Some Aspects of Radiation Diagnostics in Traumatology

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ABSTRACT

To develop and improve new methods of radiation diagnostics in traumatology and orthopedics, 1,310 patients with various injuries and diseases of the musculoskeletal system were examined using radiography, ultrasound, CT, and MRI. As a result of the work, new methods for diagnosing chronic osteomyelitis, quantitative assessment of reparative osteogenesis during limb lengthening and treatment of fractures, methods for assessing distraction regenerate, new methods for quantitative and qualitative diagnosis of the condition of soft tissues during lengthening, methods for assessing the condition of bone in systemic skeletal diseases have been developed.

Keywords: bones, radiation diagnostics, new methods, joints.

Introduction

It is well known that progress in science is determined by the progress of research methods. The improvement of diagnostic methods, undoubtedly, led to the discovery of new patterns of the emergence and development of the pathological process, the identification of more accurate and early symptoms of diseases, and the determination of more subtle mechanisms of influence of therapeutic measures. Classical radiology has been supplemented by such modern visualization methods as ultrasound diagnostics, computed tomography, magnetic resonance imaging, photoemission and positron emission tomography, interventional radiology [1].

Materials And Methods

One of the earliest and most closely related disciplines to radiation diagnostics is traumatology and orthopedics, the development and improvement of which is impossible without the use of modern research methods. The development and improvement of diagnostic algorithms for diseases and injuries of the musculoskeletal system are based on an integrated approach to the selection of methods and techniques of radiation examination, which consists of a combination of classical and modern, radiation and non-radiation diagnostic methods, which allows optimizing diagnostic process from the point of view of safety for the patient and efficiency for the doctor. Considering the unequal sensitivity and specificity of various medical imaging methods in displaying pathological changes in bone, cartilage and soft tissue structures, modern radiation diagnostics

makes it possible to more accurately characterize the morphological features and prevalence of pathological processes, contributes to clarification of pathogenesis, improves the semiotics of diseases and injuries of the musculoskeletal system. New diagnostic technologies and algorithms make it possible to monitor the effectiveness of treatment stages and the final result, contribute to the improvement of existing and the creation of new treatment methods [3].

To develop and improve new methods of radiation diagnostics in traumatology and orthopedics, 1310 patients with various injuries and diseases of the musculoskeletal system were examined using radiography, ultrasound, CT, and MRI (Table 1)

Table 1
Distribution of patients by nature of pathology and research methods

Nature of the pathology	Object of study	Number of patients	Research methods
Congenital and acquired shortenings and deformities of the lower extremities	Distraction regenerate	96	X-ray, CT, MRI densitometry
Erlacher-Blount disease	Metaepiphyseal zone of the tibia	80	X-ray, CT
Achondroplasia	Soft tissues of the lower extremities	84	X-ray, CT, MRI, ultrasound, densitometry
Chronic osteomyelitis of the femur	Femur	109	X-ray, CT
Developmental anomalies, hindfoot defects, foot deformities, hallux valgus	Foot bones, distraction regenerate, contact regenerate	79	X-ray, CT
Consequences of vitamin D-deficient rickets and vitamin D-resistant rickets	Metaepiphyseal zone of the tibia and femur	92	X-ray, CT, MRI
Gonarthrosis, closed injuries without fracture of the bones forming the knee joint, intra-articular fractures	Knee joint (before and after arthroscopy)	150	X-ray, ultrasound, MRI
Fractures of the thoracic and lumbar spine	Thoracic and lumbar spine (before and after treatment)	67	X-ray, CT
Osteoporosis of the spine in menopausal women	Lumbar and thoracic spine	220	X-ray, CT,
Achondroplasia	Femur, tibia and fibula before and after lengthening	71	densitometry
Osteoarthritis of the hip and knee joints	Hip and knee joint	125	X-ray, CT
Fractures of the shin bones	Fracture healing zone	53	X-ray, CT, MRI
Dysplastic coxarthrosis	Hip joint	35	X-ray, CT, MRI
Consequences of hematogenous osteomyelitis	Hip, knee, shoulder joints	28	X-ray, CT, MRI

Deforming arthrosis of the hip and	Vessels of the neck, lower extremities	21	X-ray, CT, MRI

Results And Discussion

Based on a complex of modern methods of radiation diagnostics, the stages of the pathological process were studied to determine the tactics and method of treatment for patients with vitamin D-resistant rickets and patients with the consequences of vitamin D-deficient rickets. Before treatment, patients with vitamin D-resistant rickets had uneven deposition of osteoid in the metaepiphyseal sections of the femur and tibia, which was first identified by MRI as non-mineralized areas of the growth zones in the form of an indeterminate bizarre form of formations that were especially well visualized on T1FL2D FS in the coronal plane. In the axial plane, in the medial parts of the metaepiphyseal zones, lumpy formations of a cellular nature were determined [6]. In 14 patients with vitamin D-resistant rickets, radiographic changes in the zone of restructuring of the cortical layer and adjacent bone structures manifested themselves in the form of resorption zones (Loozer zones). After the deformities were eliminated, the patients experienced closure of the Loozerov zones. At the age of 12-16 years, Loozer zones were most pronounced, their density was 549.4±78 HU. After treatment, bone density in the reconstruction zone in patients in the age group over 30 years was no less than 1416±83 HU [3].

A study of the spine in patients with achondroplasia before and after limb lengthening showed that 76% of children with achondroplasia had kyphotic deformity of the spine and 17% had grade I-II scoliosis. During the lengthening process, a decrease in bone mineral density was noted in the lumbar vertebrae of patients with achondroplasia, with a significant difference for LI. The frontal and sagittal dimensions of the spinal canal in patients with achondroplasia decrease in the caudal direction with obvious signs of stenosis in 9% of children [4]. When lengthening the femur and tibia in patients with skeletal dysplasia at the first and second stages of treatment, the age-related dynamics of the development of growth zones is preserved, which makes it possible to consider lengthening at any age. During the first stage of treatment and in the interval between the first and second stages, non-elongated segments have greater growth potential than elongated ones.

Densitometry and CT data in women with menopausal osteoporosis showed that in patients without vertebral compression fractures, osteopenia and osteoporosis were detected in 80% with early menopause and in 74.3% with surgical menopause. According to the results of quantitative computed tomography of patients with vertebral compression fractures, the density of cancellous bone in patients 40-49 years old was 111.44 mg/cm^3, 50-59 years old - 79.03 mg/cm^3, 60-69 years old - 72.85 mg/cm^3. The compact bone density in the indicated age groups was 241.78 mg/cm^3, 208.99 mg/cm^3 and 185.83 mg/cm^3, respectively, and significantly decreased with the age of the patients, influencing the decrease in the strength of the vertebrae. The developed algorithm for radiological diagnostics contributes to the early diagnosis of osteoporosis in women at risk, identification of vertebrae with a high risk of fracture and the use of minimally invasive technologies for the treatment and prevention of osteoporotic vertebral fractures [5]

Conclusion

1. The use of modern methods of radiation diagnostics has made it possible to obtain new data on X-ray morphological changes in the joints and long bones of the extremities in patients with systemic and dysplastic diseases with a quantitative assessment of the severity of the pathological process.

2. An algorithm for describing the distraction regenerate was proposed and methods for quantitative assessment using CT and MRI were developed.

3. A set of indicators has been developed to assess the condition of the soft tissues of the limbs during lengthening, depending on the period of lengthening and the research method.

4. Algorithms for studying the distraction regenerate and muscles during limb lengthening have been developed.

5. Features of fusion were identified with a quantitative assessment of the reparative process and bone restructuring in fractures of the tibia and proximal end of the tibia.

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