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Renin and ovarian vascularization in cows with follicular cysts after epidural administration of a GnRH analogue

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ABSTRACT

The ovarian renin–angiotensin system may play an important role in follicular growth and maturation, as well as in the process of ovulation. The aim of this study was to investigate the effects of administration of a GnRH analogue to cows with ovarian follicular cysts on plasma renin concentrations and ovarian vascularization. This study was performed with 60 Friesian cows, which were diagnosed with follicular cysts, and randomly allocated into two groups: group A (treatment; $n = 30$) received 2 ml of lecirelin (Dalmarelin® – Fatro), per head via sacro-coccygeal epidural, and group B (control; $n = 30$) received 2 ml saline solution (0.9% NaCl) per head by the same route. Blood samples were immediately collected prior to administration (T0) and then 24 h (T1), 48 h (T2) and 8 days (T3) after administration of the treatment, for both groups. Ovarian vascularization was evaluated utilizing Power Doppler on these same days in 10 animals from each group. The number of pixels detected by Power Doppler was used as an indicator of the degree of vascularization. Plasma renin concentrations remained relatively constant for the control (group B) animals, but increased as the sampling period progressed (NS) for the treated cows (group A). Similarly, there were no changes in ovarian vascularization (number of pixels) for the control cows, but vascularization increased throughout the sampling period in the treated animals. The number of pixels associated with cysts was significantly higher for treated compared to control cows at 24 h after treatment ($P < 0.001$). The epidural administration of a GnRH analogue was determined to be a highly effective therapy for follicular cysts (regression occurred in 82% of treated

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cows within 8 ± 2 days after treatment, but in none of the control cows), which also enhanced ovarian vascularization.

1. Introduction

Bovine follicular cysts (FC) are anovular follicles with a diameter greater than greater than 17 mm, found in single or multiple forms, presenting a thin wall (Silvia et al., 2002). These cysts may persist on one or both ovaries usually for more than 6 days (Silvia et al., 2002). The etiopathogenesis of the follicular cysts is multifactorial and still not well established in all its endocrine, histological, clinical and therapeutic aspects. Many studies have identified dysfunctions of the hypothalamus–hypophysis–ovary axis as the main factors involved in this pathology (Silvia et al., 2002). Recently, studies regarding the etiopathogenesis of the Polycystic Ovarian Syndrome (PCOS) in women suggest the involvement of vascular dysfunction and the renin–angiotensin system (RAS) (Li et al., 2000). RAS is a mixed enzymatic-hormonal system, derived from the kidneys, as well as extrarenal sources (Sealey et al., 1977). This system has a pivotal role in the regulation of systemic blood pressure and in fluid homeostasis. The primary components of RAS are renin, the enzyme that catalyzes the proteolytic conversion of angiotensinogen to the decapeptide angiotensin I (Ang I); angiotensinogen, the major substrate for renin and the precursor of angiotensin II (Ang II); angiotensin converting enzyme (ACE), a dipeptidyl carboxypeptidase that converts Ang I to the octapeptide Ang II; and Ang II, and Ang II receptors responsible for signal transduction of Ang II (Douglas, 1987).

In humans, the ovary is a source of prorenin which is regulated by gonadotropins. Ovaries were found to secrete prorenin into the circulatory system for approximately 3 days during the surge of luteinizing hormone (LH) in the normal menstrual cycle (Sealey et al., 1985). Hagemann et al. (1994) found an increase in renin concentrations also in bovine ovarian follicles after the LH peak, which suggests that the ovarian renin–angiotensin system may play an important role in follicular growth and maturation, as well as in the process of ovulation (Schauser et al., 2001).

Basing on these data, the aim of this study was to investigate the effects of the administration of a GnRH analogue, one of the most effective known drugs for the therapy of bovine follicular cyst, on blood renin concentrations and ovarian vascularization.

2. Material and methods

2.1. Experimental animals

The study was conducted between March and July 2007, on 60 Friesian cows, that were diagnosed with follicular cysts, at 60 days postpartum.

The cows were 3–5 years old, with a mean weight of 600 kg (ranging from 560 to 650 kg) and a mean milk yield ranging between 8600 and 9200 kg.

All animals were tethered in tie stalls and fed with hay, concentrate and minerals. Water was available *ad libitum*.

All animals considered in this study were free from common parasites (coccidian and strongyloides) and declared free from bovine diarrhoea, brucellosis, bovine leukosis virus and tuberculosis. Cysts diagnosis was performed by clinical examination (transrectal palpation), transrectal ultrasonographic genital monitoring (Scanner 480 linear probe 5–7.5 MHz, Pie Medical, The Netherlands) and determination of plasma progesterone (P_4) (Enzyme-linked fluorescent assay-VIDAS® Progesterone, bioMerieux® Lyon, France). These diagnostic procedures were repeated in 10 days intervals. The cows considered during this study exhibited blood P_4 concentrations <1 ng/ml and ovarian follicle-like structures, with diameters that were larger than 17 mm and walls that were less than 3 mm thick, which persisted for more than 10 days (Silvia et al., 2002).