

Anaesthetic Emergencies

REASONS FOR ANAESTHETIC EMERGENCIES

- Human error
 - Not familiar with the equipment and anaesthetic drug and its action, miscalculation of dose, incorrect route of administration and wrong medications.
- Equipment problems
 - Failure to deliver oxygen, empty cylinders, misconnected gas lines and kinked or plugged endotracheal tubes.
- Ventilatory problems
 - Hypoventilation due to anaesthetic over dose, hyperventilation due to inadequate anaesthesia and ventilatory depression.
- Circulatory problems
 - Hypotension, bradycardia, tachycardia and shock.

BRADYCARDIA

- Bradycardia may arise due to
 - Excessive depth of anaesthesia
 - Excessive vagal tone (often increased by intubation vasovagal reflex and traction of abdominal organs)
 - Terminal hypoxia
 - Endogenous and exogenous toxaeemias
 - Conduction disturbances in myocardium
 - Hyperkalaemia
 - Hypothyroidism

Treatment

- Administration of atropine or glycopyrrolate.
- Dopamine 2.5 to 20ug/kg/min (40 to 200 mg in 250 to 500 ml of 5% dextrose or saline) I.V.
- Dobutamine 2.5 to 20 ug/kg/min (20 to 200 mg in 250 to 500 ml of 5% dextrose or saline) I.V.
- Mephenteramine 0.1 to 0.75 mg/kg I.V. duration 15 to 30 minutes
- Ephedrine 0.05 to 0.5 mg/kg I.V. duration 15 to 30 minutes.
- Isoproterenol 5 to 10 ug/kg/min (0.4 to 1.0 mg in 250 to 500 ml of 5% dextrose or saline)I.V.

Reasons for intraoperative bradycardia

- Due to increase in vagal tone
 - Difficulty in intubation
 - Deep abdominal surgery
 - Intraocular surgery
 - Neck and thoracic surgery
 - Effect of anaesthetics
 - Premedication with atropine or glycopyrrolate will control this condition.
- Non vagal bradycardia
 - Excessive depth of anaesthesia
 - Hypoxia
 - Hypothermia
 - Hyperkalemia

TACHYCARDIA

- Tachycardia may arise due to
 - Light level of anaesthesia
 - Hypovolaemia
 - Hypoxia
 - Hypercarbia
 - Hyperthyroidism
- Normally pulse rate may either be equal or slightly deficit of heart rate because all the contraction may not produce palpable effective wave and waves may overlap.
- The abnormal conditions which cause deficit of pulse rates are
 - Premature contraction,
 - Variable diastolic ventricular filling
 - Electromechanical dissociation of heart.
- Heart rate above 180 per minute in dogs and above 200 per minute in cats are considered as tachycardia.

SHOCK

- Shock is defined as inadequate blood flow to the vital organs or the inability of the body cells to metabolize nutrients normally.
- The tissue perfusion depends on the cardiac function, circulatory volume and integrity of vascular function.
- Shock can be classified as
 - Hypovolemic shock
 - Cardiogenic shock
 - Vasculogenic shock
 - Hyperdynamic shock
 - Hypodynamic shock

HYPERDYNAMIC SHOCK

Causes

- An early stage of septic shock is an example of hyperdynamic shock.

Signs

Stage I

- Increase in cardiac output
- Decrease in arteriovenous oxygen difference
- Decrease in systemic vascular resistance
- Blood pressure may be normal or reduced
- Oxygen utilization at cellular level is reduced

Stage 2

- Cardiac output may be normal
- Hypotension
- Respiratory acidosis with metabolic alkalosis
- Elevated heart rate

Stage 3

- Reduction in cardiac out put
- Elevated heart rate
- Increased difference in arteriovenous oxygen level
- Increase in systemic vascular resistance
- Hypotension
- Brick red mucous membrane due to peripheral vasodilation
- Pyrexia due to toxins and damaged leukocytes

HYPODYNAMIC SHOCK

- It occurs at the terminal stage of sepsis or during the absorption of toxins. This can be otherwise called as fourth stage of septic shock.
- Hypodynamic shock is common in large animal practice. E.g. terminal stage of horses with colic and cow with coliform mastitis.

Signs

- Myocardial depression
- Maldistribution of blood volume
- High peripheral resistance
- Endothelial damage
- Infarcts in vital organs
- Acute respiratory failure and hypoxaemia

SIGNS OF CPR

- No auscultable heart sound
- No palpable pulse
- Cyanotic mucous membrane
- Dilated pupil
- No ventilatory attempts or agonal gasps
- Unconsciousness
- It is really a true emergency condition, which is to be treated immediately within a period of 2 to 3 minutes.
- The basic life support in cardio pulmonary resuscitation (CPR) is the optimal management of airway(A), Breathing(B) and circulation (C). Otherwise called as ABC of CPR.

AIRWAY

- The head must be immediately extended
- If not intubated intubate the animal immediately.
- Examine for the possible obstruction of the airway with food materials or kinked endotracheal tube
- In emergency perform tracheostomy to maintain airway patent
- In case of bronchospasm treat the animal with aminophylline 5 mg/kg I.V.

TREATMENT OF CPR

Airway

- The head must be immediately extended
- If not intubated intubate the animal immediately.
- Examine for the possible obstruction of the airway with food materials or kinked endotracheal tube
- In emergency perform tracheostomy to maintain airway patent
- In case of bronchospasm treat the animal with aminophylline 5 mg/kg I.V.

Breathing

- Institute artificial respiration using rebreathing bag or mechanical ventilators at the rate of 12 to 20 breaths per minute.
- Supply 100% oxygen
- Or use Ambubag type resuscitation bag (using room air 21% oxygen) or mouth to endotracheal or mouth to muzzle procedures to maintain breathing
- Analeptic agents like doxapram can be administered at the rate of 1 mg/kg I.V.
- The other agents are specific alpha 2 antagonist (yohimbine) and opioid pure antagonists (naloxone).

Circulation

- External cardiac massage by chest compression at the rate of 90 to 120 per minute. In dogs the chest compression can be attempted by placing the hands on either side of the chest. In cats the forefinger and the thumb are used.
- Open cardiac massage is done at the rate of 60 to 100 per minute. If surgery is performed in the thorax it is easy to provide open chest massage. During abdominal procedures if emergency occurs the thoracic cavity can be entered through the diaphragm.
- Defibrillation - The defibrillation is done using external or internal paddles of cardiac defibrillators. The power setting depends on the weight of the animals. In small animals the heart is defibrillated at the rate of 1 to 10 J/kg using external paddles and 0.1 to 1 J/kg using internal paddles.

DRUGS USED IN CPR

Calcium solutions

- Administered as inotropic agent or in *hypocalcaemic agent*. (halothane decreases calcium availability in heart muscles).
- It strengthens the myocardial contraction. Dose Calcium chloride 10% solution at the rate of 0.1 mg/kg I.V, Calcium gluconate 10% solution at the rate of 0.5 mg/kg I.V.

Dobutamine

- It is a *sympathomimetic amine*, which stimulates beta 1 and beta 2 adrenergic receptors and to a lesser extent alpha 1 receptor.
- It decreases peripheral vascular resistance and increases cardiac output, blood pressure and tissue perfusion.
- Rapid intravenous administration may cause cardiac dysrhythmias.
- Dose 0.25 to 20 µg/kg/min in small animals and 0.5 to 2.0 µg/kg/min in large animals (40 to 200 mg in 250 to 500 ml of 5% dextrose or saline).

Ephedrine

- It stimulates *beta 1, beta 2 and alpha 1 receptors*.
- The cardiac output and blood pressure are increased.
- It is indicated in mild to moderate hypotension.
- Dose 0.05 to 0.5 mg/kg I.V in small animals and 0.022 to 0.66 mg/kg I.V in large animals as a bolus.

Isoproterenol

- It is a *sympathomimetic amine*, which stimulates beta 1, beta 2 and adrenergic receptors located in the heart, bronchial smooth muscles, skeletal muscle vasculature and alimentary tract.
- It decreases peripheral vascular resistance, diastolic blood pressure and mean arterial pressure and increases cardiac output and systolic blood pressure.

Epinephrine

- It is a *sympathomimetic amine* that stimulates alpha 1, 2 and beta 2 adrenergic receptors.
- It dilates the vasculature of muscles and constricts cutaneous, mucosal and renal vasculature.
- The systolic, MAP and pulmonary blood pressures are increased following administration.
- It can cause dysrhythmia if administered during halothane anaesthesia.
- It is administered at a dose of 5 ml of a 1 in 1000 solution for a 454 kg horse.
- In extreme condition it is administered through intracardiac route.

Doxapram (Dopram)

- It is a *nonspecific analeptic agent* used to act on the peripheral chemoreceptors. Dose. 0.55 mg/kg I.V. to reverse the effect of xylazine it is administered at the rate of 1.0 mg/kg I.V.

Sodium bicarbonate

- It is a buffer aids in reversing metabolic acidosis. Dose mEq of HCO₃ = 0.3 x base deficit (mEq/L) x Body weight.

Corticosteroids

- These group of agents increases the glucose production, induce hypokalemia by sodium retention.
- They have inotropic effect on the heart and maintain vasomotor response and suppress the adrenal gland.
- Indicated in shock and malignant hyperthermia.

Lignocaine

- Indicated in premature ventricular contraction.
- Only the epinephrine free preparation is used.
- Dose 0.5 to 2 mg/kg in large animals and 1 to 5 mg/kg in small animals followed by 40 to 60 $\mu\text{g}/\text{kg}/\text{min}$ I.V. It is contraindicated in slow ventricular rate combined with sinus arrest, sinoatrial block or atrioventricular block.