

Pediatric Emergencies

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The term pediatric usually refers to the first 12 weeks of life in dogs and cats. The neonatal stage is from birth to 2 weeks of age, infant from 2 to 6 weeks of age, and juvenile from 6 to 12 weeks of age.

Healthy neonates are active and have good muscle tone. Crying is normal in response to pain, cold, hunger, or loss of contact with the mother; however, crying should not continue longer than 20 minutes. Hyperemic mucous membranes are normal until day 4 to 7. Renal function does not mature until about 8 weeks of age although by 4 weeks of age they are able to excrete drugs at the same rate as adults. By 6 weeks of age hepatic metabolizing enzyme systems are functioning at nearly adult levels.

Environment

Neonates lack the ability to regulate their temperature well and easily become hypothermic. If they are separated from the mother they should be placed in an incubator that is kept at 29-32C (84-90F). Humidity should be kept between 55-65%. External warming devices such as hot water bottles and heating pads can be used but the neonate should be able to get away from the heat and the source should be covered in a towel or blanket to prevent burns.

Oxygen

Neonates may require oxygen supplementation. This can be provided by placing the neonate in an oxygen-rich environment or by placing a small nasal catheter (intravenous catheter in very small patients).

Fluid Therapy

Intravenous or intraosseous fluids are preferred over subcutaneous or intraperitoneal fluids. Intraosseous access is performed using hypodermic needles or commercial intraosseous needles. Commonly used access points include the greater tubercle of the humerus and trochanteric fossa of the femur. The tibia can also be used. If only rehydration and maintenance fluids are indicated then fluids can be given into the gastrointestinal tract if it is functional. A long intravenous catheter can be used as a nasogastric tube to deliver fluids. If the patient is not eating the fluid will need to be supplemented with dextrose at concentrations between 2.5% to 10% to maintain euglycemia. Maintenance fluid requirements are between 2-4 ml/kg/hour for pediatric patients.

Blood Transfusions

Blood transfusions may be required to treat parasitic infestations, trauma, or rodenticide coagulopathies. They should be given intravenously or intraosseously. The same rules apply to transfusion medicine in pediatric patients as in adult patients. As a last resort intraperitoneal transfusion can be given; however, only about 70% of the blood will be absorbed over 72 hours.

Nutrition

Nutrition is key in the treatment of neonates since they lack sufficient glycogen stores to maintain glucose levels for extended periods of time. Hypothermic neonates should not be fed until they are warm since hypothermia leads to ileus and poor digestion, often causing curdling of milk in the stomach. The patient should be weighed on a daily basis and should gain approximately 10% of its body weight daily. A goal of 2.5-4 g/kg of anticipated adult weight also is an acceptable estimation.

Hypoglycemic neonates should be treated with intravenous or intraosseous dextrose (1-2 ml/kg of 25% dextrose). Dextrose given orally is rarely effective at reversing a crisis.

Milk replacers should be used until weaning (which can be done as early as 2.5-3 weeks of age). Patients can be fed with nursing bottles or eye droppers. Some nursing bottles have nipples that require the neonate to generate a lot of negative suction. Expanding the hole a little using a hypodermic needle will help the weaker patient nurse more effectively. If the patient does not have bowel sounds oral feeding should proceed very slowly. If the patient is too weak to nurse tube feeding may be required.

Tube feeding can be accomplished with an orogastric tube (short term) or with nasogastric tubes (longer term). For orogastric feeding a red rubber or other infant feeding tube approximately 5-10 Fr in size is premeasured from the tip of the nose to the last rib. The tube can be cut short if necessary. A small amount of water soluble gel is used to lubricate the tube and the tube is passed with the neck held in a flexed position. The gag reflex does not develop until approximately day 10 so the tube always should be checked for proper placement prior to infusing liquids or food. This can be done by aspirating to check for air or gastric contents or taking a radiograph. Caution should be exercised in interpreting results of injecting a small amount of air and listening over the stomach with a stethoscope, or injecting a small amount of sterile saline or water and observing for a cough as this may not confirm the tube is in the right location. Once the feeding has been completed the tube should be kinked and then withdrawn. This will help prevent liquid from being aspirated during tube removal.

The stomach capacity is approximately 50 ml/kg. Initially feedings may need to start at 1-2 ml/kg every 1-2 hours. This can progress to larger volume feedings every 4 hours. Gastric overdistention should be avoided since this will lead to delayed emptying, nausea, and sometimes compromised ventilation. Feedings should always be done at body temperature.

If diarrhea is present in the neonate milk replacer may need to be diluted 1:1 with an oral electrolyte solution.

Analgesia

Pain kills. No matter how small the patient analgesics should be provided. Opioids can be used safely in pediatric patients. However, it should be kept in mind that the effects of the drugs may be much more magnified in the pediatric patient especially if the animal is sick or injured. Doses should be reduced significantly (20-25% of normal) and titrated upwards.

Antibiotics

Due to an increase in body water neonates and infants may need a higher dose and a longer dosing interval of drugs such as penicillins, cephalosporins, and aminoglycosides. Because they have lower albumin levels, drugs that are protein bound may be more active in pediatric patients. Tetracycline and trimethoprim-sulfonamide antibiotics should be avoided. Fluoroquinolone antibiotics also should be avoided since they can cause a developmental arthropathy.

Miscellaneous Medications

Vitamin K1 may be indicated in any sick neonate less than 48 hours old or any neonate showing signs of bleeding since they have decreased thrombin levels.

Diagnostics

A drop of blood retrieved from an intravenous or intraosseous catheter or from a jugular stick can be placed on a portable glucometer reagent stick. Larger blood samples should be taken from the jugular; however, the total blood volume of a 300g patient may be less than 30 ml and, in very small animals iatrogenic anemia is a possible complication of blood sampling, especially if the patient is anemic to begin with.

Radiographs of pediatric patients are indicated as for adult patients. Abdominal radiographs may be difficult to interpret due to the lack of body fat.

Specific Conditions

Sick neonates often cry incessantly until they become too weak. Mucous membranes may be pale or cyanotic. Dehydration is not uncommon secondary to lack of intake or disease causing increased losses and can be difficult to assess due to the lack of body fat. Mucous membranes should be moist. Due to their increased maintenance fluid requirements it is often easy to underestimate their fluid needs.

Diarrhea is common in pediatric patients. This can be due to dietary changes, maternal disease, and infections (virus, bacteria, parasites). Bowel sounds may be absent in these patients which often is consistent with generalized gastrointestinal dysfunction. If severe enough this can lead to problems such as prolapsed rectum and intussusception.

Whelping and Cesarean Section

Hypoxia and trauma can develop during whelping secondary to early placental separation, entrapment in the birth canal, and difficulty in passage through the birth canal. Fortunately these complications are not common. More commonly problems occur during delivery of puppies or kittens during a cesarean section. In order to minimize problems the hospital should be ready to deal with the arrival of the neonates. An incubator or box lined with a heating pad or hot water bottles should be made ready. Plenty of sterile (ideally) towels should be available to dry off the neonates. Oxygen should be available as well as small masks and an AMBU bag. Over-the-needle catheters (14-20 ga) can be used as tracheotomy tubes to provide oxygen and assist ventilate the newborns. The adaptor from 2.0-3.5 mm endotracheal tubes fits onto the end of the catheter so that an AMBU bag can be attached to aid in resuscitation. Suction may be necessary in order to be able to remove meconium and other secretions from the oropharynx and sometimes from the trachea. An ear bulb syringe can be used if mechanical or electric suction is not available. Extra hemostats and suture should be available to tie off the umbilicus which should be tied about 0.5 cm from the body wall.

If an animal is delivered by cesarean section the surgeon can administer naloxone to reverse any of the opioid effects present from the maternal circulation. Naloxone also appears to have other stimulatory effects in the brain. Naloxone can be given sublingually but uptake is unpredictable and ideally injections should be given into the umbilical vein. Doxapram is only useful if the animal is breathing and can lead to a worse outcome if the patient is not breathing. The neonate should not be swung back and forth between the legs since this can cause traumatic brain injury.

Neonates should be encouraged to nurse as soon as the bitch or queen is alert.

Congenital Abnormalities

A variety of congenital abnormalities can lead to dysfunction of multiple organ systems and the reader is encouraged to consult other texts for detailed information. Serious abnormalities often lead to mortality in the early hours or days of life. Some abnormalities may not show up immediately. These include problems such as atresia ani and megaesophagus secondary to a persistent right aortic arch (which may not be evident until the animal is weaned). Cleft palate can lead to nursing problems, swallowing disorders, and aspiration pneumonia. Isolated swallowing abnormalities can lead to aspiration pneumonia and an unthrifty neonate. Other neurologic abnormalities can lead to abnormal ambulation.

Fading Puppy/Kitten Syndrome

Fading puppy or kitten syndrome can be caused by malnutrition, hypoglycemia, and septicemia (see below). Common signs associated with hypoglycemia include weakness, collapse, stupor, and hypothermia. Tremors and seizures can be seen but often are absent. Intravenous or intraosseous access should be established immediately and 1-2 ml/kg of 25% dextrose infused. Vitamin B should be supplemented whenever glucose is used to control seizures since vitamin B is required for aerobic metabolism of glucose. If a drop of blood is retrieved it can be used for blood glucose determination. If the puppy or kitten responds or if hypoglycemia is diagnosed the animal should be placed on a constant rate infusion of 5-10% dextrose until it is eating normally.

Infection

Many neonatal infections caused by viruses or bacteria can be rapidly fatal. As the healthy puppy or kitten becomes older their ability to fight off infection improves; however, aggressive supportive care may be needed to improve the chance of survival. Particularly susceptible times for viral infections include the neonatal period and the juvenile period when the maternal antibody protection has worn off but the protection from vaccination is not yet effective.

Neonatal Conjunctivitis

Neonatal conjunctivitis results from accumulation of purulent exudate behind the eyelids before they open. The eyelids should be separated to encourage drainage. A scalpel blade is rarely necessary and should be used with extreme caution due to the possibility for damaging the eyelids. If the eyelids are very stuck warm compresses will often cause them to separate. Gentle cleansing should be performed using warm compresses, saline lavage and a broad spectrum topic antibiotic drop or ointment should be instilled.

Umbilical Infection

Umbilical infections can develop in the first 4 days of life. They are often associated with the neonate's environment. A streptococcal infection is most likely. Any abscess should be lanced and drained and the umbilicus should be treated with warm compresses and systemic antibiotics. Fluid therapy and other supportive care may be indicated.

Neonatal Septicemia

Neonatal septicemia can be associated with staphylococcal, streptococcal, E. coli and Pseudomonas infections. Lack of colostrum intake and maternal infections (mastitis, metritis) can lead to the development of septicemia. The neonate should be separated from the mother and the bitch or queen should be treated for any infection. Intravenous fluids, antibiotics, nutritional support, and supportive care are key if the neonate is to survive.

Toxic Milk Syndrome

Mastitis and metritis in the bitch or queen can lead to toxic milk syndrome which is characterized by signs of bloating and green diarrhea. The neonate should be treated with fluids and a milk replacer until the infection in the bitch or queen has resolved.

Parasites

Intestinal parasites can start to become a problem as early as 2-4 weeks of age. Some parasites can be transmitted transplacentally and some can be transmitted in the milk. Most parasites will cause vomiting, diarrhea, and lack of appetite. Hookworms can cause significant anemia as can fleas. Pyrantel pamoate can be used as early as 2-3 weeks of age. Giardia is treated with metronidazole or fenbendazole. Coccidiosis is common in infant and juvenile patients and is often found in addition to other infections. It is treated with sulfadimethoxine. External parasites can be treated with pyrethrin once the animal is old enough. Label directions should be followed closely. Flea combs can be used in patients too young for insecticides. Cleaning the environment is essential in the control of parasitic infections.

Juvenile Cellulitis

This is an idiopathic disease that occurs between 3-16 weeks of age. Facial swelling, lymphadenopathy, fever, and anorexia are hallmarks of the disease. Deep pyoderma may be present. Immunosuppressive doses of prednisone are required until clinical signs resolve. Antibiotics are recommended and are essential if a deep pyoderma is present. Topical antibacterial shampoos also may be needed.

Trauma

Trauma in early life can be caused by the bitch or queen lying on or stepping on the neonate. This can lead to head trauma, pulmonary contusions, and fractures. Later in life trauma can lead to lacerations, head injury, and fractures most commonly. Treatment should be directed to the specific injury. Fortunately most young patients

have an incredible ability to heal.

Electric Cord Injury

Electric cord injuries can be seen in juveniles as their natural curiosity leads them to chew on objects. The electrical injury causes oral burns, which are usually seen on the tongue and commissures of the lips, as well as neurogenic pulmonary edema. Supplemental oxygen should be provided until the patient is breathing normally and eating well. A dose of furosemide may help relieve the pulmonary edema. Bronchodilators also may be useful. An esophagostomy tube may be needed if several oral burns are present. Cage rest is indicated until the pulmonary edema has cleared which generally takes 48-96 hours.

Foreign Body Ingestion

Juvenile patients often ingest foreign materials. Inducing vomiting may be helpful in removing objects still in the stomach although this should be done with care if the object is sharp or large since it may cause lacerations or obstruction respectively during emesis. Other material will require endoscopic or surgical removal.

Intussusception

Chronic diarrhea (viral, bacterial, parasitic, dietary indiscretion-related) can lead to intussusception. Patients with chronic diarrhea should be palpated 3-4 times daily for the presence of a tubular structure that may indicate an intussusception. This is a surgical emergency. The intussusception is reduced if possible, nonviable intestine should be resected and, enteroplication of the intestine should be performed to prevent recurrence. Even with enteroplication recurrence is possible – especially if the cause of the diarrhea is not diagnosed and treated appropriately.

Prolapsed Rectum

A prolapsed rectum is not uncommon with severe diarrhea. A fecal exam is always warranted to help determine the underlying etiology. If the rectum is prolapsed it should be manually reduced. The blunt end of a pencil should be placed about 1 cm into the rectum and a pursestring should be placed and tied tightly around the pencil. Once the suture is tied the pencil is removed. This ensures the pursestring is tight enough to prevent a recurrence of the prolapse while ensuring the animal can still defecate.

References available on request.