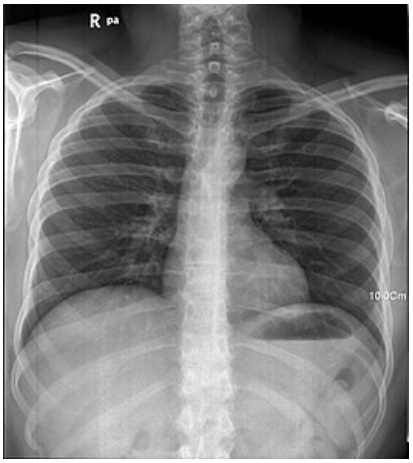
Sciagraphy

General

Skiagraphy is a diagnostic method for imaging hard and soft human tissues that uses **X-rays**. It works on the principle of different absorption values of the X-ray beam passing through it in different tissues. The resulting image is captured on a sensitive material - X-ray film or the device's detection system (this is what distinguishes the method from **fluoroscopy**, where the given image is only observed, but not captured on the recording medium). From the image, we can then estimate the internal structure or injury of the examined organ or structure. This method is most often used to examine bones, teeth and joints, but it can also be used to visualize soft tissues such as musclesor lungs. It is one of the first diagnostic methods for most diseases.

Imaging technique



Chest X-ray

In most imaging, two projections are made due to the two-dimensionality of the image - **front-back (anteroposterior) and side**. Thanks to this, it is possible to determine the spatial location of the displayed structures. The exception is chest images, which are taken from the **back (posteroanterior)**. It is important to mark the images with the letters L or P (depending on the left/right side) and a sign photo that contains basic information about the patient. X-raysthey penetrate the human body. During their passage, there is a varying degree of attenuation (absorption of radiation), which allows us to image the tissues on special X-ray films. The resulting image is a negative on which individual body structures can be recognized by highlighting and shading. Brighter areas represent structures absorbing more radiation, while dark areas are structures where less radiation is absorbed. A device called a negatoscope is used to evaluate the images. **Hard techniques** are used, when imaging is taken at an x-ray voltage above 100 kV (e.g. for imaging lungs, hard tissues) and **soft techniques** at a voltage of up to 45 kV (e.g. breast imaging). To reduce radiation exposureboth operators and patients must use X-ray beam filtering and shielding. The primary filter (aperture) serves to absorb low-energy photons and is placed near the X- ray tube. Secondary filters (a Lysholm diaphragm with a fixed grid for imaging under adverse conditions - at the bedside or in the operating room, or better a **Bucky diaphragm**, which moves irregularly and therefore does not cast a sharp shadow on the resulting image) are placed between the patient and the film cartridge, where it acts as a trap for scattered photons.

1. **Direct digitization method (DR)** – exposure detected directly in a special detector that is part of the device; instant generation of image information.
2. **Indirect digitization method (CR)** – image documentation is obtained by "reading" (digitizing information from the film in a special digitizer).

In order to achieve greater contrast and sensitivity of the method, special X-ray films with a significantly thicker emulsion layer and a higher proportion of silver halides are used for imaging.

Contrast substances

X-ray image of the foot

The examination can be carried out more easily with the use of a **contrast agent**, which will allow a perfect visualization of the tissues. The substance **can change the amount of radiation** absorption in the body, thereby causing greater differences in the transparency of the examined tissue or organ compared to the surroundings in the X-ray image. It can be positive or negative. Positive contrast agents include, for example, iodine or barium. Between negative air, oxygen or CO_2 . Before using it, however, it is necessary to discuss possible allergic reactions with the patient, and thus exclude adverse effects of the contrast agent.

Negative contrast substances

These substances absorb less radiation than the examined organ. Negative contrast agents are thus used to **clarify** X-ray images. These substances include, for example, **air, carbon dioxide, nitrous oxide** (paradise gas).

Positive contrast substances

Substances with a high proton number that have a **high absorption capacity** and give a deep **shadow** in images . Positive contrast agents are divided into two groups: **iodine and barium** contrast agents. Iodine contrast agents are most often in liquid form (iodine organic compounds in water) and are used in lymphography. Barium contrast agents contain barium sulfate and are used for examination of the digestive tract.

- **Double-contrast method**: When examining the digestive tract, both negative and positive contrast agents

are sometimes used simultaneously.

Contraindications

Relative in **pregnancy**, especially in the first four months. X-ray radiation could damage the fetus.

Classic imaging

In this method, instead of a shield, an X-ray film is used, on which a latent image is formed after exposure to radiation. This image is a two-dimensional recording of a three-dimensional object. Foil films with photographic emulsion are most often used, which are placed between reinforcing foils. X- ray radiation falling on this film induces fluorescenceand significantly enhances the effect of radiation on the film. The film is then developed using the same procedure as in photographic practice. The resulting image is a negative on which the structures of the body are manifested by highlighting and shading. Structures absorbing more radiation create brighter areas, structures absorbing less radiation create darker areas (thanks to the negative). The evaluation of images is most often done using a negatoscope - a medical device that emits homogeneous intense light.

Digital imaging

A more modern method where images are obtained in digital form. This is done in several ways:

- **Computed radiography** - the use of phosphor foils, which are placed in similar cassettes as X-ray films. The image is obtained by scanning the cassettes with a laser point by point, and is thus transferred to the computer.
- **Direct radiography** – radiation is captured by a matrix of detectors, where it is converted directly into an electrical signal. The advantage of this method is the high quality of the images, the possibility of editing the image on the computer (brightness, contrast, etc.), archiving the images in digital form and easy distribution around the hospital or outside it. Last but not least, lower economic costs. The disadvantage is the higher purchase price of the equipment.

Benefits

X-rays are a permanent document. The high resolution of the photographic material enables the study of even very small details.

Lateral projection of the skull

Disadvantages

The images cannot capture the whole event, but only a section of it, and therefore cannot be used to accurately study the function of the organs of the human body. The method does not even allow capturing a spatial image when locating the disease focus, as is possible with the fluoroscopy method. X-ray examination has ionizing effects on the human organism, which brings certain risks.

Links

Related articles

- X-Ray
- X-rays in medicine
- Computed tomography

External links

- ŠPRINDRICH, Jan. *Radiologické zobrazovací metody : Multimediální podpora výuky klinických a zdravotnických oborů* [online]. Portál 3. lékařské fakulty UK, The last revision 2011-06-02, [cit. 2011-12-22]. <http://portal.lf3.cuni.cz/clanky.php?aid=71>.
- ŠPRINDRICH, Jan. *Rtg dynamické metody a kontrastní látky : Multimediální podpora výuky klinických a zdravotnických oborů* [online]. Portál 3. lékařské fakulty UK, The last revision 2011-06-02, [cit. 2011-12-22]. <http://portal.lf3.cuni.cz/clanky.php?aid=85>.
- Fyzika v moderním lékařství: Skiagrafie. (http://cz7asm.wz.cz/fyz/)

References

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- JOSEF NEKULA, Miroslav Heřman. *Radiologie.* 1. edition. Univerzita Palackého v Olomouci, 2001. 205 pp. pp. 12–13. ISBN 80-244-0259-9.

- SVOBODA, Milan. *Základní techniky vyšetřování rentgenem.* Druhé edition. AVICENUM, zdravotnické nakladatelství, n.p., 1976. 604 pp. pp. 79-87. ISBN 08-013-76.