Radionuclide examinations of blood vessels

Nuclear medicine methods are used less than classical angiography in vascular imaging . However, they have their justification, especially when it comes to supplementing radiological examinations.

Examination of the arteries

The arterial system can be examined by two different groups of **radiopharmaceuticals** :

- **with labeled microparticles** ;
- **without microparticles** .

The microparticle examination

Particles with a size of about 50μm are used, which are marked with a radioisotope , most often ^{99m}Tc. Most commonly, human albumin processed as either an aggregate or microspheres is used . Its administration results in **microembolization** , which does not cause the patient health problems, because approximately one capillary per thousand is embolized and the embolizer is resorbed from the vascular bed by the next day.

Microparticle examinations are most often used to monitor the pulmonary system (suspected embolism) and to detect arteriovenous shunts and malformations.

Examination without microparticles

We monitor substances that pass freely through the capillary bed (size up to 10 μm). Labeled erythrocytes , albumins and other plasma proteins can be used , again most often labeled with ^{99m}Tc. According to the permeability of the radiopharmaceutical through the vascular wall, we divide the examination into **diffusible** and **non- diffusible**

Diffusible radiopharmaceuticals

The radiopharmaceutical can **escape freely from the blood vessels** into the surrounding interstitium and vice versa. For this, ^{133}Xe dissolved in physiological saline is most often used . Testing is accomplished by applying the radiopharmaceutical **extravasation** and monitors its **gradual penetration** into the vessel and flushing out (washout). We find out local blood circulation , most often the skin and muscles of the lower limbs . In case of insufficient arterial supply (caused e.g by stenosis or embolization of DK arteries), radionuclide flushing is slowed down. Activity measured above the site of administration decreases more slowly than in a healthy individual.

Non-diffusible radiopharmaceuticals

The labelled substances **do not penetrate** from the vascular bed . We monitor their passage through the vessels .

Radionuclide angiography - is performed by applying a bolus of radioactive substance to the artery and monitors the first passage of the radiopharmaceutical through the organ (kidneys , brain). It is indicated in cases where the patient cannot undergo radiological angiography with a contrast agent (iodine allergy, damaged kidneys).

"Blood pool" - even in the applied substance passes into the arterial bed. We compare activity over normally circulating organs and over parts of the body in which we suspect hypoperfusion. The affected tissues show lower activity = lower blood supply to the radiopharmaceutical-saturated blood .

Examination of the venous vasculature

Radionuclide examinations of veins and their pathologies focus primarily on the search for thrombi . They can be divided into methods , bypassing the 'thrombus (cold spot), or vice versa, there sequester (hot spot). Examinations are fraught with a large number of inaccuracies, such as slow flow through the venous system and dense venous plexus, where the foci may be overlapped.

Radionuclide venography

Radionuclide phlebography is performed by applying a radiopharmaceutical to a vein in the arm or leg. The tourniquets prevent penetration into the surface system. We observe the gradual filling of the venous bed, outages in activity indicate occlusion of the vein with a thrombus. Microaggregates of ^{99m}Tc -labeled human albumin are

most often performed . This allows the condition of the pulmonary system to be assessed after the radiopharmaceutical has passed through the right heart (see Radionuclide examinations of the respiratory system).

Direct search thrombus

Direct detection of thrombus formation can be carried radiopharmaceuticals that thrombus scavenge . The thrombus then represents a site of increased radiopharmaceutical accumulation. However, these methods are more time-consuming, as the blood needs to be "cleaned" of the rest of the radiopharmaceutical after the labeled substances have been trapped in the thrombus, so that the thrombi are more detectable. Up to 24 hours must be waited between drug administration and self- scintigraphy .

^{111}indium- labeled autologous platelets are taken up in the thrombus. Scintigraphy is performed 24 hours after administration of the labeled platelets . This method is not completely accurate in older, slow-growing or stable thrombi.

Similarly, radiolabeled fibrinogen reveals fresh thrombus well, but an older clot may not be detected.

Antibodies to platelets and fibrin also bind to the older thrombus. Their disadvantage is the high price and worse excretion from the body.

Links

Related articles

- Angiography
- Thrombosis

References

- KUPKA, Karel – KUBINYI, Jozef – ŠÁMAL, Martin, et al. *Nukleární medicína.* 1. edition. vydavatel, 2007. 185 pp. ISBN 978-80-903584-9-2.