

RADIOGRAPHS/X-RAYS

Radiographs are the oldest form of imaging used in medicine. Imaging technologies use rays or particles that penetrate the body in order to view inside it. In the case of radiographs, electromagnetic energy in the form of x-rays is beamed through the patient and onto a piece of film. The x-rays pass right through air and gas, so many x-ray particles penetrate through air, such as in the lungs, reach the film and expose it, turning it dark. Most of the x-rays hitting bone bounce back and don't reach the film. The film is unexposed in those areas and stays white. The most dense materials are metals – a piece of metal looks bright white on an x-ray. Bone or minerals are a little darker but still mostly white. Fluid and tissue are gray, fat is dark gray, and air and gas look black.

Because fluids and tissues all look gray they tend to blend together and may be hard to distinguish. For example, a coin or pin that a pet may have swallowed will look bright white and be easily distinguished from liquid stomach contents on a radiograph. A piece of plastic, rubber or fabric, on the other hand, cannot be distinguished from fluid. As another example, a tumor may show up well in the lungs because it is gray and the lungs are black. The same tumor in the liver may be impossible to see.

“Contrast” x-rays are used to better delineate soft tissues such as the intestines or kidneys and to enable us to see objects that would ordinarily just blend together. To outline the stomach or intestines, or objects contained within, a liquid such as a suspension of the mineral barium is placed into the stomach. The barium will flow around an object or through the intestines and look bright white. It will outline a grayer area where there is a piece of plastic or other object, so that we can actually see its shadow. This type of x-ray study is called a GI, for gastrointestinal, series. With an upper GI series, the barium is given by mouth or via a tube into the stomach. With a lower GI series, the barium is given via enema to outline the colon, or large intestine.

Iodine is also a good contrast material. Unlike barium, iodine solution can be injected into the bladder or blood vessels. When given intravenously (into a vein) it travels throughout the body in the bloodstream. When it reaches the kidneys it is filtered out and excreted in the urine. It is thus possible to take x-rays while the iodine passes through the blood vessels to the kidneys, through the kidneys themselves, down the ureters and into the bladder. The iodine shows up brightly and outlines a cyst, tumor or stone.

An angiogram is another contrast study, in which the iodine material is injected into a specific area and then pictures are taken as it flows through the blood vessels, to see whether the blood can flow through them properly. In a myelogram it is injected into the spinal canal to outline the spinal cord as it passes through the bones of the spine, invisible to a normal radiograph.

The ionizing radiation produced from the x-ray beam can damage the body. The danger is not to the patient, who only gets x-rayed a few times in life. The danger is to the people taking the radiographs, who are exposed to this radiation day after day. The more a patient wiggles or struggles, the more times an x-ray needs to be repeated and the more exposure to radiation for the hospital personnel. In addition, in order to x-ray the right area of the body so that it can be seen well on the radiograph the patient may need to lie in an awkward or uncomfortable position. For these reasons, pets often must be sedated for good x-rays to be taken.

Once they are taken, under most state's laws radiographs are the property of the hospital. They must be retained by the clinic as part of the medical record, usually for about seven years. Veterinarians commonly send x-rays to other doctors for consultation or second opinions requested by the owner of the pet. However, clients are generally legally obligated to return them. Many hospitals will send x-rays only to another doctor, whereas others will let owners hand carry them to the other clinic. Some larger institutions have the equipment necessary to reproduce them. More and more practices have digital imaging capabilities, allowing high quality pictures of the x-ray to be sent over the Internet.

Some veterinarians, just as with human doctors, specialize in radiology, which is the interpretation or "reading" of images such as x-rays and MRI scans. Veterinary schools and large referral clinics usually have doctors board certified in radiology to read radiographs, both those taken at their hospital and ones sent in by other doctors. This, too, can now be done on-line with digital imaging. This allows even the most isolated veterinarians in Alaska or Siberia to consult with experts about a case.

FLUOROSCOPY

Fluoroscopy is a special type of x-ray in which the beam of x-rays is continuous and flashes on a screen instead of a single piece of film. With fluoroscopy it is possible to watch an animal swallow or the diaphragm move with breathing. This allows the diagnosis of conditions that are only visible at a certain moment in time, making a single x-ray image unlikely to detect it. Once produced, the images can be saved and stored on x-ray film, photographic film, videotape or computer.

The major disadvantage of fluoroscopy is the higher level of radiation exposure to personnel. Instead of an x-ray beam that lasts a fraction of a second, the continuous beam of the fluoroscope produces many times the amount of radiation. Special shielding is needed, the equipment is very expensive and the patient must always be anesthetized so that people are not needed to restrain them on the table during exposure. For these reasons fluoroscopy is used selectively at larger hospitals and has been largely replaced by ultrasound imaging, which is much safer.