Neonatal Critical Care

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The care of the neonate is a daunting challenge for many in the veterinary community because these young animals are different in many ways physiologically and anatomically from their older counterparts. These differences dramatically impact the neonate's response to the environment, diseases, and treatments. A comprehensive, recent text has been published which addresses the needs of the neonate. This review will highlight important points in neonatal care.

Thermoregulation

Until they are at least 1 week old, neonatal puppies are unable to generate their own heat through shivering. Instead, they rely on brown fat metabolism and the environment to maintain an adequate body temperature. If their core body temperature falls below 94° F, gastrointestinal stasis will likely occur. Immune function will be further compromised, as well, at lower temperatures, making the neonate more susceptible to septicemia and viral infections. Temperatures are best measured with a rectal thermometer. Normal neonatal temperatures during the first week of life range from 95° and 97° F (35° to 36° C). During the second and third weeks of life, normal body temperatures range from 97° to 100.0° F (36° to 38.2° C).

For most healthy, normal neonates, having an environmental temperature between 85° and 90° F (30° to 32° C) is adequate to maintain normal core body temperatures. Heat sources should be safe and monitored regularly to ensure they are delivering the desired heat. Neonatal incubators or heat bulbs seem to work the best, as heating pads are inconsistent. Relative humidity is also an important component of environmental control to avoid dehydration and respiratory distress. Relative humidity between 55 and 65% seems best for neonates.

Treatment for hypothermia is to warm the neonate slowly back to the normal range. Warming must be done before any attempts to feed the neonate, as gastric ileus is likely to be present in a hypothermic neonate.

Hypoglycemia

Neonates are more susceptible to hypoglycemia since they only have a small store of brown adipose tissue and have limited capacity for gluconeogenesis or glycogenolysis due to the immaturity of the neonatal liver. It is important, therefore, for the neonate to nurse frequently.

Clinical signs of hypoglycemia include failure to nurse, depression, lethargy, stupor, tremors, and seizures. Blood glucose should be measured to confirm the diagnosis. Blood is best obtained from the external jugular vein. Treatment with 5% to 10% dextrose (0.5 to 1.0 g/kg) should be administered slowly over several minutes intravenously. If IV administration is not possible, higher concentrations of dextrose may be applied directly to the mucous membranes (but higher concentrations should never be given IV).

Immune system

Very little (5%) of passive transfer in puppies is acquired through the placenta. Ingestion of colostrum, therefore, is extremely important. The gastrointestinal tract of the neonate will absorb colostral antibodies only during the first 24 hours of life; nursing during this time is critical. If colostrum cannot be obtained, the neonate may be tube-fed serum from the dam during the first 24 hours, or have serum from the dam injected subcutaneously after that time.

Hepatic and renal systems

As alluded to above, the neonatal liver and kidney are not yet fully functional. The neonatal liver lacks complete enzyme pathways, including the P450, reduction, hydroxylation, and demethylation pathways. Nephrogenesis is not completed until the 3rd week after whelping. Drugs that require hepatic or renal metabolism should be avoided, or at least a modified dosing schedule should be followed. Modified schedules, however, have not been delineated for most medications.

Because of the immaturity of the kidneys, the neonate is unable to concentrate urine as an older animal would. Urine may be evaluated by direct collection (cystocentesis is not recommended in neonates) by stimulating the genitalia with a warm, wet cotton ball. Urine should be essentially clear. Yellow urine is a strong indicator of dehydration (note that skin tenting is not a good test for neonatal hydration due to a lack of neonatal subcutaneous fat). Urine specific gravity in neonates ranges from 1.006 to 1.017. After 8 weeks of age, urine specific gravity is essentially within the same range as an adult animal.

Nervous system and mentation

Three different reflexes may be assessed in neonate. The righting reflex is tested by placing the newborn on a soft, warm surface on its back. The neonate should be able to turn itself into sternal position fairly quickly. The suckle reflex is tested by placing a finger in the neonate's mouth. The finger should be warm and free of bad tastes (e.g., disinfectants) in order for the puppy to fairly suckle. The rooting reflex is tested by placing the neonate's muzzle in a ring made of the of the examiner's forefinger and thumb.

In addition, neonatal viability testing, similar to the Apgar scores for human neonates, have been suggested and are included in the following table (found in Chapter 3 of the referenced text):

Parameter	0 points	1 point	2 points
Activity, muscle tone	Flaccid	Some tone in extremities	Active movements
Pulse, heart rate	Absent or <110 bpm	110-220 bpm	>220 bpm
Reflexes when stressed	Absent	Some movement	Crying out
Mucous membranes color	Pale or cyanotic	Slightly cyanotic	Pink
Respiratory rate	Absent	Weak, irregular	>15/minute, rhythmic

Interpretation: Total points 0-3: weak vitality; 4-6: moderate vitality; 7-10: normal vitality

Cardiovascular system

As noted, normal heartrates for neonates are >220 bpm. Heart murmurs of grades I to III/IV are considered normal most of the time and are usually due to functional variability in closures of fetal cardiovascular connections.

Respiratory system

Newborns may have respiration rates as low as 15 bpm, but that will usually increase to between 20 and 30 bpm by the first day of life. Lung sounds should be clear.

Growth

Newborns will usually lose weight in the first day of life, but thereafter should gain between 5% and 10% of their body weight each day. Owners should purchase a digital gram scale and take weights daily on each neonate, keeping accurate records of each growth curve. If a neonate fails to gain weight, it should be taken to the veterinarian. Failure to gain weight is often the first sign of illness and may precede other clinical signs by 16 hours.

Supplemental feedings may be given to neonates safely with a bottle or by tube feeding. It should be established that the neonate is normothermic prior to any tube feeding (see above).

Physical exam

Some parameters have already been discussed (temperature, heart rate, respiration). The mouth should be checked for cleft palate. The abdomen should be palpated for discomfort and umbilical hernia. The skull should be palpated to check for an open fontanelle. The urogenital area should be examined to check for the presence and patency of the anus.

Venipuncture and fluid therapy

For any venipuncture, attempt to access the external jugular vein and use a small gauge catheter (24 g). The catheter can burr easily in the skin, so making a nick in the skin with a 20 g needle is helpful prior to threading the catheter. If IV catheterization fails, an IO catheter may be placed by inserting the catheter in to the proximal femur or humerus using an 18 to 22 g spinal needle or 18 to 25 g hypodermic needle.

Dehydration can be a serious concern in neonates and their fluid requirements are higher than adults. Overhydration, however, is also a concern since the kidneys are not yet fully functional. It is important that fluids be kept warm to avoid inducing hypothermia. A loading bolus of 30-40 ml/kg may be given to moderately dehydrated neonates, followed by a maintenance rate of 80-100 ml/kg/day of warm crystalloids. Dehydration and consequent hypovolemia are serious problems in the neonate and often are caused by diarrhea, vomiting, or lack of nursing.

Sepsis is another serious concern in neonates and can be the result of tail or dewclaw removal or ligation of the umbilicus, as well as gastrointestinal distress. Fluid therapy is key, along with appropriate antibiotic therapy. Use care in choosing an antibiotic that is appropriate for neonates (see Chapter 27 in the reference below).

Laboratory values

The hematocrit of neonates decreases from around 48% at birth to 30% in month-old puppies. Clotting factors are low at birth, but increase after about one week after birth. Liver values are hugely higher in neonates than in adults. Other differences also exist and normal for neonates should be consulted rather than comparing to normal adult ranges.

References

Small Animal Pediatrics. St. Louis, MO: Elsevier Saunders, 2011.