VETERINARY COUNCIL OF NIGERIA

Compilation of Papers Presented at the
VCN Professional Continuing Education Seminar 2015

Theme:

THE ROLE OF VETERINARY PRACTICE IN ENHANCING NATIONAL SECURITY

Venues & Dates

SOUTHERN CENTRE
Afe Babalola University,
Ado-Ekiti,
Ekiti State.

2nd July, 2015

NORTHERN CENTRE
Usmanu Danfodiyo University,
Sokoto,
Sokoto State.

13th August, 2015

VETERINARY SURGEONS:

A. General Session

i. National Security: The Use of Animal in Crime Control by **HRM, Dr. Aisha Abubakar Baju, ACP**

B. Parallel Session

i. **Public Health:** The Role of Veterinarians in Emerging and Re-Emerging Diseases by ***Prof. J. U. Umoh***
ii. **Theriogenology:** Ultrasonograhy in Veterinary Diagnosis by ***Dr. Abdulkadir Usman***
iii. **Surgery:** Pain Management by ***Prof. J. B. Adeyanju***
iv. **Medicine/Pathology:** Current Challenges in Diagnosis and Treatment of the Poultry Diseases by ***Prof. Daniel Adene***

ULTRASONOGRAPHY IN VETERINARY DIAGNOSIS

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Introduction

Diagnosis of any disease affecting an animal is a very important step towards its successful treatment and an inspiration, usually, to a number of clients that are attached emotionally or otherwise, to such animal. Accurate diagnosis is a necessary confidence building step in veterinary practice which could enhance a fulfilling career. Although, it may involve series of procedures which could be complex requiring patience, skill and passion; and May also require the use of modern technology that may be expensive but gives a real time result. Several imaging procedures have been developed and adapted as one of the modern technology to help diagnose diseases in animals. Most of these imaging procedures provide a large amount of information by non-invasive means without much discomfort and does not change the process of the disease in the animal. X-ray, Ultrasonography, Computed Tomography, Magnetic Resonance Imaging and Nuclear Medicine Imaging are examples of Diagnostic imaging procedures used in veterinary practice but for the purpose of this Seminar, this paper will be limited to the use of Ultrasonography in Veterinary Diagnosis.

Ultrasonography

Ultrasonography or Ultrasound is the second most commonly used diagnostic imaging procedure in veterinary practice after the X-ray and it uses ultrasonic sound waves in the frequency range of 1.5–15 megahertz (MHz) to create images of body structures based on the pattern of echoes reflected from the tissues and organs. The image produced from such Ultrasonography using the ultra sound machine is referred to as Ultrasound scan and can show the shape, size and location of most tissues and organs in the animal's body in different image format. It can also show abnormalities within these tissues and organs in the animal's body.

Ultrasound machine

There are several types of ultrasound machines available for use in veterinary practice ranging from the desk top type to the mobile hand held type. However, they all have the same basic components which are;

a) CPU with Monitor
b) Probe with transducer
c) Gel
d) Power source.

The CPU with monitor records electrical impulses from tissue or organ echoes and displays created image of these echoes during ultrasonography that represents the appearance of the tissues or organs when cut in the same plane on an anatomic specimen. The monitor may also vary in size and could also depend on the type of ultrasound machine.

The probe contains the transducer which is made up of piezoelectric crystals that sends sound waves into the body and receives echoes reflected back from animal's tissues and organs which then reconverts the energy of the echoes into electrical impulses recorded by the computer in the ultrasound machine. The probes are of different shapes depending on their type and they are normally connected to the CPU with monitor by a cord. There are basically two different types of probes and these are;

1. Internal probe such as Trans oesophageal, Trans vaginal or Trans rectal usually inserted into the rectum and mostly used in larger animals
2. External probe such as Transcutaneous probe

The gel is made up mineral oil base and it function to remove or eliminate air and prevent air from interfering with the transducer.

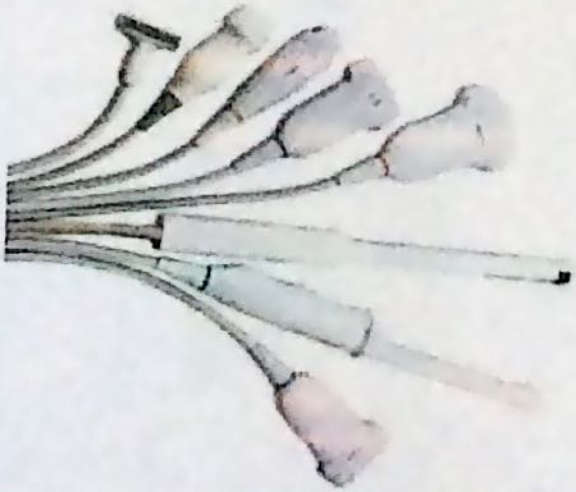
The power source provides the CPU with monitor electric current. Some of the portable hand held ultrasound machines contain batteries that energize the machine.

Types of ultrasound machines

1. Slice ultrasound machine is the most commonest and it provides 2D image
2. 3D-4D ultrasound machine which provides several two dimensional images that are acquired by moving the probe across the body surface (transcutaneous probe) or by rotating inserted probes (trans rectal, trans vaginal or trans oesophageal probes) and the two dimensional scans are then combined by specialized computer software to form 3D or 4D images which allows you to get a better look at the tissue or organ being examined.
3. Doppler ultrasound machine which is based on the Doppler effect by differencing changes in the frequency of echoes by a moving object reflecting ultrasound, creating

a higher frequency of the one moving toward the probe. The frequency change depends on how fast the object is moving.

1portable hand held ultrasound machine

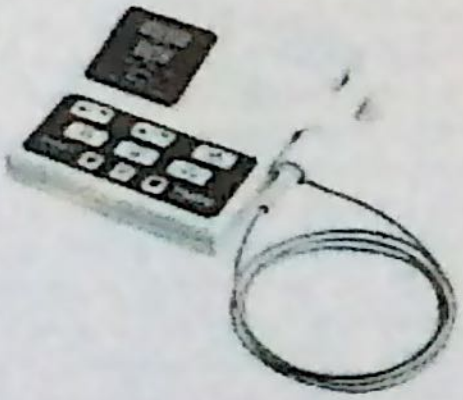


2different types of probes

3Desk top type ultrasound machine

4Desk top type ultrasound machine

5Portable ultrasound machine



6Portable ultrasound machine

Requirements for using ultrasound machine

Before using an ultrasound machine for diagnostic purpose in veterinary practice, a sound knowledge of Anatomy, Disease process and pathology is required for any meaningful result. It is essential to note too that ultrasonography is practice dependent (i.e small animal practice or large animal practice) as this will greatly influence the choice of ultrasound machine. A wrong choice of ultrasound machine will give a poor image and this will greatly influence the veterinarian's ability to make the right diagnosis.

Ultrasound technique

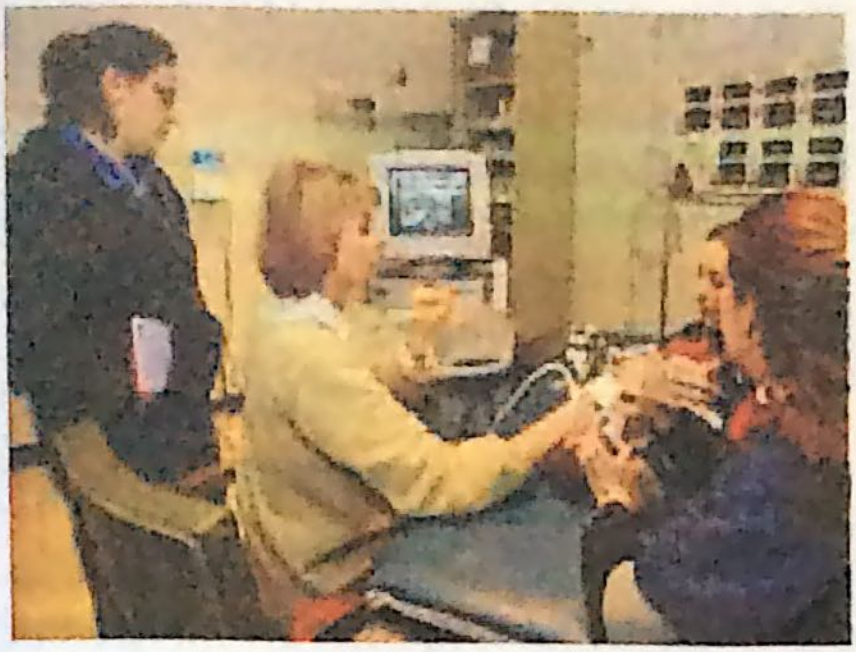
The animal should be restrained appropriately and mineral oil based gel should be applied on the area to be scanned (Trans cutaneous) or on the transducer area of the probe (Trans vaginal, Trans rectal or Trans oesophageal) while the ultrasound machine is powered on and the probe is placed appropriately. The probe is moved around the area to be scanned until a clear image is obtained which can be saved on the ultrasound machine for review. Care should be taken to void tissues or organs surrounded by air and tissues or organs

covered by bones as these will obstruct the quality of ultrasound scans and could make any diagnostic effort worthless to frustrate a veterinarian.

Uses of ultrasonography

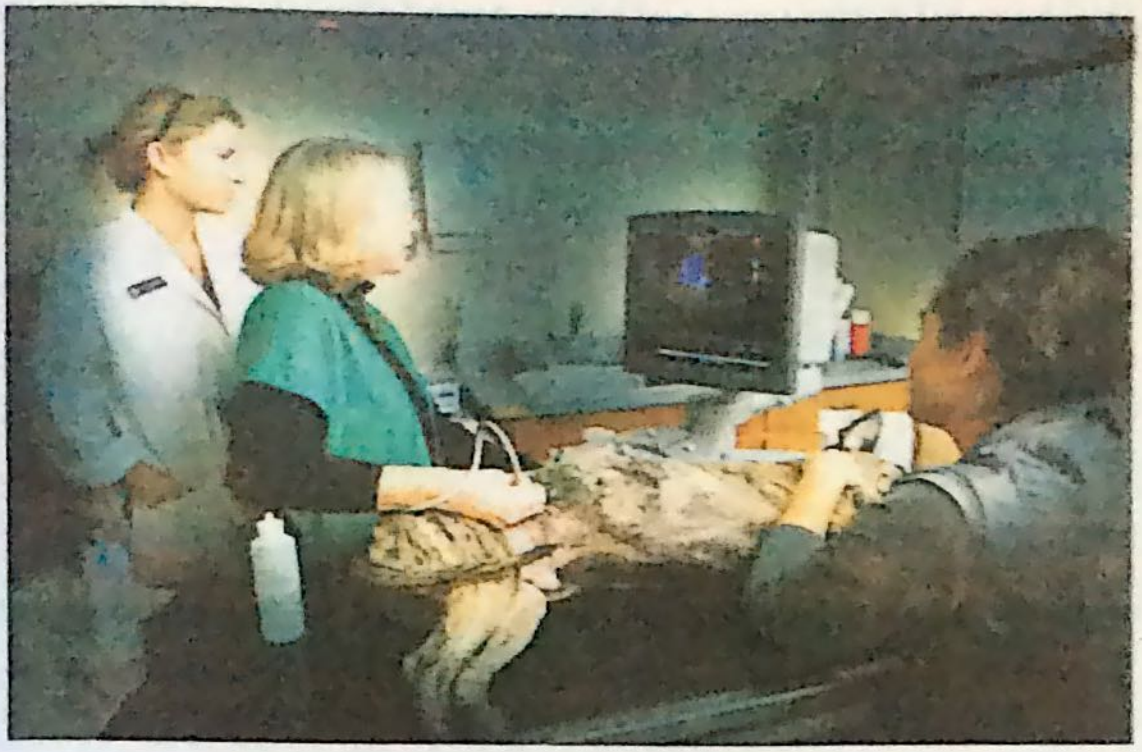
Ultrasonography is also referred to as sonography. It is a powerful real time diagnostic imagery aid that gives a lot of information about the animals body painlessly and non-invasively. Disease conditions and abnormalities in tissues and organs can be detected easily using sonography and progress or otherwise of such abnormalities can also be monitored easily. Disease conditions such as cancer, rupture of tendons, ectopic pregnancy, cardiac and other circulatory anomalies. Even though ultrasound can be used to evaluate most soft tissues and organs in the animal body, the heart and abdominal organs constitute the majority of examinations performed in small animals. While scanning the abdomen for example, the abdominal structures should be systematically evaluated. Each sonographer develops his or her own system of completely evaluating the abdomen. Systematic evaluation ensures that all tissues and organs in the animal's abdomen are scanned effectively and satisfactorily. Organs such as the adrenal glands and pancreas were seen only if diseased and enlarged, but modern ultrasound machines operated by an experienced sonographer are capable of producing images of such quality that the normal adrenal glands, pancreas, and lymph nodes can be imaged. Ultrasonography also is used to evaluate the soft tissues of the musculoskeletal system. In horses, ultrasound is used to detect and evaluate the presence of tears in the tendons and ligaments of the limbs. Examination of joints and the margins of bones around the joints in both large and small animals are widely performed but ultrasound cannot be used to evaluate the bones themselves. Ultrasonography cannot be used to scan gas-filled or bony tissues. The sound beam is totally reflected at soft tissue/gas interfaces and absorbed at soft tissue/bone interfaces. Gas and bone also "shadow" any other organs beyond them. Bowel gas can inhibit imaging of adjacent abdominal organs, and the heart must be imaged from locations that do not require the sound beam to pass through the lungs. Sonography is limited in regard to the depth of tissue that can be examined. Most scanners will display tissues to a depth of ~24 cm, but the image is often quite noisy at that depth. This is because most tissue echoes do not return directly to the transducer but are reflected in some other direction. By a depth of 24 cm, the loss of energy from the sound beam results in echoes so weak that the scanner cannot separate the returning echoes from the background electronic noise. In addition, some echoes that are not directly reflected may return to the transducer by reflection from a tissue outside the beam path. Such echoes require longer to return to the transducer and are depicted at a spurious location, adding noise to the image. Low-frequency transducers can scan deeper than high-frequency transducers, but resolution is decreased. There is much less loss of beam intensity in fluid media such as the urinary bladder, so if the beam passes through such a fluid media, the maximum scanning depth may be increased at the expense of temporal resolution. In small animals however, soft-tissue lesions of the ligaments, tendons, joint capsule, and articular cartilage of the shoulder and stifle joints are readily detectable by an experienced examiner. Most joints and muscles can be evaluated by sonography if the

veterinarian is familiar with the normal anatomy and the manner in which pathology of those structures is manifest on the image. Changes in the size and shape of tissues, organs and structures are evident in most cases, but evaluation of the echo pattern during sonography is based on comparison with that of other tissues and organs the veterinarian has scanned in other animals. The veterinarian must have a firm idea, developed from experience and comparison with known normal, of the normal echo pattern for each tissue or organ scanned with each transducer. The echo pattern will change between transducers because of changes in axial and trans axial resolution as well as transducer design. Comparison of the echogenicity of several tissues and organs must be made, because any tissue or organ may have increased or decreased in the echogenicity of its parenchyma. Abnormal tissues or organs may either be uniformly altered in echogenicity or exhibit focal or multifocal changes in their echogenicity. Focal changes are usually easier to detect than uniform changes. Sonographic lesions are sometimes quite characteristic of a given disease process, but more often the changes are nonspecific unless a characteristic change in anatomic presentation is detected along with changes in echogenicity. Pancreatitis is a primary example, and in the past 10 years, sonographic evaluation of the pancreas has become a mainstay of assessing animals with suspected pancreatic disease but it does not always agree with clinical pathologic evaluation or physical examination. In some cases, the physical examination and pathologic data will suggest pancreatitis, but it is not usually detected during sonography probably due to the great difficulty of interrogating the entire pancreas using sonography. Chronic pancreatitis may also be indicated by sonography but could be poorly characterized by clinical pathologic data because of the chronic status of the disease. Cushing disease is also frequently difficult to interpret on the basis of sonography because of the problems of benign adenomas that have no clinical significance in the adrenal glands and because in true Cushing disease, the adrenal glands are being overdriven by a pituitary adenoma and are not themselves usually structurally abnormal. Ultrasonography can also be used to direct biopsy instruments to acquire tissue for a specific pathologic diagnosis and lesions buried within large organs such as the liver and kidneys that might not be detectable at surgery may be detected and biopsied with sonographic guidance. Presurgical diagnosis permits more thorough and specific planning of surgical procedures and enhances presurgical treatment of lesions. Ultrasound contrast agents have been used to increase the reflectivity of blood and any tissue through which blood flows. Enhancement of blood reflectivity is usually accomplished by injection or formation of transient microscopic bubbles which are quickly absorbed into the plasma and therefore do not constitute an embolism hazard in the plasma. The increase in echogenicity is related to the amount of blood flowing through the tissue. The ability to evaluate the vascularity of a tissue provides additional information about the type of lesion present e.g. granulomas generally have poorer blood flow than normal tissue and do not enhance as much as the surrounding tissue, whereas tumors may enhance more and retain the contrast for a longer time than the surrounding tissue. Contrast agents hold great promise for improving both the sensitivity and specificity of sonography but they are extremely expensive, which precludes their use in all but special instances or funded research.



7An ultrasound being performed

8Sonography in progress



9small animal ultrasound

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