Clinical Diagnosis of Diseases of Pet Animals

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The science of bio-instrumentation has provided many modern gadgets to explore the different organ systems of the mammalian body. These instruments have increased the diagnostic skill and aid the clinicians in getting information from organs beyond the reach of his conventional diagnostic procedures. The aim of the modern day veterinary profession is to evolve improved strains by improved selection procedures. This increase the value of the animals and lowers the resistance against diseases and other stress related disorders. The diagnostic equipments play a major role in assisting the veterinary clinician to arrive at an early diagnosis and also in identifying the disease of the livestock. In future, more emphasis will be given for forcasting the occurrence of the diseases by monitoring organ profiles for which we have to rely on the judicious utilisation of diagnostic equipments.

But unfortunately, Indian practicing veterinarians are not at all using any of the modern diagnostic equipments compared to the counterparts in the developing countries. They show keen interest only in laboratory equipments but not in diagnostic equipments. The academic personnels in the Indian veterinary institutions are also showing more emphasis only to laboratory diagnosis and its techniques, rather than to clinical diagnosis by using modern diagnostic equipments which seems to be reflected in practicing veterinarians. Now the cost of many modern diagnostic equipments are within arm reach of the practicing veterinarians especially canine practitioners in metropolitan cities. It is my duty to bring certain details to this forum since many of the diagnostic equipments are in day to day use at Madras Veterinary College Hospital and also we are adding some more diagnostic equipments to enrich our armamentarium.

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Electroencephalograph (EEG)

The EEG is still regarded with considerable sceptism by most of the members of the veterinary profession. Such doubts usually arise through unfamiliarity with the equipment and an unreasonable expectation of its function. EEG can contribute valuable information in making a diagnosis in conjunction with the conventional lines of investigation. Although Electroencephalography has been used as a research procedure in animals for several decades its use in clinical cases has only been practised since about 1963.

When electrodes are placed on the head of an animal directly over the cerebral hemispheres, an oscillating electrical potential can be detected and recorded. The actual origin of electricity has long been the subject of debate and has been variously ascribed to the cerebral cortical cells, their synapses and processes. EEG results from the sum of changing potential differences from all the sources. The rhythmicity of this activity is conferred by the subcortical nuclei and the medullary reticular formation. The electrical activity recorded at the scalp electrodes originates from the cortex and that activity from deeper structures is too attenuated at the surface to be recorded by the EEG. Deeply seated pathological processes may well alter the regulatory influence of the subcortical structures and result in changes recorded at the scalp, although deep-seated tumors often do not produce any appreciable change in EEG recordings.

There are a number of commercially available EEG machines. All basically comprise an amplification system and a recording device. Because the magnitude of the electrical activity of the brain is so small the amplifier is of particular importance and should promote at least 1 mm of pen deflection for 2 uv. Most machines use moving coil galvanometers to translate the amplified signal into movement of a pen. The most used paper speeds are either 15

mm/sec or 30 mm/sec. The electrodes are usually alligator clips that can be applied to the skin without causing pain. The commonly used electrodes in veterinary practice are (1) Left frontal (LF) (2) Right frontal (RF) (3) Left occipital (LO) (4) Right occipital (RO) (5) Vertex and (6) Earth. This arrangements allows recordings to be made between various pairs of electrodes.

It is not necessary to clip the hair from the scalp before electrode placement. Some operators recommend defatting the skin with acetone or alcohol and also the infiltration of the skin with a local anaesthetic. It is not necessary to follow these procedures but infiltration of local anaesthetic can be helpful to reduce muscle potential artifacts.

Restraint is a must, prior to the recording of a electroencephalogram, and the method of restraint influences the interpretation. Restraint can be of three types: (a) Physical (b) General or (c) by paralysis with muscle relaxants. Muscle relaxants and anaesthetics require hospitalization and produce high voltage slow activity which may obscure abnormality. The major disadvantages of physical restraint are the likelihood of movements and muscle potential artifacts. This can be minimized by carrying out the EEG examination in a comfortable environment. Dimlighting and a room temperature of 70° F often conducive to relaxation of the patient. The owner should be present during the examination and all the procedures should be carried out in a quiet unhurried manner.

A major limitation of the electroencephalogram in veterinary practice is improper positioning of the patient and resultant misinterpretation due to the many artifacts that can occur. The successful use of the EEG depends very much upon the ability to recognize and identify artifacts. Swallowing, licking and panting all produce characteristic alterations of the EEG, occasionally the rhythmic spike activity of the electroencephalogram is recorded. Poor electrode contacts or earthing will produce noise but once identified they are fairly easily traced.

Abnormalities of EEG are generally seen as alterations in the frequency of activity but interpretation must take account of the age and state of consciousness of the patient. Commonly recorded EEG patterns that occur as a result of disease are (i) High voltage slow activity (HVSA) (ii) Low voltage fast activity (LVFA) (iii) Abnormal spike discharges and (iv) Paroxysms of either fast or slow activity. LVFA, is seen in irritative disease processes like encephalitis. Persistent and abnormal HVSA suggests large areas of dead or absent neurons like tumors, hydrocephalous and trauma. Apart from providing contributory diagnostic information the EEG can assist clinical assessment by

1) Helping to localize a focal lesion

2) Providing information on the course of a disease through serial recordings

3) Allowing an evolution of therapy through serial recordings.

EEG in Epilepsy

EEG recordings are often carried out in dogs presented with history of seizures. It is common to obtain a perfectly normal tracing in a known epileptic, except in cases where the reason for the seizures is due to hydrocephalus, encephalitis or a tumor. Occasionally a patient suffering from idiopathic epilepsy will yield a paroxysm of fast frequency spindles. Alert EEG is not altered by anticonvulsant therapy but abrupt cessation of anticonvulsant therapy often results in a rebound effect and may promote paroxysmal discharges (or) some times an actual seizure. Certain drugs can be used to promote abnormalities of the EEG as phenothiazine tranquilizers such as

acepromazine are some times used to activate paroxysmal discharges of seizure activity.

The EEG in veterinary medicine should be regarded as an additional diagnostic tool contributing to the clinical data obtained through physical examination and laboratory investigation. The veterinarian using EEG must be aware of the physical variations that occur in cortical electrical activity during various levels of consciousness and at different ages. Artifacts on the EEG tracing should be recognized and attempts should be made to minimize their occurrence.

Electrocardiograph

The elctrocardiogram is a graphic record of the variations in voltage produced by a mass of associated cardiac muscle cells plotted against time. Electrocardiography has become established as an atraumatic relatively inexpensive and extremely useful technique for gaining information about the heart. It is now generally accepted as a necessary part of the cardiac examination of a dog (or) cat. However, it is yet to make an impact on general veterinary practice in India, although portable and relatively inexpensive electrocardiographs are available.

The conduction system of the heart is consisting of the sino-atrial node, the inter atrial bundles, the Atrio-ventricular node, the common bundle of His, the right and left branches of the bundle of His and the purkinge fibres. The heart is suspended in conductive medium, the tissues and fluids surrounding it conduct electrical currents. During depolarization current flows from the electro negative areas to electropositive areas. The electrocardiograph records only the major waves of occuring electrical activity. Using arms and legs as electrodes the electrocardiograph detect, magnify and records the major cardiac forces that are conducted to the body surface.

Several lead systems were developed to provide an accurate measurement of the electrical forces produced during cardiac contraction. A practical technique for recording ECG in clinical patients is as follows. The dogs are placed on their right sides and the electrodes are attached behind the point of shoulder on the forelimbs and at the stifle joint on the hind limbs. Recordings are made at a paper speed of 25 mm/sec and vertical sensitivity of 1 cm/mV. Monitoring the ECG at a paper speed of 25 mm/sec permits measurements as accurate as using higher paper speeds that deflection of short duration and low magnitude can be detected more easily at accuracy are required paper speed may be increased. The electrocardiogram is used to study the rate and rhythm of heart action, duration form, amplitude and spacing of the bioelectric forces (P, QRS, T) of the cardiac cycle.

Atrial depolarization is represented by the 'P' wave and the iso-electric or zero potential that follows the 'P' wave is by the P-R segment reflecting the delay of the cardiac impulse at the atrio ventricular node. The period from the beginning of the 'P' wave to the beginning of the QRS complex is called the P-R interval. The electrical phenomenon reflected by the QRS complex is the depolarization of the ventricles. The S-T segment and 'T' wave of the electrocardiogram represent ventricular repolarization.

Endoscopes

Livestock and pet owners always hope that their animals will get recovered within a very short time, whenever they come across clinicians. No doubt that it is the vital and advanced diagnostic aid like 'ENDOSCOPE' that helps to enrich such hopes in a positive way. The instrument like 'ENDOSCOPE' which provides the "first standard ref-

erence – informations" for the clinicians who get involved with cases. It is crystal-clear that endoscope is one of the vital component of the modern veterinary hospitals / veterinary science-teaching institutions. This basic infrastructural facility affords the clinician, the opportunity to investigate into disorders of gastro-intestinal tract, lower and upper airways, post uterine and lower urinary tracts, the abdominal cavity and ear canals.

Endoscopy of Gastro Intestinal Tract

Canine gastric disorders are assuming more importance now a days and often vomiting is the chief complaint we receive from the pet owners. Needless to say that substantial percentage of the cases often involve the primary gastric disorders and gastrofibroscopy is a vital diagnostic aid as far as the gastro intestinal tract is concerned. Endoscopical study of canine stomach often helps us to probe into the canine gastric disorders like tumors, ulcers, inflammation, foreign bodies, stenosis and obstruction.

Endoscopes are more useful in locating small growths or tumors, which are often not detectable by radiography and in their removal. In addition, they can also be employed to perform gastric lavage and to obtain biopsy samples.

Different types of endoscopes are available to examine the different part of gastro intestinal tract and some are even fitted with video cameras. Each of them has its own deflection range, and even endoscopes suitable for all the species of animals are also available for veterinary use, commercially.

Oesophagoscopy

It provides much more accurate and sensitive means for diagnosis of disorders like oesophagitis, early structure formations and neoplasia including the lumen-masses.

Gastroscopy

Anorexia, vomiting, melena, haematemesis, salivation, nausea and persistent diarrhoea-all become the important signs that warrant the need of the gastroscopy examination. In cattle, the functioning of oesophageal groove is probed, well during endoscopic practice. Contrary to the earlier opinions, the use of gastroscopes in small animals like dogs and cats has highlighted the fact that gastric mucosal disorders occur fairly often. Gastric biopsies can be undertaken with the aid of gastroscope and it also helps to remove foreign bodies. Acute gastric ulcers, which are common in foals, can easily be diagnosed with this type of instrument.

Enteroscopy

Enteroscopy with biopsy is excellent for the detection of diffuse mucosal small bowel disease and complete oesophago gastroduodenoscopy should be the routine examination to be undertaken always rather than the examination of oesophagus or stomach alone. Dueodenoscopy helps in the diagnosis of duodenitis, neoplastic masses and giardiasis.

Colonoscopy

The large intestines of dogs and cats are anatomically simple and colonoscopy is hence relatively easy to perform. Chronic large bowel diarrhoea, constipation or tenesmus, dyschezia or haematochezia that accompanies formed faeces are the conditions that warrant the use of colonoscopes. Further coloscopes pave a way in therapeutic monitoring. Rigid proctosigmoidosocopes are inexpensive and easy to use and are available in both adult and pediatric diameters. Examination of intestinal segments in cats and small dogs need the pediatric size proctoscopes.

The advent of fiberoptic endoscopy has made revolution in the clinical diagno-

sis of canine gastric disorders by aiding the veterinarian to visualize the ongoing pathology in the gastro intestinal tract.

Endoscopy of upper respiratory tract

Upper respiratory tract becomes the major portal of entry for infectious agents, a common site for tumour development, physical trauma and foreign body trapment. Sneezing, stridor, stertor and nasal discharge, are the conditions that warrant the utilization of this instrument. A flexible adult or pediatric bronchoscope (insertion tube outside diameter ranging from 3.6 to 5 mm) is recommended for endoscopy examination for the upper and lower respiratory tract of small animals.

Rhinoscopy

Flexible or rigid type endoscope is used to explore the nasal cavity.

Pharyngoscopy

This is usually performed with a pediatric or adult bronchoscope.

Endoscopy of lower respiratory tract

Bronchoscopy

Instruments with atleast two-way deflections capability are recommended and are useful in ruling out tracheitis, bronchitis, bronchopneumonia, tracheal collapse foreign bodies, parasites, lung lobe torsion and neoplasia, chronic cough, haemoptysis or acute-onset of respiratory distress.

Post-uterine endoscopy in the bitch

This term is used to mention the endoscopy of the cervix (Colonoscopy), Vagina (Vaginoscopy), Vestibule (Vestibuloscopy) and Uterus (Hysteroscopy).

Hysteroscopy

The technique is more or less done ina smaller manner as in human medicine and it requires only a few minutes and hysteroscopy may be combined with the collection of biopsy material. This technique helps to reveal clearly the changing conditions of the endometrium during oestrus, purulent endometritis etc. The performance of a hysteroscopy is contra-indicated in the event of a possible or existing pregnancy.

Otoscopy

Outer diameter of these instruments varies from 4 to 9mm in veterinary practice and biopsy including foreign body retrieval is possible with this instrument.

Cystoscopy

This helps to probe into urinary bladder abnormalities.

Arthroscopy

Though it can not be denied that is requires highly skilled personnel, it is equally true that this is a diagnostic procedure of great information value. However, it is an invasive procedure, requiring penetration of the articular cavity and it requires general anaesthesia. In the horse and cattle, arthroscopic examinations are carried out on the hip shoulder, stifle, elbow, tarsal and fetlock joints, in the dog and pig only on the stifle joint. This reveals Chondral lesions, arthrophytes and foreign bodies.

Laparoscopy

This is an invasive procedure unlike other endoscopic examinations and is designed for visual inspection and biopsy of the peritoneal cavity and its organs. Laparoscopes with various directions of vision are available. Complications like development of severe pneumothorax (if diaphragm is punctured) and pneumoperitonium (if hollow organs like stomach, urinary bladder are ruptured) may occur if procedure is not done in proper techniques. Hepatic and pancreatic disorders are probed with these instruments.

To cope pace with the public-expecta-

tions towards a quick recovery of their ailing animals, despite the higher cost comparatively, endoscopes become a must for any developing veterinary institutions.

Haemodialysis

Dialysis is the recommended treatment for patients with acute reversible renal failure, during the period of compromised renal functions. This procedure avoids the progressive uraemic state and allows the kidneys to regenerate and regain their function.

Haemodialysis is the technique of choice for managing acute renal failure in human medicine. The principal veterinary indication for haemodialysis is acute and reversible renal failure in patients whose fluid, electrolyte and metabolic disturbances are unresponsive or unmanagable by conservative supportive measures.

Slit lamp biomicroscope

Slit lamp biomicroscopy is the observation of the transparent structures of the eye in optical section with the slitlight beam and the microscope. In 1911 Allvar Gullstrand of Stockholm devised the first slit corneal microscope and illumination from a slitlamp. The light source was glowing oxide of magnesium. Since then numerous refinements, with improved illuminating systems and increased mechanical flexibility have been developed for the biomicroscope.

Tono meter

Tonometry refers to the measurement of intra ocular pressure, where as Tonography refers the study of aqueous out flow in response to the pressure applied to the eye. There are two types of tonometry, the identation tonometry and the applanation tonometry, of which the former is more useful in veterinary practice.

Ultrasonography

Veterinary ultrasound has grown from in exotic imaging modality in the late 1970's to an essential service at University hospitals and many private veterinary clinics. Ultrasound is characterized by sound waves with a frequency higher than the upper range of human hearing, approximately 2000 cycles per second (20 KHz are commonly employed in diagnostic examinations. Normally, each ultrasound transducer (scan head) emits sound waves of only one frequency. Transducer selection comes with experience but general guidelines may help the new sonographer select in appropriate frequency. Small dogs (<10 kgs) and cats can be examined wit 7.5 or 10 MHz whereas large breed dogs sometimes require 3.0 MHz or lower frequencies. For example, a 3.0 MHz transducer may be needed to penetrate to the dorsal liver of a large dog, but a 5.0 to 7.5 MHz transducer can be used to examine the spleen and left kidney in the same dog.

Ultrasound (US) frequencies from 1.0 to 10 MHz are created by electrical stimulation of piezoelectric crystals. These crystals are housed within transducer, which, when applied to the body surface with a coupling agent will produce sound waves, referred to as the sound beam, which are propagated through the soft tissues of the body. When the sound beam encounters tissue interferes of differing acoustic impedance, a portion of sound beam is reflected back to the transducer which also acts as a receiver. Echoes returning from soft tissue acoustic interfaces are converted to electrical impulses and displayed on an oscilloscope screen as a cross section of the tissue. Lower frequency sound beams penetrate further into soft tissue, but have poorer resolving capabilities, than higher frequency sound beam.

The 3 principle modes of ultrasound are Amplitude mode (A-mode), Brightness mode (B-mode) and Time Motion or Motion mode (T-M or M-mode). A-mode ultrasonic imaging is a one-dimensional display of echo-amplitudes versus distance, B-mode ultrasonic imaging produces an accurate two dimensional cross sectional image of soft tissues. M-mode ultrasonic imaging is an adoptation of B-mode to evaluate moving structures of the heart. M-mode is used primarily in echo cardiolographic studies to measure cardiac wall motion and value excursions. An actual image of the heart is not produced.

Fluid filled cystic structures have characteristic clear (anechoic) central areas with acoustic enhancement of the back wall of cyst and deeper structures. Solid masses have echoes in their central portion with resultant poor accentuation of deeper structures.

Application of ultrasound to animals requires hair removal since trapped air is a barrier for transmission of the sound beam. Gas filled bowel and bone are effective barriers to ultrasonic imaging because of their large acoustic impedance differences compared to soft tissues. The position of the focal point of a focused transducer relative to tissue interfaces is important to accurately depict tissue character. For example, the focal point of the transducer should be superficial to the back wall when scanning cystic structures. When solid lesions, such as liver metastasis, are scanned a focal point that lies deep to the lesion should be selected in order to accentuate sound beam attenuation.

Time Gain Compensation (TGC) settings are important to produce a balanced scan with equal echo production within like tissues throughout the depth of ultrasound tissue penetration. Initial TGC settings can be made from knowledge of the focal point of the particular transducer, but may have to be adjusted during scanning to produce a balanced image.

Organs of interest should be scanned in two planes at 90° angles to each other to thoroughly evaluate the internal organ interfaces as well as organ size, shape and position. Anatomic points of reference should be utilized to locate areas of interest when the scans are reviewed after the examination. Certain organs may act as a acoustic windows. Acoustic windows attenuate little of the sound beam, thus allowing more of the sound to pass beyond it to more effectively scan pelvic organs. The poorly echogenic spleen of the horse has proven to be an aid in visualizing the left kidney in studies at Washington State University.

Many renal masses have a complex sonographic appearance i.e., they contain a variable mixture of anechoic, hypoechoic and hyperechoic components. The an-echoic and hypoechoic regions represent areas of hemorrhage or neurosis that sonographers sometimes refer to as 'cystic' areas despite the fact that their appearance does not resemble true cysts. In addition to neoplastic, other causes of hyperechoic lesions in the renal cortex, include calcification, fibrosis, gas or renal infarcts. Survey radiographs and excretory urography are required for a definitive diagnosis. Renal calculi produce intense hyperechoic foci with strong acoustic shadowing on kidney images. Imaging artifacts produced by ultra sound matter interactions inlcude reverberations, shadowing, through transmission and refractive and reflective zones.

Ultrasound is an attractive imaging modality in animals, since it is non invasive and presents to known hazard to the operator or patient.

Electrical Safety Of Medical Equipment

In future, the use of electrical and electronic equipments may increase in vet-

erinary practice. Accidentally electrocution may occur. So, sufficient attention should be paid to avoid such incident in future.

Electrical accidents are caused by the interaction of electric current with the tissues of the body. For an accident to occur current of sufficient magnitude must flow through the body of the victim in such a way that it impairs the functioning vital organs. The figure shows approximate current ranges and the resulting effects for one-second exposure to various levels of 60 Hz alternating current applied externally into the body by electrical contact with the extremities in such a way that the current path includes the chest region.

Methods of accident prevention

In order to reduce the likelihood of accidents a number of protective methods have evolved. Some are used universally some are required in areas that are generally considered especially hazardous and still others have been developed essentially for use in hospitals. They are as follows.

1. Grounding
2. Double insulation
3. Protection by low voltage
4. Ground fault circuit interrupter
5. Isolation of the patient connected parts
6. Isolated power distribution system

Many more sophisticated instruments are available and are used in human medicine but their cost, limit their use in veterinary hospitals. It is an unpleasant truth to admit that, even basic diagnostic equipments like stethoscope, phonendoscope, ophthalmoscope etc are not utilized properly by veterinarians of our country. These clinical diagnostic equipments are not a substitute for the conventional diagnostic procedures. Their interpretation must be always in conjunction with the clinical examination of the patient. The idea of this paper is to increase the awareness among the veterinary clinicians to employ the clinical diagnostic equipments to increase the efficiency of their diagnosis and to impart better health coverage to the livestock and companion animals.

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