

CLINICAL PEARLS: EQUINE INTERNAL MEDICINE  
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The term 'clinical pearls' refers to small bits of free-standing clinically-relevant information, based on observation and experience. These 'pearls' are part of the vast domain of experience-based medicine and are meant to supplement evidence-based medicine. Three common qualities of the veterinary team make clinical pearls appealing: we enjoy problem solving, learning from case-based instruction, and we value a take-home point. The aim of this presentation is to share tips and techniques for working through a few common and some not so common internal medicine cases.

Case 1

10-hour old Arabian colt, gestation 315 days, born unattended on large breeding farm. Colt was found standing and nursing with a dry haircoat in the morning. He was born in a small dirt paddock, as his birth was not anticipated for another two weeks by the farm. Evaluation was requested. Laboratory abnormalities were detected in the absence of any clinical signs of disease or physical exam abnormalities. Interpretation of laboratory values in neonatal foals is essential to developing an appropriate plan. Typically, adult reference ranges are used for both in-clinic and reference laboratory reports. The reader is referred to 2015 AAEP Proceedings "How To Interpret Common Hematologic and Serum Biochemistry Differences Between Neonatal Foals and Mature Horses", by Dr. Michelle Barton. An excerpt from this publication is below:

HOW-TO SESSION: CLINICAL PATHOLOGY

Table 1. Common Unique Differences in Equine Neonatal Clinical Pathologic Parameters Relative to Adult Horses

Parameter	Interpretation Relative to Adult Reference Ranges
Packed cell volume	Lower for first few months
Mean corpuscular volume and mean corpuscular hemoglobin concentration	Lower for first few months
White blood cells	Variable, but tend to be the same or slightly greater. Lymphopenia or lymphocytosis is not uncommon.
Prothrombin and activated partial thromboplastin times	Same or longer for first few days
Fibrinogen concentration	Lower for first few days
Fibrin degradation products concentration	Greater for first two weeks
Total serum protein concentration	Lower for four to six weeks
Serum globulin concentration	Lower for four to six weeks
Creatinine concentration	May be greater for first 48 hours, then drop below adult values
Blood urea nitrogen concentration	Initially the same at birth, but may drop below adult values during first few months
Glucose concentration	Same or greater during first month
Triglyceride concentration	Same or greater during first several months
Total bilirubin and unconjugated bilirubin concentrations	Greater during the first 2 weeks of life
Gamma glutamyltransferase activity	May be slightly greater for first 2 weeks
Alkaline phosphatase activity	Greater during first year
Serum bile acids concentration	Greater during first 6 weeks
Phosphorus concentration	Greater during the first year
Creatinine phosphokinase activity	May be lower during the first year
T <sub>3</sub> and T <sub>4</sub> concentrations	Greater than adults for first year
Cortisol concentrations	Initially greater at birth, then often falling below the adult mean during the first few weeks

Ultrasound of the umbilicus

Navel ill, or omphalitis, is a common infection in foals 6 weeks of age and younger. The external portion of the umbilical remnants may be swollen or moist, or it may appear normal,

rendering gross appearance of the stump minimally useful in diagnosing navel ill. Sonographic evaluation of the umbilicus is recommended for all foals with palpable umbilical stump abnormalities, bacteremia, septic arthritis, septic phylitis, pneumonia, fever of unknown origin and elevations in white blood cell count and fibrinogen of undetermined origin. Because the umbilical structures lie close to the body wall in the caudoventral abdomen, ultrasonography is easily performed in young foals. After 8 weeks of age, the structures regress toward the pelvic brim and become difficult to visualize.

The internal umbilicus is comprised of four umbilical remnants: the umbilical vein, paired umbilical arteries, and the urachus. The umbilical vein provides afferent blood from the placenta to the fetus, and courses cranially from the external stump to the liver. The umbilical vein atrophies over time and becomes the falciform ligament of the liver. The umbilical arteries provide efferent blood flow from the fetus to the placenta and course caudally from the stump to the bladder. The arteries course along the sides of the bladder, eventually becoming the round ligaments of the bladder. The apex of the bladder is connected to the allantoic cavity by the urachus in fetal life.

Foals can be positioned in lateral recumbency or held standing for ultrasound of the umbilicus. Sedation may be required in some foals, usually midazolam (0.1mg/kg IV) or butorphanol (0.05 mg/kg IV). Clipping the hair on the ventral midline from the xiphoid to the inguinal region allows for good contact between the probe and the skin. Ultrasound coupling gel is applied to the probe and/or the region of interest. A 5.0 MHz or greater linear array transducer is best for scanning the umbilicus. The depth is set at 6cm, given the superficial location of the umbilical structures. Power and gain are adjusted as needed to provide a clear image in the near field.

Holding the transducer perpendicular to the spine immediately cranial to the umbilical stump, the umbilical vein is visible 1-2 cm deep to the skin surface. This image is a cross sectional view of the umbilical vein. It appears as a thin walled ovoid structure. Following the vein cranially to the liver in this plane, measurements are normally 0.5-1.0cm diameter. Larger foals will have larger internal structures (1.0-1.3cm diameter) and smaller foals may have tiny structures (0.3-0.5cm diameter). The umbilical vein is typically largest just cranial to the umbilical stump and near the liver. The umbilical arteries are imaged caudal to the external stump, also 1-2cm deep to the skin surface. The right and left umbilical arteries appear as thick-walled vessels and may be asymmetrical in size in normal foals. Normal diameter of the umbilical arteries in a neonate is less than 1.3cm. The arteries may pulsate in the first day post-partum and they may have an echogenic center if filled with clotted blood. Just cranial to the apex of the bladder, the arteries are imaged together with the urachus. Collectively, these structures at this location should measure 2.5cm in diameter or less. The arteries diverge along the lateral aspects of the bladder and are measured separately at this level, disappearing at the caudal aspect of the bladder. The urachus extends from the umbilical stump to the apex of the bladder but is often collapsed and difficult to image.<sup>1</sup> When filled with fluid, it is easily recognized as abnormal. A valuable view of the urachus is made in long section at its attachment to the bladder at the apex. In the case of a patent urachus, communication between the bladder and the urachus is imaged.

The external umbilical stump is imaged by holding onto the tip and scanning along its length in both short and long axis planes. Small fluid pockets which may be unrecognizable grossly are discerned sonographically. Hyperechoic flecks within the tissue or within a fluid pocket indicate gas bubbles, consistent with anaerobic infection. Size standards have not been established for the umbilical stump as there is considerable variation in size among various

breeds. However, scanning the stump is a valuable portion of the umbilical ultrasound and should not be overlooked.

Infection of the internal umbilical remnants results in sonographic changes that have been well correlated with surgical findings. Enlargement of the structures occurs with infection, but because size variation exists among foals, more specific sonographic abnormalities must be used in many cases to discern infection. Intraluminal distension with hypo- or hyperechoic fluid may be seen. The presence of small gas echoes suggests anaerobic infection. Blood clots from traumatic foaling or inappropriate tearing of the umbilical cord may be indistinguishable from infection. For this reason, ultrasound findings should be correlated with history, clinical signs, and laboratory data.

#### Case 2

24-hour old Arabian colt, normal gestation & attended parturition, normal initial labwork, noted to exhibit tremors when ambulatory in stall. Cerebellar abiotrophy (CA) is a genetic neurological condition almost exclusively found in the Arabian breed. Rarely the condition is seen in breeds which have use Arabians in their foundation breeding stock. These breeds include Danish Sport Horse, Bashkir Curly, Trakehner and Welsh Pony. Breeding experiments suggest a recessive mode of inheritance, meaning carrier horses exhibiting no clinical signs will produce an affected foal 25% of the time when bred to another carrier. Clinical signs typically appear between six week and four months of age, ranging from mild to severe. Mildly-affected foals exhibit "intention tremor" of the head only, when moving toward a goal (i.e., moving toward the dam, looking at something of interest). Severely affected foals exhibit forelimb stiffness and marked ataxia and may fall when startled. The foal in this case exhibited moderate signs at 24 hours of age, which is unusual. Hair and blood samples submitted to UC Davis Veterinary Genetics Laboratory confirmed the CA status of this foal. Genetic testing of breeding animals with Arabian ancestry is recommended to avoid producing CA-affected foals.

#### Case 3

36-hour old Thoroughbred filly, normal gestation & attended parturition, IgG>800 mg/dL at 18 hours of age. Filly exhibited normal affinity for the dam, nursing, urinating and defecating normally. Crusting, bleeding punctate skin lesions developed at 36 hours of age, in addition to sloughing oral mucous membranes. Physical exam abnormalities included ulcerative dermatitis, oral petechiae, and sloughing oral mucous membranes. Labwork revealed marked neutropenia and thrombocytopenia. Skin biopsy revealed subepidermal clefting with subjacent vascular dilation, dermal hemorrhage, and superficial papillary necrosis. A single dose of dexamethasone (1 mg/kg) was administered along with ceftiofur (10 mg/kg BID for 7 days) as supportive therapy. Neutropenia and thrombocytopenia, along with dermatitis or mucous membrane lesions resolved by 10 days of age. Neonatal thrombocytopenia, neutropenia, ulcerative dermatitis is an uncommon condition of foals, believed to be an alloimmune condition related to colostral antibody ingestion. The dam's subsequent foal will not be allowed to nurse from her for the initial 48 hours, but rather fed banked colostrum, similar to the management of neonatal isoerythrolysis-producing dams.

#### Case 4

10-year old Warmblood gelding, recently imported to the US for use as a hunter-jumper, referred for episodic collapse. The term collapse in this case describes loss

of postural tone with partial recumbency-going down to the knees or to sternum. Causes of collapse may be syncopal, including cardiac, neutrally mediated and blood pressure-related conditions, or non-syncopal, including conscious or unconscious conditions. The observer's description of the collapsing episodes may be specific and allow for directed diagnostics or may be vague. A systematic approach in these cases allows for careful selection of diagnostics to achieve an accurate diagnosis. Physical examination in Case 4 revealed a Grade 2 systolic murmur and an irregularly irregular heart rhythm that did not dissipate with excitement or exercise. Initially believed to be second degree AV block, caused by high resting vagal tone in normal horses, this arrhythmia was not significantly altered by trot work. Bloodwork, including cardiac troponin I, echocardiogram, resting and exercising ECGs were performed. Cardiac troponin I was moderately elevated, and 24 hour Holter monitor with exercising ECG confirmed the presence of high-grade, or pathological AV block. This case highlights the importance of abolishing resting vagal tone when an irregularly irregular rhythm is ausculted at rest.