

Cardiovascular System

The functional cardiac and cardiovascular diseases are comparatively less common or may be less frequently identified in bovines by the general practitioner. Equines particularly race horses and bullocks used for heavy draft work, do suffer from condition like cardiac dilatation and other decompensatory changes. In canines various types of cardiac and cardiovascular disorders including the congenital abnormalities have been diagnosed with the help of electrocardiography and angiography. Lack of psychological stressors, abundant exercise etc., are some of the reasons why functional and organic cardiovascular diseases are comparatively less common in domestic animals as compared to human beings. Traumatic pericarditis and myocarditis are economically important conditions in bovines. Probably more investigational approach in near future may be useful in this area.

Symptoms of Cardiac Involvement

- (i) Poor exercise tolerance and dyspnoea at rest. Arching of back with abduction of elbows (as a sign of chest pain).
- (ii) Arrhythmia (Bradycardia and Tachycardia).
- (iii) Cardiac murmurs on auscultation.
- (iv) Muffled heart beats and splashing sounds indicating pericarditis with effusion or hydropericardium.
- (v) Oedema of brisket and extremities, prominent jugular pulsation.

Traumatic Pericarditis

Traumatic pericarditis and myocarditis are the common conditions observed in bovines when the foreign body crosses the reticulum-peritoneum-diaphragm and reaches the heart.

There is usually suppuration and effusion. The pericardial sac contains exudate in significant quantity.

Diagnosis

A definite history of chronic, repeated attacks of indigestion and recurrent attacks of tympanites or impaction with atony of rumen.

Symptoms of chest pain *Expression of pain clearly evident on face.* Arched back, extended neck, abducted elbows and unwillingness to walk, oedema of brisket and prominent jugular vein. A pericardial friction sound is detectable on auscultation of the cardiac area in the first stage. The second stage of effusion is manifested by muffling of heart sounds if gas is present in the pericardial sac each cardiac cycle may be accompanied by splashing sound. Tinkling and splashing sounds are audible when heart beats are increased due to exertion. Animal sits or stands cautiously, voids urine in small quantities with signs of pain while arching of back.

Treatment

Medicinal treatment is of no avail. Pericardial lavage and attempts to remove foreign body may be attempted by experienced surgeon but chances of saving animal are very meagre. Long acting antibiotics in high doses may be employed.

Early diagnosis and rumenotomy could save progress of foreign body.

Special Investigations

Thoracic radiography is essential in the proper assessment of the cardiovascular system and so are considered as part of routine examination. Standard dorso-ventral and right lateral views of thorax give much information.

Electrocardiography and angiocardiology are the investigations to diagnose organic and functional cardiovascular problems in canines. Use of ultrasound evaluation has become useful technique to obtain images of cardiac structures like valves and atrio ventricular flow of blood.

Angiocardiology consists of injecting a contrast material into the chambers of heart, the great veins (aorta and pulmonary

artery) or the coronary arteries while serial films are exposed.

Cardiac Arrest (*Acute Heart Failure*)

Causes

- (i) Sudden and unexpected cardiac arrest during operation involving manipulation of mesentery.
- (ii) Obstruction of respiratory tract resulting in asphyxia and reflex vagal inhibition.
- (iii) Rapid and excess administration of anaesthetic or rapid iv administration of hypertonic solution.
- (iv) Existing heart disease and shock.

Symptoms of Cardiac Arrest

- (i) Dark blood indicating cyanosis.
- (ii) Increased rate and shallow respiration.
- (iii) Irregular pulse.
- (iv) Absence of bleeding, dilatation of pupil and coldness of skin.

What to do?

Irreversible brain damage occurs within three minutes of cardiac arrest. Hence act immediately.

- (1) Note presence or absence of heart sounds.
- (2) Stop administration of the anaesthetic or iv solutions and administer Sorbitrate tablets.
- (3) In case of small animals raise the hind quarters and lower the head.
- (4) Provide pulmonary ventilation by oxygen.
- (5) Artificial respiration and external cardiac massage possible in small animals.
- (6) Inject Epinephrine or Adrenaline 1 : 1000 soln. 1 ml intracardially.
- (7) Open chest massage possible in dogs and cats.

Peripheral Circulatory Failure

Causes

- (i) Failures of venous return or peripheral vasodilation as in shock.
- (ii) Hypocalcemia (*Milk fever*)
- (iii) Reduction of circulatory blood volume (CBV) as in excessive haemorrhage and dehydration.

Symptoms

Profound depression, fall in temperature to sub. normal, increased intensity but heart rate feeble. Imperceptible pulse. Skin cold and bloching of mucus membranes. Respiration increased in rate but shallow, coma, clonic convulsions.

Treatment

Clearly identify whether due to vasodilatation or reduced CBV.

Inj. Adrenaline (1 : 1000 soln) 2 - 4 ml, iv for combating vasodilation.

In case of haemorrhage and dehydration restore CBV by blood transfusion. Dextrans like Dextravan 40, 70, 110, 150 as plasma extenders of different molecular weight are available for varying degrees of dehydration. Do not use adrenalin if CBV is reduced as it will cause vasoconstriction and blood flow will be further restricted.

Dexamethasone and prednisolone. in high doses

Cardiac stimulants are of no value in peripheral circulatory failure because of the absence of cardiac efficiency.

Heart Tonics

For improving functional capacity of heart muscle. Weakness of myocardium occurs in chronic anaemia, vitamin E and Cu deficiency, certain poisonings, effect of FMD virus and in B.Q. cannot sustain excessive exercise. Slight exercise causes excessive increase in heart rate. Dilatation of heart occurs as a compensatory effect (increase in area of cardiac dullness). Arrhythmia, auricular fibrillation and systolic murmur.

Heart Tonics (In Congestive Heart Failure)

Horse & Cattle

Rx	
Tr. Digitalis	8 ml
Tr. Nux Vom	16 ml
Tr. Zingiberis	30 ml
Aqua	ad 125 ml
Mft. Haust	Sig. once daily for 8 days

Digitalis is still the most accepted drug for correcting functional heart diseases.

Inj. Lanoxin (Burroughs Wellcome) contain Digoxin 0.5 mg/2ml

Horse : Initial iv loading dose of 1-1.5 mg/100kg

Followed by a maintenance dose of 0.5-0.7 mg/100 kg every 24 hours.

Cattle : Initial iv loading dose of 2.2 mg/100 kg

Followed by 0.34 mg/100 kg every 4 hrs.

Dog : Emergency digitalisation - 0.05 mg/kg bwt P.O.

Rapid digitalisation - Loading dose of 0.05-0.20 mg/kg b. wt. to be given orally in divided doses over 48 hrs. Slow digitalisation - 0.02 mg/kg b.wt. daily in divided doses for a period of one week.

Horse & Cattle

Rx	
Tr. Scilla	15 ml
Tr. Digilalis	10 ml
Mft. Haust	Sig. once daily for 8 days.

Dog :

Rx	
Tr. Scilla	0.5 ml
Spt. Amm. Arom	1.5 ml.

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Syrup	10.0 ml.
Aqua	ad 20.0 ml.
Mft . Haust	Sig . B.D. for a week

Haematinics (*In iron deficiency anaemias*)

Indicated in anaemias. Confirm by haemoglobin estimation and watch the improvement by periodical estimation.

Horse & Cattle

Rx

Ferri Sulph Exsci	5 g
Copper Sulph.	0.2 g
Cobalt Sulph.	0.2 g
Treacle	Q.S.
Mft . Elect	Sig. one daily for 10 days.

Tab. Cofecu

Inj. Ferritas

Inj. Imferon with B12 -H and C 10 ml im every 10th day.
Dog : 3 ml im every 10th day. Sometimes anaphylactic reactions are reported with iron dextran which may prove fatal.

LIVOFORINA (*Inventa*) Liquid - 30 ml daily can be given to horses orally as haematinic and liver tonic.

For Dogs :

Rx.

Ferr. et. Amm. Citr	5 g
Syrup	20 ml
Aqua	ad 125 ml
Mft . Mist	Sig . One teaspoonful BD.P.C.

FERRADOL, or TONOFERRON or MINOLAD (*TCF*) or LIVOFORINA (*Inventa*), or SHARKOFERROL (*Alembic*) DEXORANGE etc. 1 teaspoonful B.D. with food.

Fesovit Capsules Rediplex tabs 1 B.D.P.C.

Advice Liver soup in the diet.

(Several other haematinic preparations are available in market)

Blood Transfusion

Very useful and can save animal in emergencies of haemorrhage and shock as well as in extensive haemolytic anemias (*Theileriosis, Anaplasmosis*) when hemoglobin level goes down below 4 g%. Blood transfusion is also useful in conferring passive immunity.

Cross-Matching: Cross matching not essential for first transfusion in cattle. In dogs blood should be tested for A-group if time permits. (*A - negative recipient whereas A positive recipient can receive blood from donor*).

Donor's RBC should be tested in recipient's serum in test tube. No haemolysis should occur in 30 minutes. Recipient's RBC and also be likewise tested in donor's serum, but the first test is more important. Cross matching must be done if the recipient is being given more than one transfusion.

Procedure

Collect blood in a sterile autoclaved saline bottle containing 3.85% soln. of sodium citrate @ 10 ml for each 100 ml blood to be collected. ACD bottles or blood bags used for human blood collection could be used. Blood is to be collected from jugular vein using a wide bore needle or a cannula.

Rate of bleeding for transfusions : @7 ml/kg b. wt. Av 2-4 liters in cattle, for Dogs. : 5 ml. /kg Av. : 100 ml.

Keep the bottle rotating while blood is received on the inner wall of bottle to prevent frothing. Blood can be stored in refrigerator at 4°C for a week. It can be stored for nearly 21 days for use in emergencies. There is no bad effect except some haemolysis.

Transfusion should be done after bringing blood to body temperature, by iv route.

In some cases the recipient shows restlessness and shivering. Reaction can be controlled by antihistamines. Exceptionally, reaction occurs 10-14 days after transfusion but the reaction is mild and controllable.

Animal Blood Bank is established in Maharashtra Animal and Fisheries Science University (MAFSU), at Mumbai and Madras Veterinary University (TANUAS) the protocol for blood and blood component therapy has been standardised.

Nervous System

Symptoms of Nervous System Disorders

- (i) Change in temperament
- (ii) Excitation (*Violent movements, fury*) or
- (b) Depression (*Drowsy appearance, head pressing, unconsciousness*)
- (ii) Involuntary movements (*convulsions, tremors*)
- (iii) Abnormal postures and gait (*Circling, inco-ordination*)
- (iv) Paralysis (*sensory or motor*)
- (v) Loss of control on anal sphincters , bladder, atony of bowels due to vagal injury

Types of CNS Syndromes

- (a) *Increased Intracranial pressure*: Animal is dull, drowsy, head lowered and head pressing, moving in circles etc. While removing CSF from post occipital site the CSF comes out in the form of a jet.
- (b) *Cerebral Syndrome* : Impaired vision, stiff gait, nodding of head, reduced reflexes.
- (c) *Cerebellar Syndrome*: Animal balances itself with legs wide apart, incoordinatin of gait, reluctance to walk, paralysis of varying degree, tremor.
- (d) *Base of Brain Syndrome* : Pressure paralysis may occur most probably due to trauma (*sudden occurrence*), gradual development (*growing tumor, abscess or protrusion of intervertebral disc*). There may be partial or complete loss of sensation and motor function of the area which receives nerve supply from specific branches.

Clinical Examination

The veterinary physician has to depend on the objective symptoms only. Observation by the owner as well as by the physician can bring out symptoms about the change in behaviour, restlessness, mode of walking, dashing against objects due to blindness etc. In country like India, possibility of rabies must always be thought of while dealing with a case of any type of CNS involvement because the reliable history of dog bite (for bites in case of cattle going in forest areas for grazing) is not always reliable and rabies is widely prevalent.

Protective gloves must be used while examination of buccal cavity of all animals-specifically in dog patients. Specific diseases such as "Surra", Listeriosis, botulism, poisonings "metabolic disorders" (*nervous form of ketosis, myoglobinuria, acute hypocalcemia, hypomagnesimia with tremors should be ruled out*).

Testing Sensory and Motor Functions

Sensory Functions: Assess Corneal reflex, panniculus reflex (prick method), pain, temperature.

Motor Functions : Assess bulk of muscles, tone of muscles, strength of muscles, reflexes, coordination of movement, gait and involuntary movements.

Special Investigations

The following special methods of investigations are in common use:

Examination of Cerebrospinal Fluid (CSF)

This forms a special examination and is valuable in certain conditions.

Sites For CSF Collection

- (1) *Post Occipital :* Animal has to be sedated and restrained appropriately. *This site is convenient in case of dogs.* Head is bent forward & downward as much as possible, with proper restraint. Site is prepared by shaving and disinfected. A sharp beveled pointed 10 -15 cm long needle with 1.5 mm bore diameter is used for cattle. The needle

is inserted in the midline, behind the poll below the occipital in the foramina magnum. Injury to nerve tissue and infection should be avoided. If the site is correctly approached clear CSF appears through the needle with moderate force (like a jet in case if intracranial pressure is increased). The CSF should be aspirated with dry sterile syringe and collected in a vial. For dogs use 3" long 20 gauze needle. Needle size in dogs shall depend on the age and size of animal. In all cases use brand new needle and a carefully sterilised one (preferably disposable and sterile).

- (2) *Lumber Site* : This site is more convenient in cattle and CSF can be collected while animal is restrained in standing position. If the animal cannot be stable, it may be casted down and controlled. The site is in the midline between two tuber coxae, in the hollow between the spinous process of last lumbar vertebra and the sacrum. Needle is inserted first vertically and then slightly oblique with gradual forward and backward adjustment, the CSF appears as a clear drop of fluid which should be aspirated by syringe.

CSF is examined for protein contents (*Pandy's test*), cell count, glucose, smear exam for bacteria, tryps and if necessary other investigations may be carried out depending upon the case.

The Electroencephalogram (EEG)

Electrodes applied to the patient's scalp pick up small changes of electrical potential, which after amplification are recorded on the paper. The EEG is of particular value in the investigation of epilepsy and in localization of cerebral tumors and other expanding intracranial lesions.

Myelography

This is a method of demonstrating the subarechnoid space in the spinal canal. A lumbar or cisternal puncture is performed and a spinal radiopaque medium is injected in the subarechnoid space . This is a very useful method for accurate localization of tumors in the spinal canal.

Computerised Axial Tomography (C T scanning)

The CT scanning provides tomographic sections of the brain of very high resolution, without the need of contrast procedures. A crystallographic X- ray detection device is used instead of conventional X-ray film and a photographic picture is produced by computerized imaging techniques . The method gradually reduces the need for encephalography and angiography

Principles of Treatment

- (1) Specific treatment in specific diseases. (i.e., Trypanosomiasis, Listeriosis, Nervous form of Ketosis and other metabolic disorders).
- (2) Antibiotics for control of infections. However, blood brain barrier makes the situation difficult.
- (3) Intracranial pressure of fluid can be relieved by iv Inj. of hypertonic solutions or diuretics.
- (4) C.N.S. depressants.
- (5) C.N.S. stimulants.

CNS Depressants (Cattle and Horses)

Indicated in nervous excitement, epilepsy, hysteria, tetanic convulsions and seizures for example in strychnine poisoning etc.

Rx.

(i) Chloral Hydras	30 g
Aqua	125 ml
Oil Lini	500 ml
Mft : Haust	Sig : Stat

Rx

(ii) Amm. Bromide	
Sod. or Pot. Bromide	4 g
Treacle	Q.S.
Mft : Haust	Sig : as required

- (iii) Chloral hydras 30 gm in 200 ml distilled water can be given by slow iv route.,

(iv) Inj. Largactil (*Rhone P.*) 1 mg/kg b. wt.

6 -10 ml. of 5% sol. im for cattle

(*Produces irratic results in equines hence not used*)

(v) Inj. Siquil (*Sarabhai*) 5 mg/100 lb b. wt. ml im or iv

(vi) Inj. Anazepam (*J.P.*) 4 - ml/100 kg b. wt. im

For Dogs :

Inj. Largactil (*Rhone P.*) 25% soln.

1- 2 ml im or iv or tablets 25 mg B.D.

Inj. Diazepam (*Anazepam or Calmpose*) 0.025 mg/kg b. wt.

Inj. Siquil (*Sarabhai*) 20 - 40 mg sc or iv

Siledin (*Alarsin*) tablets 2 T.D.S.

Gardenal (*Rhone P.*) 1-2 mg/ kg b. wt. p.o.

(*Dose to be adjusted in individual cases*)

"Duodil" or "Muraxyl" tablets as antipyretic and tranquilizer.

Tranquilizers used in human medicine can be suitably employed for dog. Ex. : Dilentin caps, Sedonol, Equanill, Valium or *Calmpose* tablets, *Intravel sodium* (*Rhone P.*) can be administrated by slow iv injection for profound sedation @ 25-30 mg per kg body weight (0.5 gm. in 20 ml distilled water for an average adult dog weighing 20 kg).

Epilepsy in dogs (*Convulsions & Seizures*)

Is fairly common and the tiology is not precisely known. Frequency and duration of epileptic fits varies. The diseases of CNS should be ruled out and treated. Treatment is required to be given over a long duration. Anticnvulsants (barbiturates and allied compounds) are widely used. Doses are to be regulated in individual cases.

Ex. Dialentin Caps (P.D.) 100 mg

Epileptin (IDPL) 100 mg Caps

Epilex (*Reckits*) 200 mg Caps

Epsolin (*Cadile*) 100 mg tabs

Mysoline (*ICI*) 250 mg tab.

Phenytoin (*Samarth*) 50 mg tab.

Any of these compounds may be used after computing doses as per individual case.

Ignatia 30 is the homeopathic drug which is worth evaluating in the condition.

Nervine Stimulants & Tonics

Indicated in various types of paraplegias, weakness, depression, atony of bowels due to autonomic dysfunction, after anaesthesia and in certain CNS depressant toxicities.

Rx

Caffein Citrate H and C : 2-4 mg, sc

Dog : 50 - 250 mg

Amphetamine H and C : 100 - 300 mg

Dog : 1-4 mg/kg b. wt.

Leptazol (*very useful to counteract effects of barbiturates*)

H and C : 0.5 -1 g Dog : 50 - 100 mg

Nikethadine (*Coramine - Ciba*) better for counteracting chloral hydrate and morphine.

H and C : 10 - 25 ml Dog : 1 - 3 ml

Strychnine Hydrochloride (*Spinalcord stimulant*)

H and C : 15 - 60 mg Dog : 0.3 - 10.0 mg

(Dog is highly susceptible)

Liq. strychnine Hydrochlor

4 - 8 ml for horse and cattle to be given orally or i.m.

Rx

Tr. Nux Vom 15 ml

Liq. Arsenicalis (*Fowler's soln.*) 30 ml

Aqua Q.S.

Mft . Haust Sig. once daily for 7 days.

Inj. Tonophosphan (*Hoechst*) or Inj. Hivit (*Ranbaxy*) or

Inj. Cobaphos (*Agrivet-Glaxo*) H and C. 10-20 ml sc or iv

Nervous System

Dog. : 1 -3 ml being a phosphorus compound, is useful in stimulating motor activity.

Calcium preparations e.g., Calboral (Rhone P.) or Calmex (Ranbaxy) are commonly employed as nervine stimulants.

Inj. Thiactal (*Wockhardt*) a calcium preparation with thimine is also useful in large animals.

Calcium (*Sandoz*) 5 - 10 ml for dogs.

Vit B₁ B₆ B₁₂ (*Glaxo*) Vibejec (*Ranbaxy*) or Triradisol-H, Neuroxin-12 (*Cadila*), Tribivet (*Intas*) or Neurobion Injections commonly employed in dogs. Aristoneuron capsules 1 B.D. for 10 days are also recommended for dogs.