Unit : Bovine Mastitis
Lesson : 5

# Alternate therapy, prevention and control of mastitis

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# Alternate therapy, prevention and control of mastitis

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|---|
| Ayurvedic therapy |
| Homeopathy |
| Prevention |
| Control |

# Alternate medicine

- Combination of Aloe vera, lime and turmeric powder was beneficial in treating mastitis, it also has short period of recovery compared to common antibiotic therapy (Thangadurai et al., 2017)



# Alternate medicine

- **Coconut, Babassu and Palm oils- Control bacterial contamination by minimizing the bacterial colonization on udder (Lalouckova et al., 2019)**



# Alternate medicine

- Allium sativum (Garlic-100 gms with butter-orally) and Bunium persicum (Black cumin- 80gms with wheat flour-orally) were found to be effective in E. coli, S.aureus and K.pneumoniae mastitis treatment (Amber et al., 2018)

- 'Allicin', an effectual antibacterial and antiseptic component in garlic have been discovered in many studies.

# Alternate medicine

- Rajweswari et al.,(2010), confirmed the effectiveness of honey against a range of bacteria include S. aureus, P. aeruginosa and E. coli.
- Honey inhibits and eliminates the biofilm produced by P. aeruginosa, Streptococcus species, E. coli, and P. aeruginosa (Cooper, 2014 and Lu et al., 2019)

- Ageratum Conyzoides- Goat weed – Appakkodi, poompul
- Muntinga calabura- Jam fruit- then pazham
- Piper betle
- Curcuma domestica Turmeric- against MSRA
- Mentha spicata -puthina– excellent effect over S.aureus (Mustafa, 2020).
- Ocimum sanctum- thulasi for chronic Staphylococcal mastitis (Dash et al., 2016)
- Terminalia chebula (Kadukkai)against S. aureus, E. coli, Pseudomonas aeruginosa, and Bacillus megaterium; @500 mg/ mL concentration of the extract had the same antibacterial efficacy as that of standard amoxicillin (Kher et al. 2019).







# Homeopathy for mastitis

| S. No. | Name of drug with potency | Dose rate | Indication |
|---|---|---|---|
| 1. | Belladonna 30 | One dose every two hours 4 to 5 times till relief | Udder is hot, painful, and oedematous. |
| 2. | Belladonna 200 | B.I.D for 2 days. | Udder is hot, painful, and oedematous. |
| 3. | Bryonia 30 or 200 | One dose every 3 hrs, till relief | Udder is hard, painful, hot and animal is disinclined to move. |
| 4. | Urticaria urens 30 | One dose every 1 hr till relief | Udder is hard, painful, oedematous with allergic reactions and milk let down problems, dysagalactia. |
| 5. | **Homeopathic Combination:** (Belladonna +Bryonia + Urtica aa 30) | 1 dose once in 2 hrs till temperature comes to normal | Above all indications |
| 6. | Phytolocca 200 | One dose 2 hourly 4-5 times for 2-3 days | Udder is hot, flakes/clots present in milk and refuse to allow the calf for suckling or milking. |
| 7. | Conium 200 | B.I.D. for 2 – 7 days | Udder is very hard, severe pain with yellowish and cheesy milk. |

| S. No. | Name of drug with potency | Dose rate | Indication |
|---|---|---|---|
| 8. | Merc sol 200 | B.I.D. for 2 days | Udder is hard and milk is watery or serosanguinous in appearance (Foot and Mouth affections). |
| 9. | Silicea 6x | T.I.D for 1 week to 10 days | Udder indurated; milk cheesy in consistence with yellow clots. |
| 10. | **Biochemical Preparation 1** | | |
| | Kali mur 6x+ Calc Flur 6x | B.I.D. for 1 week to 10 days | Presence of clots in milk. |
| 11. | **Biochemical Preparation 2** | | |
| | Silicea 6x+ Calc Sulph 6x | Q.I.D for 1 week | Udder is hard and clots in milk. |
| 12. | **Homeopathic Combination 1: For intra mammary use** | | |
| | Calundula Q + Belladonna 30+ Dulcamara Q + Echinaea 30 aa 1 ml Made upto 20 ml with distilled water | 10 ml B.I.D. intra mammary injection for 2 to 3 days. Massage the udder to disperse the medicine uniformly | Inflammation of the udder with loss of appetite, fever congestion and injury. |

| Sl.No | Name of the drug | Dose rate | Indication |
|---|---|---|---|
| 14. | **Homeopathic Combination 3: For internal use** | | |
| | Phytolocca 200 + Calc. Fluor 200 + Silicea 30 +Belladonna 30 + Arnica 30 +Conium 30 + Ipeca 30 aa 0.5 ml. Made up to 30 ml vimeral. | B.I.D. for 2 – 4 days | In acute, subacute and chronic mastitis. |
| 15 | Silicea 1M + Calc. Sulph 200 | Q.I.D for 2 –7 days. | Mastitis without anorexia, udder is hard and with clots. |
| 16. | Kali Mur 30 | Q.I.D for 2 to 5 days | Mastitis without anorexia, hardness of udder and white or gray or cream colour clots. |
| 17. | Ferrum Phos 6x | Q.I.D for 2 to 5 days | Mastitis without anorexia, blood in milk with or without bad smell. |
| 18. | Apis Mellifica 6c | one every three hours for four doses. | freshly calved heifers showing oedema of udder and surrounding tissues. The mammary vein is usually engorged in these cases. |
| 19. | Aconite 6x | one every half-hour for six doses. | all acute cases, especially those which develop suddenly, possibly after exposure to cold, dry winds. It will allay tension and restlessness. |

| Sl.No | Name of the drug | Dose | Indication |
|---|---|---|---|
| 20. | Bellis Perennis 6c | one T.I.D. daily for four days. | If the injuries are more deep than superficial, e.g., damage from teat cups<br>which has gone on for a few days. |
| 21. | Hepar Sulphuris 6x | one every three hours for four doses. Once the udder has been cleared of purulent material,<br>a dose or two of a higher potency should be given to complete the cure | Low potency of Hepar will help promote suppuration and clearing of the udder contents in cases of C. Pyogenes or summer mastitis infection |

| **S. No.** | **Name of drug with potency** | **Dose rate** | **Indication** |
|---|---|---|---|
| 22. | **Homeopathic Combination 2: For External use only** | | |
| | Phytolocca decandra 30 +<br>Calendula officinalis Q +<br>Apis mel 30 +<br>Belladonna 30 aa 1 ml<br>Made up to 20 ml with glycerine. | B.I.D. for 2 – 4 days | Indicated in fissures, wounds, ulcers, congestions, hematomas, inflammations, contusions etc. |

# Prevention

- Managemental practices
- Vaccines
- Genetical selection
- Nutritional status

# Management Practices

- Good udder health management practices (Kasna et al., 2018)
- Pre- and post-milking teat disinfection remains one of the most important procedures of mastitis control (Sayed, 2021)
  - Glycolic acid, Iodine and chlorhexidine based post milking barrier teat disinfectants (Lalouckova et al., 2019).
  - Iodine based teat dip in 10% glycerin is generally regarded as the gold standard teat dip.
- Dipping may eliminate up to 91% of teat bacteria (Fitzpatrick et al. 2019).

# Vaccines

- Vaccination is ineffective against bovine mastitis because a variety of microorganisms are involved in its development.
- S. aureus, Streptococcus uberis (S. uberis), and E. coli were thought to be the major targets for vaccine development (Wilson et al. 2009; Bradley et al. 2015; Collado et al. 2016; Ashraf and Imran 2020).
- Even though several commercial vaccines are available, most of them failed to demonstrate sufficient protection and at the same time are costly (Cot ^ e-Gravel and Malouin 2019)
- The insufficient protective potential could be attributed to many factors including factors related to the cow (e.g., age and health status), related to the environment, or related to the invading pathogen (Merrill et al., 2019)
- Intra nasal vaccines are effective against S.aureus infections (Nagasawa et al. 2019).

# Vaccines… Coliform vaccines

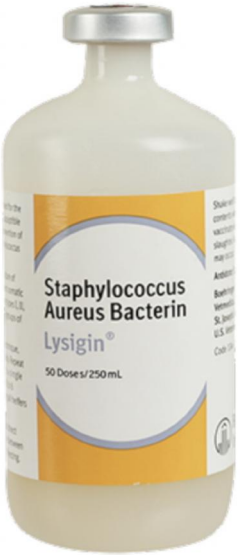
- Coliform vaccines - does not prevent new intramammary infection but significantly reduce the clinical severity of the infection.
- Dose: 5ml s/c, three doses
- Period: Variable according to manufacturer

## Coliform Vaccine Trials

| Vaccine antigen | Targeted or putative effect | Efficacy | Pitfall or knowledge gap | Salient reference |
|---|---|---|---|---|
| *Escherichia coli* J5 bacterins | Antibodies to LPS core antigen | Decreased coliform mastitis severity in field experiments | Variable effect on incidence of cases<br>Unknown mechanism | González et al., 1989; Cullor, 1991; Hogan et al., 1992a |
| *Salmonella* Re-17 bacterin toxoid | Antibodies to LPS core antigen | Decreased coliform mastitis severity in field experiment | Unknown mechanism | McClure et al., 1994 |
| *E. coli* J5 bacterin | Antibodies to LPS core antigens | Discrepant results: reduction or not of severity in experimental infection | Unknown mechanism | Hogan et al., 1992c; Hill, 1991 |
| *E. coli* J5 bacterin, hyperimmunization | Antibodies to coliform outer membrane antigens in the $IgG_2$ isotype | Decreased occurrence of severe mastitis compared with usual schedule | Variable among herds<br>Unknown mechanism | Erskine et al., 2007 |
| *E. coli* J5 bacterin with killed *Staphylococcus aureus* (StartVac, Hipra) | Antibodies to coliform outer membrane antigens | Decreased mastitis severity in a field study | No reduction in incidence of case, unknown mechanism | Bradley et al., 2015 |
| Enterobactin FepA | Iron acquisition | Growth reduction in dry mammary secretion | Likely not active in lactation, not tested in vivo | Lin et al., 1999 |
| Siderophore receptor FecA | Iron acquisition | None in experimental infection | Antibody titer insufficient in milk | Takemura et al., 2002; Wolf et al., 2004 |
| Whole *E. coli* (P4), intramammary booster with bacterial extract | Antibody and cell-mediated responses | Reduction in severity, likely independent of antibodies, related to Th17 response | Heterologous protection not tested | Herry et al., 2017 |
| *Klebsiella* siderophore receptors and porin proteins (KlebVax) | Iron acquisition and multiple bacterial functions<br>With antibodies | Effective in 1 small-scale study, ineffective in a large-scale study | | Gorden et al., 2018; Tomazi et al., 2021 |
| *Klebsiella* recombinant YidR | Unknown bacterial functions<br>With antibodies | Reduced incidence of *Klebsiella* clinical mastitis | No effect on risk of death if clinical, little antibody response to whole bacteria and activity unknown | Tomazi et al., 2021 |

# Vaccines…S.aureus

- Contains five different phage types of Staph aureus.
- Dose: 5 ml im, repeat in 14 days
- 1st dose at 6 months
- All field trials have either been unsuccessful or had limited success



# S.Aureus vaccine trials

| Vaccine antigen[1] | Targeted or putative effect | Efficacy | Pitfalls or knowledge gap | Salient reference |
|---|---|---|---|---|
| Whole killed bacteria and toxoid | Opsonization and neutralizing antibodies | Reduction in severity, intramammary challenge | No self-cure, homologous challenge | Derbyshire, 1960 |
| Bacterial lysate (5 strains) Lysigin (Boehringer Ingelheim Vetmedica) | Antibodies | Some reduction in severity and incidence of IMI | Variable results | Middleton et al., 2006; Middleton et al., 2009 |
| Live vaccine, subcutaneous | Opsonization by $IgG_2$ antibodies | Better reduction in severity than killed vaccine, boosted recruitment of neutrophils | Challenge of ewes, mechanism not identified | Watson and Kennedy, 1981; Colditz and Watson, 1982 |
| Killed vaccine, "in vivo" antigen and dextran sulfate | Opsonization by $IgG_2$ antibodies | Reduced severity | Mechanism not identified | Watson, 1992b |
| Capsular polysaccharides (CP5, CP8, teichoic acid) | Opsonization by antibodies, cell-mediated immunity | Slight increase in opsonization | No protection study | Lee et al., 2005 |
| Slime on killed bacteria, StartVac (Hipra) | Opsonization, adhesion | Reduction in bacterial shedding in milk | Mechanism not identified, little effect on severity and incidence of new IMI | Prenafeta et al., 2010; Schukken et al., 2014 |
| Live VraG mutant small-colony variant | Antibodies and cell-mediated immunity | Humoral and cell-mediated response of Th1/Th17 type | Mouse model, no challenge | Côté-Gravel et al., 2016 |
| Protein A (SpA) | Antibodies | Increased spontaneous cure of *Staph. aureus* IMI after experimental challenge | No field trial, mechanism not identified | Pankey et al., 1985 |
| FnBP and ClfA | Antibodies and cell-mediated immunity | Increased spontaneous cure of *Staph. aureus* IMI after experimental challenge | No field trial, mechanism not identified | Shkreta et al., 2004 |
| Recombinant IsdB and IsdH | Antibodies interfering with iron acquisition, opsonization | IgG2 antibodies and antigen-specific lymphoproliferation | No protection study in cows | Ster et al., 2010 |
| GapB and GapC | Antibodies | Immunogenic in mice | No protection study in cows | Kerro-Dego et al., 2006 |

[1]VraG = *Staph. aureus* ABC transporter; *Staph. aureus* surface proteins: FnBP = fibronectin-binding protein; ClfA = clumping facor A; IsdB, IsdH = *Staph. aureus* iron-regulated surface proteins; GapB, GapC = proteins with homology to GAPDH.

Reinadr et al., 2021

# Genetic selection

- Resistance to mastitis can be improved by means of genetic selection, mainly by sire selection (Weigel and Shook 2018).
- Heritability estimates of teat-end-to-floor distance or udder height range from 0.2 to 0.7 (Jensen et al., 1985)
- If traits like
  - milk production, fat level, protein level, and
  - fore-udder attachment, udder support and udder depth

  are included in the selection index, the udder health can be increased by genetic improvement (Bobbo et al. 2019).

# List of main genotypes which are linked to mastitis resistance

| Gene/locus | Property/ action | Reference |
|---|---|---|
| CXC chemokine receptor (CXCR 1 and 2) | required for neutrophil migration to infection sites | Youngerman et al., 2004 |
| bovine major histocompatibility complex (bolA) | associated with distinct microbiota profiles in colostrum | Derakhshani et al., 2017b |
| Toll-like receptor 9 (TLR9) | recognizes CpG DNA of bacteria and stimulate both the innate and adaptive immune responses | Badami et al., 2019 |
| Genes (BTA22) | encodes a protein with bacteriostatic properties in the mammary glands. | (Rupp and Boichard 2003) |
| Bovine breast cancer 1 gene (BRCA1) | main effector of the antiviral innate immune defense | Chen et al., 2018 |
| BTA5 | encodes lysozymes which cleave the bacterial cell wall and eliminate them from the udder. | Sayed, 2021 |
| BoLA (bovine major histocompatibility complex) and BTA23 | mastitis resistance through the regulation of acquired immune response against udder invaders | Sayed, 2021 |
| RAS guanyl-releasing protein 1 gene (RASGRP1) | involved in the regulation of lymphocyte development, activation, and function and in Tcell receptor signaling | Bonnefont et al. 2011 |

# Nutritional status

- Trace minerals like selenium, copper, zinc, and vitamins like vitamin A/b-carotene, and vitamin E can affect the udder health (O'Rourke 2009).
- Injectable trace mineral supplement containing zinc, manganese, selenium, and copper reduced the incidence of chronic clinical mastitis in dairy cows with elevated SCC (Ganda et al. 2016).
- Supplementation of selenium and vitamin E, shown to improve resistance to the mastitis through elevated neutrophil α-tocopherol concentrations (Sharun et al., 2021).
- Cattle with negative energy balance are predisposed to ketosis, and those animals have two-fold increase in the risk of clinical mastitis (O'Rourke 2009).

- Supplementation of vitamins A, D3, E, and H help in the recovery from subclinical mastitis by increasing the expression of host defense genes.
- Dietary zeolite- antibacterial, antioxidative, immunostimulating and detoxifying potential of vibroactivated and micronized zeolite clinoptilolite reduced the incidence of intramammary infections (Duricic et al. 2020).
- Improper or mal-nutrition and altered gut microbiota can have detrimental effect on udder microbiota through potential involvement of a microbiome-gut-brain axis signalling (Cryan and O'Mahony, 2011).

# Control

**Eliminating existing infection**

- Dry cow therapy
- Lactating cow therapy
  - Early recognition and treatment
- Culling non-responding cows
  - Three strikes and out

**Preventing new infections**

- Dry cow therapy
- Teat dipping
- Proper milking machine/method
- Environmental and nutritional management
- Quarantining of newly purchased animals

# 10 point mastitis control programme

1. Establishing udder health goals
2. Maintain clean, dry and comfortable environment
3. Proper milking procedures
4. Proper maintenance and use of milking equipment
5. Good record keeping
6. Management of clinical mastitis during lactation
7. Effective dry cow management including blanket dry cow therapy
8. Maintenance of good biosecurity for contagious pathogens and disposing chronically infected cows
9. Regular monitoring of udder health status and
10. Periodic review of mastitis control program

# Conclusion

- Mastitis is a million dollar disease causing great economic loss to farmers, not only by reduced milk production, but also due to its impact on reproduction.
- Maintaining good animal health by
  - improved nutrition, udder health
  - environmental sanitation,
  - use of teat sealants, and
  - selection for disease resistance genetic traits could minimise occurrence of mastitis.
- More rapid pathogen detection and sensitivity,
- Prudent selection of antibiotic and
- Sufficient course of treatment to completely eliminate the infection could help in minimising antibiotic resistance and reinfection and improved effectiveness of treatment.

# Updates in Bovine Mastitis

1. Epidemiology of bovine mastitis
2. Immune system of Udder and pathogenesis of mastitis
3. Clinical signs and diagnosis of mastitis
4. Treatment of mastitis
5. Alternate therapy, prevention and control of mastitis

# Thank you