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Characteristics of bovine early puerperal uterine contractility recorded under farm conditions

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Abstract

A non-invasive, digital technique was used to measure and quantify intrauterine pressure (IUP) changes in early postpartum dairy cows kept under farm conditions in order to document physiological changes in uterine contractility after uncomplicated calvings. In addition, possible relationships between characteristics of uterine contractility and blood ionized calcium (Ca^{2+})-concentrations were investigated. Recordings of uterine contractility were made by using a transcervically inserted open tip catheter in 12 healthy cows during their first 48 h after calving. The IUP recording technique appeared easily applicable under farm conditions. Although mean frequency (FREQ), amplitude (AMP) and area under the curve (AUC) of the myometrial contractions significantly decreased due to time, untreated early postpartum cows showed a high variability in characteristics of uterine contractility. There was no correlation between blood Ca^{2+}-concentrations and any of the contractility parameters.

Keywords: Early puerperium; Dairy cows; Farm conditions; Uterine contractions; Ionized calcium

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1. Introduction

Immediately after calving uterine involution starts, preparing the genital tract for a subsequent conception. Puerperal disorders in this early period may cause an extension of complete uterine involution and may lead to a delayed resumption of ovarian activity, causing prolonged calving to conception intervals and increasing production costs at the farm [1].

Uterine smooth muscle activity plays an important role in expulsion of uterine contents, clearing of its cavity and in the reduction of uterine size. These processes, however, can be perturbed, resulting in puerperal disorders, such as retained fetal membranes (RFM), or endometritis. It is still not clear whether retention of the fetal membranes is the result of a decreased uterine muscle activity. Some reports have even found an increased level of uterine muscle activity during the first days postpartum in cows with RFM [2,3]. Uterine activity is decreased in cows with severe hypocalcemia as it was shown in a preliminary study [4] where hypocalcemia was experimentally induced. In milk fever also, RFM more often occurs than in cows not suffering from milk fever [5,6].

In order to improve the efficacy of puerperal uterine involution in dairy cows, first the spontaneous physiological changes in uterine contractility should be known. One possible way of characterizing uterine contractility is to measure changes in intrauterine pressure (IUP). IUP is usually obtained from the uterine lumen and it reflects internal pressure changes caused by the contractile activity of the uterine muscular tissue. It is supposed to give a good estimation about uterine mechanical activity [7,8]. In principal, there are two different ways to measure intrauterine pressure changes. Pressure obtained at a certain location within the uterine cavity can be transformed into an electrical signal either in situ or outside the body. In situ transformation can be reached by using either a catheter with built in miniature pressure sensors (such as the Millar catheter), or an implantable microtransducer (such as the Konigsberg transducer). When pressure signals are transformed into electrical signals outside the body, pressure waves picked up with either a fluid-filled catheter or a fluid-filled balloon, are first forwarded to an external transducer, which is fixed outside the body. In systems where pressure changes are transformed into electrical signals at the place of pressure generation, the effect of noise is reduced, while in systems that use fluid filled catheters between the data acquisition point and the transducer, more artefacts can be expected especially by movements of the animal. Our previous investigations showed that by using post measurement digital filtering, this noise can be effectively reduced and filtered signals became nearly similar to those obtained through an on site signal transforming microtransducer technique [7].

More descriptions are available in human obstetrics dealing with IUP measurements and analysis; among them Finn and Porter [8], Csapo [9] and Fischer et al. [10] reviewed basic methodological knowledge of IUP recordings, while Braaksma et al. [11] compared different recording techniques. Several studies have also been performed in cows [2,12–18], but they provide hardly any quantitative information about physiological changes in intrauterine pressure during the early normal puerperium.

The aim of the present study was to record and quantify intrauterine pressure changes in early postpartum dairy cows kept under commercial farm conditions using a validated, non-invasive technique for measuring and analyzing IUP changes [7]. Uterine contractility was recorded in 12 healthy cows during the first 48 h after uncomplicated calvings. In