Mastitis in Ukrainian cows – effective ways to solve the problem

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Nowadays, after the entry of Ukraine into WTO and the introduction of new European standards, quality requirements of raw milk and dairy products have increased and this has drawn attention of veterinary specialists to mastitis in cows.

Mastitis in cows is an important economic issue because it causes milk loss and decreases competitiveness of Ukrainian dairy products.

Impact of mastitis

Mastitis is an inflammation of the mammary gland due to the activity of mechanical, thermal, chemical and biological factors that produce pathological changes in tissues and also in the quantity and composition of the milk produced.

Cow mastitis is a primary problem of veterinary practice due to its wide spreading, great economic impact and health threat to people. This disease is diagnosed in many countries all over the world including farms with a high technological level, as well as in Ukrainian farms regardless of the type of activity and proprietary form.

In the literature many authors state that mastitis occurs in 10-70% of herds and that 8-16% cows suffer this pathology twice or more during a lactation. Mastitis occurs in cows mostly in autumn, winter and spring.

The peak of disease is noted in the first month of lactation due to the great functional stress on the body, especially the udder.

During lactation mastitis gradually abates and increases again during the drying off period, namely from the last week before calving and at the beginning of lactation.

The number of cows with a positive reaction of milk to subclinical mastitis increases every lactation and its incidence is: up to three years of age – 67.4%, up to 4-5 years of age – 80.0%, up to 6-7 years of age – 80.0% and from 8 years onwards – 94.1%.

The wide introduction of milking machines, the breakdown in process and violations of veterinary and hygienic standards has resulted in raised frequency of mastitis in cows.

Almost every case of mastitis with clinical signs begins from a subclinical form, and for each case of clinical mastitis we have up to 15, and sometimes even 40, cases of subclinical mastitis.

Highly productive cows are more susceptible to mastitis due to more intensive metabolism and decreased resistance. For example, in cows with milk yields of 3,000kg per lactation, mastitis occurs in 4% of cows, while in cows with milk yields up to 3,500kg and more it occurs in 17.9% of cows.

Despite insufficient data on morbidity and notorious falsification of statistical information for Ukrainian farms, we can give an example: in 2006-2008 in farms in the Luhansk Oblast region about 30.4% of the cows had mastitis.

Subclinical mastitis

Subclinical mastitis was most widespread – 82.9% of animals had mastitis, 8.9% of cows had serous mastitis, 3.8% had cistern catarrh, 1.9% had alveolar catarrh and 2.5% of cows had serous-catarrhal and purulent-catarrhal mastitis, respectively.

Summarising data on mastitis distribution in different countries for 1988-1996, E Malinowski concluded that as an average clinical form of mastitis was diagnosed in different herds in 30-50% of cows during a year. On the other hand subclinical mastitis was registered in 20-50% of cows and affected one or more udder lobes.

Finally, more than 70-80% of the general loss because of mastitis fell to the share of subclinical mastitis.

Mastitis is a great problem and in the USA and Great Britain more than 2.5 million tube syringes (single dose) of anti-mastitis products per one statistical cow and per year are used. That is why this disease is considered to be the third in importance after tuberculosis and brucellosis.

Mastitis may be acute, subacute and chronic. This disease is classified by anatomical and aetiological features, and by the type of inflammation. Most classifications are based on the aetiological principles where pathogens triggering disease development prevail.

According to international classification, all inflammatory processes in the udder are divided into clinical mastitis, subclinical mastitis, non-specific (aseptic) mastitis and latent infection.

Udder inflammation

Udder inflammation causes both economic and social damage. Economic damage mainly concerns the owners of animals and milk plants. Social damage is difficult to calculate, because it is the result of the consumption of low quality milk and dairy products by people and, especially, children.

Annual losses derived from mastitis per cow are estimated at €1000-3000 in Belgium, £75-150 in Great Britain, €150-300 in the Netherlands and €500-1000 in France.

The main damage due to mastitis is the decrease in cow productivity because of the reduced milk synthesis in the inflamed part of the udder.

Milk synthesis in the udder decreases according to three factors: the 'size' of inflammation, the extent of damage in udder parenchyma and disease duration.

In clinical mastitis, loss of milk may be considerable and up to 20-30% of milk yield per lactation. In recovered cows, the milk yield in the next lactation is not restored to a full degree and remains approximately 10% lower.

In subclinical mastitis, the decrease in milk yield is less (up to 10-15%) but this disease is not always noticed in time, and due to its widespread nature and duration losses are normally more significant.

In recovered animals the function of the mammary gland is not restored completely. In the great majority of cases this results in hypogalactia or agalactia, and in some cases (5-10%), regardless of the treatment, mastitis can cause atrophy.

Mastitis is also one of the main diseases that result in cows being removed form the herd.

From 19-50% of culled animals are cows recovered after mastitis or with atrophy and indurations of udder lobes. Premature removal decreases the period of productive use of cows to 3.5-4.0 years and causes additional loss of milk and calves during few lactations.

Decreased milk production and key reproductive features in every cow with mastitis clinical signs may cause economic loss from $175-230.

Consumption of colostrum from cows with mastitis may lead to gastro-intestinal and pulmonary diseases in calves and even to their death. One of the most dangerous concerns of mastitis is that the milk may be potentially dangerous for human health. Another issue is that poor quality milk causes allergy and diseases transmitted through it.

Treatment of mastitis

There are numerous discussions in literature about which is the way to treat and prevent mastitis with the most perceptible effect. Today there is a wide range of methods and products for treatment: antibiotic therapy via intramuscular, intravenous or intracisternal, anti-inflammatory therapy using steroid or non-steroid products, blockades, stimulation of contractile function and administration of vitamins. However, none of these methods is highly effective.

1Intracisternal antibiotic therapy was considered the panacea for cows with mastitis at one time. This method allows high concentrations of antibiotics in the mammary gland with fewer doses thanks to the active molecule directly entering

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into inflamed tissue. Disadvantages are the uneven distribution of the active antibiotic substance in udder parenchyma, the risk that other insensitive micro-organisms and fungi enter the udder, the inhibition of phagocytosis and the difficulties in tube introduction, especially in clinical mastitis when tissues of mammary gland are inflamed, oedematous and painful.

According to different data sources, efficiency of intracisternal antibiotic therapy does not exceed 40-50%.

1Parenteral antibiotic therapy was introduced into practice in the 70s, and today it still remains a priority treatment in some areas, particularly in Scandinavian countries.

Despite the fact that some pharmaceutical companies have tried to persuade veterinarians that during parenteral (intramuscular or intravenous) administration antibiotics are distributed in udder tissues more evenly, it should be noted that because of the accelerated elimination of systemic antibiotics and its short half-life in a ruminant body, it is rather difficult to achieve and keep their necessary concentrations in mammary tissues.

This would especially apply to products with durable action. Moreover, when milk is present, minimum inhibitory concentrations for most antibiotics in the udder are not achieved.

Paradoxically, the higher antibiotic tropism will be established in udder tissue, the more its metabolites will be released within milk and that is not allowed for producers of dairy products.

Antibiotic residues

Furthermore, the main disadvantage for all types of antibiotic therapy is the large amount of milk with antibiotic residues and metabolites that must be discarded.

1According to results of numerous studies, local treatments (blockades) are effective only on initial stages of disease and they can be used as auxiliary treatment. Novocaine blockades are effective on initial stages of acute mastitis only.

1Regarding corticosteroid anti-inflammatory therapy, among glucocorticosteroids used for mastitis treatment dexamethasone is rather popular. Indeed, thanks to anti-inflammatory, antiallergic and gluconeogenic activity, glucocorticoids may be useful in cases of shock, allergic reactions and inflammations based on hypersensitive reactions.

However, dexamethasone efficiency in treatment of mastitis remains controversial. Due to transient decrease of milk production, polyuria and polydipsia, immunosuppression and possible 'withdrawal syndrome', veterinarians are looking for alternatives to dexamethasone, particularly NSAIDs.

1Regarding non-steroid anti-inflammatory therapy, non-steroid anti-inflammatory drugs (NSAIDs) have more than 50 years history and are popular today.

In the USA, for instance, general practitioners issue more than 100 million prescriptions for NSAIDs, which represents more than $5 billion. NSAIDs are also very popular in veterinary medicine.

Nowadays, there are more than 10 groups of such products, differing on chemical structure, pharmacokinetics and pharmacodynamics and mechanism of action.

Having evolved from aspirin to derivates of propionic acid and coxibs, NSAIDs are an integral part of anti-inflammatory therapy in both small animals and cattle.

They are used to treat inflammations of musculoskeletal system, pain syndrome and multimodal operative analgesia. Mastitis is also in this list.

It is known that during mastitis inflammation is accompanied by phospholipase activation that produces arachidonic acid from membrane phospholipids.

At that time, different types of cells such as endotheliocytes, mastocytes, basophils, monocytes and macrophages are activated.

Arachidonic acid metabolites are necessary for cyclooxygenase and lipoxygenase enzymatic systems and their activity results in the formation of proinflammatory substances such as prostaglandins, thromboxanes and leukotrienes.

To control udder inflammation effectively, paths of cyclooxygenase and lipoxygenase activity should be blocked so that prostaglandins and leukotrienes are not formed.

Such a double inflammation inhibitor is ketoprofen – a propionic acid derivative and an ingredient of Ainil (Invesa, Spain).

Intramuscular Ainil has clear anti-inflammatory, analgesic and antipyretic action at inflammatory processes caused by diseases of the respiratory tract, udder oedema,

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Table 1. Effect of Ainil treatment in cows from Polissya Milk Ltd, Bakhmach District (red-marked Ukrainian breed).

Group (cows)	State of animals before treatment (diagnosis[1], localisation of the process)	Treatment schedule	Results of treatment	Approximate cost of treatment[2] (UAH/head)	Loss due to discarded milk because of product use[3] (UAH/head)
1 (10)	**Subclinical mastitis** (4 cows - right back lobe; 2 – right front; 2 – left front; 2 – left back lobe)	Novocaine blockade + Bicillin 5 i.m.*	Content of somatic cells is steady high (> 500,000 cells/ml)	30	> 100
2 (10)	**Subclinical mastitis** (4 cows - right back lobe; 2 – right front; 2 – left front; 2 – left back lobe)	Oxytetracycline + Neomycin + Bacitracin + Prednisolone + Canamycin sulphate in combination with procain-benzilpenicillin tube syringe i.c.**	In 5 animals content of somatic cells is steady high (> 500,000 cells/ml)	35	> 100
3 (10)	**Subclinical mastitis** (2 cows - right front lobe; 2– left back; 2 – left front; 4 – right and left front lobes)	Novocaine blockade + Oxytetracycline + Neomycinum + Bacitracin + Prednisolone tube syringe i.c.**	In 6 animals content of somatic cells is steady high (> 500,000 cells/ml)	27	> 100
4 (10)	Subclinical mastitis (5 cows - left front lobe; 2 – left back; 2 – right back; 1 – right and left front lobes)	Ainil in dose 3ml/ 100kg b.w.) once per 24 hours for 3 days i.m.*	Possible decrease in amount of somatic cells 3 days after the first administration; in 7 days – in 6 cows somatic cells were not found	38	0
5 (6)	Clinical mastitis (purulent-catarrhal) (1 cow - left front lobe; 2 – left back; 1 – right back; 2 – right and left front lobes)	Ainil in dose 3ml/ 100kg b.w.) once every 24 hours for 3 days i.m.*	In all cows there were no clots in milk, milk is not changed; oedema disappeared, affected lobe looks like others. Possible decrease in amount of somatic cells 3 days and 7 days after the first administration.	38	0

* intramuscular
** intracisternal

[1] subclinical mastitis diagnosis was based on mastidine test and automated somatic cells count; [2] the cost of veterinary medical attention etc was not included in the costs of treatment;
[3] loss was calculated on the basis of the purchase cost of milk -1.4 UAH/l-, average withdrawal period for all products was 5±2 days, average daily milk yield was 15 litres

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acute mastitis and diseases of the musculoskeletal system.

Positive opinions on this product were confirmed in clinical studies conducted in cattle farms in Chernigiv Oblast (Tables 1 and 2).

In addition to Ainil's high efficiency in mastitis treatment, an obvious therapeutic effect was seen in cows with oedematous joints and claudication.

After the five day course of treatment with a dose of 15ml per cow once every 24 hours, five injections per course, mobility was partly or completely renewed on the 4-7th day from the beginning of treatment.

Studies showed that Ainil monotherapy had a significant medical effect in cows with subclinical and clinical mastitis expressed as a reliable decrease in the content of somatic cells, reduced oedema, reduction of pain and no modified milk yield.

It is necessary to highlight that Ainil acts quite quickly – positive results are observed 48-72 hours after the first administration. It is easy to use – usual intramuscular injection – and shows no side effects. The most important thing is that it significantly saves costs because it leaves no residues in the milk (ketoprofen is metabolised in liver to insignificant metabolites and more than 90% of the product is excreted with urine as glucuronids). Consequently, there is no withdrawal period for milk, while in traditional treatments losses during the withdrawal period can exceed 100 UAH per day.

We can conclude that Ainil has a good medical effect in cows with subclinical mastitis, which is now considered the most widespread disease in dairy cattle and is often the precursor of more severe forms of mastitis. Moreover, Ainil can prevent relapses of this important disease of dairy cattle. ■

Table 2. Effect of Ainil treatment in cows from Batkivshchyna STOV of Sribnyanski District (Holstein breed).

Group (cows)	State of animals before treatment (diagnosis[1], localisation of the process)	Treatment schedule	Results of treatment	Approximate cost of treatment[2] (UAH/head)	Loss due to discarded milk because of product use[3] (UAH/head)
1	**Subclinical mastitis** (3 cows - right front lobe; 2 - left back; 2 - left front lobe)	Dexamethasone phosphate 0.2% in doses of 15ml once every 3 days, 2 injections i.m.*	In 6 animals content of somatic cells is steady high (> 500,000 cells/ml)	30	> 100
2	**Subclinical mastitis** (1 cow - right front lobe; 2 - left front; 2 - left and right back; 2 - right back lobe)	Phenylbutazone 20% in doses of 30ml once every 24 hours, 3 injections i.m*	In 5 animals content of somatic cells is steady high (> 500,000 cells/ml)	35	> 100
3	**Subclinical mastitis** (2 cows - right front lobe; 1 - left front; 1 - left and right back; 3 - right back lobe)	Glucovit 50ml, Introvit 15ml, i.m.; blockade after Logvinov	In 8 animals content of somatic cells is steady high (> 500,000 cells/ml)	27	30-30
4	Subclinical mastitis (2 cows - left front lobe; 1 - front right; 2 - left and right back; 2 – right back lobe)	Ainil in doses of 3ml/ 100 kg b.w. once every 24 hours for 3 days i.m.* * intramuscular ** intracisternal	Decrease in amount of somatic cells 3 days after the first administration.	38	0

[1] subclinical mastitis diagnosis was based on mastidine test and automated somatic cells count; [2] the cost of veterinary medical attention etc was not included in the costs of treatment;
[3] loss was calculated on the basis of the purchase cost of milk -1.4 UAH/l-, average withdrawal period for all products was 5±2 days, average daily milk yield was 15 litres