Gc globulin as a diagnostic and prognostic marker in horses
A Ph.d. project
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**Ph.d. project**

The Ph.d. project focuses on Gc-globulin as a prognostic marker in horses with acute abdominal pain.

Acute abdominal pain (colic) has a high frequency in horses and is one of the most frequent reasons for a horse to die or be euthanized (Hilary et al., 2001; Tinkler et al., 1997).

Impactions and intestinal strangulations are the most common causes of colic. When an intestine is strangulated, ischemia of the intestine will develop and the horse needs acute surgical intervention. Many horses do not survive the surgery because they develop shock or sepsis.

Goals:
- To assess the usefulness of acute phase proteins (Serum Amyloid A (SAA), haptoglobin, fibrinogen, Intestinal fatty acid binding protein (I-FABP), and Gc-globulin) for predicting the need for surgery and the prognosis of horses with acute abdominal pain.

Hypothesis:
- Low Gc-globulin concentration and high SAA, haptoglobin, fibrinogen and I-FABP in plasma and peritoneal fluid correlates with the extent of intestinal ischemia, the need for surgery and survival rate of the horse.

**Resumé**

Gc-globulin is a serum protein, which is significantly reduced shortly after tissue injury in humans and laboratory rodents. A low serum concentration of Gc-globulin can therefore be used as a diagnostic and prognostic marker in patients with trauma, sepsis and liver failure. This Ph.D. project will investigate Gc-globulin in horses and evaluate the concentration in horses with acute abdominal pain.

**Introduction**

Group specific (Gc) globulin also known as vitamin D-binding protein is part of the extracellular actin-scavenging system that removes actin from the circulation (Lind et al., 1986). Actin is an intracellular structural protein, which is released to blood in patients with tissue injury and cell death. Circulating actin forms filaments, which cause microthrombi and endothelial injury. These effects of circulating actin are extremely harmful, and high levels of free actin are potentially lethal (Haddad et al., 1990; Enukhin et al., 2000). Gc-globulin binds to actin and removes it from the circulation via the reticuloendothelial system (Figure 1).

Plasma concentrations of Gc-globulin decrease shortly after conditions causing tissue injury and cell death, for example physical trauma (Figure 2) (Dahl et al., 2001), sepsis (Lee et al., 1989), experimentally induced endotoxemia (Watt et al., 1989) or liver failure (Schmidt et al., 2007). In humans, decreases in Gc-globulin levels are observed within 60 minutes after trauma (Dahl et al., 1998).

Studies in humans and laboratory rodents have shown that very low concentration of plasma Gc-globulin are related to an increased risk of developing shock and lethal complications of trauma (Figure 3) (Dahl et al., 1999). Gc-globulin is thus a prognostic marker in intensive care medicine.

It has been suggested that treatment with Gc-globulin to patients with severe tissue injury (shock, trauma) increases survival chances (Vassenbergs & Lind, 1993). The in vivo toxicity of Gc-globulin infusion is currently being investigated in horses and other species.

Gc-globulin has been demonstrated in horse plasma and its structure closely resembles that of human Gc-globulin (Robinson & Butrick, 1992). Gc-globulin concentrations in horses under clinical conditions have never previously been investigated.

**Methods**

2. Assessment of Gc-globulin concentration in plasma and peritoneal fluid in healthy horses.
3. Comparison of the acute phase protein concentrations and the need for surgery and survival rate by collection of blood and peritoneal fluid samples of 100 horses with acute abdominal pain referred to the University Hospital for Large Animals (KU-LIFE).
4. Assessment of acute phase protein concentrations and kinetics in plasma and peritoneal fluid in horses with induced intestinal ischemia under general anaesthesia.

**References**


Dahl B, Schmidt PV, Gehrich FM, Ranteau J, Oh P. Gc-globulin is an acute phase reactant and an indicator of muscle injury after spinal surgery. Inflamm Res 2001; (50): 30-43.


**Figures**

- Figure 1. The Actin Scavenging System. Gc-globulin removes actin from the circulation, after cell injury.
- Figure 2. Concentration of Gc-globulin in survivors and non-survivors after severe trauma (Dahl et al., 2001).
- Figure 3. Gc-globulin concentration at admission in 57 multiple trauma patients (Dahl et al, 1999).