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RESEARCH ARTICLE

RECENT ADVANCES IN DIAGNOSTIC IMAGING IN VETERINARY PRACTICE

Dr. Bhagyashree K. Bhadane and *Dr. Pradeep R. Balage

Department of Veterinary Surgery and Radiology, College of Veterinary and Animal Science, Nagpur MAFSU, Nagpur-43140199 Maharashtra, India

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Corresponding author:
Dr. Pradeep R. Balage

ABSTRACT

The more we are able to peer into the future, the better equipped we will be to prepare ourselves to do well in the environment ahead. It may therefore be interesting to look at trends we can expect in veterinary medicine in the upcoming years. Medical diagnostic technology has made rapid strides after the advent of computer. Many of the advances in human diagnostic medicines are translated into veterinary medicine in the developed countries. In brief, newer branches like Imaging, Radiodiagnosis, Telemedicine, Telesonography and Teleradiology have emerged.

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INTRODUCTION

Broadly, the instrumentation/ devices devised with the modern technology in the present digital age are listed below.

- Digital Radiography
- I.I.T.V.
- Ultrasound
- MRI
- Computed tomography
- Positron emission tomography (PET)
- Nuclear scintigraphy
- Laparoscopy
- Digital Subtraction Angiography
- Endoscopy
- Pulse Oximetry
- Telemedicine & Teleradiology

All these imaging modalities have brought sea change in the diagnosis of a clinical case. Precise and an instant diagnosis of an intricate case can be made with their usage. The modalities which can be used under Indian conditions are:

Digital Radiography: Computerization in Radiology in the form of digital X- rays which can be captured on a computer chip and the digitalized image can be viewed interdepartmentally. It provides a vehicle for doctors in remote locations to interact while also enabling doctors in distant locations to share information

Image Intensifier T.V. system: Generally used in orthopedics surgery. This facilitates fracture repair using a small incision thus achieving minimal invasive surgical maneuver. IITV helps in X-ray imaging of the intraoperative site for the intraoperative orthopedics manipulations, and the same can be stored for future reference purpose. This facilitates introduction of Steinman pin giving a small incision

Ultrasound: In small animal and equine practice, ultrasound is routinely used as a diagnostic aid. Applications of ultrasound in ruminants have not been fully exploited, except in pregnancy. There could be numerous organs which can be scanned using an ultrasound scanner. Ultrasonography seems to have a promising future in veterinary medicine, particularly for the assessment of intra-periabdominal disease. Ultrasonography is viewed as the single most versatile addition to the noninvasive andnonsurgical mamentarium of the veterinary clinician since the advent of fibreoptic endoscope. Although other sophisticated imaging modalities like CT and nuclear imaging can provide additional information, the accessibility and cost effectiveness of these procedures do not make these as promising as Ultrasonography.

MRI: MRI is a highly sensitive and noninvasive technique providing accurate and detailed anatomic images with good contrast and spatial resolution. However, in veterinary medicine MRI is still in its infancy and its use is infrequent. To date, MRI has been used in developed countries in clinical cases as well as a research too especially for CNS diseases in small animals. MRI has a wide spectrum of application. It can be used for imaging all body regions in small animals, but only the extremities and the head can be imagined in large animals. It is useful in answering many questions related to the musculoskeletal diseases in animals such as understanding the pathogenesis of navicular disease, traumatic arthritis and osteochondrosis in equines and wobbler syndrome in dogs. The newer applications of MRI are Magnetic resonance angiography and MR spectroscopy. It is especially used to differentiate an inflammatory process from a neoplastic mass, tumors from peritumoral oedema. It is more specific and sensitive in detecting localizing and differentiating osteomyelitis, cellulites and abscess. However, its use is contraindicated in pregnancy.

Computed tomography: CT has been an extremely significant development which has a unique cross sectional imaging ability useful for the diagnosis of tumors, malformations, inflammation, degenerative and vascular diseases and trauma. CT is a diagnostic modality that is fundamentally different from X-ray method in which an organ is scanned in successive layers by a narrow beam of X-rays in such a way that the transmission of X-ray photons across a particular layer can be measured and by means of a computer, used to construct a picture of the internal structure.

Positron emission tomography (PET): Positron emission tomography is used to detect certain brain diseases. Similarly to nuclear medicine, a short- lived isotopes is incorporated into a substances used by the body such as glucose which is observed by the tumor of intrest. PET scans are often viewed alongside computed tomography scans, which can be performed on the same equipment without moving the patient. This allows the tumor detected by the CT scan.

Nuclear scintigraphy: Nuclear scintigraphy is a highly sensitive advanced procedure in which radioisotopes are used to detect the functional abnormalities of the body system. The interpretation is based on the appearance of the increased (hot spots) or decreased (cold spots) radioactivity regions. For eg. an active process is indicated by a hot spot while a dull process like lack of perfusion is indicated by cold spot. Nuclear scintigraphy has been used to detect functional disorders of the kidney, liver, lungs, GI tract, thyroid gland and many other organs. It is very useful in the diagnosis of occult lameness, lung perfusion and ventilation and patency of the ureter in both large and small animals. Also used for vertebral column imaging and monitoring the progress of fracture healing and in tumor detection.

Laparoscopy: Laparoscopy has been a valuable diagnostic and therapeutic tool in human clinical medicine. Only in the last 15 years, its use has been extensive in various animal species for research and clinical diagnostic and therapeutic purposes. Laparoscopic surgery offers significant advantages over open surgeries in fields of cholecystotomy, appendicectomy, vagotomy, hernia repair and adhesion release etc. For gynecological problems like ovariancyst or in the case of oophorectomies and hysterectomies, laparoscopic surgery (scarless surgery) is now considered a better alternative in addition to laparoscopic sterilization. The most advantageous characteristic of laparoscopy is that it allows direct examination of abdominal cavity with only minimal and superficial surgical intervention. Thoracoscopy has been employed in man for the diagnosis and treatment of diseases of the pleura, lung, mediastinum, great vessels, pericardium and oesophagus. Visceral inspection of the thoracic cavity by thoracoscopy has been used to provide a more accurate diagnosis and prognosis in horses affected with pleurapneumonia and other thoracic and oesophageal disorders. Thoracoscopy allows visualization and biopsy of a large surface of the lung and provides adequatespecimen for histopathological diagnosis.

Digital Subtraction Angiography: DSA is a radiographic modality which allows dynamic imaging of the vascular system following intravascular injection of iodinated X-ray contrast media through the use of image intensification, enhancement of the iodine signal and digital processing of the image data. Temporal subtraction of the images obtained during the first arterial phase of injection of the contrast medium from the images obtained before and after contrast medium administration yield images which are devoid of bone and soft tissue. This imaging modality plays an important role in highlighting the vascular pathologies like stenosis etc.

Endoscopy: It is a minimal invasive diagnostic modality which aids in a best way to document mucosal inflammation- hyperemia, active bleeding, irregular mucosal surface, and facilitates biopsy in tubular organs like the GI tract, and respiratory and the urogenital organ systems.

Pulse Oximetry: Pulse oximetry represents the greatest advance in the patient monitoring. It has the unique advantage of continuously monitoring the saturation of haemoglobin with oxygen, easily and noninvasively, providing a measure of cardiorespiratory function. The fundamental physical property that allows the pulse oximeter to measure the oxygen saturation of haemoglobin is that blood changes colour as haemoglobin absorbs varying amounts of light dependent on it's saturation with oxygen. Hence, pulse oximetry remains the standard of care during anaesthesia as well as in the recovery room and intensive care unit. A vital part of treating equine problems is an initial accurate diagnosis. High quality images are an important aspect of this. As well fixed and mobile Xray machines, the Hospital has an image intensifier for intra-operative monitoring with x-rays. The Ausonics Impact ultrasound machine provides high quality images of muscles, tendons and 'ligaments; whereas the Ving-med System V can image the equine thorax and abdomen, as well as giving detailed analysis of blood flow in various organs and tissues.

Telemedicine & Teleradiology: Veterinary surgeons have a long tradition of consulting one another about problem cases and many have unwittingly practiced telemedication when discussing case by telephone or by sending laboratory reports by telefax. Telemedication and teleradiology extend this further by use of internet.

To conclude, the advances in diagnostic technology in veterinary surgery is in infancy stage in India. An all out effort is required to introduce the basic imaging modality - ultrasound in veterinary practice at district polyclinics and city hospitals. The use of radiology needs to be strengthened by its optimum use in clinical cases. "The little neglect may breed mischief….for want of a nail the shoe was lost; for want of a shoe the horse was lost; and want of a horse the rider was lost." - Benjamin Franklin

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