RADIATION DIAGNOSTICS

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Abstract: Radiation diagnostics is the science of using radiation to study the structure and function of normal and pathologically altered human organs and systems for the prevention and recognition of diseases.

Keywords: electromagnetic radiation, elastic vibrations, human organs, consisting of photons.

All cures used in radiation diagnostics are divided into non-ionizing and ionizing.

Non–ionizing radiation is electromagnetic radiation of various frequencies that does not cause ionization of atoms and molecules, i.e. their decay into oppositely charged particles — ions. These include thermal (infrared — IR) radiation and resonant radiation that occurs in an object (human body) placed in a stable magnetic field under the action of high-frequency electromagnetic pulses. Also include ultrasonic waves, which are elastic vibrations of the medium.

Ionizing radiation is capable of ionizing the atoms of the environment, including the atoms that make up human tissues. All these radiations are divided into two groups: quantum (i.e. consisting of photons) and corpuscular (consisting of particles). This division is largely conditional, since any radiation has a dual nature and under certain conditions exhibits either the properties of a wave or the properties of a particle. Quantum ionizing radiation includes braking (X-ray) radiation and gamma radiation. Corpuscular radiation includes beams of electrons, protons, neutrons, mesons and other particles.

Artificial contrast is used to obtain a differentiated image of tissues that absorb radiation approximately equally.

There are two ways of contrasting organs. One of them is the direct (mechanical) introduction of a contrast agent into the organ cavity – into the esophagus, stomach, intestines, lacrimal or salivary ducts, bile ducts, urinary tract, into the uterine cavity, bronchi, blood and lymph vessels or into the cellular space surrounding the organ under study (for example, retroperitoneal tissue, surrounding the kidneys and adrenal glands), or by puncture - into the parenchyma of the organ.

The second method of contrast is based on the ability of some organs to absorb the substance introduced into the body from the blood, concentrate and secrete it. This principle – concentration and elimination – is used in X-ray contrast of the excretory system and biliary tract.

The main requirements for radiopaque substances are obvious: the creation of a high contrast image, harmlessness when injected into the patient's body, rapid excretion from the body.

The following contrast agents are currently used in radiological practice.

1. Preparations of barium sulfate (BaSO4). Aqueous suspension of barium sulfate is the main preparation for the study of the digestive canal. It is insoluble in water and digestive juices, harmless. It is used in a form of suspension at a concentration of 1:1 or higher — up to 5:1. To give the drug additional properties (slowing down the settling of barium solids, increasing adhesion to the mucous membrane), chemically active substances (tannin, sodium citrate, sorbitol, etc.) are added to the aqueous suspension, gelatin, food cellulose. There are ready-made official preparations of barium sulfate that meet all the above requirements.

2. Iodine-containing solutions of organic compounds. This is a large group of drugs that are mainly derivatives of non—aromatic acids - benzoic, adipic, phenylpropionic, etc. The drugs are used to contrast blood vessels and heart cavities. These include, for example, urographin, trazograph, triombrast, etc. These drugs are secreted by the urinary system, so they can be used to study the cup-pelvic complex of the kidneys, ureters, and bladder. Recently, a new generation of iodine—containing organic compounds has appeared — nonionic (first monomers — omnipac, ultravist, then dimers - iodixanol, yotrolan). Their osmolarity is significantly lower than that of ionic ones and approaches the osmolarity of blood plasma (300 my). As a result, they are significantly less toxic than ionic monomers. A number of iodine-containing drugs are captured from the blood by the liver and excreted with bile, so they are used to contrast the bile ducts. In order to contrast the gallbladder, iodine preparations absorbed in the intestine (cholevid) are used.

3. Iodized oils. These preparations are an emulsion of iodide compounds in vegetable oils (peach, poppy). They have gained popularity as means used in the study of bronchi,

lymphatic vessels, uterine cavity, fistula passages, ultra-liquid iodized oils (lipoidol) are especially good which are characterized by high contrast and little irritate the tissues. Iodine-containing drugs, especially the ionic group, can cause allergic reactions and have a toxic effect on the body

Common allergic manifestations are observed from the skin and mucous membranes (conjunctivitis, rhinitis, urticaria, swelling of the mucous membrane of the larynx, bronchi, trachea), the cardiovascular system (decreased blood pressure, collapse), the central nervous system (convulsions, sometimes paralysis), kidneys (violation of excretory function). These reactions are usually transient, but can reach a high degree of severity and even lead to death. In this regard, before the introduction of iodine-containing drugs into the blood, especially highly osmolar ones from the ionic group, it is necessary to conduct a biological test: carefully pour 1 ml of radiopaque drug intravenously and wait 2-3 minutes, carefully observing the patient's condition. Only in the absence of an allergic reaction, the main dose is administered, which varies from 20 to 100 ml in different studies.

4. Gases (nitrous oxide, carbon dioxide, ordinary air). Only carbon dioxide can be used for injection into the blood due to its high solubility. When injected into the body cavities and cellular spaces, nitrous oxide is also used to avoid gas embolism. It is permissible to introduce ordinary air into the digestive canal.

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