Proceeding of the NAVC
North American Veterinary Conference
Jan. 8-12, 2005, Orlando, Florida

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URINARY PROBLEMS IN THE EQUINE NEONATE

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The transition from fetus to neonate includes a variety of fascinating changes in anatomy and function of the urinary system. Errors in this adaptive process can result in serious physiologic disturbances that require rapid diagnosis and treatment in order to achieve a successful outcome. These conditions include uroperitoneum, patent urachus, and infection of the umbilical remnants.

UROPERITONEUM

Uroperitoneum is most commonly the result of a ruptured bladder, but other defects of the urinary system can produce the same clinical result. These include ruptured urachus, urachal abscessation, and ruptured ureters. Bladder rupture is typically associated with excessive compression of the abdomen during parturition, and is most common in males because of the additional resistance presented by the male urethral anatomy to voiding of the bladder when pressurized. Congenital defects in bladder wall can also contribute to rupture, which is usually located along the dorsal and dorsocranial aspect of the bladder due to an inherently thin wall in that area. Ruptures have also been reported in the ventral aspect of the bladder, but rupture of the urachus is the second most likely site of urine leakage into the abdomen. Finally, infection of the urachus or generalized sepsis can lead to urinary tract rupture in foals that have been hospitalized for a variety of unrelated conditions.

Cystorrhexis is usually recognized as a clinical entity between 1 and 5 days after foaling, and clinical signs include depression, lack of appetite, abdominal distention, and mild to moderate colic pain. Foals usually have elevated heart and respiratory rates, and a fluid wave can be ballotted across the abdomen. Affected foals typically strain to urinate, dribble urine, and have a stretched-out stance. However, foals with ruptured bladders are often able to void urine normally, although frequency of urination may be increased and the volume decreased. Scrotal distention with urine can occur, and should not be confused with a scrotal hernia.

Once suspected based on clinical signs, the diagnosis of uroperitoneum can be confirmed with a combination of peritoneal fluid analysis, blood analysis, dye studies, contrast radiography, and cystoscopy. Peritoneal fluid us usually abundant in volume, clear, slightly yellow, and with a specific gravity of 1.008 or less. Foals typically have marked hyperkalemia, hyponatremia, and hypochloremia, as well as dehydration and metabolic acidosis. These electrolyte abnormalities are exacerbated but the high concentration of potassium and low concentration of sodium in mare’s milk, and foals that are being given balanced electrolyte solutions for other reasons may not have dramatic electrolyte changes. Serum to peritoneal creatinine ratio determination is confirmatory for this condition when greater than 1:2. Blood urea nitrogen concentration is not consistently elevated, and by itself is a test of limited diagnostic usefulness. Infusion of sterile methylene blue or fluorescein into the bladder of affected foals can be detected shortly thereafter in the abdominal fluid, and infusion of a sterile radiographic contrast agent into the bladder can be visualized free in the abdomen with a lateral abdominal radiograph. Ultrasound examination of the abdomen is also an extremely useful tool in the diagnosis of uroperitoneum. Free peritoneal fluid is easily seen, urachal defects are usually apparent, and tears in the bladder result in bladder collapse that give it a distinct “U” shape. Ultrasound examination can also demonstrate pleural effusion that may be contributory to clinical signs of dyspnea, and which requires correction prior to general anesthesia.

Because of the metabolic disturbances that accompany uroperitoneum, affected foals should be stabilized medically before attempting surgical repair. Hypertonic saline in concentrations of 1.8% to 2.5% is preferred over isotonic fluids because of hyponatremia and hyperkalemia. Abdominal drainage is indicated to relieve abdominal distention, improve anesthetic ventilation, and remove creatinine and potassium, but must be performed concurrently with volume expansion to correct dehydration. Peritoneal fluid drainage can be accomplished temporarily with a teat cannula, and maintained with an indwelling Foley catheter that is attached to an empty intravenous fluid bag to prevent contamination of the abdomen.

Of the associated electrolyte abnormalities, hyperkalemia is the most life threatening because of the potential for induction of cardiac arrhythmias under general anesthesia, but reaching normal serum potassium values with medical management alone is difficult, and efforts towards that end may unnecessarily delay surgical correction of the primary problem. Administration of glucose, calcium gluconate, and insulin will assist in decreasing serum potassium, which can hopefully be reduced to less than 5.5 mEq/L prior to surgical intervention.

A midline celiotomy and cystorrhaphy is indicated for affected foals after they have been stabilized. A flexible andatraumatic urinary catheter should be sutured in place after induction to insure urinary outflow and allow intraoperative bladder lavage. In males, the prepuce should be thoroughly cleaned, then sutured closed to reduce contamination during surgery. The umbilicus and urachal remnants should be removed and cultured in all patients, and in males the skin incision is made to one side of the prepuce, which is then reflected in order to allow for a caudal ventral midline incision. The wound margins around the tear should be debrided in cases with cystorrhexis, and the defect is closed in 2 layers. The first layer can be closed with simple interrupted sutures or a simple continuous pattern, followed by a second layer using an inverting continuous Cushing pattern. Ideally, sutures should not penetrate the lumen of the bladder, and synthetic absorbable 2-0 or 3-0 material on an atraumatic tapered needle (SH) is preferred. After completion, the repair should be pressure tested for leaks, and the abdomen is thoroughly lavaged and suctioned. The abdominal incision is closed routinely in 3 layers using continuous suture patterns and synthetic absorbable suture material of appropriate size. Great care should be taken to minimize trauma to exposed intestine, which should be kept moist and in the abdominal cavity with lap sponges or temporary application of towel clamps across the incision.

In spite of the potential for peritonitis secondary to uroperitoneum, abdominal adhesions are rare following uncomplicated cases of ruptured bladder. Generally the urethral catheter is removed soon after surgery because of the potential for complications associated with ascending infection, but some surgeons advocate maintaining the catheter for several days to help minimize stress on the surgical repair.
For foals with uncomplicated uroperitoneum associated with cystorrhexis the prognosis is usually considered to be quite good, although failure of the bladder repair has been reported. If the location of the tear is elsewhere than the bladder the prognosis for recovery decreases, especially if the foal shows concurrent signs of septicemia.

PATENT URACHUS

The fetal urachus serves as a conduit for urine from the fetal bladder to the allantoic cavity, and normally closes completely at parturition. The condition of patent urachus occurs when this closure does not take place, and is usually recognized shortly after delivery. The pathogenesis of patent urachus is either excessive traction on the umbilicus during parturition, straining by the foal, or secondary to the development of omphalophlebitis. It is associated with septicemia and the development of septic arthritis and septic phylitis in young foals.

Clinical signs include dripping or streaming of urine from the umbilicus, but sometimes only dampness around the navel is noted. Patent urachus may not occur until days following birth however, and in this circumstance is often associated with other abnormalities such as septicemia or conditions which stimulate abdominal straining in the foal. Foals with patent urachus will often strain to urinate and posture for urination, suggesting there may be pain or inflammation associated with the condition. Conservative treatment includes broad spectrum antibiotics, repeated navel disinfection with dilute chlorhexidine, and oral administration of phenazopyridine hydrochloride to anesthetize the urinary tract epithelium. Cauterization of the urachus has been recommended as a treatment for patent urachus in the past, but many clinicians now consider this therapy too aggressive. Many cases of patent urachus will resolve spontaneously over a period of 1-3 days following foaling, and topical application of mild irritants like undiluted povidone iodine or chlorhexidine may stimulate urachal swelling, inflammation, and resultant closure. If conservative management is unsuccessful after 4-6 days of treatment then surgical resection of the urachus and associated umbilical vascular elements is recommended. The surgical technique is similar to that for umbilical remnant infections which is described below.

UMBILICAL REMNANT INFECTIONS

The umbilicus is a commonly accepted source of bacterial entry in the neonate, and infection of the urachus alone (omphalitis) or in combination with the umbilical vessels (omphalophlebitis) is a relatively common clinical entity. Clinical signs can include local heat, pain, swelling, and discharge, but often there are no external signs of infection, and problems with the umbilicus are suspected because of fever, septic arthritis/phylitis, or other signs of septicemia.

Ultrasonography is the diagnostic tool of choice for this condition. A 7.5-MHz linear probe and standoff are preferable for evaluation of the umbilical remnants which is usually done standing, but reliable information can also be obtained with a 5.0-MHz probe typically used for reproductive work. Usually one or more structures are larger than normal, and focal abscess or hematoma formation, gas, and edema may also be evident. Normal measurements of umbilical structures are available in the literature for foals from birth to 1 month of age, but mean diameters (+/-1 standard deviation) for the umbilical vein is 0.61+-0.20 cm cranial to the navel, 0.52 +/-0.19 cm midway between the navel and the liver, and 0.6 +/- 0.19 cm at the liver. The urachus and umbilical arteries have a mean total diameter of 1.75 +/- 0.37 cm at the bladder apex, and the umbilical arteries along the sides of the bladder have a mean diameter of 0.85 +/- 0.21 cm.

Medical management of omphalophlebitis has a high success rate in patients where the lesion is localized and small. Non-surgical treatment should also be considered in foals who are high-risk candidates for general anesthesia, or where economics preclude surgery. Broad spectrum antibiotics are indicated, and improvement in the ultrasound image and decrease in plasma fibrinogen concentrations should be expected within 5 days. However, pursuit of medical management prolongs the amount of available time for bacteremia to occur prior to resolution, and may lead to additional problems with septicemia and joint infections. Surgical removal is preferred by many clinicians because it offers the ability to completely remove the infected tissue(s). The approach is similar to that used for ruptured bladder and patent urachus, but the cranial aspect of the incision is usually longer, and may extend to the xyphoid cartilage in foals with umbilical vein infections. Care should be taken during the procedure to avoid contamination of the abdomen with infected contents of the umbilical remnants, and thorough lavage of the abdomen at the conclusion of the procedure is indicated. Prognosis is dependent on the extent and severity of other infections that may be associated with the primary problem.