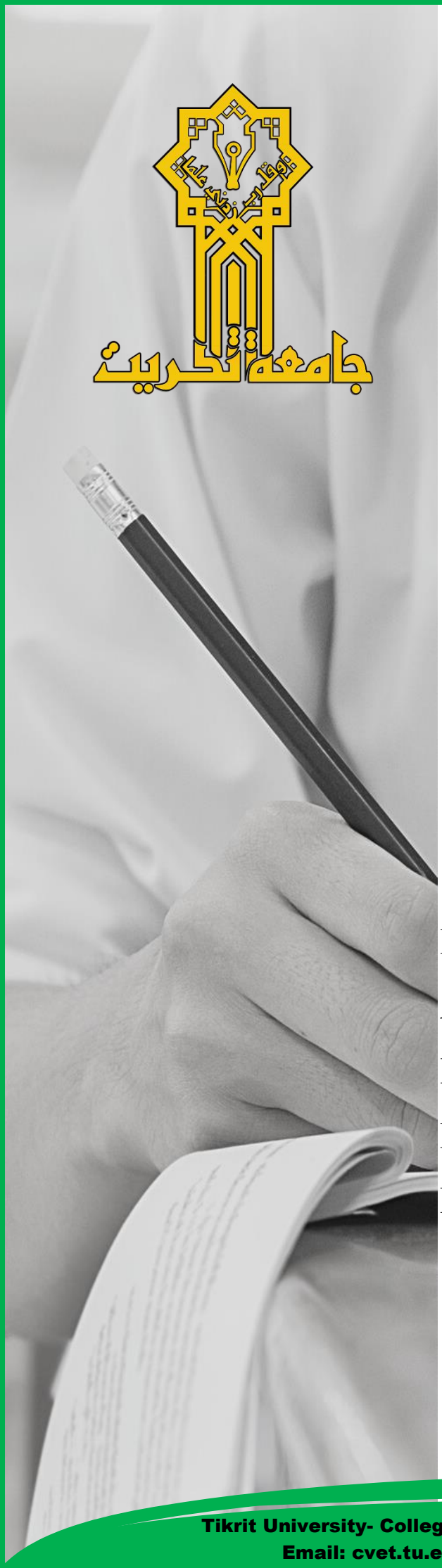

Tikrit University
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Subject name: **General anesthesia**
Subject year: **surgery \ 4th stage**

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GENERAL ANAESTHESIA

General anesthesia:- a state of total unconsciousness resulting from anesthetic drugs (as for a major surgical operation).

Anesthetic period:-

The anesthetic period can be divided into five phases:-

Phase 1 :Preoperative period:

The animal is examined and an anesthetic protocol devised by the veterinary surgeon to minimize the risk to the individual animal. The animal's health, the type of procedure, the ability and experience of both the anesthetist and the surgeon are all factors that should be considered. The area for induction and maintenance of anesthesia must be clean and prepared.

phase 2: Pre-anesthetic period:

Pre-anaesthetic medication is given as part of a balanced anesthetic protocol. Sedatives and analgesics are used to reduce anxiety, relieve discomfort, enable a smooth induction and reduce the requirement for high doses of anesthetic induction and maintenance agents. The animal should be allowed to remain undisturbed following administration of the pre-anesthetic agents, although close observation during this period is recommended.

Phase 3:Induction period:

Anesthesia should be induced in a calm and quiet environment. Placement of an intravenous catheter allows for ease of administration of intravenous agents and prevents the risk of extravascular injection of irritant drugs. To ensure a smooth transition from induction to maintenance, appropriate endotracheal tubes, anesthetic breathing system and ancillary equipment must be prepared for use. Suitable intravenous fluids should be administered during anesthesia.

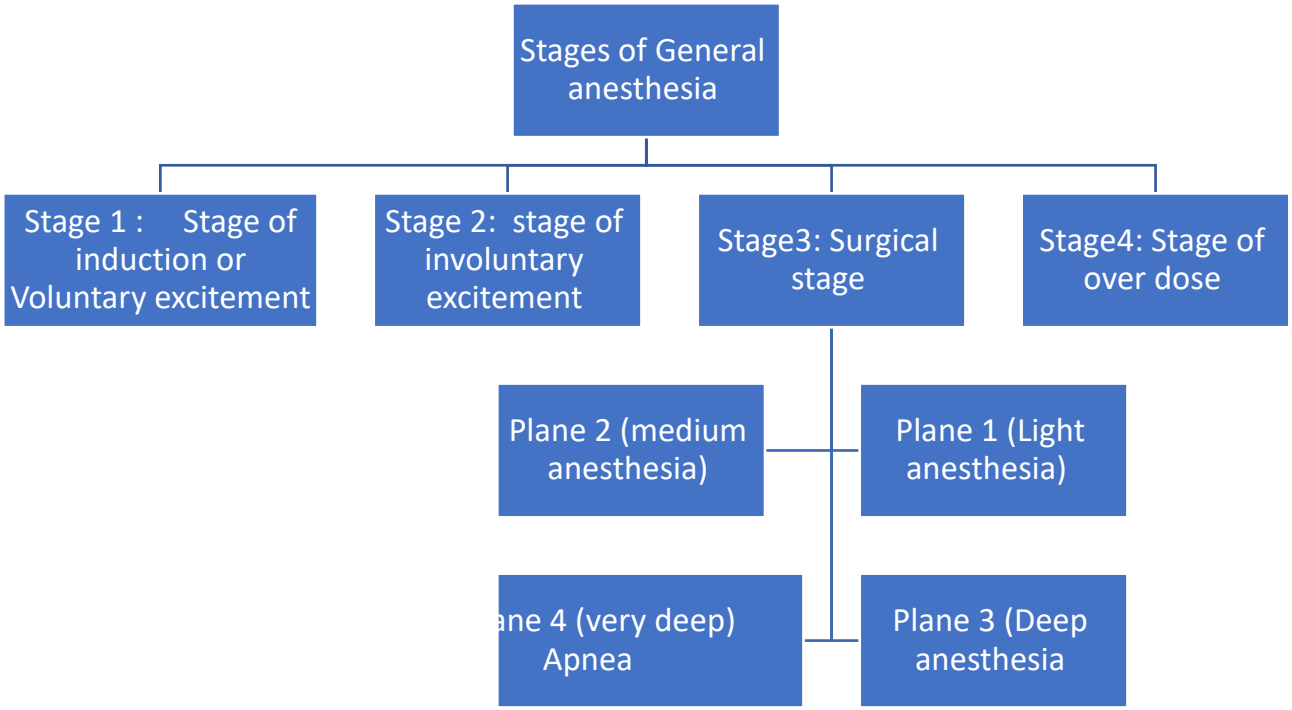
Phase 4:Maintenance period:

Unconsciousness is maintained with inhalational or injectable agents. This allows the planned procedure to be performed. A properly trained person should be dedicated to monitor anesthesia.

Unqualified staff should not be expected to monitor anesthesia. An anesthetic record should be kept for every patient. Monitoring needs to be systematic and regular, with intervals of no more than 5 minutes recommended. This enables trends and potential problems to be identify.

Phase 5:Recovery period:

Administration of anesthetic drugs ceases and the animal is allowed to regain consciousness. Monitoring should continue until the patient is fully recovered.



Stages and Signs of General Anaesthesia

Divided into 4 stages:-

Stage 1: stage of induction or voluntary excitement:-

1-It is defined as a stage from initial administration of drug to loss of consciousness.

2-In this stage the animal still conscious.

3-Animal excited and voluntary straggling which lead to epinephrine releases and cause increased in heart rate pulse rate and respiratory rate.

4-Pupil dilated

5-Some time urination and defecation.

6-All reflexes are present.

Stage 2: stage of involuntary excitement:-

1-Depression of motor reflex

2-Depression of cortical center which lead to loss of consciousness

3-Involuntary straggling

4-Still epinephrine release cause increased in heart, pulse and respiratory rate.

5-Pupil widely dilated.

6-All reflex are present

Stage 3: stage of surgical anesthesia:-

characterized by unconsciousness with progressive depression of respiration, circulation, reflexes and muscle tone.

This stage divided into 4 planes:-

Plane 1 (Light anesthesia):-

1-Heart, pulse and respiratory rate become normal

2-Stopping of limb movement

3-Muscle relaxation is poor

4-Pupils are constricted

5-Eye ball move from side to side (Nystagmus)

6-Eye reflex disappear.

Plane 2 (medium anesthesia) (spinal cord depression)

1-Eye ball fixed (disappear of nystagmus)

2-Muscle relaxation is good.

3-Corneal reflex still present

4-Pupils constricted

5-Lacrmiation and salivation still present.

Plane 3 (Deep anesthesia):-

1-The entire reflex disappears

2-Increase respiratory rate

3-Good muscle relaxation and good analgesia

4-Eye is centrally located.

Plane 4 very deep surgical anesthesia (apnea)
1-Excessive deep anesthesia.
2-Cardiovascular collapsed no reflex activity
3-eye centrally
4-muscle flaccid
5-prolonged CRT **(Capillary refilling time).**

<u>Stage 4 stage of over dose or medullar paralysis:-</u>

1-Complete paralysis of thoracic and intercostals muscle
2-Jerky movement of diaphragm
3-Gasping respiration which stops after some time
4-Pupil dilated and fish eye look due to cessation of lacrimation
5-Mucus membrane will be cyanotic then death.

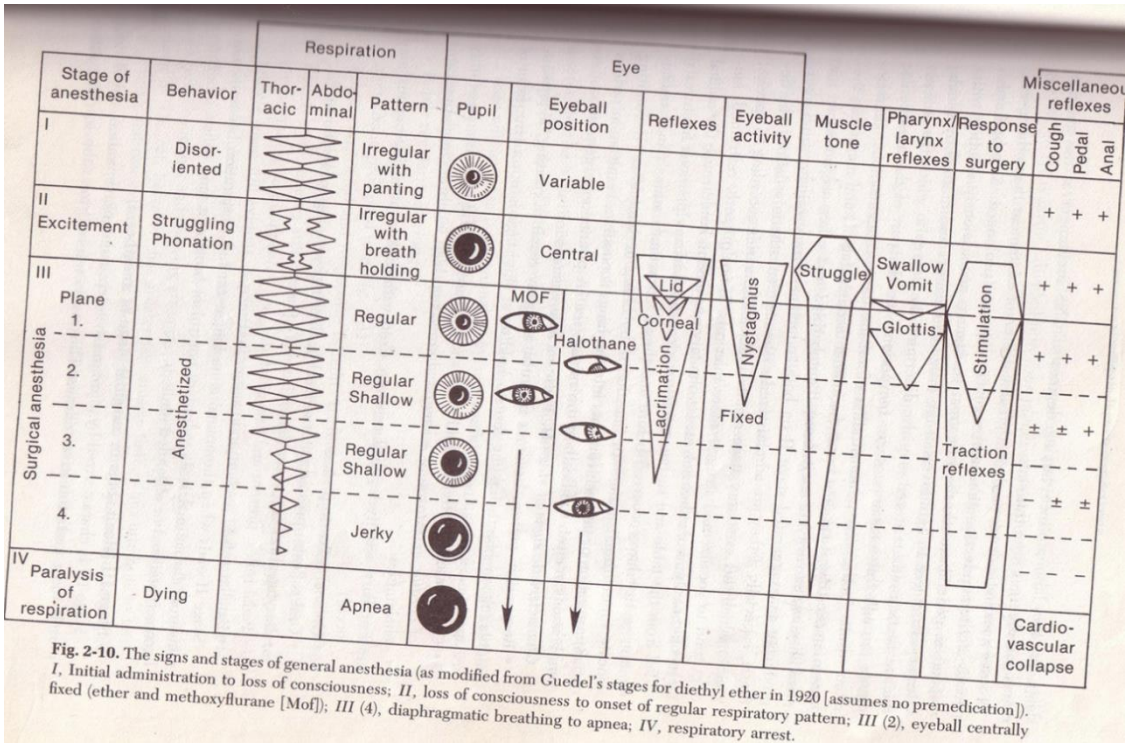


Fig. 2-10. The signs and stages of general anesthesia (as modified from Guedel's stages for diethyl ether in 1920 [assumes no premedication]). *I*, Initial administration to loss of consciousness; *II*, loss of consciousness to onset of regular respiratory pattern; *III* (2), eyeball centrally fixed (ether and methoxyflurane [Mof]); *III* (4), diaphragmatic breathing to apnea; *IV*, respiratory arrest.

<u>Notes:-</u>

1-The positions of the eyeball provide a useful guide to anesthetic depth.
2-Ocular reflexes are good indicators of anesthetic depth.

3-The corneal reflex should be present throughout anesthesia and palpebral reflex depressed by inhalation.
4-eyeball rotate medio-ventrally when patient is in light surgical plane of anesthesia.
5-the iris and pupil are centered when the patient is in deep surgical plane.
6-dilated pupil are the sign of anesthetic overdose.

Common anesthetic problems:-

1-Regurgitation : is caused by vagal effect on reticular contractions and parasympathetic effects on pharyngo -esophageal and gastro-esophageal sphincters(Relaxation) and depress of swallowing reflex .recumbence also increase risk of regurgitation especially left lateral recumbence
2-Bloat
.3-Inadequate oxidation
.4-Respiratory depress and apnea
5-Pulmonary aspiration (Ruminal tube should be used to avoid pulmonary aspiration).

General anesthetic drug divided into

1-Injectable anesthetic drugs
2-Inhalation anesthetic drugs.

I) Injectable or non-volatile general anesthetic drugs:-

Advantages:-

1-It does not required costly equipment and attained staff and constant supervision
2-It can be used in field condition
3-It is good for short duration surgery or diagnostic procedure
4-It is good for indication of anesthesia, which is to be maintained by an inhalation technique.
5-It is not-explosive and non-inflammable.

Disadvantages:-

1-After administration of inject able anesthetic drug one has no control to reverse the depth of anesthesia

2-Intravenous anesthetic drugs depends on body system for its metabolism , detoxification and excretion for that it is dangerous in animals with damaged liver and kidneys.

3-The recovery period may be long and stormy.

4-Oxygen and respiratory support equipment may be not available.

Commonly used Injectable anesthetic drugs:-

1-Barbiturate

2-Chloral hydrate

3-Choral hydrate + Magnesium sulfate

)4-Equithesine (chloral hydrate + Magnesium sulfate + pentobarbitone

5-Cataleptic or dissociative ex: ketamine

6-Steroid anesthetic drugs ex: saffan.

1-THE BARBITURATES

- It is injectable general anesthetic drugs
- It is lipid soluble in varying degrees

-The lipid solubility increases from long acting to the ultra-short acting

-The more lipid solubility makes the drug to cross the blood brain barrier easier, also the recovery from effect is quicker

-Recovery depend on a combination of redistribution and hepatic metabolism

-Elimination from the body by the liver metabolism and excretion of metabolites in the urine.

Classification of barbiturate:-

<u>A- according to duration of action:-</u>

1-Long acting. → Phenoparbital

2-Intermediate acting.→ Amobarbital, Probarbital

3-Short acting. → Pentobarbital, Cyclobarbital

4-Ultra short acting. → Thiopental sodium

B- according to chemical structure:-

1-Oxybarbiturate. →Pentobarbital, Phenobarbital

2-Methylated oxybarbiturate.→ Methohexital

3-Thiobarbiturate. →Thiopental sodium

Pentobarbital sodium (Nembutal)®

-Short acting oxybarbitale

-Recovery from pentobarbital is always slow but the duration varies according to the species of animal.

-Pentobarbital sodium is marketed as a sterile 6.5% solution containing and, for euthanasia, in non-sterile solutions of about 20%

-Can be use to induce general anesthesia alone or combination with chloral hydrate and magnesium sulfate.

-The main action of pentobarbital sodium is to depress the central nervous system.

-Because it depresses the motor areas of the brain it is used to control convulsive seizures.

-Causes excitement during induction and recovery

-Induce induction within 3-2 minute

-The period of surgical anesthesia 30 – 45 minute

-Recovery time required from 2 – 4 hours, mainly if the dosage is repeated.

The main side effects of pentobarbital are

1-prolonged recovery period

2-The drug markedly depresses the respiratory center for that it is not recommended to use in young animals (calve &foals)

3-In pregnant animals it diffuses readily across the placenta into the fetal circulation, inhibiting fetal respiratory movements

Dosage:

Dog= ===== 25 mg/kg

Cat======= 30 mg/kg

Cow/horse = 15 mg/kg I.V

Calve /foals =15- 30mg/kg

Sheep/goat = 30 mg/kg

Thiopental sodium

-It is ultra- short acting thiobarbiturate

-It is highly lipid soluble, for that the induction and recovery periods are rapid

-Use alone for short duration surgery

-It use for induction when the inhalation anesthesia use for maintenance of general anesthesia

-Less excitement during induction and recovery when compared with pentabarbitale

-Very rapid injection may cause death due to cardiac and respiratory depression

-Induction time about 1 – 1.5 minute

-Surgical anesthesia about 10 – 20 minute

-Recovery 1 – 1.5 hours

2-CHLORAL HYDRATE

-Chloral hydrate is a white, translucent, crystalline substance which volatilizes on exposure to air, producing a penetrating smell

-Chloral hydrate is a hypnotic (deep sleep) and not an anesthetic. The dose needed to produce anesthesia is very close to the minimal lethal dose (narrow margin of safety)

-It has only very weak analgesic action

-Hypnotic doses cause respiratory depression and large doses result in arterial hypotension.

-Death from chloral hydrate results as a result of respiratory depression.

-The drug was never used as an anesthetic in dogs and cats but formerly it was used extensively in large animals(5-7 g/50kg in horse), sometimes with a barbiturate

-Recovery from chloral hydrate anesthesia in horses occupies one to four or more hours and unless tranquillizers are given is often accompanied by struggling to rise.

-Chloral hydrate used in watery solution in a concentration between 6%- 10% this solution is very irritant because it is highly alkaloid (pH = 11) for that the perivascular injection causes severe tissue reaction, often followed by sloughing of the overlying tissues

-More recently introduced agents are safer and more convenient to administer to both horses and cattle and there is little to recommend its continuing use.

3-Choral hydrate + Magnesium sulfate

The combination of Choral hydrate + Magnesium sulfate in ratio 1:1 1:2 1:3. 70g magnesium sulfate + 30 g chloral hydrate dissolve with 1liter of sterile water and administered i.v

This combination is characterized by:

1-Rapid and smooth induction
2-Increase the depth of anesthesia
3-Good muscle relaxation
4-Reduce the toxicity of chloral hydrate.

4-Equithesine:

It is general anesthetic mixture composed from the (Chloral hydrate + Magnesium sulfate + Pentobarbital) in the following ratio:

-Chloral hydrate 28 g

-Magnesium sulfate 14g

-Pentobarbital 6.5g

Dissolved in(1liter) sterile distil water

This solution must be prepare with 1hour before administration to prevent precipitation which occur due to reaction between chloral hydrate and pentobarbital (freshly prepare).

Advantages:

1-Low toxicity with wide margin of safety.
2-Low quantity require for anesthesia
3-Rapid and smooth induction without excitement
4-Complete anesthesia (good analgesia and muscle relaxant

*The solution is very irritant if given perivascular.

Dosage: mainly use in cattle and horse 20- 30 ml /50kg B.W

5-DISSOCIATIVE AGENTS:

Three cyclohexylamine derivatives have been used in several species of animal to produce a state that enables a surgical operation to be carried out. These substances, phencyclidine, tiletamine and ketamine, differ markedly both in chemical and physical properties as well as in their clinical effects when compared to the non-inhalation agents already described.

They have been described as having cataleptic, analgesic and anesthetic action, but no hypnotic properties.

Catalepsy

Is defined as a characteristic akinetic state with loss of orthostatic reflexes but without impairment of consciousness in which the extremities appear to be paralyzed by motor and sensory failure. Another definition of the state produced by these agents is ‘dissociative anaesthesia’ which is characterized by complete analgesia combined with only superficial sleep. In man, hallucinations and emergence delirium phenomena are known to occur. It cannot be established whether similar phenomena are experienced by animals but the state produced by these substances is clinically very different from anaesthesia produced by other agents. Spontaneous involuntary muscle movement and hypertonus are not uncommon during induction and purposeless tonic-clonic movements of the extremities may be mistaken to indicate an inadequate level of anaesthesia and the need for additional doses and unless this possibility is recognized, overdoses may be given

KETAMINE

-In all species of animal ketamine appears to have a much shorter duration of action than phencyclidine or tiletamine.

-The effects of ketamine on the central nervous system become apparent rapidly for the brain/ plasma ratio becomes constant in less than one minute. It also rapidly crosses the placental barrier.

-Ketamine produces profound analgesia without muscle relaxtion, and tonic-clonic spasms of limb muscles may occur even in the absence of surgical or other stimulation.

-Salivation is increased and saliva can obstruct the airway even though laryngeal and pharyngeal reflexes are retained.

-To eliminate side effects a variety of other compounds such as atropine, diazepam, midazolam, xylazine, detomidine, medetomidine and even the thiobarbiturates or an inhalation agent are commonly given concurrently with ketamine

-Ketamine produce general anesthesia by alter the reactivity of central nervous system to various sensory impulse without block impulse at spinal cord or brain stem level ,its anesthetic action required the presence of functional cerebral cortex

-Ketamine is only general anesthetic drug produce general anesthesia by stimulation of nervous system to produce stat of catalepsy, analgesia and anesthesia

-Effect on cardiovascular system, cause transient hypotension and bradycardia followed by increase by heart rate and blood pressure

-Effect on respiratory system cause a dosage dependent respiratory depression and also produce apnea when giving in high dose

-Can use in deferent types of animals but its drug of choice as general anesthetic in cat

-Ketamine commonly combined with atropine, diazepam, midazolam, xylazine, detomidine, medetomidine in deferent species to provide muscle relaxation smoother induction and recovery than ketamine alone

In cat: Premedication with atropine 0.3mg/kg (s/c or IM), xylazine 1.1mg/kg IM mixed with ketamine 15 -20 mg/kg IM

In dog: Atropine sulfate 0.4 mg/kg IM or s/c then 5mg/kg xylazine mixed with 15 mg/kg ketamine

In horse: 0.2 mg/kg (I.v) diazepam after 5 minute 1.1mg/kg xylazine (I.v) and after 10 minute administration of 2.2 mg/kg ketamine (I.v). (This technique gives general anesthesia for 20 – 40 minutes

6-Steroid anesthetic drugs

SAFFAN

Research into the anaesthetic activity of steroids produced a number of hypnotic compounds. Of these alphaxalone was the most promising and, although virtually insoluble in water, when dissolved in cremophor EL the addition of another weakly hypnotic steroid, alphadolone, increased its solubility more than three fold

‘ Saffan’ is a mixture of the two steroids(alphaxalone and alphadolone) in cremophor EL and this mixture has never been given an ‘official’ name. In medical practice an identical formulation was known as ‘Althesin

Each millitre of Saffan contains 9 mg of alphaxalone and 3 mg of alphadolone. The ready-to-use solution is viscid, has a pH of about 7 and is isotonic with blood. Like all solutions made up in cremophor EL it froths when drawn up into the syringe but is miscible with water.

*Pharmacological studies in led to the introduction of Saffan as an anaesthetic for cats, but it can be used in all domesticated animals, except dogs (in these animals it causes histamine release)

*With moderate doses the arterial hypotension is transient but large doses have a more prolonged effect.

*In dogs cremophor EL produces histamine release, thus causing a further fall in arterial blood pressure and making Saffan unsuitable for use without prior antihistamine medication; even then it cannot be recommended

*The major route for excretion of steroids is via the bile and in rats 60–70% of alphaxalone and alphadolone are excreted by this route within three hours of administration

*Cats recovering from Saffan anaesthesia often show tremor of muscles, paddle and, if stimulated, may become extremely excited or convulse.This excitement and convulsions disappear as soon as the stimulation ceases

*Oedema and/or hyperaemia of the ear pinnae and paws is common under Saffan anaesthesia. although there have been occasional reports of ear pinna and paw necrosis

*Pulmonary oedema there seems to be no way of preventing it occurring and because it is a potentially lethal problem others take the view that Saffan is not an acceptable alternative to thiopental