

Clinical applications of iodinated contrast media and reactions in computed tomography (CT)

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With the new generation of multi-slice CT scanners, image acquisition times have been substantially reduced and therefore correct timing is essential in producing CT images, after administering contrast agents. Currently with the increased use of contrast media in CT imaging, radiographers should be more aware of the physiologic and pharmacokinetic principles of these agents.

Many different lesions can be visualized by the use of CT scans. It gives us a view of body structures from different directions and incorporating various types of post-processing, it can demonstrate the region of interest without over projection and in relation to other structures.

When referring to CT imaging, contrast is defined as a difference in Hounsfield Units (greyscale) between structures. Iodinated contrast agents are used to improve the visibility of internal body structures on CT images. There are two types of contrast media. A negative contrast medium has low density and appears black on an image, for example air or gas. In this presentation we will discuss the use of positive contrast agents that have a high density and appear white on images.

Contrast media are divided into ionic and non-ionic agents and both are used in CT imaging. Ionic and non-ionic agents can both be used orally. Intravenously we prefer to use non ionic agents. Ionic contrast media have more side effects, for example feeling or being sick due to the high salt content which draws fluid out of the blood circulation. Non-ionic agents do not bind to blood plasma and are therefore more readily excreted.

Imaging protocols consist of scans made at various phases; before, during and after contrast injection. Sometimes the use of a contrast medium is not necessary for diagnosis (e.g. cerebral scan) or images without contrast enhancement are required to determine lithiasis, presence of calcifications or simply to compare images before and after contrast administration.

The arterial phase is used to determine arterial abnormalities, for example aneurysm or rupture. Scans in this phase are produced on a specific trigger point when a pre-determined contrast density is achieved. This phase is excellent for post-processing image reconstruction e.g., MIP or a VRT.

The venous phase is used to visualize overall anatomy. Both arteries and veins are visible and the most common abnormalities are best demonstrated in this phase, e.g. cysts, haematoma's, tumours and metastasis.

Slow bleeding and other pathologies that have a slow uptake of contrast agents are best demonstrated in the 'late phase'. The urinary tract can be reliably interpreted in a scan performed more than 5 minutes after contrast injection.

According to Dutch law, radiographers are required to be suitably qualified and also have written permission from a performing clinician to be able to inject a contrast agent. Radiographers who administer contrast agents should have a good knowledge of the types of reaction that can occur and the treatment of reactions to iodinated contrast media.

The injection of a contrast agent can cause different reactions from a temporary warm feeling to an allergic reaction. This usually occurs within the first 5 minutes after injection but can produce a reaction up to an hour later. 'Light' reactions are feeling or being sick, sneezing or itching and the more severe include lung or glottis oedema, rash or shock. There are contra-indications to administering intravenous contrast agents. Several factors that have to be carefully considered are the use of Methformine/glucofage, Kahler's disease, abnormal function of the liver or thyroid gland, with the most important being poor kidney function or an earlier reaction to contrast media. When contrast is deemed necessary (usually the responsibility of the radiologist), there are several precautions that can be taken prior to the examination, e.g. pre-hydration and the use of DAF and Tavegil. After-care advice to patients is to increase their water intake to assist in excretion of the contrast agent.

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There should always be a crash car present with a supply of appropriate drugs. If a reaction occurs, observe and reassure the patient and notify the radiologist. In the event that the reaction is severe, then the anaesthetist should attend. All reactions are noted in the patients' medical records and reported to the drug manufacturer.

References

1. Jansen-Dol J, Radiagnostisch onderzoek. Elsevier/De Tijdstroom 1998.
2. KWINT (internal website of UMC St Radboud Nijmegen).
3. Guerbet (manufacturer of Iodinated contrast media).

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