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# REVIEW OF DIAGNOSTIC SIGNS OF POSTPARTUM UTERINE DISEASES IN DAIRY COWS BY THE HELP OF CATUS DATABASE

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**Abstract:** Postpartum (PP) reproduction anomalies (increased calving interval and semen doses, pregnancy loss, infertility culling rate) are mostly caused by postpartum uterine diseases. The aim of this study was to find diagnostic symptoms (signs) help in identifying animals having possible subclinical endometritis. As a logical first step, analyzing a database with several thousand transrectal postpartum palpations and ultrasonic findings of the genital tract and production data of dairy cows (CATUS) seemed reasonable. Healthy (H) cows and animals with clinical endometritis (CE) both are in this database. We thought that statistical analysis of large amount of H and CE animals' data should help in identifying signs or reasonable suspicion for recognizing cows with subclinical endometritis (SCE) in the future as well. During this work palpation and ultrasound data of healthy and CE cows were compared. Totally, data of 10683 cows were evaluated by chi-square test. These results show distinct differences in distribution of uterine size (volume) and ovarian phenomena in the two groups. As a sign of inappropriate involution large-sized uterus (32.9 % vs. 64.9 %) and uterine fluid content (6.1 % vs. 31.1 %) were significantly higher ($p<0.0001$) in CE group. Abnormal ovarian ovulatory phenomena (corpus luteum /CL/ with cavity: 8.0 % vs. 13.1 %; or cystic CL: 4.2 % vs. 27.4 %) also were detected in significantly higher numbers in animals with CE signs ($p<0.0001$). These results induce further examinations to compare them with SCE animals' data for identifying diagnostic signs which are typical for the examiners.

*Keywords:* metritis, subclinical endometritis, dairy cow

## 1. Introduction

Postpartum (PP) reproduction anomalies (increased calving interval and semen doses, pregnancy loss, infertility culling rate) are mostly caused by postpartum uterine diseases (Huszenicza et al. 1999, LeBlanc et al. 2002, Sheldon et al. 2006, Galvão 2012). The first PP 40-50 days is called involution period (Call 1989, Sheldon 2004, Sheldon et al. 2006, LeBlanc 2008). During this period the size of the uterus is decreasing and its structure is changing (Call 1989, Sheldon 2004). In optimal case the uterus is reverting again to the original size and structure until the end of involution period (Sheldon 2004). Absence of reverting is called delayed involution. The appearance and the severity of delayed involution should depend from several factors (nutrition, housing, time etc.) (Sheldon et al. 2006). The most frequent appearances of PP uterine diseases are: puerperal or clinical metritis, clinical endometritis (pyometra) and subclinical endometritis (Sheldon et al. 2006, Galvão 2012), furthermore also the retention of the fetal membranes (RFM) (Szenci et al. 2015, Kern et al. 2018). No question that the bacterial contamination is a key issue in their formation (except RFM) (Pécsi et al. 2007, Galvão 2012, Szenci et al. 2015). Earlier fetal membranes retention was classified as a PP uterine disease but looks more reasonable that this is one of the main reasons of the PP uterine diseases (Galvão 2012, Szenci et al. 2015). RFM has increased the probability of bacterial contamination and the metritis (LeBlanc 2008, Giuliodori et al. 2013, Palmer 2015, Szenci et al. 2015, Kern et al. 2018). According to some authors, the probability of the metritis is six times higher in case of RFM (Smith & Risco 2002, Palmer 2015).

In the first period of the involution (within 21 days PP) puerperal metritis or clinical metritis can occur (Sheldon et al. 2006, Galvão 2012, Szenci et al. 2015). This is characterized by the bigger size and thinner wall of uterus. Furthermore, at the same time huge volume of lochia is locating in the uterine lumen and there is fetid watery red-brownish uterine discharge (Galvão 2012). According to some authors, if these symptoms are accompanying with increased body temperature (higher than 39,5 °C) then it can be called puerperal metritis (Sheldon et al. 2006, Galvão 2012). Absence of systemic symptoms means clinical metritis (Sheldon et al. 2006, Galvão 2012, Szenci et al. 2015). The clinical endometritis and subclinical endometritis usually appear after 21day PP (Sheldon et al. 2006, Galvão 2012, Szenci et al. 2015) while pyometra is a specific form of the clinical endometritis (Galvão 2012). The most typical sign of clinical endometritis is purulent discharge found after 21 days or mucopurulent discharge after 26 days PP (Sheldon et al. 2006, Galvão 2012). There are no visible systemic symptoms in case of both clinical and subclinical endometritis, because these are just local inflammations of the endometrium (Sheldon et al. 2006, Palmer 2015). The diagnosis of the subclinical endometritis is really difficult because the only signs are just the reproduction anomalies (Sheldon et al. 2006, Palmer 2015). Damages caused by clinical and subclinical endometritis represent PP reproduction anomalies (increased calving interval and semen doses, pregnancy loss, infertility culling rate) (Sheldon et al. 2006, Galvão 2012, Palmer 2015). Diagnosis of subclinical endometritis is really difficult although several methods were described. The most popular method is cytological examination from the endometrium and the PMN (polymorphonuclear cell's) rate's determination from the samples (Sheldon et al. 2006, Galvão 2012, Palmer 2015). According to Galvão (2012) subclinical endometritis occurs when the PMN percentage is higher than 18% in cows between 20-33 PP, or higher than 10% between the 34-47 PP days (Kasimanickam et al. 2004, Galvão 2012, Szenci et al. 2015). But there is no exact data for the limit level and the optimal time of the examination. Thus, the possibility of definite diagnosis is doubtful too.

The delayed involution and PP uterine diseases should cause difficulties of the reproductive management and besides that significant economic damage in the dairy farms. On average appearance of all different metritis types is approx. 20-30% in dairy farms (Galvão 2012). The range of clinical endometritis is > 5-30%, subclinical endometritis can reach over 30% of the dairy cows (>11-70%) (Galvão 2012).

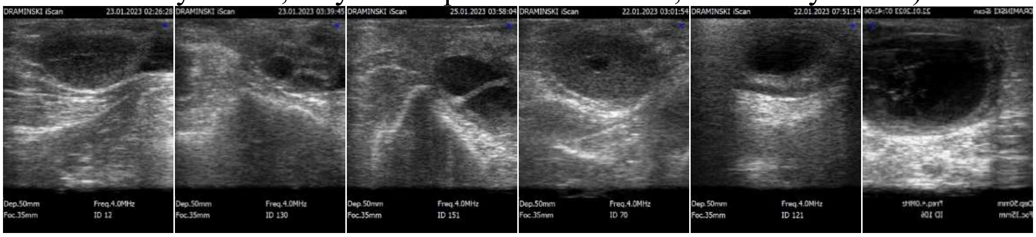
Puerperal metritis has a serious negative effect for the milk yield: Hungarian data showed 402 kg decrease of milk production in the first 100 PP days while an Argentinian study found 411 kg decrease in the first 90 PP days due to similar reasons (Giuliodori et al. 2013, Kern et al. 2018). In multipara cows' case of the metritis, beside the falling milk yield, the reproduction data were also weak (Mahnani et al. 2015, Kern et al. 2018). In summary puerperal metritis can cause decreased milk yield and increased culling rate (Kern et al. 2018, Palmer 2015). Nevertheless, defining damage caused by subclinical endometritis is not easy. Certainly, negatively influences several reproduction indicators, increase the calving interval, pregnancy loss, and culling rate due to infertility (Sheldon et al. 2006).

In this study data of CATUS database (which contains almost 43000 ultrasonic examinations of the cow genital tract) were analyzed. This database contains the results of transrectal PP palpations and ultrasonic findings. The aim was to find diagnostic symptoms (signs) which would help in identifying animals having possible subclinical endometritis.

## 2. Materials and methods

As a logical first step, analyzing a database with several thousand transrectal PP palpations and ultrasonic findings of the genital tract and production data of dairy cows (CATUS) seemed reasonable. CATUS (cattle ultrasound) is a database which includes results of palpation and ultrasonic examinations. The database contains 42508 data rows. These were recorded on 80 Hungarian dairy cow farms between 2001 and 2020. Healthy (H) cows and animals with clinical endometritis (CE) both are in this database. We thought that statistical analysis of large amount of H and CE animals' data should help in identifying signs or reasonable suspicion for recognizing cows with subclinical endometritis (SCE) in the future as well. During this work palpation and ultrasound data of healthy and CE cows were compared. In this study 10683 data entries were used. These entries are PP (not inseminated yet) cows' data. These data were analyzed by Chi-square test, with the help of SAS® 9.4 software (SAS Institute Inc. 2016. SAS® 9.4 Language Reference: Concepts, Sixth Edition. Cary, NC: SAS Institute Inc). Two groups were formed: healthy (9036) and clinical endometritis (1647). Ovarian phenomena (*Figure 1*) and the state of the uterus were comparted and analyzed.

***Figure 1:*** Pictures about the ovarian phenomena (left to right: 1 corpus luteum /CL/, 2 normal follicle /NF/, 3 anovulatory follicle /AF/, 4 corpus luteum with cavity /CLC/, 5 cystic corpus luteum /CCL/, 6 lutein cyst /LC/)



Source: The author's own editing based on his own research.

## 3. Results

The results (*Table 1*) show distinct differences in distribution of uterine size (volume) and ovarian phenomena in the two groups. As a sign of inappropriate involution large-sized uterus (32.9 % vs. 64.9 %) and uterine fluid content (6.1 % vs. 31.1 %) were significantly higher (p<0.0001) in CE group. Also, significant difference was found in the uterus condition between the two groups. It's not surprising that bigger uterus was appearing significantly more frequently in CE group (64,9%), compared to the healthy group (32,9%; p<0,0001). Comparative result of the wall thickening is interesting because it did not provide difference between the two groups. (27,8% vs 27,5%; p=0,7976).

***Table 1***: Frequency of diagnostic signs in the H and the CE groups

| Examined parameters | Large-sized uterus | Uterine wall thickening | Uterine fluid content | Follicle | Anovulatory follicle | Lutein cyst | Corpus luteum | Corpus luteum with cavity | Cystic corpus luteum |
|---|---|---|---|---|---|---|---|---|---|
| Healthy | 2976 (32.9%) | 2485 (27.5%) | 548 (6.1%) | 2741 (30.3%) | 2143 (23.7%) | 1567 (17.3%) | 3049 (33.7%) | 726 (8.0%) | 379 (4.2%) |
| Clinical endometritis | 1069 (64.9%) | 458 (27.8%) | 512 (31.1%) | 197 (11.9%) | 204 (12.4%) | 211 (12.8%) | 403 (24.4%) | 216 (13.1%) | 452 (27.4%) |
| p | <0.0001 | 0.7976 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |

Source: The author's own editing based on his own research.

Ultrasonic examination of ovaries showed that the maturing follicles, which are signaling the normal functionality of the ovary, appeared significantly higher proportion in healthy cows (30,3%) compared to cows with CE (11,9%; p<0,0001). Appearance of anovulatory follicles (AF) also shows a similar tendency: CE cows 12,4%; H cows: 23,7% (p<0.0001). Another anovulatory phenomenon, lutein cyst (LC) appears in a higher proportion in healthy animals (17,3%) than in CE cows (12,8%, p<0,0001). Incidence of corpus luteum was higher in cows without PP uterine diseases (33,7%) than in CE group (24,5%; p<0,0001). Abnormal ovarian ovulatory phenomena (corpus luteum /CL/ with cavity /CLC/: 8.0 % vs. 13.1 %; or cystic CL /CCL/: 4.2 % vs. 27.4 %) also were detected in significantly higher numbers in animals with CE signs (p<0.0001).

Among healthy cows 27.5 % uterine wall was found as thickened (*Table 2*). At least one of anovulatory phenomena (AF and/or LC) were present in 1448 cases (58.3 %). Although several cows had normal uterine wall and at the same time AF and/or LC were found, the differences between the presence or absence of these phenomena is significant (p<0.0001).

***Table 2:*** Correlation between the uterine wall thickness and frequency of AF or LC on ovaries (p<0,0001)

| Healthy cows | with AF and/or LC | without AF and/or LC |
|---|---|---|
| Thickened uterine wall (n=2485) 27.5 % | 1448 (58.3%) | 1037(41.7%) |
| Normal uterine wall (n=6551) 72.5 % | 1963 (30.0%) | 4588(70.0%) |

Source: The author's own editing based on his own research.

## 4. Discussion

Different uterine size and content in H and CE cows were expectable because these are accompanying together with local inflammation, but surprisingly no difference was found in wall thickness. That's why further analysis was carried out for checking the presence or absence of anovulatory ovarian phenomena (AF and/or LC). In our opinion the large proportion of the thickened uterine wall in the H group could be caused by increased serum estrogen level produced in these anovulatory phenomena (Bigelow et al. 1998, Balogh et al. 2014). The presence of large numbers of AF in healthy cows could be explained by the higher proportion of follicles which lead to greater numbers of anovulatory follicles and/or lutein cysts. The appearance of the two anovulatory phenomena in similar proportions can be explained by their common origin (Balogh et al. 2014).

Based on results of data analysis, it seems that beside the size and content of the uterus, the ovarian phenomena can also indicate clinical endometritis. Large number and rate of follicles and corpus luteum suggest normal cyclic ovarian activity which refers to normal involution, while lutein cyst or cystic corpus luteum (LC/CLC) should mean abnormal involution. Presence of high proportion of anovulatory follicles is probably caused by negative energy balance and they can be present in higher proportion in healthy cows as well. Ovulatory phenomena, with cavity (cavitary corpus luteum and corpus luteum cyst) occur in a higher proportion in the group with clinical endometritis.

These results suggest that physical and ultrasonic examinations of the cow genital tract should provide valuable signs for detecting subclinical endometritis too. Certainly, to make a more precise diagnosis further specific examinations are required.

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