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MULTISPIRAL COMPUTED TOMOGRAPHY OF THE CHEST WITH BOLUS CONTRAST – NEW POSSIBILITIES FOR THE DIAGNOSIS OF LUNG DISEASES

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Summary*: Mean arterial MSCT attenuations were not significantly different between the two protocols.Multispiral computed tomography (MSCT) with contrast enhancement into clinical practice has expanded the potential possibilities of the method in the visualization of pathological changes in organs and vascular structures. Data analyzed MSCT with contrast enhancement in 137 patients, 36 of whom had a focal pathological process in their lungs and 101 had pulmonary emphysema.*

Keywords: *multispiral computed tomography, bolus contrast, and lung diseases.*

Introduction. We evaluated the difference in computed tomography (CT) attenuation values of the intracranial arterial and venous systems among the various contrast injection protocols (higher iodine delivery rate or higher concentration of the agent) on the source images of intracranial three-dimensional CT angiography (3D-CTA) using a multidetector-row CT (MDCT) scanner.Multispiral computed tomography (MSCT) with contrast enhancement into clinical practice has expanded the potential possibilities of the method in the visualization of pathological changes in organs and vascular structures. More MSCT using new technologies allow to obtain high-quality images of large vessels and their branches and thereby exclude the use of invasive diagnostic methods, in part-angiography news. Based on MSCT technology, CT angiography (CT) is increasingly being used as a diagnostic-The method has broad clinical indications, both in clarifying the nature of pathological changes in the lungs, and in identifying atherosclerosis, determining the cause of chest pain in patients with atypical chest pain and visualization of pulmonary artery thrombosis. Multispiral computed tomography with bolus contrast enhancement makes it possible to diagnose oncological lung diseases at the earliest stages, thereby increasing the chances of performing radical surgery and complete cure. Stepper and spiral tomography use one or two rows of detectors, whereas multispiral computer tomographs have 4,8, 16, 24, 32, 64 rows of detectors or more (for example, 128 or 256). In multispiral devices, the time of volumetric scanning is significantly reduced and the spatial resolution along the longitudinal line of the patient's body is improved. The quality of multiplanar and volumetric reconstructions is significantly improved. On a scanner with 4 rows of detectors, during one breath delay (15-25 seconds), it is possible to obtain voluminous information about the state of the chest, abdomen and pelvis. At the same time, the usual volume (for example, the chest) can be examined in the same 15-25 seconds with the thickness of the slice 0.5–1.0 mm, that is, with improved spatial characteristics. The quality of computed tomograms directly depends on the number of photons of X-ray radiation reaching the detector. With increasing strength. The unwanted image noise is reduced and the contrast resolution is improved, but, unfortunately, the radiation dose is increased. However, the improvement of one image quality parameter is achieved at the cost of the deterioration of another, and one has to choose what is important for this clinical task. Low-dose CT of the lungs is based on this principle, for which only 20 WT is needed in contrast to 90 WT with a standard chest examination. 20 WT is sufficient to detect foci in the lungs, while the structures of the

mediastinum are very poorly visible due to significant noise. The radiation dose with this method of investigation is reduced by more than 2 times. The dependence of the quality of the image on the voltage is in many ways similar to the dependence on the current strength: more voltage – less noise – better contrast resolution – more radiation dose. It is advisable to increase the exposure in the study of obese patients to enhance the penetrating power of radiation. Although the principles of optimizing the protocol for the introduction of a radiopaque agent (RCS) have been the subject of numerous studies, there are no clear algorithms that have already been put into practice. At the same time, such developments are very important, since without individualization of the protocol of RCS administration, it is not always possible to obtain diagnostically significant chest tomograms due to insufficient synchronization of iodine delivery and scanning parameters. In a number of studies, it was shown that when performing CT with high contrast of the pulmonary arteries, up to 40% of angiograms were of insufficient quality [2-6]. The purpose of this study was to develop optimal chest MSCT programs with bolus enhancement for various types of tomography in certain lung diseases.

Material and methods

Data analyzed MSCT with contrast enhancement in 137 patients, 36 of whom Had a focal pathological process in their lungs and 11 had pulmonary emphysema. The studies were performed on MSCT Toshiba Aquilion 16 (16 slices), Toshiba

Aquilion One (320 slices) with the use of a single-column Stellant® automatic injector from Medrad Inc. (USA) and a double-bulb one from Tuso. The contrast agent was injected into the peripheral vein (ulnar vein) using an intravenous cannula (catheter-depends on body weight and density-On average, it is 11 mSv (maximum 18 mSv,minimum 8 mSv). It is optimal to use a G20 catheter for injection, the injection rate is 6 ml / min. Radiation loading on the patient is calculated by the device individually, depends on body weight and tissue density, on average it is 11 mSv (maximum 18 mSv, minimum 8 mSv). ResultsAs the analysis of the obtained Data showed, in case of suspected pathological changes in the lungs, mediastinum, and vessels, the use of modern nonionic RCS is required for chest MSCT with bolus amplification. The advantages of using nonionic RCS of the yopromide type (Ultravista) in CT of the thoracic region include:

- good local and general tolerability;excellent quality of contrusting.As shown by a comparative analysis of the quality of singlephase (with a single-column automatic injector) and twophase (two-column injector) CTcontrast agent administration,

Two–phase administration – first RCS, then a saline solution allows you to control the time of bolus administration and provides a high- quality image of the vessels of the organ with an assessment of their macrostructure. Using the capabilities of the injector software, it is possible to achieve optimal characteristics of the bolus of the contrast agent in order to achieve a diagnostically significant effect of vascular contrast (CT angiography) and contrast enhancement used to obtain different phases, with the following interpretation of simpvolumes associated with the passage of a bolus of contrast media in the area of interest in the presence of changes in the lung tissue. The main parameters that affect the achievement of optimal results with bolus contrast enhancement are the injection rate, bolus type characteristics, contrast medium concentration, injection duration, time scanning and use of a salt bolus immediately after administration of a dose of contrast agent. In CT withoutsubsequent administration of salt solution, there are often artefacts in the form of stripes, the cause of which is the presence of a significant amount of contrast

Material in the superior vena cava, which makes it difficult to visually interpretation of the picture of the lungs,mediastinum.The effectiveness of contrast in the arterial phase is ensured by a dose of iodine injectedinto the bloodstream. For the introduction of 45 g of iodine , it is necessary 150 ml of RCS at a concentration of 300 mg I/ml or 122 ml of RCS at a concentration of 370 mg I/ml. Consequently, with a diagnostically significant dose of contrast medium and a short duration of bolus, it is most advisable to use RCS at a concentration of 370 mg I/m Duration of administration The RCS depends on the scanning conditions and the clinical objectives of the study. It is equal to the ratio of the total number of RCS to the rate of administration, determines the time of maximum concentration in the zone of interest and the amount of contrast gain. Increasing the duration of the injection without reducing its speed leads to a proportional increase in contrast enhancement. The short duration of the introduction of RCS (due to the small volume or high speed of administration) leads to an earlier appearance of the peak of contrast and therefore requires shortening the scan delay time.A long duration of administration (due to a large volume or low rate of administration), on the contrary, is accompanied by an increase in the time of appearance of the peak of contrast enhancement and requires an increase in the delay time of the start scanning. For chest CT, it is necessary to inject RCS at high speed and within a short time – for a densitometric analysis of the accumulation and leaching of RCS in different phases of circulation in order to determine the nature of focal lung changes.

Results: The need for contrast during computer tomography is also pointed out by other authors who have received results confirming the significance of bolus contrast and helping to make the right choice of contrast medium:

1. "Studies without contrast are suitable only for structures with a natural high Contrast (bone) and for the appearance of hematomas. Almost all other types of soft-tissue studies benefit from the use of parenteral contrast".
2. "CT diagnostics without internal contrast mait is highly effective (up to 40% of conclusions without the use of RCS are incorrect)".
3. "Among nonionic monomeric RCS, the optimal combination of low osmotic activity,low viscosity and the highest concentration of iodine (the best diagnostic efficacy) is yopromide, which practically does not affect the cardiovascular system and kidneys and has the lowest risk of acute and delayed adverse reactions." (Federal Guidelines on the use of medicines (the formal system).

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