NeoCare
Néonatologie des Carnivores
Reproduction et Elevage

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INVITATION

Hungarian Small Animal Veterinary Association (HSAVA),

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DIAGNOSTICS AND THERAPY FOR THE SICK NEONATE

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Patients younger than 3 weeks are fragile and deteriorate very rapidly. They have thus to be treated rapidly, before any precise etiologic diagnosis (if any). Most often symptoms are nonspecific including respiratory distress, crying, abdominal distension and pain, anorexia, poor weight gain, weakness and hypothermia, none being pathognomonic for the underlying cause.

In case one newborn is declared "sick", all the litter is to be examined, and ideally also the dam.

CLINICAL EXAMINATION

NEONATES
Weight (if possible data from birth) / color and dryness of mucous membranes / Heart rate (normal = 200-250 bpm) / Respiratory rate (normal 30 rpm) / rectal temperature (see below) / vitality (spontaneous movements, crawlings, suckling reflex) / congenital abnormalities (hydrocephalus, cleft palate, anal agenesia….) / symptoms (abdominal distention and pain diarrhea, vomituritions, seizures…)

DAM
General clinical examination (bacteriemic ? presence of an infectious site ?) / metritis / mastitis / development of the mammary tissue / anatomy of the teats / body condition score (to evaluate the ability to secrete enough milk and whether the neonates can easily suckle)/ body temperature

TEMPERATURE

Rectal temperature is measured with a pediatric electronic thermometer with a smooth tip. The temperature of the newborn is normally below the adult one (Table 1). Maintenance of temperature is important especially because hypothermia below 35°C induces arrest of intestinal peristalsis and enzymatic activities. Note that shivering reflex is absent until the age of one week. Bradycardia (100-150 bpm) is often associated to hypothermia (as a protective reaction).
Since thermogenesis is limited in newborns, ambient temperature maintenance is crucial during transport to the clinic, during consultation and during hospitalization. But conversely overheating (due for example to bottles filled with hot water or too hot pads) is to be avoided since newborns put in contact with too hot surfaces are unable to move away. Overheated newborns are hyperactive and cry.

Table 1: Rectal temperature during the neonatal period

Puppies	mean±SEM (95% of puppies are within mean±2SEM) (Mila et al 2017)	At birth, around 33,6±2°C Day1 and 2: 36.5±1°C Day 7: 37.0±1.3°C Day 14-21 37.2±0.5°C.
Kittens	Range (Lopate 2012)	week 1 34.4-37.2°C week 2: 35.0-37.8°C week 3: 36.1-37.8°C

The ideal material at the clinics is an incubator (designed for puppies and kittens or alternatively for human babies or birds, the last having the advantage of portability). Heat infrared lamps are not recommended.

TWO IMPORTANT INFORMATION:

- In case of hypothermia, it is important to obtain the increase of temperature in the newborns only very progressively (1°C max/hour). Temperature in the incubator is thus increased progressively (+1°C compared to the neonates' temperature) until 37°C with a recommended humidity percentage of 55-65%.
- Oral feeding has to be delayed until newborns have reached 35°C (see below). High-sugar solutions (30% glucose; honey) can be administrated orally in order to avoid hypoglycemia (few drops applied on the tongue or on internal aspect of jaws).

BIOCHEMISTRY – NUMERATION FORMULA – BLOOD GROUP (in kittens)

Reference values for newborns are different from those in adults (table 2). Blood can be collected at any age by a puncture at the jugular vein (23-25G). In neonates, alcohol has to be avoided on skin and replaced by water to limit bleeding post blood collection and compression is to be thoroughly maintained during at least one minute. Nevertheless, jugular puncture is an act far less difficult for the practitioner than usually expected and of no danger for the newborns. In kittens, blood from umbilical cord can also be used for determination of blood group.

Table 2: References of blood parameters in neonates (adapted from Levy et al 2006; Rosset et al 2012; Van Dehn, 2014; Rortveit et al 2015)

	Puppies			Kittens		
	1 week	2 weeks	3 weeks	Day 1	Day 7	Day 14
Urea (g/l)	0.35-1.01	0.12-0.6	0.19-0.49	0.34-0.94	0.16-0.36	0.11-0.30
Creatinin (mg/l)	<1-7	2-10	2-7	0.6-1.2	0.3-0.7	0.4-0.6
Alkaline phosphatase(UI/l)	3000-7000	600-1300	110-260	1500-3700	125-360	116-306
Total proteins (g/l)	32-45	25-42	33-43	39-58	35-48	37-50
Glucose (g/l)	0.7-1.5	0.7-1.4	0.5-1.6	0.65-1.5	1.0-1.4	1.07-1.6
Hematocrit (%)	21-46	18-33	21-37	27-35		
Red blood cell conc (10^6/ml)	3.6-5.9	3.4-4.4	2.8-4.3	5.3 ± 0.2		
White blood cell conc (10^3/ml)	4-23	1.7-19	2.1-21	9.7 ± 0.6		

NUTRITION

Deficit in milk intake can be suspected when newborns are permanently crying, when they are weak (until being unable to crawl and to suckle efficiently). It can be confirmed by blood glucose assay on a small drop of blood obtained by pricking ear vessels (with a biochemistry machine at the clinics or with devices used by diabetic human patients). A glycemia below 0.9 g/l at Day 1 increases the risk of neonatal mortality and glycemia below 0.7 g/l is critical.

Before any oral administration of milk, rectal temperature is to be controlled (feeding only if temperature > 35°C) together with the filling status of the stomach. Perineal region is stimulated with a wet cotton gauze to obtain micturition and defecation, both helping in digestive transit including stomach emptying. Within the hours after birth, it is crucial to check meconium expulsion: if perineal stimulation is inefficient, the rectal ampulla can be stimulated with the tip of the thermometer.

Depending on the presence of a cleft palate and on the presence of an efficient suckling reflex, bottle feeding or tube feeding will be preferred (table 3). The tube is 1.5 mm in diameter for animals less than 300g, 2.6 to 3,3 mm above. To avoid vomiturition, the quantity administered at each meal remains lower than the stomach volume (i.e. 4 to 5 ml per 100 g body weight in puppies and 2 to 3 ml per 100 g body weight in kittens) and the milk is heated (37°C). Nasogastric tube can also be placed in order to avoid repetitive oesophagal insertion.

Safe tube feeding

- Length to introduce: equivalent to the length between the tip of the mouth and the tip of the elbow. Mark the distance with a felt-tip pen.
- Link to the seringe. Fill the tube with milk. Remove air from the tube
- Newborn in ventral decubitus. Slightly open the mouth by pressing laterally against jaws.
- Maintain the head without hyperflexion nor hyperextension
- Push the tube against the pharynx and let the newborn swallow the tube (even when weak)
- No coughing reflex even when the tube is in the trachea until the age of 6-10 days. When placed correctly into the stomach, bubbles are audible.
- Inject over 1-2 minutes to allow progressive stomach distension.
- Once milk administered, the tube is folded in order to be pulled out without milk being delivered into the pharynx.

Table 3: Choice between bottle feeding and tube feeding

	Advantages	Disadvantages
Bottle feeding	○ The neonate can eat ad libitum ○ Relaxing activity for the neonate ○ Stimulation of digestion	○ Time consuming ○ Risk of inhalation ○ Impossible in absence of suckling reflex ○ Contra-indicated in case of cleft palate
Tube feeding	○ Rapid ○ Possible in absence of suckling reflex ○ Safe feeding in case of cleft palate	• (limited) Risk of administration into the respiratory tract • Requires training (but easy) • Risk of stomach overload and vomiturition

FLUIDOTHERAPY

Dehydration status is difficult to evaluate in newborns via pinching skin as performed in adults. Dry mucus membranes and high urinary density (> 1020) are the signs of neonatal dehydration. Rehydration can be performed by subcutaneous, intravenous (jugular) route (or intraosseous into the femur but it is the last option and only for a few hours). Ringer lactate (+ glucose 1.25% in case of hypoglycemia) is administered at the dose of a 45 ml/kg bolus followed by 80-100 ml/kg/24h. The dose by subcutaneous administration is 3 ml/100g body weight. Attention has to be paid to fill the empty space of the tube and to the temperature of the perfused liquid.

ANTIBIOTHERAPY

Antibiotics are preferentially administered by subcutaneous or intravenous route. Administration per os in small sized animals leads to the use of liquid, with a risk of bad control of the dose effectively administered; moreover, antibiotics per os (especially ampicillin, metronidazole and amoxicillin) increase the risk of diarrhea and modification of the digestive flora. Amoxicillin is the first choice antibiotics, amoxicillin-clavulanic acid, cefalexin and some macrolids 2nd choice, ceftiofur in 3rd intention (table 4). Antibiotics with known side effects (table 5) can be administered but only when none other is efficient (no clinical improvement or based on the antibiogram results) and during short periods.

Table 2: **ANTIBIOTICS INDICATED IN NEONATALOGY**

Family	Molecule	Indicative posology
Beta lactams	Amoxicillin	22 mg/kg every 8-12h
	Amoxicillin – clavulanic acid	Puppies: 12.5-25 mg/kg every 8-12h Kittens: 20-30 mg/kg every 8 h
	Ampicillin	
	Penicillin G	
Cephalosporin	Cefalexin	10-30 mg/kg every 8-12h
	Ceftiofur	2.5 mg/kg every 24h
Macrolid	Erythromycin	
	Tylosin	
Sulfamids	Sulfamid-trimetoprim sulfate	

Table 3: **ANTIBIOTICS CONTRA-INDICATED**

Family	Molecule	Toxicity
Aminoglycosides	Amikacin Gentamicin Neomycin Streptomycin	Nephrotoxicity Ototoxicity
Quinolones	Ciprofloxacin Enrofloxacin Marbofloxacin	Cartilage lesions
Metronidazole		Neurotoxicity
Tetracyclins	Oxytetracyclin Doxycyclin	Nephrotoxicity Trouble in dental development

OTHER TREATMENTS

Before any treatment, the safety of each molecule for neonates must be validated. Such information can be rather found in textbooks rather than in official recommendations of use provided by the producers since most drug specialties have not been evaluated on neonates before registration.

OXYGENOTHERAPY

Oxygenotherapy can be implemented in case of obvious hypoxia (cyanotic mucous membranes, dyspnea), after long delivery, but also in any sick puppy.

Oxygen can be administered by placing newborns into an incubator (alternatively a closed aquarium or a clear plastic box) related to the oxygen tank (or concentrator) through a tube inserted into a hole. Tracheal tubing is after intubation with an intravenous catheter but in that case, only one animal can be treated.

PASSIVE IMMUNE TRANSFER

If newborns are examined during the first 12 hours of life and especially if they are suspected of not having ingested colostrum (for example weak newborns, dead mother), a transfer of a passive immunity is to be organized. The best substitute for maternal colostrum is the frozen colostrum of another dam, collected between 24 and 48 hours after parturition (i.e. after her own offspring has acquired its passive colostral immunity and before the immunoglobulin G content has dropped too dramatically). Breeders should be advised to bank colostrum in small plastic tubes, by milking the dam after disinfection of teats (chlorhexidine). The minimal dose of colostrum to be administered is 1.5 ml/100g body weight within the first 8 hours of life. From 12 hours of life, the intestinal barrier is closed in puppies and kittens. Administration of maternal serum per os provides only a very limited passive transfer; bovine colostrum contains heterologous immunoglobulins in majority non targeting canine pathogens; industrial milks do not provide any canine immunoglobulins but some are supplemented with IgY (egg yolk immunoglobulin) directed against canine pathogens.
A deficit of passive immune transfer, increasing the risk for neonatal mortality, can be evidenced by a low early weight gain (no weight gain between birth and two days of age) or by assaying gamma glutamyl transferase serum activity (lower than 62 UI/l at Day 2 of life).

FOLLOW UP

The clinical improvement is evidenced first by the cessation of constant crying, the improvement of vitality, the normalization of rectal temperature. At mid and long term, the normalization of growth is observed. The normal growth of a puppy over the first two days of life can be null, and then approximatively 2 to 4 g/kg of expected adult body weight and per day in puppy; the expected weight is *a minima* 1.5 times the birth weight at Day 7, and 3 times at Day 21. A kitten is expected to grow by 10 g between birth and Day2 and then 10-15 g/day until Day 21. One can also refer to reference curves at least to those drawn by the breeder in his own management situations, since such curves are amazingly not available for various breeds in dogs and cats.

CONCLUSION

Care of sick neonates rely finally much more on appropriate nursing (feeding, maintenance of temperature, ensuring micturition/defecation) and on antibiotherapy (due to the high prevalence of septicemia) than on any other specific therapy. Rapid onset of the treatment is also one key element of the success, together with considering all littermates for preventive actions.

REFERENCES

LEVY JK, CRAWFORD PC, WERNER LL. 2006. Effect of age on reference intervals of serum biochemical values in kittens. JAVMA, 228, 7, 1033-

MILA H, GRELLET A, DELEBARRE M, MARIANI C, FEUGIER A, CHASTANT-MAILLARD S. Monitoring of the newborn dog and prediction of neonatal mortality. Preventive Veterinary Medicine, 2017, 143:11-20.

RØRTVEIT R, SAEVIK BK, EGGERTSDÓTTIR AV, SKANCKE E, LINGAAS F, THORESEN SI, JANSEN JH. Age-related changes in hematologic and serum biochemical variables in dogs aged 16-60 days. Vet Clin Pathol. 2015;44(1):47-57.

ROSSET E, RANNOU B, CASSELEUX G, CHALVET-MONFRAY K, BUFF S. Age-related changes in biochemical and hematologic variables in Borzoi and Beagle puppies from birth to 8 weeks. Vet Clin Pathol. 2012 Jun;41(2):272-82

VON DEHN B. Pediatric clinical pathology. Vet Clin North Am Small Anim Pract. 2014;44(2):205-19