Presented by: Dr. MANSOUR A

General Anesthesia and Resuscitation

1. Definition

Anesthesia can be defined as the state in which an individual is unable to perceive sensations.

General anesthesia (GA) is a medical procedure whose main objective is the temporary and reversible suspension of consciousness and pain sensitivity, using medications (anesthetic drugs) administered intravenously and/or by inhalation. To this essential objective, allowing pain-free surgery and certain invasive examinations, is associated the necessity for continuous monitoring (follow-up and control) of vital functions: respiratory (rate and volumes, oximetry), hemodynamic (heart rate and rhythm, blood pressure), and thermoregulatory, as well as muscle tone.

Due to the specificities of the technical, pathophysiological, and pharmacological approach to the anesthetized patient and the safety imperative surrounding this procedure at all stages.

2. Goals of General Anesthesia

1. Suppress the animal's movements
2. Suppress the pain felt by the animal
3. Facilitate the surgeon's work
4. Minimize risks

3. Course of General Anesthesia

The clinical examination is a fundamental step in the management of an animal. It must allow precise determination of the patient's condition, which conditions the planning and organization of anesthetic and surgical management.

3.1 History and Signalment

Many owners do not see the need to inform the practitioner about what they consider a secondary problem, such as the recent administration of **aspirin, non-steroidal anti-inflammatory drugs (NSAIDs), angiotensin-converting enzyme (ACE) inhibitors, phenobarbital, or steroids**, or any other medication likely to influence the course of anesthesia or the choice of anesthetic agents.

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It is useful to create history forms based on:

- Abnormal clinical manifestations.
- Signs of heat.
- Confirmation of the absence (or presence) of signs of major organ failure (exercise intolerance? polyuria-polydipsia? ...)
- Confirmation of water fasting: no food for at least 6 hours.

3.2 General Examination

a. Distant Examination

1. The general, static, and dynamic behavior of the animal: is it alert? Prostrate?
2. If exercise fatigue is noted, look for a cardiac problem.
3. The external condition of the animal, particularly its body condition. Obesity or severe emaciation, for example, are often the cause of hypoventilation and prolonged recovery.

b. Clinical Pre-Examination

- Temperature.
- Cardiac auscultation and pulse palpation (HR, presence or absence of arrhythmia, murmur...)
- Respiratory auscultation (RR, abnormal sounds...)
- Mucous membrane observation (color, CRT)
- Lymph node palpation.
- Skin (to assess the animal's **hydration status**. Dehydration promotes the occurrence of **perianesthetic hypotension**).
- The clinical data obtained during this preoperative examination constitute the **reference** physiological values from which **perianesthetic** incidents will be estimated. Thus, for example, bradycardia will be considered if the **perianesthetic** heart rate is more than 20% lower than the **preanesthetic** heart rate.

Criteria for assessing the animal's hydration status are:

- Persistent skin tent
- Elevated heart rate
- Enophthalmos
- Dry mucous membranes
- Sometimes prolonged CRT (late sign)

From a practical standpoint, an animal that has not eaten or drunk for more than 24 hours should be considered 5% dehydrated. In cases of gastroenteritis, a patient should be considered at least 8% dehydrated.

3.3 Special Examination

A = Abdomen
Palpation (liver, spleen, bladder, abnormal mass), ascites (fluid wave sign), umbilical or inguinal hernias, painful reaction...

B = Cardiac
Auscultation on the right and left sides. Heart rate, rhythm, heart sounds..., cardiac efficiency with the animal's vascular status, concordance of precordial impulse and pulse. Presence of a heart murmur (apical, basal, grade).

R = Respiratory
Observation of the respiratory pattern (amplitude, paradoxical breathing...), dullness (percussion), auscultation on both sides of the thorax (respiratory rate, sounds...).

The animal's condition allows classification into one of the five clinical stages defined by the American Society of Anesthesiologists (ASA).

G = Genital System Examination:
Vulva (turgor, presence of discharge, color, ...)
Mammary glands (presence of milk production, evaluation of tumors to be removed...)

Milk production is the most frequent cause of cancellation of ovariectomy and, secondarily, mammary tumor excision!

Why avoid operating on a bitch with lactation or pseudopregnancy?

- **For ovariectomy:** Removal of the ovaries leads to a sudden suppression of progesterone secretion (progesterone inhibits prolactin secretion), therefore great difficulty in drying up lactation after the procedure.
- **For mammary tumors:** Increased vascularization leads to an increased risk of perianesthetic hemorrhage.

4. Anesthetic Risk (ASA Classification)

Clinical evaluation should allow you to classify the animal into one of the anesthetic risk classes established by the American Society of Anesthesiologists (ASA).

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Table I: Indicative lists of preanesthetic workups considering the patient's clinical status, duration of anesthesia, and age of the animal.

Table 1. ASA risk classification	
American Society of Anesthesiologists (ASA) Physical Status Scale (2016)	
Class I	Minimal risk ● Normal healthy animal, no underlying disease
Class II	Slight risk, minor disease present ● Animal with slight to mild systemic disturbance; able to compensate ● Neonate or geriatric animals, obese
Class III	Moderate risk, obvious disease present ● Animal with moderate systemic disease or disturbances, mild clinical signs ● Anaemia, moderate dehydration, fever, low-grade heart murmur or cardiac disease
Class IV	High risk, significantly compromised by disease ● Animals with pre-existing systemic disease or disturbances of a severe nature ● Severe dehydration, shock, uraemia or toxaemia, high fever, uncompensated heart disease, uncompensated diabetes, pulmonary disease, emaciation

A.Uand DU = urinalysis with urine specific gravity measurement
Ht = hematocrit
PT = total protein
creat = creatinine
urea = blood urea nitrogen (BUN)
ALP = alkaline phosphatase
ALT = alanine aminotransferase
Ionogram = Na+, K+, HCO3-, Cl-
Coagulation times: PT and aPTT

4.1 Precautions

a. Dehydrated Animal
Regardless of the cause of dehydration, such a patient must receive corrective fluid therapy before being anesthetized.
The fluid deficit calculated according to the formula (Body weight in kg x % dehydration x 10) ml.
The choice of crystalloid solution will be based on the patient's natremia (normal natremia: **0.9% NaCl** or Ringer's Lactate; low natremia: **0.9% NaCl** or hypertonic if natremia is below **110 mmol/L**; high natremia (natremia above **170 mmol/L**): **5% glucose**).

b. Animal in Respiratory Distress
In a brachycephalic, a patient with a diaphragmatic hernia, for example, preoxygenation for at least 20 to 30 minutes is essential before performing anesthetic induction.

c. animal with Pyometra
These animals are often dehydrated and in shock. Although it is evident that only surgical treatment will treat the cause of the critical condition, appropriate fluid resuscitation (Ringer's Lactate or NaCl) should be initiated and continued for 1 to 2 hours before inducing anesthesia.
This precaution is essential to prevent the ever-present risk of "shock *a vacuo*" upon vascular exclusion of a large-volume uterus.

5. Premedication

5.1 Objectives of Premedication

a) Limit Stress.
Stress triggers, among other things, the release of catecholamines, which are responsible for numerous cardiovascular disorders (arrhythmias, ventricular extrasystoles, etc.). It increases anesthetic risk and decreases perianesthetic cardiovascular stability.

b) Obtain the Animal's Cooperation.
Tranquilizing the animal allows for calm placement of an intravenous catheter, easier clipping, etc.

c) Analgesia.
Limiting painful stimuli can be important preoperatively but may also help limit intra- and postoperative pain (opioids, alpha2-agonists).

d) Potentiation.
Molecules used in premedication often allow reducing the amount of anesthetic used for induction... and thus the associated side effects.

Premedication Molecule	Effects	Side Effects	Dose

Acepromazine (Dopamine (D1,D2) antagonist, α1 antagonist)	- Tranquilizer - Sedative at high doses	- Vasodilation (hypotension) - Decrease dose in Boxers and large breeds - Hypothermia	0.01-0.05 mg/kg (IV, IM)
Xylazine, Medetomidine (α2 agonist)	- Sedative +++ - Analgesic +++ - Patient ≤ ASA2	- Decrease in HR, CO - Avoid in: cardiac, hepatic, diabetic, geriatric patients - Emetic	0.001-0.002 mg/kg (IM) Antidote: Atipamezole Treatment of bradycardia: atropine
Benzodiazepine (GABA agonist) Diazepam, Zolazepam	- Anxiolytic - Muscle relaxant	- Minor cardiovascular effects	0.2-0.5 mg/kg (IM/IV)
OPIOIDS: Morphine and Methadone: Opioid receptor agonist Buprenorphine: Partial opioid receptor agonist Butorphanol: Partial agonist-antagonist	- Sedation	- Minor effects on cardiorespiratory system - Respiratory depression - Urinary retention - Emetic effect (morphine)	Morphine and Methadone: Dog: 0.1-0.4 mg/kg (IM/IV) Cat: 0.05-0.2 mg/kg (IM/IV) Butorphanol: 0.1-0.5 mg/kg (IM/IV)

- Anticholinergics (atropine, glycopyrrolate) are no longer systematically part of anesthetic premedication. Their use is justified in specific situations:
    - **Patients with high vagal tone:** When the vagus nerve naturally exerts a strong slowing effect on the heart.
        - **Typical examples: Brachycephalic breeds** (Bulldog, Pug, Persian Cat).

- **Procedures at risk of vagal stimulation:** Certain surgical acts can provoke severe and sudden bradycardia.
  - **Examples:** Eye surgery (oculocardiac reflex), laryngeal manipulation, abdominal surgery.

Dosage: Atropine: 0.02 - 0.04 mg/kg, IV or SC.

5.2 Criteria for Choosing Molecules

- **The animal's general condition:** For example, drugs highly bound to plasma proteins like propofol have a higher effective dose in hyperproteinemia and a lower dose in hypoproteinemia. (Albumin and PT dosage). Caution is also needed with **obese animals** as many products accumulate in fat and muscle, leading to delayed recovery.
- **The animal's breed:** The dose of acepromazine must be reduced in Greyhounds and brachycephalics, as their sensitivity is increased.
- **The premedication used:** Certain preanesthetic agents potentiate the action of anesthetics inducing unconsciousness, allowing for dose reduction and consequently decreasing their adverse effects. Indicatively, the order of potentiation is **benzodiazepine < morphine < phenothiazine < alpha2-agonists**.
- The animal's response to premedication (individual variations).
- The type of metabolism ensuring the elimination of the used product: if the product is eliminated in active form by the kidneys and the animal has renal failure, the dose must be reduced as the molecule is generally eliminated less quickly.

Schematic representation of the orders of sedative and analgesic potential of different drug combinations. In choosing the combination and doses, the clinician must bear in mind that the depressive effects of these combinations are also dose-dependent.

[Image/Chart: Diagram showing the relative sedative and analgesic effects of different drug combinations]

6. General Anesthetics

6.1. Fixed Anesthetics = Injectable

1. Barbiturates (Nesdonal®, Pentobarbital®)
2. Dissociatives (Ketamine®, Imalgène®, Zoletil®)
3. Propofol

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6.2. Volatile Anesthesia

Main products used: **HALOTHANE®, FLUOTHANE®** (and modern agents like Isoflurane, Sevoflurane). They are carried by a carrier gas:

1. Pure Oxygen (O2)
2. O2 + N2O mixture (nitrous oxide)

General Anesthetic Molecule	Effects and Indications	Side Effects and Precautions	Dosage
Halogens (Halothane, Isoflurane, Sevoflurane) (GABA agonist, NMDA antagonist)	Induction of narcosis and myoresolution via the respiratory route. • Maintenance via respiratory route.	- Cardiorespiratory depression - Hypothermia - Rhythm disturbances (Halothane) - Prolonged recovery due to hypothermia, hypoventilation	
Ketamine (NMDA antagonist)	Analgesia. Sympathetic stimulation.	- Delicate clinical monitoring, difficult intubation. - Discourage in epilepsy or convulsions, head trauma.	5-10 mg/kg (IM/IV)
Thiopental (Barbiturate)	- Narcosis and myoresolution. - Anesthetic induction in epilepsy or risk of convulsion. - Rapid induction of narcosis for immediate intubation.	- Cardiorespiratory depression. - Intensification of effects in acidosis, hypoproteinemia, or uremia. - Prolongation of effects and recovery in hypothermia, severe hepatic insufficiency,	10-20 mg/kg Strict IV

		obesity, repeated administration. - Avoid (in young < 12 weeks).	
Propofol (GABA agonist)	Short duration of action in epilepsy or risk of convulsion. • Rapid induction of narcosis for immediate intubation. • Emergency treatment of convulsions and epileptic seizures.	Hypoventilation, hypotension.	2-10 mg/kg Strict IV
Thiopental (Barbiturate)	Minimal cardiovascular depression. Respiratory depression.	Hypoventilation. Avoid in young < 12 weeks.	10-20 mg/kg Strict IV

7. Procedures

7.1 Establishing an Intravenous Line

Allows easy and timely injection of:

- Fixed anesthetics (induction and maintenance)
- Perfusion fluid (maintaining blood pressure)

Usual physiological values for isotonic solutions (0.9% NaCl and Ringer's Lactate):
1 drop per kg per minute for cats (1 drop = 0.05 mL)
2 drops per kg per minute for dogs

- Resuscitation products (cardiorespiratory stimulants)

7.2 Endotracheal Intubation

- Deliver anesthetic gas to the lungs.
- Oxygenate animals (recovery, hypoxia…) via the anesthesia machine or manually.

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- Interesting in all general anesthesias, intubation is practically indispensable in the following cases: at-risk animals (brachycephalic, obese, geriatric, renal/hepatic failure...), long surgeries.

Note: Due to the laryngeal reflex, only animals that are already asleep or in a state of deep shock can be intubated.

Equipment Needed for Intubation

- 2-3 tubes of appropriate diameter and length for the animal.
- Lubricating and/or anesthetic gel +/- anesthetic spray.
- Laryngoscope (light + tube guide).
- Mouth gag.
- Syringe to inflate the cuff.
- Gauze +/- tongue forceps.
- Fixation: tape, adhesive.

Intubation: A Veterinary Act, It Requires:

1. Verify that the animal is well asleep. Otherwise: laryngeal reflex.
2. Lubricate the tube.
3. Anesthetize the larynx (++ in cats).
4. The operator, facing the animal, pulls the tongue with gauze, visualizes the back of the throat, gently but quickly introduces the tube into the trachea.
5. Secure the tube to the muzzle, inflate the cuff.

MAIN CARDIAC ABNORMALITIES	**Possible Causes to Investigate**
Tachycardia (HR > 1.2 x preoperative initial HR)	• Anesthesia too light • Pain • Hypotension / hypovolemia (baroreflex) • Profuse bleeding • Hypoperfusion / hypoxemia • Anticholinergic, dissociative agent • Hypercapnia • Hyperthermia
Bradycardia (HR = 0.6 to 0.8 x preoperative initial HR)	• Anesthesia too deep • Hypothermia and/or anesthetic drift • Hypertension (baroreflex) • Alpha2-agonists • High doses of morphine • Myocardial hypoxia • Hyperkalemia • Vagal reflex (forceful intubation, traction on intestines)
Cardiac Arrest "Asystole" (Absence of heartbeat)	• Respiratory arrest • Anesthetic intoxication • All causes of venous return deficit (shock a vacuo, vena cava compression, major hypovolemia, major prolonged bleeding...) • Severe hypoxemia, severe myocardial hypoxia • Hypercapnia, hyperkalemia

Ventricular Extrasystoles and Ventricular Hyperexcitability	• Anesthesia too light • Pain • Hypoxemia, hypercapnia
Atrio-Ventricular Blocks (1st or 2nd degree: PQ prolongation > 0.13 s, or absent P wave)	Anesthesia too deep • Hypothermia and/or anesthetic drift • Alpha2-agonists
Arterial Hypotension (MAP < 60 mmHg)	• Acepromazine • Hemorrhage • Bradycardia • Tachyarrhythmias

7.3 Monitoring Cardiovascular Function

The state of cardiovascular function largely conditions anesthetic morbidity and mortality. These alterations must be diagnosed early and treated specifically.

NOTE
Most hypotension episodes occur within 30 minutes of induction. Small animals have a lower body weight/body surface area ratio, making them more susceptible to hypothermia, a factor that can increase the risk of hypotension. Brachycephalic breeds have higher resting vagal tone, which can lead to bradycardia, decreased cardiac output, and consequently, hypotension.

Maintaining blood pressure is fundamental to ensure adequate tissue perfusion and maintain renal function. The amount to administer is 5 ml/kg/h for a dog and 3 ml/kg/h for a cat; be careful of volume overload which would lead to pulmonary edema (PE).

In case of complications, use:

Complication	Treatment	Mode of Action	Dosage
Bradycardia	Atropine	Vagolytic	0.02 mg/kg IV
Tachycardia	Propranolol	Beta-blocker	0.05 mg/kg IV
Bradypnea	Doxapram	CNS stimulant	1-2 mg/kg IV
Arrhythmias	Lidocaine 2%	Membrane stabilizer	2 mg/kg (slow inj) IV
Hypotension	- NaCl perfusion - Dopamine	- Inotrope+	3-5 mg/kg/min IV
Hyperkalemia	Insulin + Glucose solution, Calcium Gluconate 10%		Insulin 0.25 U/kg Glucose 2g

7.4. Monitoring Respiratory Function

Observe:

- Chest movements: amplitude (large/small), rhythm (regular, irregular), frequency (movements per minute).

- Reservoir bag movements (gas).

Signs of Adequate Anesthesia: Frequency = 10-30 movements/min.
Normal Awake Frequency: 40 breaths/min (large dogs) to 60 breaths/min (cats and small dogs).

- Ample and regular movements.
- Thoracic and abdominal synchrony.

3.1. Pulse Oximeter
Measures blood hemoglobin O2 saturation. Attached with a clip on the tongue. Usual values: 94-100%.

Alarming Signs:

- < 94%: hypoxemia
- 75%: mucosal cyanosis (after 2-3 min of apnea)

What to do in case of hypoxemia?

- Ventilate with pure oxygen.

3.2. Capnograph
Sensor placed at the end of the tracheal tube to measure CO2 pressure in respiratory gases throughout the cycle. Usual values: PCO2 = 40-45 mm Hg.

MAIN RESPIRATORY ABNORMALITIES	**Possible Causes to Investigate**
Tachypnea (RR > 1 to 1.2 x preoperative initial RR)	• Anesthesia too light, awakening • Pain • All causes of metabolic acidosis - hypoperfusion/hypotension - hypoxemic hypoxia... • Attempt to compensate fo hypoventilation and hypercapnia - Pleural space or lung tissue involvement - O - Intubation of a bronchus, tube too small • Severe hypoxemia • Hyperthermia Incorrect mechanical ventilation setting
Bradypnea (RR = 0.6 to 0.8 x preoperative initial RR)	• Anesthesia too deep • Drug overdosage • Hypothermia, chest pain
Apnea (Absence of respiratory movements)	• Too rapid IV induction • All uncorrected causes of bradypnea • Anesthetic intoxication • Hypothermia

7.5 Monitoring the Depth of General Anesthesia Based on Reflexes

Anesthesia Depth	Too Light	Surgical Stage	Too Deep
Involuntary Movements	Present	Absent	Absent
Righting Reflex	Present	Absent	Absent
Palpebral Reflex	Present	Absent	Absent
Corneal Reflex	Present	Present but slower	Absent
Toe Pinch Reflex (limb)	Present	Absent	Absent
Pupil Diameter	Mydriasis	Miosis (more or less constricted)	Mydriasis, poorly reactive
Heart and Respiratory Rate	Elevated	Decreased	Excessively decreased

8. Recovery Monitoring

Anesthesia ends with the animal regaining consciousness.

- Shivering observed during the recovery phase is often thermal shivering intended to warm the animal. This is a normal process but very oxygen-consuming. It is therefore prudent to leave the animal on pure oxygen as long as possible to limit the risk of hypoxia.
- Do not remove the tracheal tube until the swallowing reflex has returned (risk of aspiration). For brachycephalics, wait until the animal is almost fully awake.
- Do not forget to implement an appropriate postoperative analgesia protocol, hence the need for opioid analgesics). The most commonly used protocol combines opioids and NSAIDs.
- Recovery must be monitored until the animal is in sternal recumbency, capable of voluntary movements, and when its temperature exceeds 36°C.

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Anesthetic Protocol for Cesarean Section

A complete history and general examination (cardiovascular status, hydration status, and temperament) should be performed before devising an anesthesia plan. Management should include abdominal ultrasound (to assess fetal heart rate) and blood tests, including electrolytes, glucose, total protein, and hematocrit.

1- Pathophysiology

Changes in maternal physiology associated with gestation and fetal physiology must be well understood. The main systems affected by gestation are the cardiovascular, respiratory, gastrointestinal, and renal systems. Drugs that cross the blood-brain barrier also cross the placental barrier and can cause physiological changes in the fetus. The cardiovascular system is less developed in the fetus, and contractility capacity is therefore reduced; consequently, drugs that can decrease heart rate can also decrease cardiac output in the fetus. Moreover, enzymes responsible for hepatic metabolism are not active until 3 to 5 weeks of age, leading to increased duration of action of anesthetics in the fetus. Blood volume, especially plasma volume, is increased in pregnant bitches; therefore, hematocrit may be overestimated in a dehydrated patient.

2- Premedication

Premedication crosses the placental barrier; thus, the lowest effective dose should be administered to minimize the effect on the fetus.

- **Opioids** (e.g., methadone, morphine, hydromorphone) can be used but may cause bradycardia in the fetus.
- **Midazolam** is a fully reversible benzodiazepine that can be added to an opioid for sedation in older or debilitated animals.
- **Acepromazine** is a good sedative but has a prolonged action, depends on hepatic metabolism (which is absent or has reduced capacity in the fetus), and leads to vasodilation and possible hypotension, which can reduce placental blood flow.
- **α2 agonists** are generally avoided due to increased fetal mortality associated with **xylazine** administration.

3- Induction Agent

Anesthetic induction agents should have a short duration of action, be rapidly metabolized, and cause minimal maternal cardiovascular depression. Patients should be preoxygenated for at least 5 minutes. The main determinant of fetal viability is the time between induction and delivery, with a target of less than 15 minutes. Propofol and

alfaxalone are the induction agents of choice as they provide smooth induction, have a short duration of action and rapid clearance, and minimize fetal depression.

4- Anesthesia Maintenance

Anesthesia maintenance can be performed with Isoflurane. The use of total intravenous anesthesia (TIVA) with propofol or other agents is not recommended because the metabolic capacity of newborns is reduced, leading to lower **APGAR** scores and longer recovery time in bitches. It is important to avoid hypotension, decreased uterine perfusion, and hypoxemia during anesthesia. Crystalloid perfusion (NaCl, etc.) can be used to improve blood volume and venous return. Manual or mechanical ventilation may be necessary to prevent hypoventilation.

Modified APGAR Score (out of 20)

Parametres	Score		
	0	1	2
Fr cardiac	<180 bpm	180-220 bpm	>220bpm
Fr and respiratory effort	,<6 mvt/m	cries, 6-15 mvt/mn	Cries, >15mvt/mn
Reflexes	Absents	Moderate	Présents
Mobility	Flasque	Qlq mouvements	Animal actif
Color mucosa	Cyanotic	pale	pink

5- Neonatal Care

Neonatal management and resuscitation begin with early rubbing and drying of the newborn to stimulate breathing and keep the newborn warm; a heat lamp will be used for thermal support. A bulb syringe should be used to aspirate secretions from the oral cavity, oropharynx, and nose.

Fading Puppy Syndrome: Causes - hypoxia, hypothermia, hypoglycemia, dehydration.

A newborn showing signs of distress (e.g., bradycardia, cyanosis, very low respiratory rate) should undergo continuous stimulation and ventilation to increase heart rate, thus avoiding hypoxia and bradycardia. Oxygen supplementation can be provided via a mask or intubation if necessary.

Asystole is very common in newborns and should be treated with (0.01 mL) of epinephrine (1 mg/mL) in the umbilical vein or intrahepatically.

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A puppy below 35°C will no longer exhibit a suckling reflex, and below 34°C, it will not be able to digest milk. It must be warmed very gradually: maximum 1 degree/hour. The recommended nest temperature during the first weeks of life is between 28-30°C.

Newborns lack glucose reserves and have minimal capacity for gluconeogenesis. Clinical hypoglycemia can be treated with IV or intraosseous sugar solution, at a dose of 0.5 to 1 g/kg of dextrose using a 5% mixture. A single parenteral administration of glucose is adequate if the hypoglycemic puppy can subsequently be fed or nursed. If a newborn is too weak to suckle, 0.05 to 1 ml of warmed 5% dextrose can be administered orally via a stomach tube every 15 to 30 minutes until the newborn is able to suckle. If colostrum or milk can be obtained from the mother, they can be administered in the same way and repeated every 2 hours until the newborn can suckle on its own.

The immune system is incompletely developed during the first 10 days of life and makes newborns vulnerable to systemic infections (most commonly canine *Herpesvirus*). The placenta is endotheliochorial, with practically no antibody transfer. Puppies must ingest sufficient colostrum quickly after birth to acquire passive immunity. The newborn's umbilical cord should be cut 1 cm from the abdominal wall, ligated, and can be treated with 2% iodine tincture immediately after resuscitation to reduce contamination and prevent bacteria from ascending into the peritoneal cavity (omphalitis-peritonitis).

- **In case of Dehydration:** Sticky mucous membranes and enophthalmos; skin tent is not interpretable in young patients; measure urine specific gravity (clear urine). Normal values: 1.010 -- 1.030. Placement of a small catheter in the jugular/umbilical/cephalic vein is fundamental. Bolus in case of hypovolemia: 30-40 ml/kg (puppy) and 20-30 ml/kg (kitten), then maintenance 3-4 ml/kg/h, perfusion with warm RL or 0.9% NaCl.
- **If Severe Hypoglycemia:** Bolus 0.5 g/kg (5-10% dextrose), followed by slow infusion.