

NEONATE AND PEDIATRIC EMERGENCY AND CRITICAL CARE

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Neonates and pediatric patients can be challenging when it comes to nursing care. Their size, immune system, and how fragile they are, make it difficult to do typical nursing care with them. There are special considerations when it comes to dealing with neonate and pediatric emergencies.

Neonates are considered to be under two weeks old. Pediatric patients are considered to be two weeks to 6 months of age. During this time, these patient's immune systems are still developing and are susceptible to many diseases. Neonates should double their weight within 10 days if they are nursing appropriately. The first 48 hours of the new baby's life are important as it is the time where the mother is producing colostrum. Colostrum is rich with antibodies and are important in developing their immune system. After 48 hours, the neonate is unable to absorb immunoglobulins in colostrum.

Neonates from birth to 7 days should sleep about 90% of the day and are hypothermic based on adult temperature. Their normal temperature should be 96-98 degrees F. After 10 days, neonates should be able to stand, open their eyes, and their body temperature is around 99 degrees F. Around 14 days, Neonates should develop a menace response and pupillary light responses can be assessed around 21 days of age. This is also when they start urinating and defecating on their own and their temperature is around 100 degrees F.

Neonates are unable to maintain their body temperature and can quickly become hypothermic simply by becoming separated from littermates and the mother. Their reflexes have not developed enough to cause shivering and vasoconstriction to help keep them warm. As the neonate grows progressively colder, they will develop bradycardia. If a neonate presents to the hospital with a heart rate normal for an adult, there is a critical problem with that patient. Be aware of neonate temperature normals and do not warm them too aggressively. Accidentally warming a neonate to even 103F can cause stress; ensure that the patient can crawl away from the heat source if needed. Hypothermia in neonates can lead to ileus, so do not feed a hypothermic baby, always warm them to an appropriate temperature then attempt to feed them. This is an important point to stress with owners who are bottle feeding at home, as ileus can lead to regurgitation and aspiration pneumonia.

Neonates and Pediatric patients have a higher fluid need than adult patients due to the kidneys being immature, decreased body fat, a higher metabolic rate and increased respiratory rate. Their bodies are made of approximately 75% water, and they have large evaporative losses through the skin. Fluid Neonates and pediatric patients can become quickly dehydrated which leads to an emergency. Unfortunately, it is difficult to assess hydration status because skin tent is always present, and their heart rate will not increase. Their urine will be dilute if they are hydrated.

Neonates are born with hematocrits around 40% which declines over 2 to 6 months as the hemoglobin gets replaced by mature hemoglobin. Movement from the extracellular space into the vascular space also contributes to the decrease in hematocrit. White blood cell count is elevated in neonates, and growing puppies will have increased hepatic levels (AlkPhos, GGT) and on a blood smear, puppies and kittens will normally have polychromasia and nucleated red blood cells. Until 8 weeks of age the kidneys are still developing which results in a low specific gravity being normal. A specific gravity of 1.006 - 1.017 is normal, as well as dilute urine. Glucosuria is also normal in puppies and kittens less than 8 weeks.

Neonates also have an immature liver at birth. This leads to a higher incidence of hypoglycemia. Vomiting, hypothermia, diarrhea and infection will all quickly contribute to hypoglycemia. Once a neonate is hypoglycemic, they are lethargic, ataxic, have decreased suckle reflex, and become hypothermic. Hypoglycemia must not be prolonged due to possible brain injury and death.

Neonatal respiratory systems are also developing as they grow. Neonates require a higher oxygen requirement; therefore neonates breathe faster versus an adult. Hypoxia is the number one cause of death in neonates due to their bodies not being able to detect or respond to the hypoxia. If a neonate is exposed to bacteria, they can become septic due to respiratory infections.

If neonates present to the hospital and diagnostics performed, nurses must know that normal blood chemistry values and behavior of organ systems of babies will be different than adult dogs and cats. Nurses need to be aware of these differences in order to adjust nursing care and be alert to problems. Blood draws should be efficient and only drawn what is needed. PCV/TS in puppies and kittens starts high, then decreases until 4 weeks of age, and then increases to adult normal by 6 months of age:

PCV	Birth	~4wks	6 months
Puppies	47%	29%	37-55%
Kittens	35%	27%	30-45%

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In patients less than 4 weeks of age, their ability to absorb, metabolize, and eliminate drugs is not the same as in adult patients. Drug doses may need to be increased and time between doses decreased in order to ensure appropriate plasma levels are maintained. Care must be taken with drugs that can pass the blood brain barrier as neonates have a more permeable blood brain barrier. Drugs that undergo enterohepatic circulation can disrupt the normal bacterial colonization of the gastrointestinal tract leading to diarrhea and more complications. β -lactam antibiotics such as ampicillin and amoxicillin are considered safest for antibiotic use.

Tetracyclines can lead to developing skeletal changes and quinolones can cause cartilage lesions in developing puppies. If these antibiotics are needed, MIC cultures should support their use.

If newborn puppies or kittens do not nurse immediately, become ill and cannot nurse, or are not getting enough to eat (too many in the litter, weak) it is up to humans to intervene and supply nutrition. Commercial milk replacer should be used, and owners can be directed to multiple veterinary websites for information on how often and how much to feed. The stomach capacity of a puppy or kitten four weeks of age and under is 50 to 80ml/kg daily; the amount should be divided into feedings every 2-4 hours. Babies can be weighed daily to measure their progress – puppies should gain 1g/pound of anticipated adult body weight per day, and kittens should gain 7-10g/day. If possible, these babies should be fed with a bottle and encouraged to nurse as well. If the neonate is not suckling at all, an orogastric tube is easily passed and the liquid diet can be fed via the tube.

Parasitism is very common in neonates and pediatrics. They can be acquired by fecal-oral transmission or transplacentally. Parasitism can be fatal if left untreated. It can cause dehydration, anemia, diarrhea, impaction, or neurologic disease.

Puppies are susceptible to parvovirus if they have not been vaccinated or have been under vaccinated. These puppies require intensive nursing care. They can quickly become hypoglycemic, hypovolemic, hypothermic, and hypoxic from the constant loss of fluids and not enough nutrition. Nutrition can be supplemented via a nasoesophageal or nasogastric tube via trickle feeding. Technicians must keep these patients clean and dry and adhere to proper infectious disease protocols and personal-protective equipment.

Fading puppy/kitten syndrome is a condition where the clinical signs are very unclear. The patient does not gain weight, becomes weak, and over-time, dies. There is not a clear cause of fading puppy/kitten. Some clinicians believe that it is due to congenital defect of hypoxia.

Neonatal isoerythrolysis occurs when a female cat with Type B blood breeds with a Type A tomcat. When blood Type A or AB kittens are produced, they are at risk of hemolysis from the mom's antibodies in the colostrum. Hemolysis leads to anemia, icterus, and pigmenturia. They eventually die from disseminated intravascular coagulation.

Septicemia can occur in neonates. This can be caused by bacteria entering the blood stream in some way. This can be via the GI tract, respiratory tract, urinary tract, skin, umbilical cord, or when a puppy's tail is docked.

When drawing blood from these patients, it is important to remember a few points. The jugular is the most reasonable vessel. Do not collect more than 10% of the patient's blood volume in a 24 hour period and try to not use alcohol because it can cool the patient down too much.

If IV fluids or medications are needed to be given, IV catheterization in the jugular vein is appropriate. You can also introduce an intraosseous needle into the femur until you are able to get an IV catheter in.

Even with healthy puppies and kittens, client education is top of mind in ensuring a healthy first year and a strong immune system. The American Animal Hospital Association has published vaccine guidelines for both young and adult cats and dogs and owners should be encouraged to research, in conjunction with education from the veterinary team, appropriate vaccines and the importance of boosters. Core and non-core vaccines are defined and may differ according to geographic location.

References/Suggested Reading

1. Lopate, Cheryl. "The critical neonate: under 4 weeks of age" Clinician's Brief November 2009
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3. Lee, Justine A; Cohn, Leah A. "Pediatric critical care part 2: monitoring and treatment" Clinician's Brief February 2015
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