



Received on 18 January 2019; received in revised form, 22 June 2019; accepted, 14 July 2019; published 01 October 2019

"MITREC" AS AN EFFECTIVE DRUG FOR THE TREATMENT OF COWS WITH CHRONIC ENDOMETRITIS

A. Semivolos¹, V. Agoltsov¹, O. Popova¹, T. Rodionova¹, I. Pankov² and N. Solotova^{*1}

Department of Veterinary Medicine and Biotechnology¹, Saratov State Agrarian University named after N. I. Vavilov, Theater Square, 1-410012, Saratov, Russia.
Nita-Farm Ltd.², Osipova Street, 1-410010, Saratov, Russia.

Keywords:

Chronic endometritis, Sepranol, Endometramag-T, Tilozinocarum, Mitrec, Inhibition

Correspondence to Author:

N. Solotova

Department of Veterinary Medicine and Biotechnology, Saratov State Agrarian University named after N. I. Vavilov, Theater Square, 1- 410012, Saratov, Russia.

E-mail: nsolotova@mail.ru

ABSTRACT: The leading factor restraining the intensification of herd reproduction is endometritis. The article states that the microflora of cow uterine exudate in chronic purulent-catarrhal endometritis is represented by *Staphylococcus aureus*, *Escherichia coli*, *Proteus vulgaris*, *Citrobacter freundii*, *Streptococcus faecalis*, *Streptococcus faecium*, as well as anaerobes and group C *Streptococci*. The drug "Mitrec" showed the greatest effectiveness of suppressing the growth of the majority of isolated strains of microorganisms. Its zone of growth inhibition was as follows: *Streptococcus faecium* - 31 ± 2.06 mm, *Citrobacter freundii* - 30 ± 0.00 mm, anaerobes - 29 ± 0.00 mm, *Proteus vulgaris* - 28.5 ± 1.72 mm, *Escherichia coli* - 27.0 ± 1.45 mm; group C *Streptococci* - 27.32 ± 2.12 mm; *Staphylococcus aureus* strains - 25.5 ± 1.66 mm; *Streptococcus faecalis* - 25.0 ± 1.12 mm. The recovery of cows with chronic purulent-catarrhal endometritis after applying "Tilozinocarum" was 80%, "Endometramag-T" showed 90%, and mitrec demonstrated 100% recovery. During the 90 days of observation of the experimental group of cows injected with the drug "Sepranol" fertilization occurred in 13 animals (65%); insemination index was 4.1. Under Endometramag-T treatment fertilization occurred in 18 animals (90%); insemination index was 2.6. With tilozinocarum 16 females (80.0%) became pregnant with an insemination index of 3.1. The highest (100.0%) fertility of cows was achieved with "Mitrec" with the best insemination index of 1.8. "Mitrec" showed the best clinical recovery of cows from chronic purulent-catarrhal endometritis.

INTRODUCTION: The leading factor restraining the intensification of herd reproduction is the widespread obstetric-gynecological pathology among cows, which inevitably leads to infertility and barrenness, and premature culling of females. Chronic endometritis occupies a significant place (20.0-30.0%) among obstetric-gynecological pathology^{1, 2, 3}.

In Russia, chronic endometritis is recorded in 24.8-52.8% of cows. On the farms of the Saratov region, acute forms of endometritis were found in 17.73-36.05%, and chronic endometritis accounted for 10.94-14.03% of cows⁴.

The etiology of endometritis is very diverse. According to most scientists, the main cause of inflammation in the uterus of cows is an infection of the reproductive organs by opportunistic pathogenic and pathogenic micro flora. Microbiological studies of samples of uterus contents in cows with acute postpartum endometritis showed that in all cases the presence of microorganisms was detected: bacteria, fungi,

	QUICK RESPONSE CODE DOI: 10.13040/IJPSR.0975-8232.10(10).4444-50
	The article can be accessed online on www.ijpsr.com
DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.10(10).4444-50	

viruses^{5, 6, 7, 8, 9, 10}. Many researchers^{11, 12, 13, 14, 15} also concluded that clinical endometritis in cows is caused mainly by a mixed bacterial infection that enters the uterine cavity: *Escherichia coli*, *Trueperella*, and *A. pyogenes*. Whereas other¹⁶ considered *Prevotella melaninogenica*, *Fusobacterium necrophorum*, and *Proteus* sp. more common. Moreover, *E. coli* is the most common isolated type of bacteria in the first 7 days after delivery, and *T. pyogenes* can be considered the dominant bacterium in the uterus, which is most often associated with the occurrence of clinical endometritis in cows after calving^{17, 18}. However, information about the content of microflora in the uterus of cows with chronic endometritis is limited, which complicates the choice of the most effective methods of treatment of animals with this disease¹⁹.

Several researchers²⁰ recommend intrauterine administration of tetracycline, penicillin, chloramphenicol, gentamicin, nitrofurazone, and chlorhexidine for the treatment of cows with chronic endometritis. "Kompleksan" drug is highly effective in chronic endometritis at a dose of 75 ml with intrauterine administration. Therapeutic efficacy reaches 93.3%²¹. The original method of treating cows with acute and chronic endometritis was proposed by Varganov²². After intrauterine administration of the *Doderlein bacillus* (Biosan), clinical recovery occurred in 85-100% of the cows.

Some authors^{23, 24} prefer treating cow chronic endometritis with "Prostaglandin F2 alpha". There occurs a removal of microflora with exudate from the uterus, and earlier manifestation the sexual cycle in animals begins. It is generally accepted that the use of drugs for the treatment of cows with various forms of endometritis should be carried out only taking into account the sensitivity of the uterus microflora to medicines²⁵. Despite criticism, methods of etiotropic therapy, based on the use of drugs containing antibiotics that affect the uterus microflora, continue to be the main focus of the fight against endometritis in cows^{26, 27}.

There are many antibacterial drugs on the veterinary market for the treatment of cows with chronic endometritis. However, their therapeutic efficacy is not always high, since repeated administration of drugs into the uterus is

problematic due to the narrow lumen of the cervix. Therefore, we set ourselves the task of studying the sensitivity of microflora from exudates of the uterus of cows with chronic purulent-catarrhal endometritis and the therapeutic efficacy of widely known drugs: "Endometramag T", "Sepranol", "Tilozinocarum" compared to the new drug "Mitrec", developed by us with "Nita-Farm" Ltd., Russia.

MATERIALS AND METHODS: The cows of a red-and-white breed of average fatness, 4-6 years of age, weighing 450-542 kg, with milk productivity of 4651- 5786 kg per lactation were examined. The experiment was carried out in 2018 on the breeding farm "Trydovoy," Marx district, Saratov region, Russia.

The diagnosis of diseases of the reproductive organs in cows was made based on the analysis of the primary zootechnical examination, results of vaginal, rectal, and echographic studies. The content of the uterus for microbiological examination was taken from the cervix of cows with the chronic purulent-catarrhal form of endometritis. Microbiological studies of isolates were carried out according to generally accepted methods in the test center "Saratov Interregional Veterinary Laboratory of the Federal Service for Veterinary and Phytosanitary Surveillance" using biochemical differentiating plates produced by "Diagnostic Systems" Association, Nizhny Novgorod.

Experimental protocols and procedures were approved by the Institutional Animal Ethics Committee, Saratov State Agrarian University, Russia (protocol ref. no. SM/2/2018-09).

The species of microorganisms was determined, guided by the "Detector of bacteria" Bergi (1980)²⁴, and fungi species were found with the help of "Atlas of pathogenic fungi for farm animals and poultry" (1953). Identification was carried out, taking into account the morphological, cultural, and biochemical properties of microorganisms according to generally accepted methods. Determination of the sensitivity of the selected microorganisms to drugs: "Mitrek," "Endometramag - T," "Sepranol" and "Tilozinocarum" were performed on AGV medium by the method of

diffusion of antibiotics into the agar. To study the efficacy of various drugs in the treatment of cows, 4 experimental groups of cows, 20 heads per each group, and 1 control group were formed out of animals suffering from chronic purulent-catarrhal endometritis.

The first experimental group of cows was intrauterine injected with the "Sepranol" drug, 2 suppositories (previously dissolved in 150 ml of water) three times with an interval of 24 h. The animals of the second experimental group were intrauterine injected with the drug "Endometramag T" three times, in a dose of 100 ml with an interval of 48 h. The third experimental group was intrauterine administered with "Tilozinocarum" three times, at a dose of 20 ml/ 100 kg of body weight with an interval of 48 h. The fourth group of cows was injected with the drug "Mitrec" intrauterine, at a dose of 1 syringe dispenser (19

ml.), once, using a special catheter. The active ingredient of this drug is cefapirin. The results of recovery, fertility, and insemination efficiency of females of different groups within 90 days were studied.

RESULTS: Microbiological studies of the contents of the uterus of cows with chronic purulent-catarrhal endometritis showed that the microflora was represented predominantly by opportunistic pathogenic microflora: *Staphylococcus aureus*, *Escherichia coli*, *Proteus vulgaris*, *Citrobacter freundii*, *Streptococcus faecalis*, *Streptococcus faecium* and also by anaerobes. Opportunistic pathogenic microflora dominated, but pathogenic microorganisms were also identified (group C *Streptococcus*). Microbiological studies have shown that the bactericidal properties of various drugs had specific features.

TABLE 1: THE SENSITIVITY OF THE UTERUS MICROFLORA OF COWS WITH CHRONIC PURULENT-CATARRHAL ENDOMETRITIS TO THE DRUG "SEPRANOL"

Name of microorganisms	Inhibition zone diameter, mm (M±m)	Number of isolates sensitive to the drug, units	Number of isolates sensitive to the drug, %
<i>Staphylococcus aureus</i>	19.0 ± 0.62	3	75
<i>Escherichia coli</i>	25.11 ± 1.87	9	50
<i>Proteus vulgaris</i>	15.0 ± 0.00	1	50
<i>Citrobacter freundii</i>	21.0 ± 0.00	1	100
<i>Streptococcus</i> group C	25.0 ± 0.00	1	100
<i>Streptococcus faecalis</i>	19.33 ± 1.33	3	75
<i>Streptococcus faecium</i>	17.5 ± 0.88	2	100
Anaerobes	15.0 ± 0.00	1	100

Antibacterial activity of "Sepranol" was the highest against *Escherichia coli* (25.11 ± 1.87 mm) and *Streptococcus C* (25 ± 0.00 mm) **Table 1**. Among the tested 4 isolates of *Staphylococcus aureus* in three cases, the zone of growth inhibition of microflora was 19 ± 0.62 mm, out of 4 strains of *Streptococcus faecalis*, three were sensitive, with a zone of growth inhibition of 19.33 ± 1.33 mm. The frequency of resistance of *Proteus vulgaris* strains was 50% with a delay zone of 15.0 ± 0.00 mm. The strains of the presented microorganisms (anaerobes, *Streptococcus faecium*, *Citrobacter freundii*, *Streptococcus C* group) were 100% sensitive to "Sepranol" with a growth inhibition zone varying from 15.0 ± 0.00 to 21 ± 0.00 mm **Table 1**.

When "Endometramag T" and "Tilozinocarum" were used the zone of inhibition of microorganism strains was: *Staphylococcus aureus* - 21.67 ± 1.76

mm and 21.25 ± 1.22 mm, *Escherichia coli* - 21.62 ± 1.56 mm and 20, 67 ± 0.72 mm, *Proteus vulgaris* - 25 ± 0.00 mm and 20.5 ± 0.75 mm, *Citrobacter freundii* - 30 ± 0.00 mm and 24 ± 0.00 mm, *Streptococcus faecalis* - 23.67 ± 0.66 mm and 17.25, *Streptococcus faecium* - 28.5 ± 1.14 mm and 26.5 ± 0.00 mm, anaerobes - 19 ± 0.00 mm and 20 ± 0.00 mm respectively **Table 2** and **3**. Isolate of *Streptococcus* group C was sensitive to the drug "Endometramag T" with a zone of suppression of 27 ± 0.00 mm, but not sensitive to "Tilozinocarum" **Table 2** and **3**.

The drug "Mitrec" showed the highest zone of growth inhibition of most of the isolated strains of microorganisms **Table 4**. Its zone of growth inhibition was as follows: *Streptococcus faecium* - 31 ± 2.06 mm, *Citrobacter freundii* - 30 ± 0.00 mm, anaerobes - 29 ± 0.00 mm, *Proteus vulgaris* -

28.5 ± 1.72 mm, *Escherichia coli* - 27.0 ± 1.45 mm; *Streptococcus group C* - 27.32 ± 2.12 mm; strains of *Staphylococcus aureus* - 25.5 ± 1.66 mm; *Streptococcus faecalis* - 25.0 ± 1.12 mm.

TABLE 2: THE SENSITIVITY OF THE UTERUS MICROFLORA OF COWS WITH CHRONIC PURULENT-CATARRHAL ENDOMETRITIS TO THE DRUG “ENDOMETRAMAG T”

Name of microorganisms	Inhibition zone diameter, mm (M±m)	Number of isolates sensitive to the drug, units	Number of isolates sensitive to the drug, %
<i>Staphylococcus aureus</i>	21.67 ± 1.76	3	75
<i>Escherichia coli</i>	21.62 ± 1.56	13	72,22
<i>Proteus vulgaris</i>	25.0 ± 0.00	1	50
<i>Citrobacter freundii</i>	30.0 ± 0.00	1	100
<i>Streptococcus group C</i>	27.0 ± 0.00	1	100
<i>Streptococcus faecalis</i>	23.67 ± 0.66	3	75
<i>Streptococcus faecium</i>	28.5 ± 1.14	2	100
Anaerobes	19.0 ± 0.00	1	100

TABLE 3: THE SENSITIVITY OF THE UTERUS MICROFLORA OF COWS WITH CHRONIC PURULENT-CATARRHAL ENDOMETRITIS TO THE DRUG “TILOZINOCARUM”

Name of microorganisms	Inhibition zone diameter, mm (M±m)	Number of isolates sensitive to the drug, units	Number of isolates sensitive to the drug, %
<i>Staphylococcus aureus</i>	21.25 ± 1.22	4	100
<i>Escherichia coli</i>	20.67 ± 0.72	3	16,67
<i>Proteus vulgaris</i>	20.5 ± 0.75	2	100
<i>Citrobacter freundii</i>	24.0 ± 0.00	1	100
<i>Streptococcus group C</i>	-	-	-
<i>Streptococcus faecalis</i>	17.25 ± 0.65	4	100
<i>Streptococcus faecium</i>	26.5 ± 1.17	2	100
Anaerobes	20.0 ± 0.00	1	100

TABLE 4: THE SENSITIVITY OF THE UTERUS MICROFLORA OF COWS WITH CHRONIC PURULENT-CATARRHAL ENDOMETRITIS TO THE DRUG “MITREC”

Name of microorganisms	Inhibition zone diameter, mm (M±m)	Number of isolates sensitive to the drug, units	Number of isolates sensitive to the drug, %
<i>Staphylococcus aureus</i>	25.50 ± 1.66	4	100
<i>Escherichia coli</i>	27.0 ± 1.45	11	61,11
<i>Proteus vulgaris</i>	28.5 ± 1.72	2	100
<i>Citrobacter freundii</i>	30.0 ± 0.00	1	100
<i>Streptococcus group C</i>	27.32 ± 2.12	2	66,67
<i>Streptococcus faecalis</i>	25.0 ± 1.12	4	100
<i>Streptococcus faecium</i>	31.0 ± 2.06	2	100
Anaerobes	29.0 ± 0.00	1	100

It should be noted that veterinary specialists most often used “Tilozinocarum” for the treatment of cows with endometritis. This could contribute to an increase in the resistance of microflora to tilozin, which is the active substance of “Tilozinocarum” and “Endometramag T,” which explains the lower sensitivity of the selected strains of microorganisms to these drugs.

Therefore, the microflora of the uterus of cows with chronic purulent-catarrhal endometritis is represented by *Staphylococcus aureus*, *Escherichia coli*, *Proteus vulgaris*, *Citrobacter freundii*, *Streptococcus faecalis*, *Streptococcus faecium*, *Streptococcus C*, and anaerobes. The highest

sensitivity of opportunistic pathogenic and pathogenic microflora of the uterus is established to the drug “Mitrec.” Microbiological studies have shown that the microflora of the uterus contents with chronic purulent-catarrhal endometritis was sensitive to “Mitrec,” “Tilozinocarum,” and less sensitive to “Sepranol” and “Endometramag T.”

The results of the microbiological studies obtained served as the basis for conducting clinical trials of this drug on cows with chronic endometritis. Clinical observations and studies have shown that after applying of various drugs, a manifestation of the stage of sexual cycle initiation in all females of the experimental groups was recorded.

In the experimental group of cows, which were injected with the drug "Sepranol," fertilization **Table 5** occurred in 12 animals (60.0%) in the first sexual cycle, in the second cycle in 4 (20.0%) animals, in the third in 8 (40.0%) animals. In total, during the experiment, 13 cows or 65.0% became pregnant with a rather low insemination index of

4.1. In the experimental group of cows treated with "Endometramag T," the fertility rate in the first sexual cycle was only 10.0%. It increased in the second and third cycles, significantly reaching 50.0% and 35.0% respectively. In total, 18 cows were fertilized (90.0%) with an insemination index of 2.6.

TABLE 5: FERTILITY OF COWS WITH CHRONIC PURULENT-CATARRHAL ENDOMETRITIS WHEN TREATED BY VARIOUS DRUGS

Name of the drug	Pregnancy rates by the sexual cycles						Total rate of pregnancy		Insemination index
	1		2		3		head	%	
	head	%	head	%	head	%			
Sepranol	1	5.0	4	20,0	8	40,0	13	65	4,1
Endometramag T	1	5.0	10	50,0	7	35,0	18	90	2,6
Tilozinocarum	2	10.0	6	30,0	8	40,0	16	80	3,1
Mitrec	6	30.0	12	60,0	2	10,0	20	100	1,8

After the treatment of cows with tilozinocarum fertilization occurred in 2 females (10.0%) in the first sexual cycle, in the second cycle in 6 (30.0%) animals, and the third in 8 (40.0%) animals. In total, 16 animals became pregnant during the experiment or 80.0% with an insemination index of 3.1. The highest (100.0%) fertility of cows was achieved with the use of the drug "Mitrec" with the best insemination index of 1.8. It should be noted that in this experimental group, fertility in the first and second cycle was the highest, which is mainly decisive for artificial insemination of cows (30.0 and 60.0%, respectively).

TABLE 6: THE RECOVERY RATE OF COWS WITH CHRONIC PURULENT-CATARRHAL ENDOMETRITIS DEPENDING ON THE DRUG USED

Name of the drug	The period from the beginning of treatment to the first sexual cycle
Mitrec	14.7±0.21*
Tilozinocarum	19.9±0.26
Endometramag T	21.1±0.34
Sepranol	21.9±0.54

* P <0.05 refers to Tilozinocarum, Endometramag T and Sepranol.

When treated with Endometramag-T and Sepranol, the clinical recovery of cows, confirmed by ultrasound scanning, was 21.1 ± 0.34 and 21.9 ± 0.54 days, respectively **Table 6**. After the use of the drug "Tilozinocarum" recovery in animals occurred after 19.9 ± 0.26 days. Whereas after the use of the drug "Mitrec" the recovery period for cows was the shortest - 14.7 ± 0.21 days (with P <0.05). The study indicates that the effectiveness of fertilization of cows with chronic purulent - catarrhal endometritis after the treatment with Mitrec was higher compared to the use of

Endometramag T by 1.4; Tilozinocarum by 1.7 and Sepranol by 2.3 times.

DISCUSSION: The main cause of clinical endometritis according to ^{9, 25} is mainly mixed microflora: *Escherichia coli*, *Treponema trichodes* or *Fusobacterium necrophorum*, *Klebsiella* spp. and *Proteus vulgaris* ¹⁰. Some authors ¹¹ consider *S. pyogenes* the dominant bacterium in the uterine cavity of cows with clinical endometritis after calving. Our microbiological studies of the contents of the uterus of cows with chronic purulent-catarrhal endometritis showed that the microflora was represented not only by *Escherichia coli*, *Proteus vulgaris* but also by *Staphylococcus aureus*, *Citrobacter freundii*, *Streptococcus faecalis* and *Streptococcus faecium*.

It is recommended ^{8, 11, 23} to treat cows with the drugs containing antibiotics: tetracycline, penicillin, gentamicin, nitrofurazone, which affect the uterine microflora of animals with endometritis. However, the use of such drugs inevitably leads to a long (48-72 h) restriction of the use of milk for human nutrition. The drug "Mitrec," containing the active substance cefapirin, had the highest antibacterial activity in the uterine microflora of cows with chronic endometritis, which made it possible to achieve a 100% clinical recovery and fertilization of all animals with minimal terms of milk use (up to 24 h).

CONCLUSION: Thus, microbiological studies have shown that the drug "Mitrec" has a stronger bactericidal effect on the uterine microflora of

cows with chronic purulent-catarrhal endometritis, and its therapeutic efficacy in this disease of the uterus is higher compared to the well-known and widely used in veterinary practice " Endometramag T " and "Tilozinocarum" by 1.4 and 1.7 times, respectively.

ACKNOWLEDGEMENT: The authors are thankful to the Rector of Saratov State Agrarian University and to the Nita-Farm Ltd., Saratov, Russia for supporting with all essential requirements for the present research.

CONFLICT OF INTEREST: The authors declared that there is no conflict of interest.

REFERENCES:

- Huzzey JM and Veira DM: Weary Prepartum behavior and dry matter intake identify dairy cows at risk for metritis. *J Dairy Sci* 2007; 90: 3220-33.
- McDougall S, Macaulay R and Compton C: Theriogenology between endometritis diagnosis using a novel intravaginal device and reproductive performance in dairy cattle. *Anim Reprod Sci* 2007; 99: 9-23.
- Kimura F, Takebayashi A, Ishida M, Nakamura A, Kitazawa J, Morimune A, Hirata K, Takahashi A, Tsuji S, Takashima A, Amano T, Tsuji S, Ono T, Kaku S, Kasahara K, Moritani S, Kushima R and Murakami T: Chronic endometritis and its effect on reproduction. *J Obstet Gynaecol Res* 2009; 45(5): 951-60.
- Semyvolos AM and Pankov IY.: The spread of obstetric and gynecological pathology in cows in the farms of the Saratov region. *Journal of Saratov State Agrarian University named after N.I. Vavilov* 2017; 5(5): 14-18.
- Bettocchi S, Ceci O, Di Venere R, Pansin MV, Pellegrino A, Marelllo F and Napp L: Advanced operative office hysteroscopy without anesthesia: analysis of 501 cases treated with a 5 Fr. bipolar electrode. *Hum Reprod* 2002; 17: 2435-38.
- Ribeiro ES, Gomes G, Greco LF, Cerri RLA, Vieira-Neto A, Monteiro PL, Lima FS, Bisinotto RS, Thatcher WW and Santos JE: Carry-over the effect of postpartum inflammatory diseases on developmental biology and fertility in lactating dairy cows. *J Dairy Sci* 2016; 99: 2201-20.
- Knudsen LR, Karstrup CC, Pedersen HG, Angen O, Agerholm JS, Rasmussen EL, Jensen TK and Klitgaard K: An investigation of the microbiota in uterine flush samples and endometrial biopsies from dairy cows during the first 7 weeks postpartum. *Theriogenology* 2016; 86: 642-50.
- Karstrup CC, Klitgaard K, Jensen TK, Agerholm JS and Pedersen HG: Presence of bacteria in the endometrium and placentomes of pregnant cows. *Theriogenology* 2017; 99: 41-47.
- Ibrahim M, Peter S, Wagener K, Drillich M, Ehling-Schulz M, Einspanier R and Gabler C: Bovine endometrial epithelial cells scale their pro-inflammatory response in vitro to pathogenic *Trueperella pyogenes* isolated from the bovine uterus in a strain-specific manner. *Front Cell Infect Microbiol.* 2017; 15: 247-64.
- Sicsic R, Goshen T, Dutta R, Kedem-Vaanunu N, Kaplan-Shabtai V, Pasternak Z, Gottlieb Y and Raz T: Microbial communities and inflammatory response in the endometrium differ between normal and metritic dairy cows at 5-10 days post-partum. *Vet Res* 2018; 49(1): 77.
- LeBlanc SJ and Osawa TJ: Dubuc Reproductive tract defense and disease in postpartum dairy cows. *Theriogenology* 2011; 76(9): 1610-18.
- Vardanyan Z, Gevorkyan V, Ananyan M, Vardapetyan H and Trchounian A: Effects of various heavy metal nanoparticles on *Enterococcus hirae* and *Escherichia coli* growth and proton-coupled membrane transport. *J. Nanobiotechnol* 2015; 13: 69.
- Moore SG, Ericsson AC, Pooock SE, Melendez P and Lucy MC: Hot topic: 16S rRNA gene sequencing reveals the microbiome of the virgin and pregnant bovine uterus. *J Dairy Sci* 2017; 100: 4953-60.
- Karstrup CC, Agerholm JS, Jensen TK, Swaro LR, Klitgaard K, Rasmussen EL, Krogh KM and Pedersen HG: Presence and localization of bacteria in the bovine endometrium postpartum using fluorescence in situ hybridization. *Theriogenology* 2017; 92: 167-75.
- Cunha F, Jeon SJ, Daetz R, Vieira-Neto A, Laporta J, Jeong KC, Barbet AF, Risco CA and Galvao KN: Quantifying known and emerging uterine pathogens, and evaluating their association with metritis and fever in dairy cows. *Theriogenology* 2018; 114: 25-33.
- Madoz LV, Giuliadori MJ, Migliorisi AL, Jaureguiberry M and Sota RL: Endometrial cytology, biopsy, and bacteriology for the diagnosis of subclinical endometritis in grazing dairy cows. *J. Dairy Sci* 2014; 97(1): 195-01.
- Lefebvre RC and Stock AE: Therapeutic efficiency of antibiotics and prostaglandin F2 α in postpartum dairy cows with clinical endometritis: An evidence-based evaluation. *Veterinary Clinics of North America. Food Animal Practice* 2012; 28(1): 79-96.
- Sharma N, Malik D, Bhandu A, Batra N and Behal A: Screening and partial characterization of natural isolates of lactic acid bacteria for bacteriocin production. *Int Food Res J* 2017; 24: 915-20.
- LeBlanc SJ, Duffield TF, Leslie KE, Bateman KG, Keefe GP and Defining JS: Diagnosing postpartum clinical endometritis and its impact on reproductive performance in dairy cows. *J Dairy Sci* 2002; 85: 223-36.
- Kasimanickam R, Duffield TF, Foster RA, Gartley CJ, Leslie KE, Walton JS and Johnson WH: The effect of a single administration of cephapirin or cloprostenol on the reproductive performance of dairy cows with subclinical endometritis. *Theriogenology* 2015; 63: 818-30.
- Gromyko EV and Nazarov MV: The use of "Polivet" for the prevention and treatment of obstetric-gynecological diseases in cows. *Manual on the use of "Polivet". Krasnodar* 2002; 4: 1-3.
- Varganov AI, Filatov AV, Konopeltsev IG and Biosan SV: In the treatment of cows with endometritis. *Materials of a scientific conference. St. Petersburg* 1998; 1: 49-50.
- Galvão KN, Frajblat M, Brittin SB, Butler WR, Guard CL and Gilbert RO: Effect of prostaglandin F2 alpha on subclinical endometritis and fertility in dairy cows. *J Dairy Sci* 2009; 92: 4906-13.
- Lefebvre RC and Stock AE: Therapeutic efficiency of antibiotics and prostaglandin F2 α in postpartum dairy cows with clinical endometritis: An evidence-based evaluation. *Veterinary Clinics of North America. Food Animal Practice* 2012; 28(1): 79-96.
- Toleman MA, Gurcan S, Ozer B and Aydoslu B: Global emergence of trimethoprim/sulfamethoxazole resistance in *Stenotrophomonas maltophilia* mediated by acquisition of sul genes. *Bukavaz Emerg Infect Dis* 2007; 13: 559-65.

26. Belenky P, Ye JD, Porter CB, Cohen NR, Lobritz MA, Ferrante T, Jain S, Korry BJ, Schwarz EG and Walker GC: Bactericidal antibiotics induce toxic metabolic perturbations that lead to cellular damage. Cell Rep 2015; 13: 968-80.

27. Zhang XF, Shen W and Gurunathan S: Silver nanoparticle-mediated cellular responses in various cell lines: An *in-vitro* model. Int J Mol Sci 2016; 17: 1603.

How to cite this article:

Semivolos A, Agoltsov V, Popova O, Rodionova T, Pankov I and Solotova N: "Mitrec" as an effective drug for the treatment of cows with chronic endometritis. Int J Pharm Sci & Res 2019; 10(10): 4444-50. doi: 10.13040/IJPSR.0975-8232.10(10).4444-50.

All © 2013 are reserved by International Journal of Pharmaceutical Sciences and Research. This Journal licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License.

This article can be downloaded to **Android OS** based mobile. Scan QR Code using Code/Bar Scanner from your mobile. (Scanners are available on Google Play store)