UPGRADING THE REGULAR X-RAY RADIOGRAPHIC UNITS WITH TOMOSYNTHESIS

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Introduction. Digital tomosynthesis is a new method of X-ray visualization, which allows to increase the efficiency of X-ray diagnostics[1-6]. However, the equipment for tomosynthesis is expensive. To accelerate the introduction of tomosynthesis into clinical practice in conditions of limited financial resources, it can be implemented on X-ray equipment that is already there in medical institutions. Over 1.5 thousand digital and film fluorographs and over 7 thousand roentgen diagnostic complexes are now used in Ukraine for radiographic examinations.

The purpose of the work was implementation of tomosynthesis on standard roentgen diagnostic equipment available in health care entities.

Methods. Cabin fluorograph, X-ray diagnostic complex for 2 working places with linear tomography mode and remote control table with analog tomography mode were used in the work. 5 kW X-ray unit from C-arch on mobile platform was installed on the fluorograph. Instead of fluorographic chamber a dynamic digital receiver with 43х60 cm overview field was installed on the cabin of the fluorograph. The X-ray units were equipped with high-frequency pulse-fluoro mode feeding device and dynamic digital receiver with 43x43 cm work field. Exposure time was 4-6 sec. Linear tomography mode with tomographic angle ±20° and anode voltages of 90-120kV were used in the studies. Chest test phantom with X-ray target was studied.

Results. Tomography mode has been implemented on all three units of roentgen diagnostic equipment. 200-400 slices of study object were received in tomosynthesis mode. Resolution in image plane amounted to 2.1 x 1.6 lp/mm and the effective thickness of tomographic slices was 2-8 mm. The total exposure in chest tomosynthesis did not exceed 20.0 mAs that is 3-6 times more than with the standard chest radiography and 5-10 times less than with the standard computer tomography. According to experts, the obtained chest phantom slices presented details that are poorly visible on X-ray images.

At tomosynthesis (a) the analysis of a condition of a thorax thanking to absence of effect of superposition became easier, than at a roentgenography (b). Tomosynthesis mode compared to X-ray enabled to measure more accurately the geometric dimensions of the studied objects, as well as to assess the relative density of tissue in each slice. The probability increased of receiving correct diagnosis without referring the patient to CT or MRI study.

Conclusions. Using standard X-ray equipment devices reducing by not less than 30% the expenses connected with introduction into clinical practice of tomosynthesis. The implementation of digital tomosynthesis on standard roentgen diagnostic equipment allows accelerating introduction of this method of x-ray visualization into clinical practice and raising the efficiency of X-ray diagnostics.

Reference
3. Tsutomu Gomi, Hiroshi Hirano Clinical Potential of Digital Linear Tomosynthesis Imaging of Total Joint Arthroplasty.