NORMAL AND ABNORMAL UTERINE INVOLUTION IN COWS MONITORED BY ULTRASOUND

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Abstract: Success in cattle breeding is one of the most important goals in livestock farming and it requires particular attention when it is about securing unobstructed reproduction. Final goal in cattle breeding is to produce one live calf per year, which will likewise enhance milk production through successful pregnancy. The aim of our research was to monitor uterine involution speed with aid of ultrasound device and make records when cows are ready to be inseminated again, which cows need more time to complete involution and how many cows will have uterine disorders and require therapy. The experiment was carried out from October 2009 until the end of January 2010. In our experiment 50 cows were included and 412 transrectal ultrasound examinations were performed. Cows were transrectally examined, starting from 6th day postpartum until 52 days postpartum. Speed of uterine involution has been monitored through decrease of uterine horn diameter and wall thickness. Cows with normal puerperium have completed involution in the period from 38 – 45 days postpartum, while those with abnormal puerperium needed more time to complete it or required therapy of disturbed uterine status. In total 48% of cows had normal uterine involution, 52% of cows had some abnormalities in involution and 10% of cows in experiment required therapy. With continuous monitoring of reproductive tract in cattle with ultrasound it is possible to timely detect right time for first insemination postpartum, decrease period of open days or to detect abnormalities in uterine health status and treat it.

Key words: puerperium, ultrasound, reproductive tract, uterus, cow

Introduction

Success in cattle production and dairy cows housing represent very important work, not only in territory of Bosnia and Herzegovina, but also much wider. To ensure successful dairy cows breeding, a lot of attention must be devoted to keep good reproductive performances. By obtaining one calf per year, provides not only an increase of livestock but likewise increase of produced milk through increase of udder's secretory tissue during gestation (*Peter et al., 2009*).

After parturition begins period of puerperium, when reproductive system returns to itself former pregravid state, so female can conceive again. Puerperium lasts until reproductive functions are not fully restored, so that next gestation can occur. Genital system however never fully returns to itself former pregravid state, especially after first parturition, because certain changes are not fully reversible (*Mutevelić et al., 2003*).

Four main events during puerperium are contraction of myometrium and expel of lochia, elimination of bacterial contamination in genital system, anatomical and hystological restoration of uterus and return of ovarian cyclicity (*Nakao et al., 1992; Peter et al., 2009*). Before parturition uterine lumen is sterile. During and after parturition bacteria can enter the birth canal and uterine lumen from surroundings, as well as animal skin. A variety of different types of bacteria can be isolated from within uterus in almost all cows 10 – 14 days postpartum (*Moschov et al., 1966*). Appearance of these bacteria within uterus is common, because it can be found in over 90% of cases regardless of the presence of clinical signs (*Földi et al., 2006*).

During parturition physical barrier provided by cervix, vagina and vulva cease to function, because cervix stays relaxed and open for a several days postpartum, thereby possible entering of bacteria from vagina and skin of the animal is enabled as well as their multiplication in liquid media within uterus. Bacteria can be found in content of the uterus in 93% of cows in first 15 days after parturition, while degree of infection decreases to 9% between 46 – 60 days postpartum (*Moschow et al., 1966*).

Speed of involutive processes in the uterus just as subsequent reproductive performances is dependable of several factors like: parity, season, nursing and frequency of milking, climatic conditions where animals are held, quantity of produced milk, quality of nutrition, breed and health problems before and after parturition (*Cerri et al., 2009; Kawashima et al., 2009; Mutevelić et al., 2003; Nakao et al., 1992; Okano et al., 1987; Peter et al., 1988; Peter et al., 2009*).

Frequency and duration of nursing by calf have significant effect for producing surges of oxytocin which causes contraction of myometrium and expel of tissue debris from the uterus (*Leslie H.E. 1983*). Researches represent that there

are differences in speed of involutive processes in the uterus through all four seasons. According to (*Buch et al 1955*) time interval required for complete uterine involution in cows which had normal parturition is 42 – 50 days. Average time needed for complete involution is: spring 47 days, summer 42 days, autumn 44 days and winter 51 days.

Abnormalities in puerperium (retained fetal membranes, abnormal lochia etc) which lead to subsequent reproductive disorders my appear up to 50% in the herd, however if diagnostic and therapy of these cases carry out before 20 days postpartum, those cows have better fertility than those treated later (*Francos et al., 1988*).In 26 % of cows with clinical endometritis, there is significant detrimental effect to fertility within two months postpartum (*Gautam et al., 2009*). Identification of subclinical endometritis with standard methods is not always reliable. Subclinical endometritis represents state where uterine swab contains >18% neutrophiles 20 – 33 days postpartum or >10% neutrophiles 34 – 47 days postpartum (*Kasimanickam et al., 2004*). This state is not possible to detect just with routine transrectal examination, especially if cervix is closed and vaginal mucus is not visible. Present anehogenic fluid with echogenic or hiperechogenic „flakes" visible at ultrasound monitor is used for making suspicion at endometritis (*Fissore et al., 1986*), but most accurate is combination of ultrasonography and uterine swab citology (*Barlund et al., 2008*).

Observation of involutive processes by ultrasound scanner in cows without signs of abnormalities in puerperium, obtained results of measured uterine horn diameter and wall thickness suggest that involution is probably completed after 40 days postpartum (*Okano et al., 1987*). Disturbed uterine function contribute to early disappearance of corpus luteum developed after ovulation, shortening of estrus cycle and reducing of pregnancy rate (*Noakes 1997, Kamimura et al., 1993*). High and medium producing dairy cows equally show detrimental effects of disturbed uterine function to reproductive performances (*Gilbert et al., 2005, Nakao et al., 1992*).

The purpose of this research was to with aid of ultrasonic obtained results of uterine status, determine period when involution is complete, in which cows it is slowed, in which cows some pathological conditions of uterus are developing and does the used method is recommendable for diagnostic of subclinical endometritis.

Material and Methods

Research was conducted at PD „Butmir" farm during autumn and winter season (October – January 2009/2010). Experiment has included 50 cows during early and late puerperium. Animals used in this experiment were kept in the same conditions of housing, in separate ledges and in tie-stall without ability to move

around. Data about age, production, reproductive abnormalities and health condition have been taken from farm protocol.

Cows were separated in two main groups, with normal puerperium and those with abnormal puerperium. Cows in group of normal puerperium did not had disorders like retained placenta, milk fever, ketosis and similar, while group of abnormal puerperium had some of previous mentioned disorders and mucopurulent or purulent vaginal discharge during observed period.

Examinations have been performed starting from 6 to 52 days postpartum, through several periods. First period was 6 – 13 days, second 14 – 21 days, third 22 – 29 days, fourth 30 – 37 days, fifth 38 – 45 days and sixth 46 – 52 days postpartum, when experiment has ended. Total number of performed ultrasonic transrectal examinations of uterus was 412. In the study it is been used diagnostic ultrasound electronic linear scanner SHIMADZU SHIMASONIC SDL-32, with linear probe 100 mm length, power 3.5 MHz.

Examination technique is similar to standard transrectal manual examination, with some difference. For our needs probe has been previously prepared in this way: in the finger of standard surgical glove (No. 8) we have first placed some ultrasonic gel, than probe and after that using tape edges of glove are pasted to the cable of the probe. With this preparation we shilded sensitive parts of the probe, obtained picture was a little better, examination of large number of cows was enabled without need to change the glove, and later cleaning of the probe was very easy. After removing faeces from the rectum, we placed probe intra-rectally to obtain image of the uterus. To obtain data of uterine horn diameter and wall thickness, we have used „*freeze*" mode and after that „*caliper*" option at the edges of viewed tissues to get precise data about searched uterine dimensions.

Obtained data about tissue dimensions are calculated and graphically represent using software package Microsoft Office Excel 2003.

Results

During autumn and winter months (October, November, December, January) out of total number of cows, one animal has died after series of puerperal disorders accompanied with clinical signs of disease.

In cows with normal and abnormal puerperium all parameters of the uterus were regularly noted. In first group there was no clinical signs of disease, vaginal discharge was without unpleasant odour and later more bright. Remaining animals with puerperium abnormalities did not had expressed clinical signs of disease, but some of them had abnormal content in the uterus and lochia and few weeks later they had mucopurulent and purulent vaginal discharge.

These abnormalities in health status of the uterus could be observed through measured values of uterine horn diameter and wall thickness using ultrasonography.
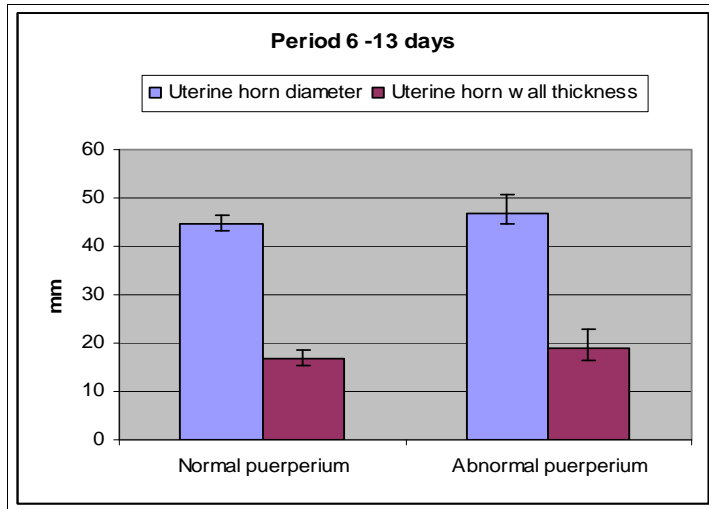
Period 6 -13 days

☐ Uterine horn diameter ■ Uterine horn w all thickness

Chart 1. Dimensions of uterine horn during first measurement

Dimensions of uterine horn diameter and wall thickness expressed in this chart represent almost identical values for both experimental groups. There are no significant differences in measured values between groups of normal and abnormal puerperium at the beginning of experiment.
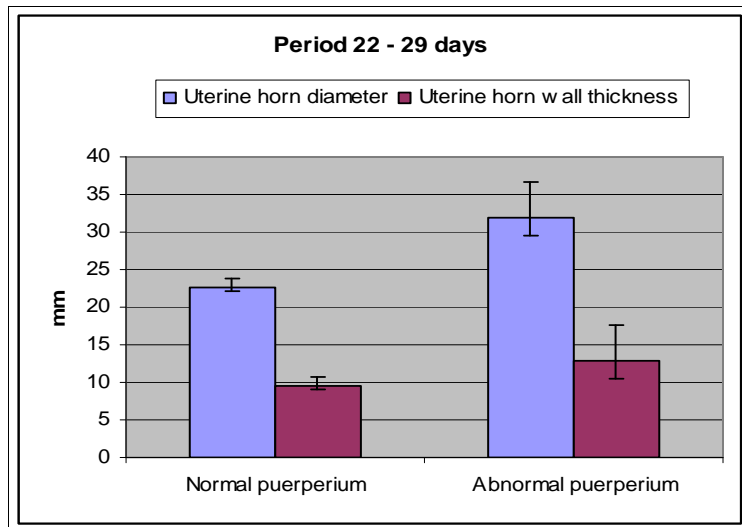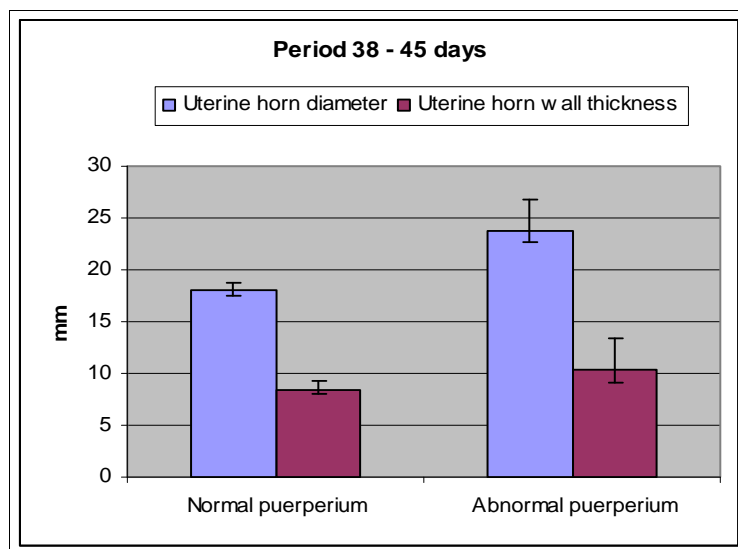
Period 22 - 29 days

☐ Uterine horn diameter ■ Uterine horn w all thickness

Chart 2. Dimensions of uterine horn during third measurement

Dimensions of uterine horn diameter and wall thickness in the middle of experimented period show differences between groups of normal and abnormal puerperium. Diameter of uterine horn in group of abnormal puerperium is visibly larger because it is filled with mucopurulent or purulent fluids and uterine wall is few millimetres thicker.

Chart 3. Dimensions of uterine horn during fifth measurement

During penultimate measurements of uterine horn dimensions, chart represent that group of normal puerperium completed uterine involution, because dimension of horn diameter and wall thickness did not further substantially changed, while other group still represent differences between both measured values of uterine horn dimensions and tends to keep it that way.
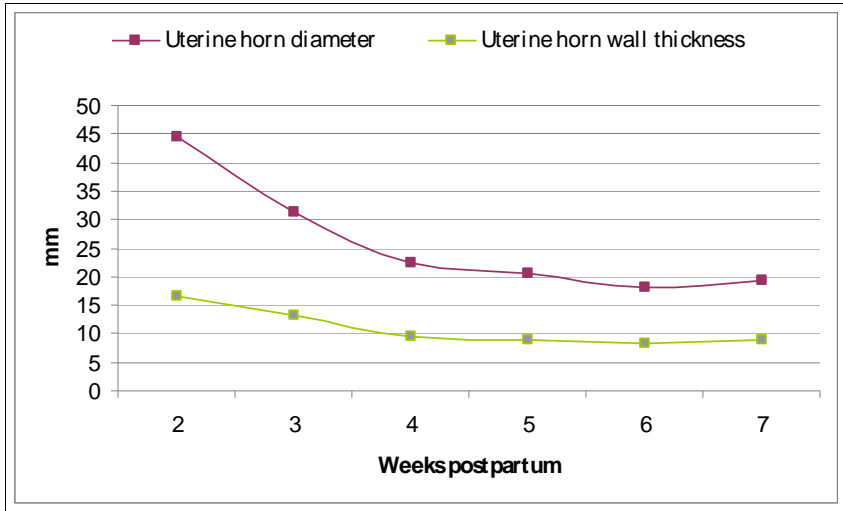
Chart 4. Decreasing dimensions of uterine horn diameter and wall thickness in group of normal puerperium.
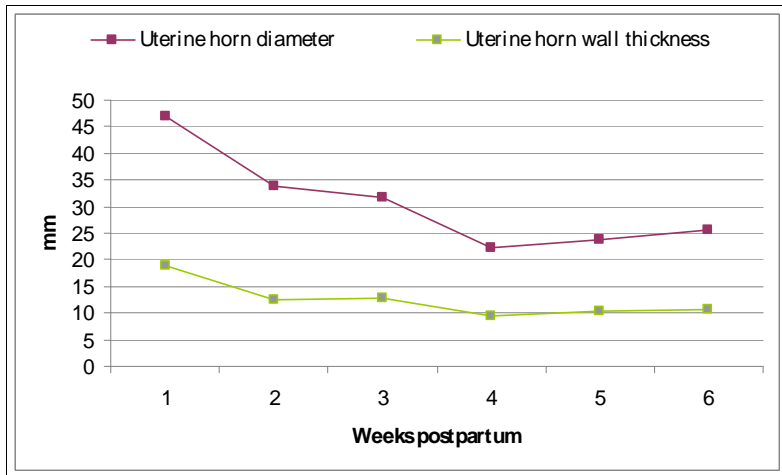

Chart 5. Decreasing dimensions of uterine horn diameter and wall thickness in group of abnormal puerperium.

Decreasing of dimensions of uterine horn diameter and wall thickness in group of abnormal puerperium are constant but not uniform during first 4 weeks postpartum. After certain fluctuations, there is some stabilisation between fourth

and fifth week postpartum. In the last part of experimented period, dimensions for uterine horn diameter and wall thickness continue to increase compared with group of normal puerperium.

We can summarise that in the begining of experiment (6 – 13 days), dimensions of uterine horn diameter and wall thickness are very similar, later (22 – 29 days) differences can be seen for both parameters in both groups and in the end of experiment (38 – 45 days), group of abnormal puerperium still tend to have increased dimensions of uterine horn diameter and wall thickness.

Results represent that normal puerperium in this study had 42% of cows, 52% of cows had minor, medium or more serious abnormality in puerperium and 10% of cows in experiment has developed endometritis at the end of research.

Figure 1. Uterus in the first week postpartum (L – lumen; C – caruncules).

Discussion

Intensive exploitation and irregular management during early and late puerperium result in decreasing or loss of reproductive performances (*Buch et al., 1955; Földi et al., 2006; Francos et al., 1988*). According to Willams (*Williams et al., 1995*) time interval from parturition to the end of involution lasts 23 – 42 days. In same study it was found that the greatest number of cows (51,4%) completed involution during period from 29 to 35 days postpartum. The most intensive involution changes are developing up to 25 days postpartum, when uterine horn

diameter is 20 – 40 mm and both horns are approximately same size (*Leslie 1983*), what coincide with our research. In our study greatest number of cows (48%) has ended uterine involution in time period from 38 – 45 days, what coincide with research of other authors (*William et al., 1995*).

In research of Leslie (*Leslie 1983*) uterine involution in nursing cows has ended already after 15 – 25 days postpartum and after immediate weaning and begining of machine milking involution is complete after 25 – 30 days postpartum. Reason for this is probably frequent surges of oxytocin which arise during nursing and often myometrium contractions. Unlike statement of previous author, where uterine involution in cows with weaned calves is completed 25 – 30 days postpartum, in our study those has ended in the period 38 – 45 days postpartum.

During first three weeks postpartum it comes to the fastest shrinking of the uterine horns (*Kamimura Shunichi et al., 1993*) which is consistent with our study. In fourth week, speed of shrinking for uterine horn diameter slows and from fifth week and after remains at approximately same level.

 Authors which studied changes in uterine wall thickness, after completed involution obtained results of 7.32 ± 1.8 mm (*Mochow Richard et al., 1966*). In our study cows with normal puerperium after completed involution had uterine wall thickness values of 8.42 – 9.02 mm in the period of 38 – 45 days postpartum, which coincide with these authors. Certain number of cows with abnormal puerperium at the end of study had uterine wall thickness values of 8.7 – 10.71 mm. which with other clinical signs indicate the existence of inflammatory processes.

Results obtained by ultrasonography by Okano (*Okano et al., 1987*) indicate that both uterine horns returns to it's former nongravid state and involution is completed after 40 days postpartum, when the measured values of uterine horns have only slight changes, which coincide with our study.

Our study had most coincides with few authors (*Leslie 1983; Mochow Richard et al., 1966; Okano et al., 1987*), but some minor divergence can always appear and had to be taken into consideration.

Veterinarians in most cases do not care enough for control of puerperium and status of reproductive organs involution, which then cause that eventual need of therapy is not well-timed taken, which leads to extension of service period (open days) and lower conception rates.

Conclusions

1. Speed of involutive processes in the uterus in both studied groups was most expressed with first three weeks postpartum, then it begins to slows

and between fourth and fifth week remains at approximately same level until involution has been completed.

2. Uterine involution in cows with normal puerperium has ended in time period between 38 – 45 days postpartum.

3. Uterine involution in cows with moderate and severe puerperium abnormalities during studied period was not fully completed because of engaged inflammatory processes which interfere with it.

4. Uterine horn diameter and wall thickness in cows with abnormal puerperium shows constantly larger measured values comparing with cows with normal puerperium.

5. By ultrasonic examination of uterus during all periods of puerperium clear insight in the mechanismus of involutive processes can be obtained and speed of involution can be precisely expressed in the milimeters through time periods, which can tell us when it is completed.

6. Cows with abnormal uterine status can be easily detected by ultrasonography after obtained values of uterine horn diameter and wall thickness, as well as by presence of uterine content and its characteristics (anechogenic, echogenic, hiperechogenic).

7. On the basis of obtained ultrasonic findings we can prove in which time period uterine involution is completed, when the animal is ready for next artifitial insemination, are there some abnormalities in involutive processes or there is inflammatory process within uterus.

Normalna i abnormalna involucija uterusa krava praćena ultrazvukom

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Rezime

Uspešnost uzgoja goveda je jedan od najvažnijih ciljeva u stočarstvu i zahteva izuzetnu pažnju kada je u pitanju neometana reprodukcija. Konačni cilj u uzgoju goveda je da se proizvede jedno živo tele godišnje, koje će na taj način povećati proizvodnju mleka kroz uspešan graviditet. Cilj našeg istraživanja je bio da pratimo brzinu involucije uterusa uz pomoć ultrazvučnog aparata i napravimo beleške o tome kada su krave spremne za ponovno osemenjavanje, koje će krave zahtevati više vremena da kompletiraju involuciju i koliko će krava imati uterine poremećaje i zahtevati terapiju. Eksperiment je vršen u periodu od oktobra 2009 do kraja januara 2010. U naš je eksperiment bilo uključeno 50 krava i obavljeno je

412 transrektalnih ultrazvučnih pregleda. Krave su transrektalno ispitivane počevši od 6. dana postpartum sve do 52. dana postpartum. Brzina involucije uterusa je praćena kroz smanjenje prečnika i debljine zida roga uterusa. Krave sa normalnim puerperijem su završile involuciju u periodu od 38 – 45 dana postpartum, dok one sa abnormalnim puerperijem su trebale više vremena da je završe ili su zahtevale terapiju radi narušenog stanja uterusa. Ukupno je 48% krava imalo normalnu involuciju uterusa, 52% krava je imalo određene abnormalnosti involucije i 10% krava u eksperimentu je zahtijevalo terapiju. Sa kontinuiranim praćenjem reproduktivnog trakta goveda sa ultrazvukom moguće je pravovremeno otkriti vreme za prvo osemenjavanje postpartum, skratiti servis period ili otkriti abnormalnosti zdravstvenog statusa uterusa i lečiti ga.

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