The Pharma Innovation Journal 2022; SP-11(3): 423-426

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(3): 423-426

www.thepharmajournal.com
Received: 01-01-2022
Accepted: 04-02-2022

Rajendra S Ghadge
Assistant Professor, Department of Veterinary Clinical Medicine, Ethics & Jurisprudence, Nagpur Veterinary College, Nagpur, Maharashtra, India

Pankaj B Hase
Department of Veterinary Clinical Medicine, Ethics & Jurisprudence, Nagpur Veterinary College, Nagpur, Maharashtra, India

Corresponding Author
Rajendra S Ghadge
Assistant Professor, Department of Veterinary Clinical Medicine, Ethics & Jurisprudence, Nagpur Veterinary College, Nagpur, Maharashtra, India

Advanced imaging diagnostic tools for animals

Rajendra S Ghadge and Pankaj B Hase

Abstract
In olden days, diagnosis was mainly considered an individual skill acquired through intelligence, experience, following gurus and tricks. Much was depending on nadi pariksha as practiced by ancient vaidyas. With the industrial revolution in the 17th Century onwards. The practice of medicine also evolved in the west into the modern sciences that depends more on documentation and therefore proven facts about aliments. Use of Physical devices both for diagnosis and treatment has become an integral part today. Because of application of computers in medicine, the techniques have further refined and accurate. Veterinary medicine has also tried to catch up with these developments.
Imaging of internal body structures has revolutionized the modern diagnostic methods in both animals and humans. The data obtained from a study can be manipulated with the help of specially developed software to obtain multiple images in various planes and contrast. This eliminates undue exposure, decrease examination time and improves image quality.

Keywords: diagnostic tools, image, specialities, techniques

Introduction
The art and science of diagnostic imaging became an integral part of veterinary health management through clinical and surgical interventions shortly after the exposure of the first radiographic films. The computers ability to manipulate data has been applied to various imaging technologies, resulting in new images such as those seen with digital subtraction fluoroscopy, computed tomography (CT), Magnetic resonance imaging (MRI), Nuclear Scintigraphy and diagnostic ultrasonography. These technological explosions have called for an expansion of veterinary expertise beyond traditional diagnostic radiology to include all types of diagnostic imaging. Of these newer technologies, ultrasonography has gained popularity most rapidly among both veterinary specialist and small animal practitioners. Diagnostic imaging has always been a mainstay of the armamentarium for the veterinarian. Veterinarians have limited resources available as regards history and routine screening procedures. Therefore diagnostic imaging has a major role in the workup of numerous clinicians however the move towards less invasive diagnostic procedures with a high precision of diagnosis has continued to drive this phenomenon.
Diagnostic radiology was utilized in for almost all livestock species and companion animals at all the veterinary institutions and in advanced states owned or in privately managed multi-facilities clinics. The use of diagnostic radiology expanded with improved knowledge, especially with better understanding of the diagnosis of various pathological conditions. The use of diagnostic radiology abated somewhat with the advance of diagnostic ultrasonography; however it has remained most acceptable diagnostic imaging in the veterinary profession. Presently there is a major push to move from conventional analog film screen technology to computed and /or digital radiography. It is presumed that veterinary radiology will continue to follow the progression realized in human radiology. Merin RG (1975) [8].
Imaging plays a vital role in the evaluation of a sick patient. First and foremost images are a data set. The information is there. The clever and methodical evaluator can glean a vast amount of information from images. Integration into the work up of the patient requires insight and an abundance of skill and experience. Perseverance and dedication have no equal for the acquisition of asuitable skill set. Historically, radiology has been confined to disease diagnosis, but the advent of interventional radiology brings exciting in roads into therapeutic techniques. Some alternative imaging techniques are indicated to narrow down the differential list and to plan a therapeutic approach. A range of imaging options is now available to veterinarians including radiography (Traditional and digital X-rays), fluoroscopy, ultrasonography, video endoscopy, laproscopy, nuclear scientigraphy (bone scan), computer-aided tomography (CT

Scan) and magnetic resonanace imaging (MRI).
A number of imaging procedures have been developed to help diagnose diseases in humans, and many of these have been adapted for use in animals.
Most imaging methods provide a lot of information by noninvasive and economical means and, at the same time, do not change the disease process or cause unacceptable discomfort to the pet. However, because of the complexity and expense of the equipment and instruments, some of these procedures are carried out in facilities designed especially for their use.

Fluoroscopy
Another technology using X-rays is the fluoroscope. A fluroscope is a real time radiographic unit that has flexible arm. The arm receives the X-rays and connects to a processor with a screen to display the image it is portable and is used for procedures such as following a needle during joint injection and during surgery to ensure correct placements of implants. The image it produces is real time imaging and its portability makes it a valuable tool for assisting with procedures.

Digital Xray
X-rays have been in use for many decades to create images called radiographs (black, white, and gray images). Radiography is the most common imaging procedure used in veterinary practices X-ray Imaging (Radiography) Radiography has long been a staple in imaging diagnostic for in clinics. They can be used to diagnose a variety of condition such as fractures, abscesses, malformations, abdominal and thoracic affections and lesions, X-rays work well for creating images of bones, foreign objects, and large body cavities. They are often used to help detect fractures, tumors, injuries, infections, and deformities. Although radiographs may not give enough information to determine the exact cause of your pet's problem, they can help your veterinarian determine which other tests may be needed to make a diagnosis. With digital radiography practitioners have immediate internal visualizations. Digital radiography today offers high –detail images that can be viewed on a computer screen for analysis, transferred to a radiographic monitor for evaluation and diagnosis, saved to computer, saved to disk or e-mailed to another practioner for a second opinion. Although the procedure is painless, in some cases pets are sedated to reduce the anxiety and stress associated with the procedure, to position the animal, and to help the animal stay still while the images are taken.
The body's soft tissues do not absorb X-rays well and can be difficult to see using this technology alone. Specialized x-ray techniques, called contrast procedures, are used to help provide more detailed images of body organs. In these procedures the animal is given a dye that will block x-rays. This can be given intravenously to examine organs like the kidneys or heart, or by mouth to examine the digestive tract. A series of x-rays is taken after the dye is given, which will outline the organs where the dye collects. This makes it easier to spot any abnormalities. Baker ML & Dalrymple GV(1978) [2].
The x-ray machine is positioned so that x-rays are focused on the area to be examined. Exposure to x-rays lasts only a fraction of a second. However, the greater the exposure, the greater the risk that radiation may damage cells. For this reason, a very low dose is used, and lead shields may be used to protect areas that are not being x-rayed and the people taking the radiograph.Traditionally, radiographs were captured on film. However, recent advances in technology have made it possible for these images to be stored digitally on computers.
There are many advantages to storing radiographs on computers. One of the most important is the ability to rapidly and economically transmit copies of the images to specialists or other clinics. The individual digital cameras widely used today, the benefits of instant images and the ability to retake images to get a better shot are quite remarkable. The benefit to the patient is significant, because the diagnosis can be done on-site and treatment can commence immediately.

Echocardiogram
An ultrasound (echocardiogram) is a non-invasive procedure used to evaluate the internal organs of dogs and other animals. An echocardiogram is commonly referred as an "Echo". Ultrasound examinations can be used to examine the heart, abdominal organs, eyes and reproductive organs in dogs. Ultrasound applied to the heart is called an "echocardiogram". Allen DG. (1982) [1].
An echocardiogram is indicated to evaluate pets with a suspicion of congenital or acquired heart disease. An echocardiogram may be performed when indicated by the results of an X-ray, when there is a suspicion of heart disease based on physical examination. For example, detection of a heart murmur or irregular heart rhythm could be an indication for an echocardiogram. Many veterinarians refer dogs needing an echocardiogram to a specialist because performing the procedure requires particular skills and equipment. Some clinics do have ultrasound facilities on-site, while others use the services of mobile specialists who come to the clinic to perform echocardiograms. There is no real contraindication to performing this test. Even normal results help determine health or exclude certain diseases. Echocardiograms help to evaluate the structure and function of the heart. This test can be extremely useful for identifying birth defects, diseases of the heart valves, and heart muscle diseases (cardiomyopathy). The exam also can be used to identify fluid around the heart (pericardial effusion), cardiac tumors, and certain types of heartworm infections. The chest cavity and cranial mediastinum (upper chest cavity) also can be evaluated, though in most cases the lungs cannot be visualized (due to the air in this organ). Pipers FS (1981) [9].

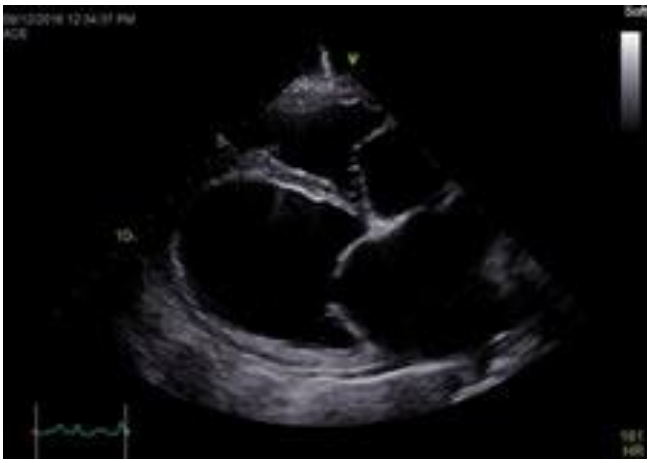

Fig 1: Echocardiogram to evaluate the structure and function of the heart

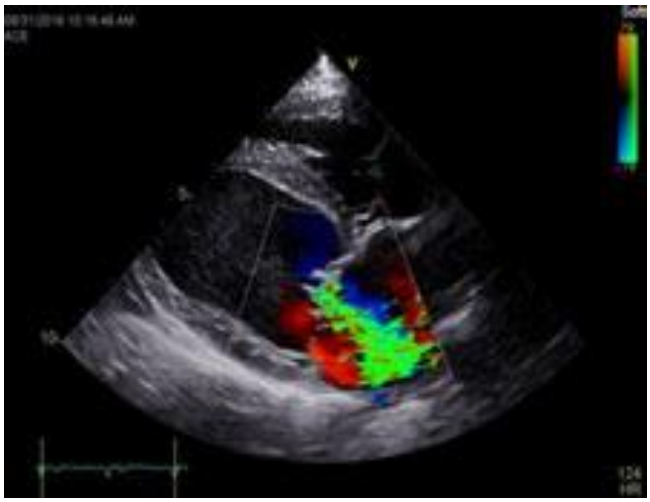

Fig 2: Showing blood flow & diseases of the heart valves

Fig 3: Showing Echocardiography in cat

Computed Tomography

Computed tomography (CT) is a computer-enhanced x-ray procedure used to detect abnormalities in various body organs. Because of the expense and size of the equipment, and the need for specially trained technicians, this procedure is not used for pets as often as other imaging types. However, it may be available in some locations (such as hospitals associated with veterinary schools or large specialty practices) and may occasionally be recommended.

In this procedure, the animal is placed on a motorized bed inside a CT scanner, which takes a series of x-rays from different angles. When one series, or scan, is completed, the bed is moved forward, and another scan is taken. CT scans differ from ordinary x-rays because they show different levels of tissue density and produce more detailed images. From these scans, a computer creates cross-sectional images of the body part under investigation and displays the images on a monitor. A dye that can be seen on x-rays may be injected intravenously to make it easier to see abnormalities in the images. By sequentially scanning a body area, an entire organ or other structure can be imaged without interference from neighboring or overlying structures. These scans can be used by the veterinarian to detect structural changes deep within the body, including tumors, abscesses, changes in blood vessels, and fractures. Because of the need to remain still for a relatively long time while scanning is completed, animals undergoing a CT scan are anesthetized. Kalra MK (2004) [5].

Fig 4: Computed tomography of dog for Encephalitis

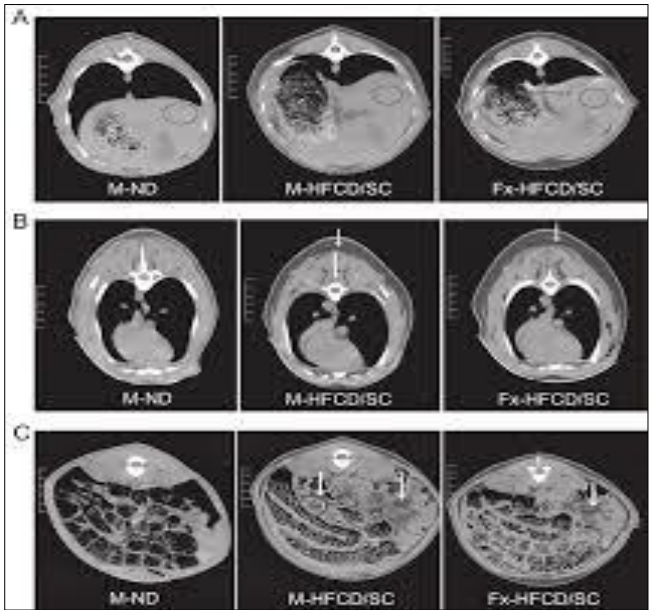

Fig 5: Showing digital imaging of Abdominal organs

Magnetic Resonance Imaging

Magnetic resonance imaging (MRI) is another form of imaging in use today. It is an alternative to computed tomography. With this procedure, a very powerful magnetic field generates detailed anatomic images. No x-rays are involved and it is extremely safe. However, because of the expense and size of the equipment and the need for specially trained technicians, this procedure is not often used for pets. And, due to size constraints, it is not practical for use with horses or other large animals. Mendelson DS, Rubin DL. (2013) [7].

For the procedure, the animal is placed in a tubular electromagnetic chamber and pulsed with radio waves, causing tissues in the body to emit radio frequency waves that can be detected. Many repetitions of these pulses and subsequent emissions are required. The emitted waves are then converted into images that are displayed on a computer screen. The images can also be saved for additional study. Sequential examination of slices through the body is done in the same way as for computed tomography. Because the procedure is rather lengthy and the animal must not move throughout the procedure, general anesthesia is used in most cases.

Fig 6: (M R I Scan of Dogs for Spinal injury)

Nuclear Medicine Imaging

Nuclear medicine imaging, also known as radionuclide imaging or Scintigraphy, involves dosing the animal with an element that emits a type of radiation known as gamma rays. This element is then detected within the body by means of a special camera attached to a computer, which generates the image. The element is attached to a molecule that has an affinity for the organ or tissue of interest. If the molecule is metabolized by the organ or tissue or stays in the tissue for only a short time, consecutive camera images can be used to evaluate the function of the organ or tissue. Veterinarians most frequently use nuclear medicine imaging to analyze the lungs, kidneys, liver, thyroid, and heart, although other portions of a pet's body may also be studied with this technique.

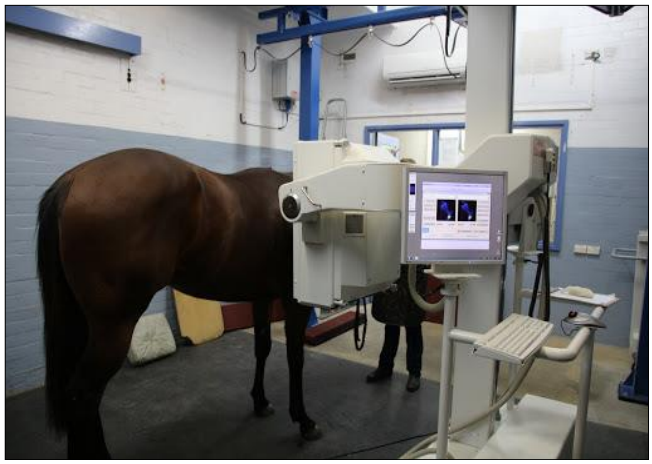

Fig 7: C-Arm set up with real time imaging in equines

References

1. Allen DG. Echocardiographic study of the anesthetized cat. Can J Comp Med. 1982 Apr;46(2):115-122.
2. Baker ML, Dalrymple GV. Biological effects of diagnostic ultrasound: A review. Radiology. 1978 Feb;126(2):479-483.
3. Chauhan RS, Agarwal DK. Textbook of Veterinary, Clinical and Laboratory Diagnosis. 2nd edn. Jaypee Publishers, New Delhi, India, 2008.
4. Fortuin NJ, Hood WP, Jr, Craige E. Evaluation of left ventricular function by echocardiography. Circulation. 1972 Jul;46(1):26-35.
5. Kalra MK, Maher MM, D'Souza R, Saini S. Multidetector computed tomography technology: current status and emerging developments. J Comput Assist Tomogr. 2004;28(Suppl1):S2. 6.10.1097/01.rct.0000120857.80935.bd
6. Lu G, Fei B. Medical hyperspectral imaging: A review. J Biomed Opt 2014;19(1):010901. 10.1117/1.JBO.19.1.010901Mai W, Sutherland-Smith J. Academic radiology careers: what is academia all about? Vet Radiol Ultrasound. 2010;51(3):239-45.10.1111/j.1740-8261.2010.01685
7. Mendelson DS, Rubin DL. Imaging informatics: essential tools for the delivery of imaging services. Acad Radiol. 2013;20(10):1195-212.10.1016/j.acra.2013.07.006
8. Merin RG. Effect of anesthetics on the heart. Surg Clin North Am. 1975 Aug; 55(4):759-774.
9. Pipers FS, Bonagura JD, Hamlin RL, Kittleson M. Echocardiographic abnormalities of the mitral valve associated with left sided heart diseases in the dog. J Am Vet Med Assoc. 1981 Sep 15; 179(6):580-586.
10. Pipers FS, Hamlin RL. Clinical use of echocardiography in the domestic cat. J Am Vet Med Assoc. 1980 Jan 1;176(1):57-61.
11. Pipers FS, Reef V, Hamlin RL. Echocardiography in the domestic cat. Am J Vet Res. 1979 Jun;40(6):882-886.
12. Pipers FS, Rings DM, Hull BL, Hoffsis GF, Reef V, Hamlin RL. Echocardiographic diagnosis of endocarditis in a bull. J Am Vet Med Assoc. 1978 Jun 1;172(11):1313-1316.
13. Urthaler F, Krames BL, James TN. Selective effects of pentobarbital on automaticity and conduction in the intact canine heart. Cardiovasc Res. 1974 Jan;8(1):46-57.