Need for Radiation Diagnosis in Pediatric Practice

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ABSTRACT

One of the significant factors influencing the nature and outcome of treatment measures is a complete and timely diagnosis of various diseases in children. This is especially true in the early stages of the disease, when adequate therapy can significantly affect the nature of the development of the pathological process.

Keywords: computed tomography, radiography, ultrasound diagnostics, magnetic resonance imaging

Introduction

The main limitations of the use of radiographic examination in children are high radiation exposure, low specificity and resolution.

Computed tomography is an important special technique for radiation research, the use of which can significantly increase the information content of x-ray diagnostics of diseases in children [2, 3, 4].

The methods of choice in pediatric practice are ultrasound and magnetic resonance imaging due to the absence of ionizing radiation [2, 5].

Magnetic resonance imaging is a safe method with good tissue contrast and the possibility of multiplanar examination [2].

Materials And Methods

Despite the introduction of new methods for examining the musculoskeletal system in recent years, radiography remains the method of choice. At the same time, the radiation exposure is minimal, and at the same time, this research method is informative and widely available. This is especially important for traumatic injuries [2].

In most cases of trauma, examination should begin with x-rays; other methods of radiation diagnostics are used as necessary (to obtain additional information). A complete skeletal examination should be performed if polytrauma, Langerhans' histiocytosis is suspected, and the degree of skeletal dysplasia is assessed. For specific clinical conditions, additional information can be obtained using other radiological diagnostic methods.

Results And Discussion

Ultrasound examination is accessible, safe and highly specific. This method allows for differential diagnosis of cystic changes and solid formations, assessing the condition of the bones of the cranial vault, the size of the fontanelles, and the condition of the spinal column. When examining in color Doppler mapping mode, it is possible to determine the presence and evaluate the condition and characteristics of blood flow. Ultrasound examination of the hip joints is a screening tool for diagnosing hip dysplasia [4]. This method can also be used to detect x-ray negative foreign bodies. Other indications for ultrasound examination include soft tissue formations, fluid accumulation under the periosteum,

pathological changes in cartilaginous structures, tendon injuries, and vascular malformations.

Computed tomography has better soft tissue contrast compared to radiography. This method allows for multiplanar reconstructions, so complex fractures can be assessed.

X-ray computed tomography is indicated in the differential diagnosis of inflammatory and tumor lesions of bones (such as osteoid osteomas, sequestra, changes in the periosteum when the integrity of the cortical layer is violated) [4].

Magnetic resonance imaging is widely used in the diagnosis of tumor diseases of the extremities and spine, traumatic and infectious lesions of joints, as well as soft tissues; bone tumors. The main advantage of this method is the ability to assess the condition of the spinal and bone marrow.

Radionuclide diagnostic methods include: skeletal scintigraphy (indications: search for metastases, traumatic lesions, stress fractures, spondylolysis, osteomyelitis, osteoid osteoma, aseptic necrosis), study with leukocytes labeled with 67Ga and 111In (osteomyelitis or infectious lesion) and positron emission tomography with 19-fluorodeoxyglucose (bone and soft tissue tumors, metastatic lesions) [1].

Thanks to the active implementation of modern methods for studying the central nervous system, it has become possible to diagnose pathological conditions that were previously diagnosed only at autopsy. It has become possible to diagnose perinatal brain damage, including developmental anomalies, which are the main cause of neuropsychiatric disability and infant mortality, which were previously identified only pathomorphologically. Timely diagnosis of cerebral disorders makes it possible to determine the strategy and tactics of treatment, monitor its effectiveness, predict the further development of the child and the outcome of the disease, and expands the possibilities of medical genetic counseling.

In neonatology and early childhood neurology, three main methods of radiation diagnostics are used: ultrasound (neurosonography), magnetic resonance imaging and computed tomography.

Neurosonography is used quite widely, as it has a number of obvious advantages. The equipment is relatively inexpensive and portable, which determines its role as the method of choice for further research. However, this technique has significant limitations: neurosonography can only be performed on very young children who have acoustic windows—fontanelles. Information about the basal regions of the brain and the structures of the posterior cranial fossa obtained by this method is often insufficient [2].

Computed tomography allows you to obtain complete information about the state of brain structures. To correctly assess anatomical structures and identify possible anomalies, good spatial resolution is necessary, for which in most cases it is necessary to select a small slice thickness (0.5 cm) in newborns and children of the first year of life, given the small size of the brain. If it is necessary to clarify the detected changes in the area of interest, slices 2 mm thick can be obtained. More often, the study is carried out in the axial plane, but depending on the results obtained, the study can be supplemented by obtaining tomograms in other planes. To do this, the child's head is extended as much as possible and fixed using special headrests. If tumors, arteriovenous malformations are suspected, or an abscess capsule is detected, a repeat study can be performed using contrast agents. In this case, it is allowed to use only non-ionic contrast agents "Omnipak" or "Ultravist".

Chest radiography is the most common type of radiation examination performed in childhood [3].

Respiratory tract lesions are more common in children than in adults. There are three main categories of pathological changes in the respiratory tract in children. These include acute upper airway stenosis, external compression of the lower airway, and obstructive sleep apnea [4].

Acute stenosis of the upper respiratory tract in most cases manifests itself as stridor breathing during inspiration. Most pathological

conditions in this category are inflammatory in nature.

Differential diagnosis of acute stenosis of the upper respiratory tract is carried out with croup (average age - 1 year), inflammation of the epiglottis (average age - 14 years), exudative tracheitis (average age - 6-10 years), retropharyngeal abscess (average age - 6-12 months). The later in life a pathological condition develops, the more severe it is.

With inflammation of the epiglottis, thickening of the contours of the epiglottis is noted, a “thumb” symptom occurs, as well as thickening and bulging anteriorly of the aryepiglottic folds. An increase in the thickness of the soft tissue behind the pharynx (should not exceed the thickness of one vertebral body) may be noted when an abscess develops in this area. Signs of thickening of the soft tissues in this area can be observed in young children with incomplete neck extension [5].

Conclusion

Magnetic resonance imaging allows you to visualize the organs of the urinary system in 3 planes. MR urography is used quite widely due to the ability to determine the excretory function of the kidneys. A disadvantage of magnetic resonance imaging is its sensitivity to patient movement, so sedation is required in most cases in children. The main advantage of magnetic resonance imaging when examining children is its safety, i.e. absence of ionizing radiation [2].

Computed tomography has limitations when used in pediatric practice. Mainly used for diagnosing traumatic lesions, urolithiasis and cancer.

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