

MESSAGE FROM THE GRAYSON-JOCKEY CLUB RESEARCH FOUNDATION

ENDOCRINE DYSREGULATION IN CRITICALLY ILL FOALS – PROGRESS MADE IN A DECADE

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FOR THE EQUINE NEONATE to survive the new environmental conditions, it must quickly adapt. This requires a rapid and effective response of multiple endocrine systems to overcome adversities. Sepsis, defined as a generalized inflammatory response to microorganisms, is the main cause of mortality in foals, representing major economic losses to the equine industry. Recent studies in septic foals have shown that hormone disorders contribute to disease progression and mortality. Neonatal maladjustment syndrome (dummy foals) also appears to be linked to hormone imbalances. It is reasonable to assume that a better understanding of endocrine disorders in sick foals will improve our ability to increase survival.

The energy system: Equine neonates are born with minimal energy reserves. Low blood glucose (hypoglycemia) is common in critically ill foals. To maintain energy supply during illness, there is a regulatory system (brain, pituitary gland, adrenal gland, pancreas, liver, and adipose tissue). Failure at different levels of this system has been identified in premature and septic foals. This information has clinical value.

The stress system: The transition from intrauterine to extrauterine life is a major biological challenge that depends on endocrine adaptations. Animals and people have developed a stress response system (hypothalamus, pituitary gland, adrenal gland). During sepsis this system releases hormones to control inflammation, enhance blood pressure, and promote energy delivery. We have identified a failure of this system (adrenal insufficiency) in some foals with severe sepsis that is characterized by a poor production of glucocorticoids. There are therapies based on this information that could be used to assist these foals.

Progesterones and neurosteroids: The adrenal gland also pro-


duces progesterones (e.g., progesterone) that are important to maintain the fetus in a quiet state. Progesterones can be metabolized by brain cells into more potent neurosteroids. In the brain, neurosteroids promote neurogenesis, energy conservation, and protect neurons against ischemia. It was recently shown that septic and dummy foals have high levels of neurosteroids. One can speculate that the abnormal behavior observed in some sick foals could be in part due to high neurosteroids.

Calcium regulation: Septic foals often develop hypocalcemia (low calcium) that could impair the function of the gastrointestinal tract (colic), heart (arrhythmias), muscle (weakness), and nervous system (seizures). We recently showed that hypocalcemia in sick foals is associated with abnormal concentrations of the hormone (parathyroid hormone) responsible for maintaining calcium levels. These abnormalities were associated with mortality. The use of calcium and magnesium salts to treat these foals has become routine, in part as a result of this research.

Vitamin D: Vitamin D has a multitude of functions (bone health, calcium and phosphorus regulation, anti-

inflammatory, anti-bacterial, immune modulation). A recent finding by our group is that vitamin D levels in septic foals decrease by half the values of healthy foals and that foals with the lowest levels are more likely to die. We also found low vitamin D levels were associated with hypocalcemia. We can speculate low vitamin D in sick foals leads to a multitude of complications (hypocalcemia, immune suppression, inflammation, bacterial invasion). We can speculate vitamin D therapy could be beneficial to these foals. However, no study on vitamin D therapy in sick foals has been performed.

Thyroid hormones: The differentiation and maturation of most organs at the end of pregnancy depend on thyroid hormones. They are important to maintain body temperature and organ function in the neonate. Low thyroid hormones could be devastating to foals. We showed this to be a serious problem in premature and sepsis foals. It is unclear whether replacement therapy could be beneficial to these foals.

It is evident that progress to understand various endocrine systems in healthy and sick foals has been made in recent years. This information has clinical implications. It is important to give credit to organizations such as the Morris Animal Foundation and the Grayson-Jockey Club Research Foundation for supporting this type of research. 

References:

Toribio RE, 2011; Himler et al. 2012; Madigan et al. 2012; Aleman et al. 2013; Dembek et al. 2017