome of patients.

Keywords: Anthracycline induced cardiomyopathy; speckle tracing; strain imaging and pediatric cardiotoxicity

Maternal inflammation during gestation alters hippocampal neuronal morphology: Mitigated by physical exercise and environmental enrichment in adult Wistar rats

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Abstract:

Adverse events during gestation, especially inflammation due to infection, affects the vital processes of brain development that predispose to development of neuropsychiatric illness in adulthood. The present study aimed to elucidate the role of physical exercise and environmental enrichment during adolescence in mitigating the prenatal inflammation induced alterations in dendritic morphology of adult hippocampal CA3 neurons. Pregnant Wistar dams were injected intraperitoneally either saline (0.5ml; control group) or lipopolysaccharide (LPS group) (0.5mg/kg) on alternate days from embryonic day 14 [E14] till delivery. After delivery, pups were divided into following groups [n=6 per group]: (1) Control, (2) LPS, (3) LPS-exercise, (4) LPS-environmental enrichment and (5) LPS-exercise-environmental enrichment. On postnatal day (PND) 15 to 60, animals of group 3, 4 and 5 were subjected either to treadmill running exercise or environmental enrichment or both respectively. Animals were euthanized on PND 67, after staining with Golgi-cox, brain sections were used to trace hippocampal CA3 neuronal morphology by camera lucida. Further these neuronal tracings were analyzed for dendritic arborization by Sholl's method. Young adult rats of LPS group exposed to prenatal infection showed significant reduction in dendritic arborization of hippocampal CA3 neurons. Whereas, LPS-exercise-environmental-enrichment group that were exposed to prenatal inflammation and later subjected to environmental enrichment followed by running exercise, showed significant increase in dendritic branching points and dendritic intersections of CA3 hippocampal neurons. Physical exercise combined with environmental enrichment during juvenile/adolescent age effectively rescues the prenatal infection induced changes in dendritic arborization of neurons of CA3 sub-region of young adult hippocampus.

Keywords: Prenatal inflammation; lipopolysaccharides; dendritic arborization; physical exercise and environmental enrichment

Statistical analysis of the regularities of the development of degenerative-dystrophic changes of the cervical spine according to MRI data

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Abstract

Degenerative-dystrophic changes in the spine lead to a decrease in working capacity, increased fatigue, chronic pain in the head and neck. Assessment of the morphometric characteristics of the cervical vertebrae is an urgent issue when studying the dynamics of the course of osteochondrosis of the cervical spine. The aim of our work was to evaluate changes in the morphometric characteristics of the vertebrae cervical spine with different severity of degenerative-dystrophic changes according to the results of MRI. 203 volunteers, including 75 men and 128 women, were examined using a GE Brivo 350 MR tomograph. The data were grouped based on the severity of changes in the cervical spine and gender. A statistical analysis of the results was carried out. In the first group from 18 to 66 years. The greatest length of the entire cervical spine was observed among men of the first group - 103.0 ± 5.0 mm and women - 90.1 ± 4.1 mm. The average values for height of the cervical spine in the third group in men are 96.2 ± 4.9 mm, and among women 87.2 ± 3.9 mm. The average height of the cervical vertebral bodies among the participants of the first group is 13.1 mm for men and 11.3 mm for women. The greatest decrease in the vertical size of the vertebral bodies was observed in men of the third group up to 12.4 ± 0.5 mm. It was noted that there was no significant dynamics of changes in the difference in the vertical size of the vertebral bodies ($0.8-0.7$ mm). The presented information is relevant in the complex of changes in the cervical spine associated with the progression of degenerative-dystrophic diseases. The use of multiple sets of morphometric data makes it possible to improve diagnostic software taking into account regional and sexual characteristics.

Keywords: MRI; cervical spine and morphometry

Features of the position of the uterus and ovaries in the pelvic cavity according to ultrasound observations

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Abstract

Anatomical features of the organs of the female reproductive system are required in solving clinical problems. We performed ultrasound examinations of the female genital organs with an assessment of the position of the uterus and ovaries, counting the number of follicles. 73 women were examined using SonoAce R7 ultrasound machine. The angle between the cervix and the body of the uterus was measured, the position of the ovaries was defined. The data were grouped and subjected to statistical analysis. In the case of the vertical position of the uterus body, a uniform distribution of ovarian position variants was noted. When the uterus body was tilted anteriorly, the average position of the ovaries prevailed. In the case of deviation of the uterine body dorsally on the right, the predominance of the high and low position of the ovaries was noted, on the left, the results were closer to the average follow-up indicators. In general, the results of observation showed a predominance of the average position of the ovaries in the pelvic cavity and close values of the occurrence of high and low ovarian positions. The distribution of the number of follicles in the ovaries showed a slightly larger number of them on the right in all groups, and the highest average rates were among women with a deviation of the uterine body posteriorly. The average age of participants in the observation had similar values in all groups, in cases of vertical position of the uterus, the lowest average age was 30.8 ± 8.4 years. The greatest variation in the size of the deviation of the uterine body and the inconstancy of the position of the ovaries in the pelvic cavity was observed in women with the inclination of the uterine body dorsally and demonstrated the highest average values of the recorded follicles.

Keywords: Ovaries; ultrasound examination and reproductive system

The quantitative parameters of the different shapes of the heart in human fetuses

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Abstract:

The study of the morphogenesis of the heart and formation of its shape in the early stages of development is an important theoretical and practical problem. The aim of the work is to study the parameters the heart, its structures, the interrelations with the shape of the organ, the age and size of the fetus in uncomplicated pregnancy. On 149 preparations of human fetuses 12 – 32 weeks, the parameters of the fetus, its heart, intra cardiac formations were determined. Statistical processing of the received data was made. In the fetuses of the one gestation period, it is possible to distinguish three forms of the heart: a narrow long, transient, wide short. In the fetuses of 12 – 32 weeks, the relationship between the sizes of different parts of the heart, independent of age, but related to the shape of organ, appears. The heart of transitional form has maximum dimensions of the left atrioventricular ostium and aorta, the minimum lengths of inflow and outflow of the left ventricle, the length of trabecular part of the interventricular septum. According to the formula for the determining the cross-ratio (wurf), the relationships between three dimensions were calculated: length, width and thickness of the hearts; the length of the distance between the openings of the hollow veins, the inflow pathways, the outflow of right ventricle; length of the sinus, trabecular, conical parts of the interventricular septum; length of the inflow pathways, outflow of ventricles, their width. Wurfs of the indicated sizes for the heart of the transitional form in each age interval were close to 1,31, deviating by no more, than 5%. For narrow long and wide short hearts, in half the observations the deviation of the Wurf from the value 1,31 was more than 5%. The heart of the transitional form has a more harmonious ratio of sizes. In the construction of the heart and its chambers, the principle of conformal symmetry is realized, determining the similarity in the variety of organ shapes.

Keywords: *Fetus; heart; quantitative parameters and analysis*

Distribution of human skeleton bones for balance in bipedalism

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Abstract

The relevance of the analysis of the distribution of organs of functional systems by body parts is due to the search for mathematical patterns for the transition from the empirical to the theoretical stage of development of human anatomy. The purpose of the study was to identify patterns of distribution of bones in parts of the human body. The material of the study was bone skeletons from the collection of the Department of Human Anatomy, as well as information from educational literature. Skeletal bones were counted. There were revealed the ratios between paired left and right bones relative to the median sagittal plane $1/2:1/2$, and between the anterior and posterior bones of the body relative to the frontal plane in front of the spine $1/2:1/2$; and between the number of bones above and below the horizontal plane through the center of gravity of the body $2/3:1/3$, and between the axial skeleton and the skeletons of the upper and lower extremities $1/3:1/3:1/3$. The revealed ratios in the distribution of bones in parts of the body relative to three planes of three-dimensional space should be considered as adaptations of evolutionary development associated with human upright posture and ensuring body balance. They can be associated with the types of symmetry (central and bilateral) and segmentation of the body, and the balance for bipedalism in human evolution.

Keywords: Human skeleton; distribution of bones; balance and bipedalism

Safety management in sport: Focus on anatomical dysplastic features

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Abstract

In recent years, many countries have been actively implementing programs aimed at the development of physical education and sport. At the same time, there is a significant increase in injuries and sudden death in athletes, of which the main cause is connective tissue dysplasia. This study aimed to identify clinically significant indicators of high injury risk in individuals involved in physical activity and sport. A total of 117 subjects aged 26 to 47 years old (average – 35.1 ± 5.6) with recurrent musculoskeletal injuries were examined at Sechenov University. Dysplastic features were revealed according to a special validated questionnaire. Our findings showed that pathognomonic injury predictors are kyphotic spinal deformity, gothic palate, joint hypermobility, temporomandibular joint crunching, O- or X-shaped legs, hyperelastic auricles, varicose veins and moderate to high degree myopia. A positive correlation ($r=0.72$) was observed between the number of established signs and the severity of visceral manifestations, primarily cardiovascular changes. Identification of the established markers needs personalized selection of the sports type and training program, and additional cardiac and vascular examination. In conclusion, this study proposed that connective tissue screening in individuals involved in sport will allow for a safer environment for physical training and will contribute to the health preservation of youth.

Keywords: Sports activity; connective tissue dysplasia; personalized approach; pathognomonic injury predictors and youth health preservation

Anthropometric features of the structure of the head of persons of adolescent and adolescent age

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Abstract

In the course of the work, measurements were made of the head (height, width, circumference), as well as cephalic, altitude-longitudinal and altitude-latitude indices. 1186 adolescents and male youths from 14 to 19 years old were studied. The separation was carried out taking into account motor activity (YES): 1) average level of motor activity (SDA) (n=693); 2) high level of motor activity (VDA) (n=493). The head circumference of adolescents and young men is almost the same (56.6 ± 0.1 cm and 56.8 ± 0.1 cm). Persons with SDA have a higher indicator – by 0.7 cm ($p=0.003$) at the age of 14 years. The average head height of adolescents is 12.9 ± 0.1 cm. The height of the boys' heads is 13.3 ± 0.1 cm ($p=0.005$). The height of the head in persons with VDA at the age of 15 years is 0.8 cm ($p=0.000$) more than in the group of persons with SDA, and at the age of 16 years less by 0.4 cm ($p=0.004$) than in the group of persons with SDA. The longitudinal head size of adolescents is 18.3 ± 0.1 cm. The average value in the group of young men is 18.1 ± 0.1 cm ($p=0.158$). The width of the head of adolescents is 14.3 ± 0.1 cm. The width of the head of young men is equal to 14.5 ± 0.1 cm ($p=0.158$). Conclusion: Adolescents in the majority have a mesocephalic, narrow, medium-high head. At the age of 14, the low head shape dominates. 17-year-old boys have a low head, the shape of the head remains narrow. Boys 18 years old have a mesocephalic narrow head of medium height. The group of 19-year-olds is dominated by persons with mesocephalic shape, average height and width of the head.

Keywords: Teenagers; young men; physical development and physique indices

Tissue features of the prostate in men with different body weight with benign prostate hyperplasia

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Abstract

Benign prostatic hyperplasia (BPH) is one of the most common age-associated diseases in men. It is known that BPH is a multifactorial disease in which the leading hormonal-metabolic factor is being overweight. Thirty one patients underwent surgical treatment of BPH. Fragments of the prostate were taken intraoperatively to study their structure. Based on body mass index, patients were divided into 3 groups. Group 1 (n = 6, 19.4%) – men with normal body weight, Group 2 (n = 15, 46.88%) – overweight and Group 3 (n = 10, 31.25%) – with obesity class I. Preparation of prostate fragments was performed using standard methods. Immunohistochemical study of endothelial factor CD34+, clone QBEnd-10, was performed using ready-to-use primary monoclonal antibodies. The number of vessels was calculated using the point counting method, with a microscope magnification of 100 times, in a square test system with 88 points, in 40 images. The level of statistical significance was accepted at $p \leq 0.05$. With an increase in body weight, the microvascular bed of the prostate becomes depleted, which manifests itself in a decrease in the specific density of vessels and in an increase of avascular areas between the end sections of the glands in men with overweight and obesity. This is accompanied by an increase in the proportion of connective tissue in groups 2 and 3 compared to group 1. Morphometry of the glandular component (lumen, area of glandular epithelium) did not reveal significant differences. With an increase in body weight, a restructuring of the microvascular bed occurs in the prostate, manifested in its depletion, which causes the development of hypoxia and fibrotic changes in the organ. Further studies involving larger groups of patients are required.

Keywords: Benign prostate hyperplasia; microvessels; CD34+ and obesity

Effect of high-calorie diet on uterus in adolescent rats

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Abstract

At this time obesity is an important problem of modern medicine. By 2013, the number of overweight people had grown to 2.1 billion, according to WHO. UK scientists predict that a quarter of children under 16 years will have been obese by 2025. People with obesity have low quality of life, psychological and social problems, chronic diseases. Objective: To explore the structure of the uterus in adolescent rats that taking a high-calorie diet. Materials and Methods. Rats aged 4 weeks were used. They were divided into 4 groups of 5 rats. The first group took a standard diet with a liquid probiotic (*Bifidobacterium longum* MC-42). The second group took high-calorie diet with lard and 20% sucrose solution. The third group took high-calorie diet with lard, 10% sucrose solution and probiotic. The fourth group took high-calorie diet with lard, 20% sucrose solution and probiotic. After 12 weeks the uterus was taken for the research and treated with a standard method for pouring into paraffin. The program ImageJ was used for morphometry. Results: Wall thickness uterus is $1373 \pm 15 \mu\text{m}$ in rats that took a standard diet with probiotic. Wall thickness uterus more by 11% in rats in the second group, in the third group – more by 27%, in the fourth group – more by 25%. The growth of uterus wall thickness is a growth of endometrial area and reduction of myometrium area. Conclusions: High-calorie diet induces the growth of uterus wall thickness through the growth of endometrial area. This is a reflection of accelerated puberty.

Keywords: High-calorie diet; obesity; uterus and adolescent rats

The structure of the oral mucosa when cadmium accumulates

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Abstract

Relevance. The problem associated with chronic poisoning of people with heavy metals is becoming more acute, since many toxic elements accumulate in soil, water and plants and enter the human body. Children of different ages are most sensitive to the action of heavy metals. Among the toxic elements, cadmium compounds occupy one of the first places. The aim of the work is to identify structural rearrangements of the oral mucosa in male adolescent rats under conditions of chronic cadmium intoxication. Materials and methods. The specialized and lining mucous membrane of 4-month-old male adolescent Wistar rats was studied. The animals were divided into 2 groups of 10 individuals each: the 1st group was an intact control, the 2nd group of animals received food with an injected solution of cadmium sulfate at a dose of 0.5 mg/kg. Morphometry was performed using the ImageJ 1.54d program. Results. The introduction of cadmium sulfate leads to the formation of a tendency to decrease the cell area of the basal and spiny layers of the specialized mucous membrane of the tongue. The area of the granular layer is significantly reduced by 9%. The thickness of the stratum corneum in the specialized mucous membrane of the tongue significantly increases by 13.8%.

The cheek mucosa of male Wistar rats is represented by a chewing-type mucosa. of the basal layer. Under the conditions of cadmium administration, the most pronounced was the increase in the area of the surface keratinizing layer, which increased by 3.86 times. Conclusions. The revealed changes in the mucous membrane under conditions of cadmium indicate a change in the ratio of the areas of various layers of the epithelial lining, as well as a violation of the processes of peeling of the surface layers of epithelial cells, which leads to a significant increase in their area.

Keywords: Adolescent males; cadmium and mucous membrane

COVID-19 and thyroid structure

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Abstract

To date, COVID-19 has the status of a systemic disease. Since it has the ability to affect many internal organs. We suggest that the thyroid gland may be a target for COVID-19 due to the epithelium that expresses ACE2. The role of endocrinopathy in the thanatogenesis of COVID-19 is still unclear. The next objective of the study was to study the pathomorphological characteristics of the thyroid gland in patients with identified SARS-COV-2 virus RNA by PCR. Autopsy material of the thyroid gland from 100 patients was used in the work. The macrostructure was evaluated: the absolute majority of autopsies showed an increase in the mass of the gland. The gland is covered with a thin fibrous capsule. The color on the cut is brown, the consistency is dense. Using the histological method (staining with hemotoxylin and eosin) in thyroid samples of patients of the I wave (n=100), the most frequent findings were subacute thyroiditis, hemorrhages in thyroid tissue. The morphometric study assessed the average diameter of the follicles, the area of sclerosis in lymphoid hyperplasia, the area of lymphoid zones, and thus the average diameter of the follicle was: 173 mm, with severe lymphoid hyperplasia, sclerosis reaches 10%, and lymphoid zones 7%. We performed a retrospective analysis of the patient's medical record with an assessment of clinical blood parameters and the presence of concomitant endocrinopathology, all data were subjected to statistical processing. The following conclusions were made: in the study of autopsies, pronounced structural changes of the thyroid gland of patients who died from laboratory-confirmed COVID-19 infection were determined, which prove the involvement of the SARS-COV-2 virus in the initiation of changes in the structure of thyroid cells.

Keywords: Covid-19; thyroid structure; morphometric study and cytokine storm

Hallus valgus affects the gait parameters in middle-aged and old women

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Abstract

Hallus valgus (HV) is known to cause foot pain and deformity mostly in old women and affect the gait parameters and biomechanics of the lower limb joints. The objective of the study is to consider the gait parameters in middle-aged and old female patients with HV compared to the age-matched healthy woman. A total of 41 middle-aged and old women are enrolled in the study; 17 of them (45-65 years of age) suffer from HV, while another 24 (40-60 years of age) comprise the group of age-matched controls without pathology of the musculoskeletal system. Gait patterns are assessed using a three-dimensional video data analysis system. A Vicon motion capture and analysis system (Vicon, Oxford, UK), including 10 Vicon T40 infrared cameras, an AMTI dynamometer platform (OR6-5-1000, Watertown MA, USA), Vicon Nexus and Vicon Polygon software (UK) are used in the study with statistical data processing using SPSS 27.0.1 software; the difference is considered significant if $p < 0.05$. Comprehensive analysis of the gait parameters reveals that in patients with HV time of double support (0.29 ± 0.07 vs. 0.21 ± 0.05 sec) and step time (1.26 ± 0.11 vs. 1.06 ± 0.16) increase ($p < 0.05$), while gait speed (0.92 ± 0.18 vs. 1.21 ± 0.15 m/sec) and step length (1.05 ± 0.16 vs. 1.27 ± 0.12 m) decrease ($p < 0.05$). Therefore the decrease in gait speed in the vast majority of women in the main group occurs primarily due to an increase in step time and a decrease in step length. This also caused a downward change in cadence in the main group (104 ± 8.84 vs. 114.00 ± 6.9 steps/min). There are no significant differences between the gait indicators on both sides which may indicate the involvement of the contralateral lower limb in the pathological process. These observations expand understanding of the HV- and age-related gait pattern changes in aging women.

Keywords: Hallux valgus; motion capture; gait and women

Interplay between modelled depression and hypothalamo-pituitary-adrenal axis

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Abstract

It is well known that stress-related activation of the hypothalamo-pituitary-adrenal axis (HPAA) may result in depression, however information on the reverse effect of depression on the HPAA is missing. The objective of the study is to evaluate the effect of modelled depression not associated with stress on the hypothalamo-pituitary-adrenal axis (HPAA). A total of sixteen C57BL/6 mice (weight 20+/-2 g) divided into two groups were included in the study. Reserpine-induced depression was modelled in animals of Group 1 (n=8); while Group 2 mice (n=8) received normal saline. At the end of depression modelling open field, sucrose preference and forced swimming tests were performed. The concentration of corticosterone in blood was measured using ELISA. Morphometric histological changes in the adrenal and pituitary glands were assessed. All results were statistically processed using SPSS 27.0.1 software, with $p < 0.05$ level of significant differences. Animals of Group 1 have higher levels of corticosterone in the blood ($p < 0.05$) and significant changes in distance travelled, rearing, grooming, urination and defecation ($p < 0.05$) compared to Group 2 mice. A significant increase in the volume density of the zona fasciculata ($p < 0.05$), area of spongiocytes and their nuclei ($p < 0.01$) was discovered in experimental animals compared to the negative control. Modelled depression, not associated with stress, results in activation of the HPAA, as demonstrated by increased serum corticosterone, hyperplasia of the adrenal cortex, hypertrophy of cells of the zona fasciculata and behavioural tests; indicating the cross-talk between modelled depression not associated with stress and the HPAA activation pattern in experimental animals. This observation prompts new solutions in treatment of depression.

Keywords: Depression; mice and hypothalamo-pituitary-adrenal axis

Dependence of linear dimensions of liver by anatomical position of the organ in abdominal cavity of examined individuals according to data spiral computed tomography

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Abstract

Computed tomograms of 205 people of both sexes in adolescence and the first period of adulthood were analyzed. The examined persons were divided into 6 groups depending on anatomical position of the organ in abdominal cavity relative to the frontal and sagittal planes. For each group, laterolateral size, craniocaudal and anteroposterior size of right and left lobes of liver were determined. The craniocaudal size right lobe of liver with ventropetal position of liver is larger (14.48 ± 0.26 cm) than with the intermediate-sagittal (10.89 ± 0.15 cm) and dorsopetal (10.50 ± 0.27 cm) positions of organ. The anteroposterior size right lobe of liver with intermediate-sagittal and dorsopetal position of liver (16.27 ± 0.18 and 16.03 ± 0.38 cm, respectively) significantly exceeds that with ventropetal position of organ (13.73 ± 0.21 cm) ($p < 0.05$). The craniocaudal size left lobe of liver is greatest in the ventropetal position (10.03 ± 0.29 cm), the smallest in the dorsopetal position (3.89 ± 0.21 cm). Anteroposterior size left lobe of liver is minimal in ventropetal position of organ (6.27 ± 0.15 cm) and is statistically significantly different from the values of this indicator in intermediate-sagittal (7.60 ± 0.12 cm) and dorsopetal (7.56 ± 0.34 cm) position of liver in abdominal cavity ($p < 0.05$). The laterolateral size (length) of liver vary greatly when liver is displaced in frontal plane: the smallest values of liver length are observed with dextrapetal position of organ (15.23 ± 0.21 cm), the largest - with sinistropetal position (22.74 ± 0.39 cm). With intermediate-frontal, ventro- and dorsopetal positions of organ, the length of liver did not differ statistically significantly between the groups. When conducting spiral computed tomography, significant differences in linear dimensions of liver were established between groups of people with different anatomical variants of the position of organ in abdominal cavity. These differences must be taken into account when the results of spiral computed tomography are interpreting.

Keywords: *Spiral computed tomography; linear liver dimensions and position of liver*

The role of gut microbiota in liver regeneration: Immune associated hepatic genes and signalling pathways after partial hepatectomy in mice

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Abstract

Liver regeneration is a complex process orchestrated by redundancy of multiple signalling pathways particularly immune related signalling pathways. Despite many studies, the actual mechanism of liver regeneration is not fully understood. This study investigated the involvement of gut microbiota in liver regeneration focusing on immune related genes and signalling pathways, specifically toll-like receptor (TLR), nuclear factor-kappa B (NFκB) and tumour necrosis factor (TNF) signalling pathways in the early phase of liver regeneration in mice. Male, 8-10 weeks old, wild-type (WT, C57BL/6), germ-free (GF) and germ-free mice recolonised with gut microbiota (XGF) mice underwent a 70% partial hepatectomy (PHx). Liver tissue harvested at 3 hours after PHx was used for mRNA sequencing. Significantly differentially expressed genes (DEGs) were compared between different mouse groups and were subjected to KEGG pathway enrichment analysis using DAVID. An adjusted p-value < 0.05 was considered significant. At 3 hours after PHx, totals of 3338, 1200 and 3647 genes showed significantly different expression in WT vs. GF, WT vs. XGF and GF vs. XGF, respectively. From these DEGs, 36, 13 and 70 pathways were enriched in KEGG pathways in WT vs. GF, WT vs. XGF and GF vs. XGF, respectively. TLR, NFκB and TNF signalling pathways were enriched in WT vs. GF and GF vs. XGF but not in WT vs. XGF mice. *Tab2*, *Ikbkg*, *Traf3*, *Ripk1*, *Nfkbia* genes were significantly expressed in these three pathways. Regulation of TLR, NFκB and TNF signalling pathways during liver regeneration may be dependent on the presence of gut microbiota. Reintroduction of gut microbiota may have activated these immune related signalling pathways, resulting in the improved restoration of liver mass in the XGF mice. These findings denote that early activation of immune related - signalling pathways and genes by the gut microbiota may be pivotal in liver regeneration.

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Keywords: Immune signalling pathway; partial hepatectomy; germ-free mice and gut microbiota

Deciphering the potential mechanisms of *Alternanthera sessilis* red against atherosclerosis using network pharmacology and molecular docking approach

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Abstract

The red cultivar of *Alternanthera sessilis* (ASR), a medicinal weed traditionally consumed by Asians, reduces risk of cardiovascular disease with established athero-protective effects from previous studies. However, the underlying mechanism of ASR against atherosclerosis remains unknown. This investigation aims to discover the potential mechanisms of ASR in treating atherosclerosis using network pharmacology and molecular docking. ASR's phytochemicals were collected via literature search. Screening of their pharmacokinetic properties was aligned with Traditional Chinese Medicine System Pharmacology (TCMSP) database's criteria of oral bioavailability $\geq 30\%$ and drug-likeness ≥ 0.18 . Potential targets of ASR bioactive compounds were sourced from SwissTargetPrediction and DrugBank databases; atherosclerosis targets from OMIM, DisGeNet, and GeneCards databases. The Venn diagram demonstrated overlapping genes. STRING database and Cytoscape software were used to construct protein-protein interaction (PPI) and compound-target networks respectively. Hub genes were retrieved based on three topological parameters: Degree, Betweenness, and Closeness. DAVID bioinformatics tool was employed for Gene Ontology (GO) and Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway enrichment analysis. Molecular docking validated binding affinities between bioactive compounds and the hub genes. Among 189 compounds identified from ASR, only 5 (Dehydrodieugenol, Luteolin, Quercetin, Thymine, and Xanthosine) emerged as key bioactive compounds meeting the criteria. PPI network between ASR and atherosclerosis targets revealed 239 intersecting genes, from which 5 hub genes were discovered: AKT1, HSP90AA1, SRC, ESR1, and STAT3. These targets were associated with positive regulation of MAPK cascade according to GO analysis. KEGG pathway analysis ranked lipid and atherosclerosis third preceded by AGE-RAGE signaling, emphasizing ASR's role in reducing diabetic conditions, a significant atherosclerosis risk factor. Molecular docking showed Dehydrodieugenol-ESR1 complex with the highest binding affinity at -8.56 kcal/mol. Our study uncovers potential molecular pathways for treating atherosclerosis with ASR through network pharmacology and molecular docking. Experimental validation *in-vitro* and *in-vivo* is necessary to confirm these computational findings.

Keywords: *Alternanthera sessilis* red; medicinal weed; atherosclerosis; network pharmacology and molecular docking

Patterns of glycosylation of lymph node cells in a variety of human lymphomas

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Abstract

Glycosylated cellular proteins have been reported to correlate with the metastatic potential of tumours, including lymphoma. Changes in glycosylation of cells can be detected using plant lectins. For example, Lycopersicon esculentum tomato lectin (LT) binds to surface glycoproteins of lymphocytic and lymph node (LN) stromal cells and may serve as a universal marker for cellular participants in lymphoproliferative transformation. The aim of this study was to investigate protein glycosylation in lymph node (LN) cells from normal subjects and patients with chronic lymphocytic leukaemia (CLL) and splenic marginal zone lymphoma (SML). Histochemical staining with FITC-labelled LT was performed on LN sections. Dramatic changes were found between LNs from different lymphoproliferative diseases, not only in the labelling intensity of lymphocytes and macrophages, but also in the organisation of the LN follicles, the conduit system and the structure of the subcapsular sinus. We suggest that the loss of the functional activity of the LNs is not only associated with the neoplasia of the lymphocytes, but also with the loss of the normal lymphocytic microenvironment. A difference in the expression of TL between CLL and SML enables it to be used in the differential diagnosis of lymphomas.

Keywords: Splenic marginal zone lymphoma; chronic lymphocytic leukemia; lymphocytic microenvironment and tomato lectin

Unravelling the effects of bisphenol a on colorectal cancer progression in obese Sprague-Dawley rats

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Abstract

The emergence of Bisphenol A (BPA) as a carcinogenesis agent has been linked to cancer development in oestrogen-responsive organs. However, its impact on colorectal cancer (CRC) remains an uncharted endpoint in research. Moreover, obesity is recognized as a significant environmental risk factor for CRC. Thus, this study aims to investigate the influence of BPA on the progression of CRC in obese *Sprague-Dawley* (SD) rats. Thirty male SD rats were randomly divided into five groups (n=6): N (normal diet), NC (normal diet with CRC), HC (high-fat diet with CRC), NCB (normal diet with CRC and BPA), and HCB (high-fat diet with CRC and BPA). CRC was induced by administration of 1, 2-dimethylhydrazine (DMH) at a dose of 40mg/kg body weight (BW) once a week for 10 weeks. Meanwhile, 25mg/kg BW of BPA with olive oil was administered orally for a duration period of 19 weeks. In addition, the BW and food intake of the rats were recorded weekly. At week 20, the animals were sacrificed, and both blood and related tissue samples (liver, white adipose tissue, and colon) were collected for biochemical analysis, Luminex assay and histopathological evaluation, respectively. The HCB group exhibited the development of nodular lymphoid hyperplasia with concurrent inflammatory bowel disease compared to other groups. Additionally, the HCB group displayed significant pathological changes in the liver, characterized by moderate to slightly severe hepatotoxicity in contrast to the N group. Meanwhile, the HC group showed significantly larger adipocyte sizes in comparison to the other groups. Notably, the impact of BPA on adipocytes' hypertrophy was diet dependent. Lastly, the HCB group also demonstrated significantly higher expression of IL1-beta when compared to the other groups. In conclusion, BPA increases the risk of CRC progression in the obese rats, potentially by exacerbating multiple organ-related issues.

Keywords: Bisphenol A; colorectal cancer; obesity and histopathology

Evaluating the therapeutic potential of tualang honey in atherosclerosis treatment: A comprehensive analysis incorporating network pharmacology and molecular docking approaches

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Abstract

Tualang honey (TH), a nutritionally rich natural product with an extensive history in folk medicine, has recently demonstrated promising cardioprotective properties, implying its potential for addressing atherosclerosis. The primary objective of this study is to employ network pharmacology and molecular docking approaches to investigate the pharmacological mechanisms underlying the potential of TH as a treatment for atherosclerosis. The active components of TH were screened from extensive literature search. The Swiss Target Prediction and SuperPred databases were utilized to predict potential gene targets associated with the compounds, while genes relevant to atherosclerosis were extracted from OMIM, DisGeNet, and GeneCards databases. Interactions between the identified compounds and atherosclerosis-associated genes were established through protein-protein interaction analysis. Gene ontology analysis and KEGG pathway analysis were used to analyze and screen key targets and pathways. This comprehensive procedure resulted in the identification of the top 10 hub genes, which served as the foundation for constructing a network illustrating the connections between the compounds and their respective targets. To substantiate these findings, molecular docking studies were conducted using the AutoDock Tools software. This study revealed that among the 103 compounds identified in TH, only six compounds met the screening criteria. These compounds demonstrated a notable capacity to interact with a total of 336 gene targets, with 238 of them being shared with atherosclerosis-related genes. These compounds were shown to have significant associations with biological processes related to inflammation, which are pivotal in the pathophysiology of atherosclerosis. Additionally, these compounds exhibited clear links to lipid and atherosclerosis pathways. The docking analysis confirmed that the active components exhibited strong binding potential with the key targets. In summary, this research provides valuable insights into the potential pharmacological effects of bioactive compounds found in TH and underscores its promising role as a therapeutic option for addressing atherosclerosis.

Keywords: Tualang honey; atherosclerosis; network pharmacology and molecular docking

Anti-angiogenic effect of astaxanthin (ATX) in human umbilical vein endothelial cells (HUVECs) induced by VEGF

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Abstract

Angiogenesis is the development of new blood vessels from preexisting ones that is essential for tumor growth and metastasis. Anti-VEGF therapy such as Bevacizumab; Avastin has been used as anti-angiogenic agent in cancer treatment yet the treatment is frequently associated with severe adverse effects. Alternatives are investigated for complementary natural products with comparable anti-angiogenic effectiveness and minimal adverse effects. Despite research demonstrating that astaxanthin (ATX) possesses anti-oxidant and anti-inflammatory properties, its effect on the angiogenesis process is yet unknown. Therefore, the purpose of this study is to ascertain ATX's anti-angiogenic properties. By using cytotoxicity, proliferation, migration, and tube-formation assays, the effects of ATX at concentrations ranging from 25 μ M to 6.25 μ M on VEGF-induced human umbilical vein endothelial cells (HUVEC) angiogenesis were assessed. Angio-suppressive agent Suramin was used as a positive control. Both cytotoxic and proliferation assay were tested at concentration ranging from 3.125 μ M to 50 μ M. The result showed ATX exhibited cytotoxic effect ($LC_{50}=95.38\mu M$) and at 50 μM ATX killed 31% of the HUVEC when treated for 24 h ($P<0.05$). Moreover, ATX exhibited anti-proliferative effect ($IC_{50}=58.87\mu M$) on HUVEC when treated for 72 h ($P<0.05$). Next, ATX inhibited migration in concentration-dependent manner with increasing concentration ($P<0.05$) through scratch wound healing assay and the migration rate at 25 μ M is 20% for 8 h. Furthermore, ATX decreased the average of tube length (μ m) in concentration-dependent manner with increasing concentration ($P<0.05$) through tube formation assay for 8 h. In conclusion, ATX exhibited anti-angiogenic effect on HUVEC induced by VEGF through cytotoxicity, proliferation, migration, and tube-formation assays. This study provides useful basis for further investigations on ATX against angiogenesis related diseases.

Keywords: Anti-angiogenic; Astaxanthin; VEGF and HUVEC

Seminal plasma polyamines, their antimicrobial activity and role in male fertility

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Abstract

Most childless marriages with male infertility are associated with different factors, the most common being infectious and inflammatory processes of various parts of male urogenital tract. A characteristic feature of inflammatory diseases of the male reproductive system has recently become a low-symptomatic or asymptomatic course, as well as the prevalence of conditionally pathogenic bacteria (CPB) among etiopathogens. In this regard, the detection of latent inflammatory processes in the male genital tract associated with CPB is of particular relevance. Infertile patients with acute and latent inflammatory processes were included in this study. The contents of seminal plasma polyamines (PA) and factors of PA precipitation in blood serum and in seminal plasma were assayed in infertile men with asymptomatic bacteriospermia, in patients with inflammation of the urogenital system (pyospermia), and in healthy donors. The effects of PA (spermine (Sm) and spermidine (Sd)) on microorganisms most commonly found in semen during pyospermia and/or bacteriospermia, were studied to assess the antimicrobial activity (AA) of these substances. In pyospermia patients the levels of PA in the ejaculate were significantly lower compared to their content in the spermoplasm of healthy donors. Precipitating factors to PA were absent in healthy people, but were found in the seminal plasma of bacteria carriers. These results can be used in the diagnosis of sluggish inflammatory processes in the genitourinary tract of men with infertility. The physiological concentrations of Sm and Sd were found to inhibit, up to complete death, etiopathogenic strains, while commensal strains isolated from the urogenital tract of men were resistant to the effects of PA. This observation allows the grading of conditionally pathogenic microorganisms isolated during infertility by their etiological significance and indicates the classification of the isolated bacteria to a certain ecological niche.

Keywords: Polyamines; male infertility; semen and bacteriospermia

The role of BPA in inducing obesity by *in vivo* study

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Abstract

Bisphenol A (BPA) is an endocrine-disrupting agent used in the production of polycarbonate plastics and epoxy resins. There is a strong correlation between BPA exposure and several chronic metabolic disorders. However, the relationship between BPA exposure and obesity is still unclear. This study aimed to determine the chronic effect of BPA exposure on body weight and lipid profile of rat models. A total of twenty-four Sprague *Dawley* rats were divided into four groups (n=6), normal diet + vehicle (G1), high-fat diet+ vehicle (G2), ND+ 25mg/kg BPA (G3) and HFD+25mg/kg BPA (G4) administered orally for 20 weeks. The body weight and food consumption of the rats were recorded weekly. At the end of week 20, the animals were sacrificed. The serum and adipose tissues, including white adipose tissue (rWAT, visceral, and gonadal) were collected to determine the lipid profile, fasting blood sugar (FBS), and organ weight. This study showed that body weight was increased by more than 10% in all groups compared with G1, suggesting that chronic exposure to BPA may lead to obesity. The lipid profile showed that total cholesterol (TC) and high-density lipoprotein (HDL) levels were higher in all groups than in G1, while only G4 showed a significant increase in the triglycerides (TG) and low-density lipoprotein (LDL) levels compared with G2. Meanwhile, we found non-significant results in FBS, and total white adipose tissue weight (rWAT and visceral) collected in all groups compared to G1 and G2. Moreover, G4 showed a significant increase in gonadal tissue weight compared to G2. This result shows that BPA significantly affects the body weight gain of rats and the occurrence of obesity. Further investigation in terms of the mechanism of action is warranted.

Keywords: BPA; white adipose tissue; obesity and *In vivo* study

Aza-analogs of amantadine upregulate the locomotor activity and orient-researching behavior of mice in the model of cuprizone demyelination

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Abstract

Amantadine (AMD) is used in the complex therapy of some neurodegenerative diseases such as multiple sclerosis for down-regulation of neurological deficiency. AMD has also antiviral properties, which are of special interest in developing of AMD structural analogs to be used in correction of neurological disorders following complications in COVID-19 infection and post-COVID syndrome. The demyelination of axons in the central nervous system characteristic of multiple sclerosis is usually studied using a murine cuprizone model. The goal is to study effects of two aza-analogs of AMD (K-238 and K-302) synthesized in the Vorozhtsov Novosibirsk Institute of Organic Chemistry. All animals, except intact mice, received 0.3% water solution of cuprizone ad libitum. AMD and its analogs were injected intraperitoneally to mice C57BL/6 at a dose of 20 mg/kg three times a week for 40 days. The photo-sensitive equipment for automatic registration of motor functions and behavior TRUSCAN ("COULBOURNE Inst.", USA) was used. The corpus callosum foci of the murine brain species were studied using immunohistochemistry with CD68 marker. It was revealed, that K-238 statistically significantly upregulated the "total movement time", "mean of velocity" and "total movement distance" comparing with intact, control (only cuprizone) and AMD-groups. K-302 significantly upregulated the "total movement time" against control and the "mean of velocity" and "total movement distance" relative to the AMD-group. The K-302 significantly upregulated the "total time of orient-researching activity" versus to the intact, control and the AMD-group. The CD68 expression was down-regulated in groups with two aza-adamantans. In conclusion, the aza-analogs of AMD have a stimulating effect on locomotor activity and behavior of mice in conditions of demyelization which is the main symptom of multiple sclerosis. The data indicate the prospects of further researches of these agents as modulators of the central nervous system in conditions of neurodegenerative processes.

Keywords: Amantadine; aza-adamantans; cuprizone model of demyelination; motor functions and behavior and corpus callosum

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Heparan sulfates content in the myomatous nodes does not depend on the upregulated progesterone background during pregnancy

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Abstract

Proteoglycans of the myomatous nodes extracellular matrix represent a reservoir of growth factors and cytokines as mediators of angiogenic and inflammatory responses. Uterine fibroids, being the most common benign hormone-dependent women tumor, have become increasingly common in obstetric practice. Fundamental and clinical impact of uterine myoma is still important. The goal is immunohistochemical study of heparan sulfates content in surgical samples of women with uterine fibroids during pregnancy. Women with uterine myoma were delivered by cesarean section; the 1st group took progestogens in the I-II trimesters according to clinical indications of a miscarriage threat, the 2nd group without hormone therapy. Immunohistochemical analysis of the expression of heparan sulfate carbohydrate chains (HS), also progesterone receptors (PR) and macrophages (CD68) was performed. During histological examination ordinary fibroids predominated compared to the phenotypic variant of cellular leiomyoma with increased number of small tumor myocytes. Some samples of the 1st group revealed high diffuse expression of PR in the nuclei, but without statistical significance. As a result of scoring the expression of markers and Mann-Whitney analysis, taking progesterone drugs in group 1 was accompanied by a statistically significant increase in the infiltration of CD68-positive macrophages compared with group 2 ($p < 0.001$). A positive moderate Spearman's correlation was detected between the PR and CD68 in group 1, indicating the proinflammatory role of progesterone drugs during pregnancy. The least studied is the role of HS molecules, the expression of which in the present study in semiquantitative analysis did not have significant differences between the groups of patients. In conclusion, heparan sulfates content in the myomatous nodes does not depend on the upregulated progesterone background during pregnancy. Simultaneously gestagens during pregnancy was accompanied by an increase of macrophages in myoma nodes resected during cesarean section.

Keywords: Heparan sulfates; uterine myoma; pregnancy; progesterone receptors and CD68-macrophages

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Controlling gut homeostasis: focus on Paneth cell physiology

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Abstract

The human intestine is constantly in contact with various agents, so it is provided with a special defense system, in which Paneth cells play a significant role. This study aimed to investigate all biochemical compounds synthesized by Paneth cells. Recent electronic resource data were analyzed. Our findings showed uniqueness of Paneth cells, which, by maintaining constant concentrations of antimicrobial peptides such as lysozyme, α -defensins, RegIII β and RegIII γ lectins, secretory phospholipase A2, angiogenin-4 and α 1-antitrypsin, regulate gut microbiome. The IgA production provides specific local immunity. By coordinating division and proliferation of stem cells through transforming growth factor (TGF- α), transcription factor (SOX9), Wnt- and Notch- ligands, Paneth cells provide reparative processes both under normal conditions and in pathology. The membrane-bound Ephrin-B receptors and ligands determine the proper positioning of new enterocytes along the crypt-villus axis. Interleukin-17A and proinflammatory tumor necrosis factor- α control the immune response. Of particular importance is cathepsin G, which is involved in defense-inflammatory reactions. In addition, Paneth cells, being a source of enzymes, participate in digestive processes. Finally, these enterocytes are the only epithelial cells that, due to the FAS-ligand expression, are able to destroy abnormal enterocytes. In conclusion, understanding Paneth cell physiology will facilitate development of new therapies for gut diseases.

Keywords: Paneth cells; secretion; gut homeostasis; gut diseases and new treatment vectors

Zonulin increases blood-brain barrier permeability and induces neuroinflammation in the substantia nigra of highly anxious rats

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Abstract

Increased permeability of the interstitial epithelial barrier (IEB) and blood-brain barrier (BBB) leading to neuroinflammation, precede the onset of Parkinson disease. Stress may influence processes linking IEB disruption and neuroinflammation. Zonulin is a protein produced by the small intestine epithelial cells that enhances intestinal permeability. It is uncertain whether zonulin has a similar effect on the BBB and whether this is dependent on the individual's level of anxiety. This study examines the effect of zonulin on increasing BBB permeability and resulting neuroinflammation in the substantia nigra (SN) of rats exhibiting various anxiety-like behaviours (ALB). Zonulin was administered intraperitoneally to animals with low and high levels of ALB, as measured by the elevated plus maze test. Another group of animals received zonulin and Evans blue. Brains were removed for immunohistochemical (GFAP, CD-11 β , TNF- α) and spectrophotometric analysis of Evans blue in the SN. Zonulin administration resulted in extravasation of Evans Blue from the circulation into the SN due to disruption of the BBB and pro-inflammatory activation of micro- and astroglia in the SN of rats with high ALB levels.

Keywords: Zonulin; blood-brain barrier; neuroinflammation; astroglia and microglia

GFAP expression in olfactory bulbs and olfactory epithelium after unilateral intranasal administration of lipopolysaccharide

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Abstract

Currently, we lack sufficient knowledge of the way inflammation of the nasal sinuses can impact inflammation of the olfactory bulbs (OB), potentially leading to neurodegeneration in the CNS. Signs of inflammation in these areas can be detected by observing the increasing expression of astrocytic GFAP. The aim of this study was to investigate the expression of GFAP in the olfactory epithelium (OE) and olfactory bulb (OB) after unilateral intranasal application of bacterial lipopolysaccharide (LPS) at high (1 mg/ml) and low (0.1 mg/ml) concentrations in mice (n=9 for both groups). We examined OB and OE cryostat sections using GFAP antibodies through immunohistochemistry. The intranasal administration of a low concentration of LPS increased the size of immunopositive structures for GFAP in the rostral migratory stream (RMS), GL and PL, but this effect was not observed in the OE compared to the control. Conversely, administering a high concentration of LPS leads to enhanced GFAP expression in the GL and PL of the olfactory bulb, as well as in the basal layer of OE. Despite this, there is a decrease in GFAP positive structures in the RMS. This suggests that high levels of LPS induce activation and astrogliosis in the OB. Moreover, it is probable that the decrease in astroglia count in the RMS is due to the decrease in migration of progenitors from the subventricular zone.

Keywords: GFAP; olfactory bulbs and olfactory epithelium

Exploring students' feedback using 'VAPER' (Virtual Anatomy Practical Escape Room) as psychomotor assessment

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Abstract

The way anatomy is taught and learned has changed significantly since the COVID-19 epidemic. In response to the increasing enrolment of medical students and the limitations imposed by resource constraints, such as the limited availability of cadavers, some medical schools have adopted innovative approaches to both teaching and evaluation methods. The escape room game has gained significant popularity as a kind of entertainment, wherein participants are tasked with successfully "escaping" a confined space within a predetermined time limit. This objective is achieved through collaborative efforts, as players work together in teams to decipher and answer a series of clues and riddles. The Objective Structured Practical Examination (OSPE) is a standardized assessment method designed to evaluate students' competency in psychomotor areas. It employs an organized pattern of examinations that aim to objectively and directly assess their skills. In order to evaluate the feasibility of introducing 'Virtual Anatomy Practical Escape Room', known as VAPER, for the purpose of conducting anatomical practical assessments, we aim to explore the potential of utilizing an online platform as an alternative formative assessment approach. VAPER was created and used by the second-year medical students in Faculty of Medicine, UniSZA to identify anatomical components in pictures of anatomical models. Questionnaires with a Likert scale were utilized to assess students' perception of teaching and learning with VAPER. In general, the students expressed high levels of satisfaction with the session, deriving enjoyment from the interactive nature of the VAPER and experiencing a strong sense of engagement. This activity proved to be highly effective in reinforcing acquired knowledge and assessing the students' psychomotor domain.

Keywords: *Escape room; anatomy education; game platform; online teaching and OSPE*

Structural changes of the kidney in experimental hyperglycemia

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Abstract

Structural changes of nephrons in diabetes mellitus have been well studied, however, changes in the glomerular and tubular apparatus at the early stages of carbohydrate metabolism disorders have not been sufficiently studied. Experiments were carried out on mongrel male rats weighing 330.0-360.0 g. Animal maintenance and experimental manipulations met the international recommendations of the "European Convention for the Protection of Vertebrates Used for Experiments or Other Scientific Purposes" (1986), Directive of the Council of the European Communities of September 22, 2010 (2010/63/EU) on the care of laboratory animals. Experimental animals were divided into two groups: control and experimental (streptozotocin hyperglycemia). Micro-preparations of the kidneys were stained with hematoxylin and eosin, trichrome by Masson and a PAS reaction was performed. During histological examination of micro-preparations from the group with experimental streptozotocin hyperglycemia, the glomeruli were moderately enlarged in size, a nodular expansion of the mesangial matrix with focal moderate hypercellularity was noted. Synechiae were found in individual glomeruli between the parietal and visceral leaves of the capsule, the urinary space was moderately narrowed. Periglomerular fibrosis was found in part of the glomeruli, single fully sclerosed glomeruli were found. There was a statistically significant decrease ($p < 0.05$) in the number of glomeruli compared to the intact control group by 241.0 ± 12.4 and 301.4 ± 22.9 , respectively. There were signs of incipient intimal fibrosis, moderate perivascular fibrosis and hypertrophy of the blood vessel wall in the blood vessels. In the epithelium of mainly proximal convoluted tubules, pronounced hydropic dystrophy, partial loss of the brush border of epithelial cells during PAS staining was noted. Moderate thickening of the tubular basement membrane was noted in part of the tubules. Uneven edema and focal fibrosis were detected in interstitial spaces without signs of tubular atrophy.

Keywords: *Experimental hyperglycemia; kidney and mesangium*

MIND-to-MASTER an enhanced educational training module designed for integrated field hospital set-up

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Abstract

Introduction A Field Hospital plays a crucial role in humanitarian and disaster relief operations, demanding a skilled workforce for its successful deployment. Our previous work introduced the Mobile Infirmary Installation & Deployment (MIND) module, which improved various learning domains in training of integrated field hospital set up. However, it fell short in addressing technical competency. Thus, the present study aimed to describe development and enhancement of MAnagement of Strategic TEchnology Transfer Through Competency Roadmap into an educational training module known as MIND-to-MASTER. Using the methods rooted in the Bloom's Taxonomy and Miller's pyramid of competency, drawing insights from the healthcare and military sectors. Our findings showed the synergy of those modules represents a forward-looking approach to building comprehensive integrated field hospital expertise, ensuring effective setup and operation in diverse environments, including basic medical science knowledge of anatomy and physiology. In conclusion, the symbiosis of MIND-to-MASTER module can be regarded as the future of a systematic knowledge and technical manpower capacity building of a comprehensive and an ideal field hospital setup.

Keywords: Integrated field hospital set up; Bloom's Taxonomy and Miller's Pyramid

Enhancing anatomy and physiology education: Harnessing the power of ai and ar integration

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Abstract:

Anatomy and physiology education are integral to medical training and healthcare professions, but traditional teaching methods face limitations in engagement, visualisation, and contextual understanding. Recent technological advances, particularly in artificial intelligence (AI) and augmented reality (AR), have the potential to revolutionise this education. AI is increasingly employed in medical education for enhanced learning experiences, offering personalised and adaptive approaches tailored to individual students' learning styles and needs. It aids in interpreting complex medical images, improving diagnostic skills, and can develop intelligent tutoring systems for real-time feedback, enhancing understanding of anatomical structures. AR provides an immersive learning experience by overlaying virtual objects onto the real world, reducing cognitive load, increasing student motivation, and improving visualisation of anatomical structures. AR applications, like the AR Magic Mirror system, integrate radiology teaching into gross anatomy courses, allowing interactive exploration of cross-sectional images. AR apps such as Human Anatomy Atlas and Complete Anatomy Platform present interactive 3D models, enhancing spatial understanding and knowledge retention. The integration of AI and AR in anatomy education offers benefits like personalised learning experiences, adapting to individual needs, enhancing diagnostic skills, and improving visualisation and engagement. Combining these technologies creates interactive, immersive learning environments that foster active learning, critical thinking, and clinical relevance. However, the effectiveness varies, necessitating more research to evaluate their impact on learning outcomes. In conclusion, integrating AI and AR has the potential to enhance anatomy and physiology education, providing personalised, interactive, and immersive experiences that improve visualisation, engagement, and understanding. Further research is needed to fully grasp their impact on learning outcomes and to develop effective pedagogical approaches.

Keywords: *Anatomy and physiology education; artificial intelligence (AI); augmented reality (AR); learning outcomes and interactive learning environment*

Modern methodological tools in teaching of morphological disciplines

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Abstract

Current educational trends determine the need to use innovative information technologies in teaching students. New educational standards emphasize formation of practical skills. Morphology is a visual discipline in which the main component depends on the quality of reality and the clarity of the anatomical structure presented, which dictates its requirements for the quality of visual multimedia components presented to students in the educational process. The most practical and frequently used is e-learning as a modern process carried out using Internet technologies that do not require the presence of a teacher and a student offline at the same time. Computer technologies within the framework of learning tools contribute to the formation of high student education. It is impossible to imagine the representation of macro- and microstructures of the structure of organs and systems without the use of modern microscopes, the transmission of the drug and the image to students in maximum resolution through a multimedia installation, when the teacher tells the topic of the lesson in an interactive format, the visualization of the topic under study takes place. The use of digital technologies in training is one of the options for improving the effectiveness of the formation of personalization of future specialists. To implement the tasks of teaching, the following are used: Moodle programs, online courses, educational resources of the Internet of disciplinary orientation, platforms for conducting online classes in videoconference mode, allowing students to carry out full-fledged work. Thus, a special role belongs to the interactivity of learning, which determines a completely different approach to the discipline of morphological profile being studied. It is achieved through dialogue between the teacher and the student, activation of attention, peers' comments. Lecturers actively implement the teaching methods based on the active interpersonal interaction of all participants in the learning process.

Keywords: Education; digital technologies and morphology

Parameters of the mandibular dental arch with a mesocranial type of skull

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Abstract

For appropriate diagnosis and devising an adequate and rational treatment plan, it is essential to perform linear measurements of dental arc to establish correlations between arc length and skull type. We analyzed 113 certified lower jaw samples of both sexes to identify the relationship between mandibular arc length and skull type. Calculate the arc length using the formula we developed (Patent for invention No. 2685689, Russia). The dental arc width was measured between the most protruding points at the level of the canines and second molars; the dental arc depth - from a point located at the center of the cutting edge of the medial incisor to the point of intersection with the line connecting the distal surfaces of the crowns of canine, premolars and molars. The results of the study showed that at the canine's level, the male dental arc length ($Cv = 21.64\%$) and female ($Cv = 21.64\%$) were unreliable ($p > 0.05$). At the second premolars level, the average indicator of men ($Cv = 15.79\%$) doesn't have a significant difference relative to that of women ($Cv = 18.21\%$, $p > 0.05$). At the second molars level, the average statistical indicator of men was significantly higher than that of women ($p < 0.05$). The average statistical value of both sexes significantly exceeded indicators of the level of canines and second premolars ($p < 0.001$). At the same time, the variability of both indicators was weak: in men, $Cv = 8.73\%$, in women, $Cv = 7.75\%$. Thus, the results of the study demonstrated that the difference in the indicators of limits, as well as the length of the mandibular dental arc in men and women, increases from canines to second molars, and the variability of these indicators decreases in the same direction.

Keywords: *Mandible, dental arch, skull type and craniometry*

Lymph node sinuses as a morphological marker of organism stress responses

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Abstract

Nowadays, mankind lives in conditions of permanent stress, which is reflected in the structure of lymph nodes, whose reaction depends on the specificity of response of drained areas, organs and tissues. To understand the general regularities of the lymphatic system response under stress, the peculiarities of the sinus system response of lymph nodes of different topographic localization remain actual. The aim of the study was to identify structural transformations sinuses of lymph nodes of different topographic localization under experimental stress, which could be used as a morphological "indicator" of the influence of this destabilising factor. Following the local ethical committee review, deep cervical lymph nodes (somatic) and pancreaticoduodenal (visceral) lymph nodes were studied on 15, 21, 30, 45 days of the investigation. The stress model was created by intramuscular injection to rats of 0.2 ml of 0.1% adrenaline hydrochloride solution (2 times a day), daily, for 45 days. Our findings showed that structural changes in somatic lymph nodes correlate with changes in the size of the marginal, cortical and medullary sinuses. The marginal sinus decreased by 30%, the cortical sinus by 8.8%, and the medullary sinus increased twice as compared to the values of the intact control. This indicates disturbances in lymphatic drainage through the deep cervical lymph nodes during stress. The studying of visceral lymph nodes showed that the area of the marginal sinus was 3.5 times higher than the intact control. The area of medullary sinuses insignificantly exceeded the control figures (in 12 %). This indicates active afferent lymph inflow and activation of drainage function of the lymph node. In conclusion, it was found that the identified changes in the sinuses of somatic and visceral lymph nodes can be used as a marker of stress reactions.

Keywords: *Lymph node; lymph node sinuses; stress responses and markers of stress reactions*

Reformation of the small intestine of immature rats during a high-calorie diet

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Abstract

According to WHO, by 2018, 38 million children under the age of five were overweight or obese worldwide. and this number may reach 70 million by 2025. The relationship between obesity and GIT pathology is pronounced. The objective of the study was to investigate structural changes in the small intestine of immature rats on a high-calorie diet. The experiment was carried out on fifteen 4-week-old males, with 5 animals per group, during 10 weeks. In Group I, rats were on a high-calorie diet, which included lard and a 10% sucrose solution daily. Animals of Group II were kept on a diet with lard daily and a 20% sucrose solution every other day. The control group was on standard food. A probiotic preparation containing *Bifidobacterium longum* MS-42 was introduced into the diet of all animals. Morphometry of the histological slides of the small intestine was carried out using the Image J 1.54d software. In the experimental groups, the thickness of the small intestine wall was $569.75 \pm 8.15 \mu\text{m}$ and $670.6 \pm 13.18 \mu\text{m}$ in Group I and II respectively. In the control group it was $767.69 \pm 24.23 \mu\text{m}$, while thickness of the mucosa was $605.1 \pm 21.44 \mu\text{m}$. In Group I the latter was $556 \pm 24.86 \mu\text{m}$, in Group II - $557.26 \pm 13.33 \mu\text{m}$, which indicated a reduction in the intestinal wall thickness in the experimental groups due to a decreased mucosa thickness. There was a decrease in the villi height by 17.7% and 23.3% in the experimental groups I and II respectively in comparison with the control group, which was combined with a decreased villi diameter and depth of the intestinal crypts. Thus, during the high-calorie diet, a decrease in all morphometric parameters of the small intestine wall was observed in male adolescent rats, which indicated a decrease in the absorption surface and the development of enteropathy.

Keywords: Small intestine; rat; high-calorie diet and obesity

The incidence of asymptomatic lesions of the joints and spine review

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Abstract

X-ray or MRI are the main methods to diagnose the musculoskeletal disorders and choose the proper mode of treatment, but treatment prescribed based only on the X-ray and MRI image does not achieve its goals. A detailed survey, testing and careful history taking could provide a more reliable clue in the correct diagnosis and selection of treatment. We assessed the global experience in finding the changes on the X-ray and MRI images that do not cause any symptoms in the patient. When such patients develop pain or other symptoms, the specified X-ray or MRI changes may not be their only cause. The objective of the study is to evaluate the frequency of the X-ray and MRI pathological changes in asymptomatic patients or which are inconsistent with the patient's symptoms. A search was carried out in the Pubmed, Scopus and Google Scholar databases using the queries "abnormal findings", "asymptomatic", "magnetic resonance image (MRI)", "Radiology", "asymptomatic findings". Eight works were selected for analysis. The incidence of disc herniation in 1,211 asymptomatic patients aged 20-70 years was 87.6%. Disc protrusion in 3,110 asymptomatic patients was in 29%-43% of cases directly relating to age. MRI images of 230 study participants leading a sedentary lifestyle revealed knee joint lesions in 97% of cases, and meniscus tears in 30% of cases. In the meta-analysis of images of 5,397 knees showed asymptomatic lesions in 14%-43% of cases over the age of 40 years. MRI images demonstrated up to 72% of shoulder labral tears in 53 asymptomatic middle-aged patients. Thus, imaging should be an additional examination method but not the only one when making a diagnosis and choosing a treatment method. Damage to the structures of the musculoskeletal system may be a normal variant, especially with age, and these data should be taken into account by clinicians.

Keywords. *Asymptomatic findings and asymptomatic lesions*

Glomerular integrity in kidneys of Hsp70-treated mice

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Abstract

Excessive systemic levels of heat shock proteins weighed 70 kDa (Hsp70) might modify tissue resistance to damage both in the brain and kidneys (Ondruschka et al., 2018). This work is a step of studying neuroimmunological phenomena of Hsp70 impact to assess renal parenchyma changes after subcutaneous Hsp70 at low and high doses. We randomized 30 three-month-old CD1 male mice staying in hot temperature (30-32 °C) in three equal groups. Group 1 received single subcutaneous saline injections, Group 2 – recombinant human Hsp70 (HspA1A) at 500 µg/kg (low dose), and Group 3 – at 5000 µg/kg (high dose). On Day 5, we lethalized the animals with further histological study with HES and AI-based morphometrics. We calculated the mean number of intact renal glomeruli for six fields of view with Kolmogorov-Smirnov normality test and ANOVA with Tukey test via OriginPro software. Group 1 retained 7.0 ± 0.52 , Group 2 – 9.5 ± 0.40 , and Group 3 – 7.7 ± 0.26 intact glomeruli. Groups 1 and 2 as well as Groups 2 and 3 revealed significant difference at 0,05 p value level with no difference between Groups 1 and 3. Neither hemorrhage or fatal tissue destruction were found for all the groups. We observed an increased number of normal glomeruli in mice treated by low Hsp70 dose. However, high Hsp70 doses showed no difference with controls after saline. We consider that Hsp70 might exhibit a nephroprotective effect while the excessive doses provide probably their own negative impact. Our study discovered a positive impact of subcutaneous Hsp70 on glomerular integrity in mice at low doses. We might expect low subcutaneous Hsp70 doses to be preferred for further studies.

Keywords: Heat shock proteins; recombinant human Hsp70; mice; Hsp70 in kidneys and Hsp70 immunological effects

Morphofunctional changes in the uterus during dark deprivation

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Abstract

One of the factors that have a negative impact on the human body is light desynchronosis. Working the night shift can provoke a violation of circadian rhythms, leading to hormonal disorders and morphofunctional changes in the organs of the reproductive system. In the literature, there are no details of endocrine shifts and morphofunctional changes in the uterus during light desynchronosis caused by dark deprivation, which determined the need for an experiment. The aim of the study was to study the morphometric parameters of the uterus in dark deprivation. Studies were conducted on the level of hormones in the blood: follicle-stimulating hormone, melatonin, morphofunctional changes in the endometrium of the uterus, uterine glands. Our studies have shown a decrease in the secretion of melatonin by the epiphysis, which was accompanied by an increase in the level of female sex hormones, an increase in the level of follicle-stimulating hormone. Morphological changes were detected in the single-layer columnar epithelium of the uterus and uterine glands in the form of thickening of the endometrium, a decrease in the height of the single-layer columnar epithelium and an increase in the area of epithelial cells. There was an increase in the volume fraction of the nucleus of cells of the single-layer columnar epithelium of the endometrium. There was an increase in the number of uterine glands with a simultaneous decrease in the height and area of secretory epithelial cells. The data obtained indicate a decrease in adaptive mechanisms in the endometrium and uterine glands when exposed to dark deprivation.

Keywords: *Fertility; uterus and dark deprivation*

Gait kinematic characteristics of individuals with an endomorphic body type

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Abstract

Clinical gait analysis is one of the effective tools for assessing the state of the musculoskeletal system. The use of the somatotyping method in the distribution of the sample of subjects allows us to obtain more accurate gait characteristics. In the laboratory of biomechanics and artificial intelligence of the Astrakhan State University named after V.N. Tatishchev, studies the gait analysis of individuals with different somatotypes using Vicon motion capture system (Vicon, Great Britain). A group of men aged 18-25 years was analyzed. We used the most widely applied method for obtaining the somatotype - anthropometric method of Heath and Carter. Out of the total number of the studied (49 people), 12 people (25%) were representatives of endomorphs, 30 people (61%) were mesomorphs, 7 people (14%) were ectomorphs. A comparison group was consisting of 42 males aged 18-25 years, which were no distribution by somatotypes. Ectomorphs showed an increase in gait speed, time of double support, stride length and time of step. Changes in the kinematic parameters of the movements of the joints of the lower extremities, in particular, in the hip joints, regarding the comparison group. In the hip joint of men of endomorphic body type in the stance phase, the external rotation relative to the group without somatotyping was increased ($35.9 \pm 1.25^\circ$ and $25.2 \pm 1.9^\circ$, respectively), in the swing phase, this joint is in a state of external rotation exceeding similar parameters in the group without somatotyping with maximum values reaching $35.6 \pm 0.9^\circ$ (at $30.2 \pm 1.8^\circ$ in the comparison group) and minimum $18.3 \pm 1.34^\circ$ (at $9 \pm 2.1^\circ$ in the comparison group). The use of the somatotyping method in compiling a database of normative parameters for clinical gait analysis can increase the accuracy of the study.

Keywords: Musculoskeletal system; motion capture; Vicon; somatotype and endomorphic body type

Experience of distance learning of anatomy among medical students of the Kyrgyz-Russian Slavic University during the COVID-19 pandemic

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Abstract

Online learning difficulties are associated not only with technical issues, such as the stability of the Internet connection and the development of new platforms for online meetings, as well as resources for the placement of educational materials. The purpose of the study is to analyze the use of the Internet to study anatomy among medical students before switching to online education and during that time. One hundred twenty-four medical students (45 boys and 79 girls) participated in the study. Of them, 62 were surveyed before quarantine (28 males, 36 females), 62 – during quarantine (19 males, 45 females). The respondents were selected random and non-repetitively. The results of the study showed that students became 24.2% less likely to use a smartphone during quarantine, and 32.3% more likely to use a computer. This can be explained by the desire to avoid an excessively high load on the eyesight (which increases in proportion to the decrease in screen size) and the inconvenience of mobile versions of many online resources. It is noted that with the transition to distance learning, the number of complaints about the lack of free online 3D models for studying anatomy has increased. From 24.7% to 12.9%, the number of those who believed that there were enough resources on the Internet to fully prepare for classes decreased. We associate this with their gaining extensive experience of "online learning" and awareness of the complexity of Internet searching and selecting information. During quarantine, the use of textbook material as a reliable source of information in preparation for classes on human anatomy increased by 24.2%. The percentage of lecture material used during quarantine has also increased (by 2 times). Thus, teachers should help students identify difficulties and improve results, establish student interaction, and select effective and accessible resources, despite any difficulties that arise.

Keywords: Anatomy; distance education; medical education and covid19

Normal anatomy of the palate and the anatomy with a cleft palate

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Abstract

Normally, the muscles of the soft palate attach to the median palatal suture, which is absent in pathology, the muscles have pathological attachment points, which slows down the functioning of the muscles and leads to their atrophy. With a cleft palate, the velopharyngeal muscle is attached to the posterior edge of the hard palate, some bundles pass further along the edge of the cleft, forming, together with the m. levator, the so-called split Veau muscle. In our clinic, we operate only in the anterior part of the Veau muscle, the mobility and course of the muscle are changed, which has a positive effect on the function of the middle ear. M. levator veli palatinae is connected by means of replacement inclusions with the tendons of the bundles from the m. tensor veli palatinae muscle, and from behind with m. Palatopharyngeus. There is no palatine aponeurosis in the cleft, in this area a rudimentary tendon m. tensor veli palatinae. M. Levator veli palatinae does not move backwards and upwards, as with a normal palate, but laterally forwards and upwards. Thus, halves of the palate are retracted to the sides, and not backwards. When the Veau muscle complex contracts; and it was this fact that Braithwaite considered extremely important in the elimination of cleft palate, since due to the scissor movement of the muscle complex, deformation of the soft tissues occurs. According to his observations, MLVP expands like a fan and attaches to the area of the edge of the hard palate. When the MLVP fibers are released from the edge of the hard palate and from adjacent tissues, it becomes narrower, and after this procedure it is not difficult to suture the MLVP muscle bundle with the opposite one, which is an extremely important step for the formation of palatal mobility.

Keywords: Cleft Palate; velopharyngeal muscles and veau muscle

Creation of an educational video at Tver State Medical University as a variant of innovative educational technologies

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Abstract

Creation of a videos with its subsequent demonstration in practical classes plays a significant role among modern educational technologies in the medical universities. At the Department of Anatomy, Histology and Embryology, as part of the study of the discipline "Histology, Embryology and Cytology" at the first practical lesson, students are shown educational films on the technique of working with a microscope, the manufacture of educational histological preparations, as well as the organization of histological laboratories. Russian films were created by 1st and 2nd year students under the guidance of experienced teachers of the department in two versions: in Russian (for demonstration to Russian-speaking students and foreign students studying in Russian) and English, used as an intermediary language (for demonstration to students studying in a foreign language). Since 1962, foreign students from different countries of the world have been studying at Tver State Medical University (currently more than 1,000 people are studying). Along with the increase in the number of foreign students, the material and technical support of the department was expanded and improved with the use of innovative technologies in education. Initially, the training was conducted only in Russian, and then English began to be used, which became an intermediary language. The teachers of the department have developed methodological manuals in English for classroom and extracurricular training of students, created electronic versions of micro-preparations, prepared materials for the final intermediate certification. Students have supplemented this list with an educational film to make it easier for foreign students to study such an important and fundamental discipline. Students watch these educational films with interest and use the acquired knowledge in further education. In the process of filming and editing educational videos, students develop skills of critical thinking, behavior, communication, mastery of macro- and micro- photography techniques and logical composition of the material.

Keywords: *Educational film; microscope; foreign students and intermediary language*

The immune response of the intestine

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Abstract

The lymphoid system of the gastrointestinal tract, comprised of lymphocytes and plasmocytes, offers local and general immunity to the body, safeguarding it from various pathogens that enter the gastrointestinal tract. Immunoglobulin A plays a vital role in specific antiviral and antibacterial activity. The aim of this study was to examine the impact of cholera toxoid antigen on the dispersion of plasma cells that produce antibodies in the lamina propria of the intestinal mucosa. For the study, 88 male guinea pigs weighing between 200-250 grams were selected, as they are well-established models for experimental cholera research. The antigen, cholera toxin, was used due to its non-toxicity and high immunogenicity. A highly reproducible immune response was achieved through the application of a combination of parenteral and enteral approaches for antigen administration. As time elapsed from the start of the immunisation process, it became increasingly evident that two distinct peaks emerged regarding the rise in plasma cell numbers within the lamina propria of the intestinal mucosa. A significant plasmocyte increase is documented in the duodenum when compared to the control group. The initial parenteral application of the antigen primes plasma cells for a secondary response. Secondary intraduodenal administration of cholera toxin accelerates the dissemination of plasmocytes in the lamina propria of the intestinal mucosa of guinea pigs. Our research demonstrates a significant association between the degree of protective immunity and the count of plasma cells across different regions of the intestine. Administering a small dose of cholera toxin intraperitoneally leads to a marked increase in plasma cell count. This effect is most significant on day 56 in the lamina propria of the duodenal mucosa and on day 70 in the jejunum.

Keywords: *Plasma cells; cholera toxin and intestinal lamina propria*

Study of antiplatelet action of a new class of benzimidazole derivatives having a spatially hindered phenolic substituent in their structure

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Abstract

Searches for new compounds with antiplatelet activity in the series of benzimidazole derivatives having a shielded phenolic substituent in the structure are very urgent. After identification of the most active substance among these derivatives the leading compound RU-1144 was found, showing a pronounced combined antiplatelet and antioxidant effect. In this relation, antithrombotic effects of this compound were evaluated on various arterial thrombosis models. Experimental study of antithrombotic activity of RU-1144 and comparison drugs—acetylsalicylic acid (ASA) and clopidogrel was conducted. RU-1144, ASA and clopidogrel were administered p.o. 2h before the thrombosis induction. Electrically induced thrombosis was carried out on a segment of the carotid artery. Thrombosis was conducted by application of two stainless steel electrodes that were fixed under the artery. Thrombosis was induced by permanent electric current of 12 V and 50 mA until complete occlusion of the vessel. Ferrum chloride induced thrombosis was induced by application of FeCl₃ solution. Arterial blood flow was recorded using «Minimaks-Doppler-K» until total occlusion of artery. RU-1144 was given at doses of 12, 24 and 48 mg/kg, while ASA and clopidogrel were given at a dose of 20;100;150 and 60;120;180 mg/kg. The oral intake of the compounds contributed variably to prevent total carotid artery occlusion in rats. On a model of an electrically-induced thrombosis for the compound RU-1144; ASA and clopidogrel ED₅₀ was 6.7; 16.8 and 49.6 mg/kg. On the second model ED₅₀ for these compounds were 18.8; 40.1 and 37.9 mg/kg, respectively. RU-1144 demonstrates antithrombotic activity in a model of arterial thrombosis that is much higher than comparison drugs. Thus, it was proven that RU-1144 prolonged the duration of thrombus formation in rat carotid artery in arterial thrombosis models. ED₅₀ showed a superiority over ASA and clopidogrel. The antithrombotic action of the RU-1144 compound is associated with its potent antiplatelet activity.

Keywords: *Antiplatelet activity; thrombosis; antioxidant activity and benzimidazoles*

Citation:

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