



BOVINE MASTITIS PRODUCTS & THERAPY OPTIONS

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Outline of Presentation

- Brief introduction of Mastitis, its types, risk factors and etiology
- Need for Therapy
- Important stages regarding mastitis therapy
- Specific therapy for the various forms of mastitis
- Therapeutic options
- Conclusion

MASTITIS

- Mastitis?
- Definition

Types of Mastitis	Characteristic Symptoms or Definition
Acute clinical	Inflammation of the teat, fever above 39°C, weak and dejected animal, lack of appetite. Drastic drop in milk yield. Often follows calving and, less seriously, after cow goes dry.
Peracute clinical	Swollen, red, painful quarter. Milk passes with difficulty. Fever over 41°C. Cow has no appetite, shivers and loses weight quickly. Lactation often stops.
Subacute clinical	No apparent change in udder, presence of flaky particles in milk, especially in initial ejection. Subject appears healthy.
Subclinical	No symptoms. 15 to 40 cases for every clinical case. Milk appears normal. Only change is detection of pathogenic agent in analysis and increased somatic cell count. Mostly caused by <i>Staphylococcus aureus</i> .
Chronic	Repeated but mild clinical attacks, generally without fever. Lumpy milk, quarters sometimes swollen. Quarter may become hard (fibrous indurations). Antibiotic treatments often do not work.
Gangrenous	Affected quarter is blue and cold to the touch. Progressive discolouration from the tip to the top. Necrotic parts drop off. Cow often dies.
Contagious	Mastitis caused by bacteria such as <i>Staphylococcus aureus</i> and <i>Streptococcus agalactiae</i> , of which other infected cows are the main source.
Environmental	Mastitis caused by bacteria such as coliforms (e.g. <i>E. coli</i>), of which the main source is a contaminated environment, i.e. manure.

Species	Main Source	Living Conditions	Propagation Factors
<i>Streptococcus agalactiae</i>	Infected cows	Infected quarters and udder only	Using same rag for cleaning
<i>Staphylococcus aureus</i>	Infected cows	On abnormal udder and teat, milkers, vagina, tonsils	Transmitted by hands or rags, enters during milking
<i>Streptococcus dysgalactiae</i>	Infected cows	Infected quarter, injuries	
<i>Streptococcus uberis</i>	Contaminated environment	On cow's skin, mouth, ground	Neglected udder washing, insufficient drying, lack of bedding, muddy yards
<i>Escherichia coli</i>	Contaminated environment	Ground, bedding (sawdust and shavings), manure, water	Dirty calving stall, lack of bedding, inadequate udder washing
<i>Corynebacterium pyrogenes</i>	Certain insects	Humid valleys, wooded areas	

Need for Mastitis therapy

- High economic losses
- To prevent the infection passing on to other animals of the herd
- To avoid the additional labor, veterinary and management costs
- To maintain the productivity at farm
- Ethical aspects

Important stages regarding mastitis therapy

- Early Lactation & Transitional phase/early dry period
- Most new infections occur during the early part of the dry period and in the first 2 months of lactation, especially with the environmental pathogens.
- In heifers, the prevalence of infection is often high in the last trimester of pregnancy & several days before parturition, followed by a marked decline after parturition.(Aarestrup and Jensen1997)



- ❑ ToDAY is an antibiotic mastitis treatment providing bactericidal activity against Gram-positive and Gram-negative bacteria in lactating dairy cows
- ❑ Each 10 mL disposable, ready-to-use syringe contains the active ingredient cephapirin sodium
- ❑ Provides control against mastitis-causing pathogens – including penicillin-resistant Staph aureus and Strep agalactiae
- ❑ Easy two-tube treatment given 12 hours apart



- ToMORROW has been shown by extensive clinical studies to be efficacious in the treatment of mastitis in dry cows, when caused by *Streptococcus agalactiae* and *Staphylococcus aureus* including penicillin-resistant strains.

MASTITIS PRODUCTS

- They can be divided into
- Antibiotics based therapeutics
- Non-Antibiotics / Alternative therapeutics

TREATING MASTITIS WITH ANTIBIOTICS

Form and usage of Antibiotic therapeutics

Commonly employed antibiotics for treating bovine mastitis include;

- Parenterally used antibiotics/ injectables
- Locally used antibiotics/ Intra-mammary
- Topically used/ teat applications



Table : Antimicrobial drugs of choice, if pathogens are sensitive, in the local and parenteral therapy of bovine mastitis

Pathogen	Therapy	Antimicrobial drugs
<i>Staphylococcus aureus</i>	Local	Cephalosporins, cloxacillin, erythromycin, nitrofurans, penicillin-neomycin, rifampin
	Parenteral	Cephalothin, cloxacillin, erythromycin, procaine penicillin G, tylosin
Coagulase-negative staphylococci <i>e.g. S. hyicus, S. epidermidis</i>	Local	As for <i>S. aureus</i>
	Local	Cephalosporins, cloxacillin, penicillin G, penicillin-neomycin, penicillin-streptomycin, oxytetracycline
Streptococci	Parenteral	Macrolides, penicillin G, procaine penicillin, oxytetracycline
Coliforms <i>e.g. Escherichia coli,</i>	Local	Ampicillin-cloxacillin, enrofloxacin,
<i>Klebsiella spp., Proteus spp.</i>		cephalosporins (cefamandole, cephalothin, cefotaxime), gentamicin, kanamycin, neomycin, nitrofurans, polymyxin B. trimethoprim-sulfonamide

Pathogen	Therapy	Antimicrobial drugs
<i>Pseudomonas aeruginosa</i>	Local and/or parenteral	Carbenicillin, colistin, gentamicin, polymyxin B
<i>Arcanobacterium pyogenes</i>	Parenteral	Macrolides, penicillin
<i>Clostridium perfringens</i> and <i>Bacillus cereus</i>	Parenteral	Penicillin G, sodium benzylpenicillin
Anaerobic bacteria e.g. <i>Bacteroides fragilis</i> , <i>Eubacterium combesii</i> , <i>Peptococcus indolicus</i> , <i>Fusobacterium necrophorum</i> <i>Nocardia</i> spp.	Local and/or parenteral	Cefoxitin, clindamycin, erythromycin, metranidazole, penicillin G
<i>Mycoplasma</i> spp.	Local	Amikacin, minocycline, nitrofurantoin, trimethoprim-sulfamethoxazole (may be unrewarding)
Fungi (moulds and yeasts)	Local	Aminoglycosides, macrolides, nitrofurantoin (may be unrewarding)
<i>Candida</i> , <i>Saccharomyces</i> , <i>Cryptococcus neoformans</i>		Amphotericin B, clotrimazole, ketoconazole, natamycin, yeasts also nystatin

SPECIFIC THERAPY FOR VARIOUS FORMS OF MASTITIS

- **Teat canal infection (TCI)**
- Treating lactating cows with small quantities of antibiotic (1 to 2 droplets) introduced 3 times at 12-hourly intervals effectively eliminates teat canal infection.
- Though, not advocated commercially as a high percentage (> 50 %) undergo spontaneous recovery when predisposing factors to mastitis are limited or eliminated.

(Preez, 1985)

Subclinical mastitis

- Usually 15–40 subclinical cases for every clinical case.
- Treatment at drying-off with a dry-cow antibiotic preparation is practical and inexpensive
- Treatment during lactation is not indicated, unless a very high infection rate endangers the marketing of milk.
- The cost of therapy and milk discarded during the withdrawal period seriously reduces the benefit of the therapy.

Subclinical mastitis Cont.

- The organism most readily treated in lactation is *Strep agalactiae*, cure rates usually 90–95 %
- The cure rate for environmental streptococci and various staphylococci may be as low as 10 % and will rarely exceed 40–50 %.
- These infections are best treated at drying-off.
- Usually only intramammary therapy, by infusion of antibiotic preparations 3 times at 12-hourly intervals, is recommended.

Subclinical mastitis Cont.

- It is only worth treating subclinical mastitis when the predisposing factors have been limited or eliminated.
- Cows with chronic infections, evidenced by previous clinical episodes and persistent high somatic cell counts, may not respond to dry-cow treatment and should be culled.

Subacute clinical mastitis

- This is the most prevalent form of clinical mastitis in dairy herds.
- Duration of treatment depends on the causative organism and clinical improvement.
- I/ Mam treatments are usually administered 4 times at 12-hourly intervals with drugs that are rapidly absorbed, or 3 times at 24-hourly intervals with slowly absorbed drugs.

Subacute clinical mastitis

- Treatment should be continued for at least 24 hours after the disappearance of clinical signs.
- Since the aim is to achieve bacteriological and not only clinical cure.
- Initially, 2 syringes of intramammary antibiotic preparations may be infused into the affected quarter in high-yielding cows.

Subacute clinical mastitis

- Multidose intramammary syringes should be avoided for hygienic reasons.
- The introduction of cefoperazone for intramammary administration with single-dose treatment is a significant advance.
- Parenteral antibiotic therapy is not routinely advocated but may be indicated in the circumstances mentioned for subclinical mastitis.

Acute clinical mastitis

- In acute mastitis, frequent failure of I/ Mam antimicrobial therapy is due, at least partly, to poor or uneven distribution of the drug in the intensely swollen udder parenchyma.
- Parenteral antibiotic therapy may be preferred.
- Either the same antibiotic, or compatible antibiotics with identical or synergistic action are administered parenterally and locally for 3–5 days, depending on clinical cure.
- The I/V must be used to achieve max parenchymal diffusion.

Acute clinical mastitis cont.

- Initially, a double infusion with an I/Mam Ab formulation into the affected quarters & a single infusion into each of the healthy quarters
- After the initial infusion of I/Mm antibiotic preparations into the affected quarter, I/Mm antibiotic preparations as per manufacturer recommendation @12-hrs & continued 3–5 days.
- For increased bioavailability of the drug, a large volume should be administered I/M

Acute clinical mastitis cont.

- Macrolide antibiotics are potentially best for the treatment of Gram-positive bacterial mastitis & gentamicin or polymyxin B for G-ve infections.
- Penicillin G.....drug of choice for *Clostridium perfringens* and *Bacillus cereus* infections.
- Mastitis caused by *S. agalactiae*, *S. dysgalactiae* and penicillin-sensitive coagulase-negative staphylococci is usually cured by penicillin treatment for 2–3 days.

- *S. uberis* may be more problematic and some authors recommend that treatment should be continued for 3–5 days.

Acute clinical mastitis cont.

- Staphylococcus aureus is known to be therapy-resistant, and 5-day treatment has produced better results.
- Different drugs should be administered together only if synergism or at least no antagonism exists
- when using combinations the risk of residues is increased.
- Use of >2 antimicrobial drugs together in routine treatment of mastitis is not pharmacologically justified.

Acute clinical mastitis cont.

- There are very few antimicrobial drugs suitable for treating coliform mastitis.
- High concentrations of some drugs (tetracyclines, chloramphenicol, novobiocin-penicillin, streptomycin) have been found to suppress phagocytosis in the udder.
- This effect is enhanced if corticosteroids are combined with the drugs.

Acute clinical mastitis cont.

- These considerations are important when treating severe coliform mastitis, in which the local defence mechanism is of major significance.
- The most frequently-used drugs are enrofloxacin and trimethoprim-sulphonamide.

Yeast Mastitis

- Causal agents of yeast mastitis are usually sensitive to fungicidal drugs (amphotericin B).
- Many fungicides are, however, toxic to udder tissue and may be more damaging to the udder than the fungus itself.
- Spontaneous recovery from fungal mastitis is relatively common, and frequent milking out enhances recovery.
- A cow that persistently has yeasts in her milk should be culled.

Peracute clinical mastitis

- In principle, treatment is the same as for acute mastitis, but more aggressive, and special attention must be given to Shock.
- When the response to antibiotic and other supportive therapy for acute and peracute mastitis cases is insufficient, additional measures may be required to prevent death or to treat a severely affected quarter.

Peracute clinical mastitis cont.

- When affected quarter is gangrenous/ severely damaged, I/Mm treatment will be ineffective, and teat amputation may help drainage if it is economically feasible.
- Tying off the mammary veins advocated in severe cases to ↓ uptake of toxins into the bloodstream.
- Severely affected cows that have survived the peracute stage may not recover completely, and may develop persistent pyrexia and evidence of damage to vital organs such as the liver.
- Prognosis.... poor in these cases.

Chronic Mastitis

- It is usually necessary to cull the cow or to destroy the affected quarter/s by means of an infusion of 25–40 ml of concentrated ether to eliminate an important potential source of bacterial infection for healthy quarters.
- Parenteral & intramammary antibiotic treatment for 3–5 days may be used in conjunction with anti-inflammatory products, but the prognosis remains poor.

Chronic Mastitis cont.

- Infusion of 100–250 ml of a 5 % or 10 % dextrose solution in combination with antibiotics to which the bacteria are sensitive into the affected quarter 3 times at 12-hourly intervals has been recommended 46

TREATING MASTITIS WITHOUT ANTIBIOTICS

- Using antibiotics is not an ideal solution.
- Other than the problems they cause with the milk (withdrawal for x days, contamination from antibiotic residues, problems associated with yogurt and cheese processing), antibiotics have not reduced the incidence of mastitis
- Problems associated with resistance or even ineffectiveness are quite real in the case of mastitis caused by coliforms and *Staphylococcus aureus*

(Hill, A.W. 1986)

Modification in some practices during treatment

- When a treatment is being administered it is important to modify other practices:
- Infected cows must be fed prudently. Concentrates must be reduced and extra fibres & laxatives must be included.
- In cases of clinical mastitis, Eckles recommends reducing grain rations by one third as soon as symptoms appear and until they disappear (Eckles, 1913)
- Avoid exposing infected animals to cold and draughts
- Milk gently by hand 3 to 6 times a day.

Modification in some practices during treatment

- Extreme caution must be used with products that are injected into the teat.
- It is quite difficult to make a «clean" injection in a contaminated environment such as a dairy barn without provoking a new contamination in the quarter.
- In all cases, it is important to immediately contact a veterinarian if there is no rapid improvement.

CLAY THERAPY

- Clay has several therapeutic properties.
- On account of its high absorbency, it has proved efficient as dressing to treat inflammation caused by mastitis.
- To prepare a clay dressing, the clay is mixed with a liquid.
- Some producers use room-temperature water, while others use olive oil.
- A good way to use half water, half oil, with the oil giving a more elastic consistency to the paste.
- Final result must be fairly liquid adhering well to udder.
- When using water, it can be allowed to penetrate slowly into the clay without mixing. The container should be covered with a cloth and set out in the sun.

CLAY THERAPY Cont.

- The oil mixture on the other hand must be mixed.
- In both cases, a wooden spoon must be used and ideally the container should be a non-reactive material like porcelain or glass.
- The therapeutic effect of the paste may be increased by adding 2 to 3 drops of pine oil for every 2 lit. mixture.
- <https://www.youtube.com/watch?v=m8yueUa5jng>

CLAY THERAPY Cont.

- Clay dressing must be spread over the infected parts of the udder after milking & may be removed once dry and replaced 2 to 3 times a day by a new application.
- The dressing may be left on all night after evening milking.
- In the case of the mixture containing oil, the mastitis has healed when the udder stays oily after the dry clay has been removed.
- This treatment should produce results in two to three hours in the case of acute mastitis, 4 to 6 hours with less serious forms and two to three days with chronic mastitis.
- If the treatment does not appear to be having any effect after this time, other measures must be considered.

CURATIVE MEASURES

- The following curative measures are particularly effective for clinical and chronic mastitis.
- A vast range of curative methods may be used as an alternative to antibiotics: homeopathy, clay therapy, phytotherapy, etc.
- The advantage of homeopathy over antibiotics is that milking may be continued.
- The other alternative products used must not go in the bulk milk b/c tests for detecting antibiotics in milk may react positively to certain products like some essential oils.

HOMEOPATHY

- The following information is general advice only and should not be considered a replacement for professional advice from a homeopathic veterinarian.
- Preventive homeopathic treatments are administered using nosodes on an entire herd rather than on individual animals.
- Nosodes are fragments of pathogenic cells that increase the immune response.
- Preparation is established according to the species of bacteria causing the problem in the herd. MacLeod recommends a nosode of 30 dilutions in liquid form administered by the mouth or in the herd's drinking water.
- {Nosodes are a homeopathic remedy often sold in pellet form that are said to be an alternative to vaccines.}

Table- Homeopathic remedies used by MacLeod to treat mastitis

Source: Adapted from MacLeod (1981) Legend: x, c and m refer to dilutions 10, 100 and 1,000

Homeopathic Remedy	Symptoms	Dose
Belladonna 1m	For acute postpartum mastitis. Udder very hot and red, painful to the touch. Animal is hot, and pulse is quick and strong.	1 dose every hour. 4 doses.
Aconitum 6x	Routine treatment for all acute cases, particularly those that develop rapidly after exposure to cold dry wind. Relieves tension & anxiety.	1 dose every half-hour. 6 doses.
Bryonia Alba 30c	Indicated for swollen and very hard udders. Pain is less intense when pressed. Animal is often lying down. Especially good for chronic cases with fibrosis.	4 doses. Chronic cases: 1 dose 2 times a week for one month. Acute cases: 1 dose every 4 hours.
Arnica Montana 30 c	For mastitis resulting from udder injuries. There may then be blood in the secretions.	3 doses per day for 3 day
Phytolacca 30c	Useful for clinical and chronic cases. Clinic cases with sour, coagulated milk. Chronic cases with small clots at mid-lactation.	Clinical: 3x/day for 3 days, followed by 1 dose a day for 4 days. Chronic: 1 dose every 3 hours, 4 doses.

Source: Adapted from MacLeod (1981) Legend: x, c and m refer to dilutions 10, 100 and 1,000

PHYTOTHERAPY

•Aloe

- Particularly indicated for treating udder injuries often leading to staphylococcal mastitis.
- Application of the aloes will quickly heal the tissue.
- For treatment of the mastitis, Coats and Holland⁵ recommend injecting 20 to 60 cc of aloes (in gel or juice form) into the infected quarter at least once a day.



PHYTOTHERAPY cont.

- The teat end must be sterilized before an injection because the aloes will carry all the filth with it into the teat, thus aggravating the situation.
- Aloes helps to drain the infection, has anti-inflammatory properties and a coagulant.
- It has a diuretic property also, which serves to soften the hardened udder.
- Once again, it is important to remember that the milk from cows treated this way cannot be put into the milk tank.

PHYTOTHERAPY cont.

•Kelp

- Kelp, a variety of seaweed, is one of the rare plants whose effect against mastitis has been proven scientifically.
- Its effect is preventive, however, rather than curative.
- In a seven-year experiment with twin cows, where one was given kelp in its ration and the other not, the incidence of mastitis was greatly reduced in the cows receiving kelp.
- Kelp has an effect on different types of bacteria.



OXYGEN THERAPY

- Oxygen therapy is increasingly talked about as a cure-all for disease, both for plants and animals.
- In oxygen therapy, it is usually $H_2 O_2$ is used.
- A mastitis treatment, called Koch Treatment after its inventor Dr. William Frederick Koch has an oxygenating substance similar to peroxide for its base, glyoxilide.
- Tests of this treatment with British Columbia dairy producers, under the supervision of the BC ministry of agriculture, produced very good results.
- A large number of Michigan dairy producers attest its effectiveness.

OXYGEN THERAPY cont.

Glyoxilide is sold in 5 cc ampoules, which is the treatment dosage.

The dose is injected with a hypodermic needle into the cow's neck or shoulder muscle.

A single treatment is administered, sometimes two, and rarely three.

- Glyoxilide provokes reactions in 21-day cycles, reactions that fade with time.
- Its action extends over one to two years.

ACUPUNCTURE

- According to Kendall²⁰, acupuncture is effective against mastitis but the treatment is very long and therefore less appealing compared to the other therapies.
- Furthermore, there are few acupuncturists that treat bovines at the moment in North America.

ANTIBODIES

- Certain commercial products are made with antibodies.
- Colostrum is one such product, from Iowa (USA), available through homeopathic veterinarians.
- It is administered by intramuscular injection.
- Claimed to eliminate the problem in less than 12 hours and does not cause loss of milk.

