Contrast agents

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Checked version of the article can be found here (https://www.wikilectures.eu/index.php?title=Contrast_agents&oldid=390532).

See also comparation of actual and checked version (https://www.wikilectures.eu/index.php?title=Contrast_agents&diff=-&oldid=390532).

The contrast material is used to increase the contrast between different tissues, distinguish anatomical structures, display and highlight pathology and for functional imaging (dynamic studies). Contrast agents are basically distinguished:

- **according to the physical principle of the imaging method:**
  - X-rays (scanography, fluoroscopy, CT, angiography),
  - ultrasound (contrast ultrasound, CEUS),
  - magnetic resonance;
- **by method of administration:**
  - systemically (intravenous, intraarterial administration),
  - endoluminally and into preformed spaces (GIT, bile ducts, peritoneal cavity, fistulas);
- **according to radiation absorption:**
  - positive - they increase the absorption of radiation (iodine, barium),
  - negative − reduce radiation absorption (gases, water, methylcellulose).

Skiagraphy

In skiagraphy, contrast agents are used only exceptionally - for example, to mark the position of mammillae, which can mimic a pathological foci shadow.

Fluoroscopy

In the vast majority of fluoroscopy examinations, the administration of a contrast agent is necessary. An exception is, for example, fluoroscopy of the diaphragm.

A barium or *iodine* contrast agent is used to examine **the digestive tube.**

Barium contrast material must not be used in case of suspected perforation or obstruction of the digestive tube.

Barium contrast material achieves better contrast, in addition to **cast filling, relief** filling can also be visualized.

We will achieve the relief filling

- by giving a sip of water when examining the esophagus,
- adding snuff when examining the stomach,
- methylcellulose in enteroclysis,
- air insufflation in irrigography,

... of course, all until the administration of the barium contrast agent.

Angiography

Angiography cannot be performed at all without the administration of a contrast agent. **An iodinated contrast agent** is usually used, however **negative contrast agents** can also be used for imaging (rarely).

Ultrasound

Contrast material is generally not needed for an ultrasound examination. The exception is on the one hand a special dynamic examination (CEUS – Contrast Enhanced UltraSound (https://en.wikipedia.org/wiki/Contrast-enhanced_ultrasound)), e.g. of the liver, when a contrast agent in the form of microbubbles in a polymer package is also administered, on the other hand the THI method in Doppler ultrasonography, also for the administration of a contrast agent in the form of microbubbles.

Computed Tomography (CT)

The administration of the contrast agent for computed tomography (CT) is guided by the examination indication and the clinical question.

Some examinations can be performed **natively** (without contrast material), e.g. HRCT of the lungs, CT of the bones, CT of the brain to rule out bleeding.

In most examinations, however, the contrast agent is administered both iv (during the examination) and **per os** (abdominal examination), sometimes even **into a preformed cavity** (fistulography, peritoneography).

Computed tomography **requires correct timing of** the intravenous administration of the contrast agent - the examination can then be performed in the arterial, portal, venous, excretory, or delayed phase. *An iodine contrast agent* is administered **intravenously**. For **accurate timing of the examination in the arterial phase (CT angiography), the bolus-tracking method** is used: during the application of the contrast material, the device scans the selected volume with a low-dose scan and the examination starts only when the threshold value is reached. Diluted iodine contrast agent, water (for enterochromaffin tumors) or mannitol solution (for CT enterography) is administered **orally**.

Magnetic resonance imaging (MRI)

A gadolinium contrast agent is administered **intravenously** for magnetic resonance imaging (MRI) - again, it depends on the examined area and the clinical question.

Adverse effects of contrast agents

Iodine contrast agent:

- anaphylaxis, bronchospasm, hypotension, vasovagal reaction, nausea, vomiting, erythema,
- **contrast nephropathy**:
  - the largest part of the iodinated contrast agent is excreted by the kidneys, only a fraction by bile
  - prevention is important - hydration,
  - in case of renal insufficiency, carefully consider the indication, dop. max amount of administered contrast material,
  - higher risk in diabetics.
- Biguanides: risk of lactic acidosis, recommended temporary withdrawal.
- Uncorrected hyperthyroidism: the contrast agent can induce a thyrotoxic crisis.
- Do not administer iodine contrast material before thyroid scintigraphy (necessity of iodine deprivation).

Methodical sheet for intravascular administration of iodine contrast agents

According to the methodical sheet for the administration of iodine contrast material of the Radiological Society ČLS JEP, premedication is recommended for high-risk patients (polyvalent allergy, bronchial asthma, allergy to iodine contrast material):

- Prednisone tbl: 40 mg 12-18 hours before application of iodine kl and 20 mg 6-9 hours before application of iodine kl,
- in an acute case, when it is not possible to properly prepare the patient: corticoids and antihistamine iv,
- in severe cases of allergy, it is recommended to premedicate for 24−48 hours in cooperation with an anesthetist,
- the anesthesiologist should be available during the examination with the application of iodine kl in high-risk patients.

In high-risk patients, it is recommended to consider performing an alternative examination (e.g. ultrasound, MR).

Gadolinium contrast agents

- Nephrogenic systemic fibrosis: a late rare but very severe complication.

Links

Related articles

- Preparation for examination by diagnostic imaging methods
- Principles of diagnostic imaging methods

External links

- Methodical sheet for intravascular administration of iodine contrast agents on the website of the ČLS JEP Radiological Society (https://www.crs.cz/cs/dokumenty/doporuceni-prehled/metodicky-list-intravaskularniho-po

dani-jodovych-kontrastnich-latek-jkl.html)

- The maximum amount of iodinated contrast agent that can be administered at one time - calculator (http://www.mudr.org/web/jodova-kontrastni-latka-maximalni-objem)
- **Images on the topic at atlas.mudr.org**
  - Irrigography: relief filling of the large intestine (http://atlas.mudr.org/Case-images-Tumour-of-sigmoid-colon-irrigography-884)
  - Fistulography (http://atlas.mudr.org/Case-images-Fistulography-of-a-cavity-adjacent-to-pancreas-81)
  - X-ray of the esophagus and stomach (http://atlas.mudr.org/Case-images-Hiatal-hernia-115)
  - Contrast-enhanced ultrasound (CEUS) (http://atlas.mudr.org/Case-images-Focal-nodular-hyperplasia-%28FNH%29-CEUS-72)
  - Angiography (http://atlas.mudr.org/Case-images-Shunt-stenosis-angioplasty-753)
  - CT fistulography (http://atlas.mudr.org/Case-images-CT-fistulography-enterocutaneous-fistula-677)