МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
БУКОВИНСЬКИЙ ДЕРЖАВНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ»

М А Т Е Р І А Л И

104-ї підсумкової науково-практичної конференції
з міжнародною участю
професорсько-викладацького персоналу
БУКОВИНСЬКОГО ДЕРЖАВНОГО МЕДИЧНОГО УНІВЕРСИТЕТУ
06, 08, 13 лютого 2023 року

Конференція внесена до Реєстру заходів безперервного професійного розвитку, які проводитимуться у 2023 році №5500074

Чернівці – 2023

athletes, Crohn's disease, celiac disease, and Cushing's syndrome are factors that lead to fractures. It is clear that it is impossible to insure yourself against a fracture.

The aim of the study. Innovative design of osseous plates for osteosynthesis.

Material and methods. Solid osseous plates, flushes, wire cerclage,the cavity fixators, device for conducting wire cerclages. Developing design and installation of bone plates.

Results. There are the following types of damage: one that affects a narrow area of long bones, namely a flexion fracture; one where the parts of the broken bone will be turned to each other along the axis - twisted fractures; such, where with unexpected tension due to the fact that the strength of the muscles and ligaments is greater than the strength of the bones, the integrity of the periosteum is violated – a detached type. There are also fractures due to displacement, transverse, scapular, hammered, oblique, screw-shaped, longitudinal, etc. The relevance of the topic increases in direct proportion to the increase in mortality and the number of disabled persons among young patients, because, due to such statistics, we have less able-bodied population, which in turn creates an economic problem.

Periosteal osteosynthesis is widely used in the operative treatment of fractures and injuries of long bones. The use of this type of osteosynthesis is associated with a number of problems that arise during the installation of the fixator, its blocking, and the creation of stable fixation of fragments.To install existing bone plates, it is necessary to drill holes through the cortical substance of the bone, cut a thread in the holes, insert screws to create a static or compressive version of osteosynthesis. It is known that in order to create a reliable and stable fixation of fragments, it is necessary to drill at least 4-6 holes for screws on each side of the fracture line, however, as is known, a large number of holes in the cortical substance of the bone causes its significant weakening, which negatively affects strength and rigidity of the created biotechnical system "bone-fixator". In addition, the nature of the fracture (multifragmentary, helical, etc.) does not always allow for the required number of fixing screws, which makes it impossible to create stable and reliable fixation of broken bone fragments. All stages of the operation are associated with certain medical and technical difficulties.

Innovative developments in the direction of changing the design of osseous plates for osteosynthesis in case of fractures indicate the feasibility of using solid osseous plates, flushes on both sides of them, and wire cerclage attached to these flushes using a device for conducting wire cerclages (Pat. 114603, 2017); the expediency of reducing the weight of the plate, reducing the area of its contact with the bone surface with minimal damage to the periosteum, thanks to the use of cavity fixators, which allows free circulation of biological fluids, which significantly accelerates the period of bone growth; and increased rigidity in the sagittal and frontal planes, as well as during torsion, due to the use of the S-shaped side sections (Pat. 128128, Pat. 140568, 2020).

Conclusions. The proposed changes in the designs of the periosteal plates eliminate a number of problems: they do not require drilling holes in the cortical horn of the bone, prevent the eccentricity effect of fragment compression, etc.

Nahirniak V.M.

ADVANTAGES IN THE USE OF THE LAPLACIAN KERNEL FOR IMAGE PROCESSING IN MATLAB

Department of Biological Physics and Medical Informatics
Bukovinian State Medical University

Introduction. When preparing and conducting radiation therapy for a patient, an important prerequisite for a quality radiation treatment is the development of a treatment plan. In order to start developing a treatment plan in the treatment planning system (TPS), you need a high-quality CT image of the patient, which visualizes the area of irradiation and clearly visible organs located in risk zones near the tumor. The presence of visualization noise on CT images, unclear contours of tissues and organs, and artifacts complicate the preparation of a treatment plan and reduces its quality.

The aim of the study. In order to improve the quality of CT images, different image processing tools may be used. We would like to demonstrate the feasibility of the use of MATLAB for that and the technique.

Material and methods. Digital filters are used to blur or sharpen digital images. It concerns the MATLAB software as well. Filtering can be performed by convolution with specifically designed kernels (filter array) in the spatial domain.

Results. Use of the Laplacian operator and appropriate kernels for image processing is well known approach. Sometimes, it may be desirable to smooth the image first by a convolution with a Gaussian kernel since a Laplace operator is very sensitive to noise it may detect edges (margins) along with undesired visual noise (isolated, out-of-range).

The Laplace operator is a second-order differential operator. It is the sum of the second derivatives along each of the axes of the image. If the image matrix, is *I*, then the Laplace operator D_L is given by the following expression:

$$D_L(I) = \frac{d^2I}{dx^2} + \frac{d^2I}{dy^2}.$$

Usually, CT image is represented by a two-dimensional matrix each element of which is an eight-bit integer. Each integer gives a shade of grey color in the range between 0 and 256. Calculations of the image derivatives and gradients for edge detection must be done numerically using programming language. For instance, MATLAB.

MATLAB allows processing images in versatile methods. It has a vast on-line library of radiological images, well-known specialized for image processing functions built in MATLAB (e.g. imadjust, imnoise, edge, fspecial etc.) which allows developing the unique algorithm in image processing by combining them. It provides a user with the ability for development of the custom functions library and the easy way to visualize the results and modify the initial problem. Also, using MATLAB, one may conduct to assessment of dimensions and a volume of the region of interest (ROI) for some particular tasks.

Conclusions. The use of Laplace kernels in the MATLAB software allows user to demonstrate clearly the quality reducing effect of imaging noise in radiological images. Application of the built-in MATLAB Laplace kernels to images reduces noise and improves their quality.

Olar O.I.

CURRENT DEVELOPMENTS IN X-RAY IMAGING TECHNOLOGY: CHALLENGES AND FUTURE

Department of Biological Physics and Medical Informatics
Bukovinian State Medical University

Introduction. X-rays is a discovery that took the shortest path from the moment of invention to practical use in medicine. The high penetrating ability of X-rays has made it a powerful imaging tool in medical practice. In turn, the requests of practical medicine, the development of diagnostic radiographic technologies contributed to the advancement of a wide range of disciplines from fundamental research to practical applications in close combination with modern technologies.

The aim of the study. The development of diagnostic radiographic technologies analyzing is.

Material and methods. Reviews analysis of the results presented in the latest world research in the field of X-ray imaging technology developments.

Results. The rapid development of materials science opens up a great opportunity to revolutionize the future of X-rays imaging technology. Recently, materials characterized by a tunable band gap, high quantum yield of photoluminescence and high mobility of charge carriers have been developed.They became promising materials for photovoltaic devices, fluorescent displays and radiation detection. In the recent years, the scientific community has mainly focused on the development of lanthanide-doped materials, perovskites and organometallic frameworks. Overall, new advanced materials provide opportunities to advance low-dose, high-resolution, and