

The use of X-rays in diagnostics

X-rays are electromagnetic radiation with a wavelength of 10 – 1 pm. X-rays, or X-rays, as they were originally called, were discovered by the German scientist Wilhelm Conrad Röntgen at the end of the nineteenth century. Today, they are one of the most used methods for detecting various defects in the patient's body, and we would hardly be able to do without them. In addition to the well-known "x-ray" in order to detect a fracture or other damage in the patient's body, the x-ray is also used for therapeutic purposes.

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X-ray imaging works on the principle of different attenuation of radiation by tissues, the decisive factor being their **biochemical composition**. Bones absorb the most X-rays, which is why we see them in white on the image. Conversely, watery organs such as the kidneys appear in dark shades of gray. For this reason, contrast agents must be used when examining organs with a large water content. According to the method of creating an X-ray image, we distinguish 2 basic methods: Skiascopy and skiagraphy. In addition, so-called computed tomography, was developed in the second half of the twentieth century, which allows us to view individual tissue sections.

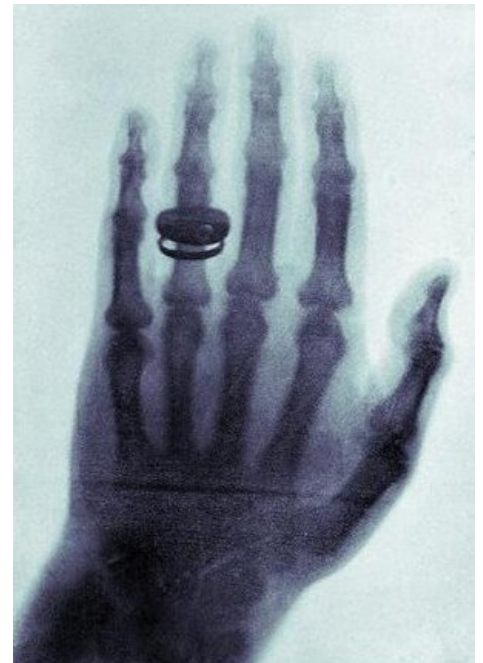
Fluoroscopy

1. REDIRECT Fluoroscopy

Skiagraphy

1. REDIRECT Skiagraphy

	sensitivity	additional components	image size	spacial localization of the bearing	dose of ionizing radiation
fluoroscopy	small	shield image intensifier	the whole plot	yes	high
skiagraphy	large (details)	reinforcing film	only a slice of the story	no	low



X-ray of Mrs. Röntgen's hand

Computed Tomography

1. REDIRECT Computed tomography and Hounsfield units

The X-ray examination itself

In order to achieve the best possible result during the examination, it is important to use the right type of projection and the appropriate radiation voltage. In general, the lower the voltage, the better, as the tissues will appear more contrasted (with greater color differences). Regarding projections, there are 3 basic ones: Front-back, back-front and side. We use the anterior-posterior projection if we want to better visualize the cervical spine, the back of the trunk or the head (parts closer to the sensor and further to the radiation source). With the back-to-front projection, you can see the face more clearly, including the jaw, ribs, etc. Finally, with the side projection, it depends on which side is the incriminated area that we want to examine more closely, and we have to direct the radiator or the patient accordingly.

Side effects of X-rays

Considering the fact that X-rays belong to ionizing form of radiation, there are certain side effects that its use can cause. Therefore, the use of X-rays should be avoided unless absolutely necessary. With the number of exposures to the patient, the probability of possible damage to the patient increases. This is usually of a similar nature to damage caused by radiation, for example, in nuclear power plant disasters. DNA damage, burns, tumor growth, various degenerations and many other health problems can occur. However, the radiation to which medical personnel are exposed on a daily basis cannot be neglected either. To protect it, lead doors, barium plaster are installed in the X-ray rooms, and there are many other protective measures, including personal dosimeters, with which workers regularly check whether they have really been exposed to radiation.

Points of interest

- Statistics show that the CT machine is the biggest source of radiation exposure for residents of developed countries.
- Every 2 hours in an airplane at flight level for transoceanic flights - 11,000 masl have the same radiation effects as 1 x-ray of the lungs.
- In the Czech Republic, 12 million X-rays and 500,000 CT examinations are performed every year.
- Angiographic examinations are more burdensome than other X-ray examinations.
- The radiation dose during a CT examination is up to 2 orders of magnitude higher than during a plain X-ray.

	CT (mSv)	RTG (mSv)
thorax	5,8	0,02
belly	5,3	1,06
head	1,5	0,1

Table comparing the radiation effects of a CT scan versus an X-ray scan.

Links

Related articles

- X-rays
- Ionizing radiation
- X-ray therapy
- Fluoroscopy
- Skiagraphy

Resources

- BENEŠ, – JIRÁK, Daniel – VÍTEK, František. *Základy lékařské fyziky*. 4. edition. Praha : nakladatelství Karolinum, 2015. ISBN 978-80-246-2645-1.
- NAVRÁTIL, Leoš – ROSINA, Josef. *Medicínská biofyzika*. 1. edition. Praha : Grada Publishing, 2005. ISBN 80-247-1152-4.