AN UPDATE ON MASTITIS VACCINES

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Introduction

Effective immunization against mastitis has been a goal of researchers for many years. Research on mastitis vaccines has been conducted for at least 30 years and several vaccines for controlling mastitis are commercially available now. Effective immunization is difficult because of the very nature of milk. The volume of milk present in the gland dilutes the number of immune cells available to fight infection and milk components such as fat and casein reduce the bactericidal abilities of the infection fighting immune cells Moreover, the cow is exposed to numerous organisms that have the potential to cause mastitis and the milk is an excellent substrate for bacterial multiplication. In addition to this various other factors like incomplete knowledge of bovine immune defenses, diversity of bacterial species, strains and antigens, selection of relevant antigens, lack of appropriate immunization schedules etc. makes this a difficult task to accomplish.

The past decade has seen the development of effective and economical [1]R-mutant vaccines against mastitis due to gram negative organisms. Development of vaccines for other pathogens has been noticeably slower. Mastitis vaccine research in the past has led to the commercialization of several products. Commercial mastitis vaccines are currently available in countries like United States for immunization against mastitis caused by *Staphylococcus aureus*, *Escherichia coli* and *Mycoplasma bovis*.

Vaccines against coliform organisms

All coliform mastitis vaccine formulations use gram negative core antigens (Core antigen is a part of the gram negative cell wall consisting of a short chain of sugars. With minor variations, the core polysaccharide is common to all members of a bacterial genus) to produce non-specific immunity directed against endotoxins produced.

(i) **J-5 bacterin (Pharmacia & Upjohn)**

It is an Escherichia coli bacterin (a suspension of killed or weakened bacteria used as a vaccine) recommended for use in healthy dairy cattle for the prevention of clinical mastitis caused by E. coli. For effective mastitis control, this product should be used in conjunction with acceptable good management practices.

Regimen: Three doses are required. Each of the 5 ml doses are administered subcutaneously, one hand-width cranial to the shoulder. Cows or heifers can be vaccinated at 7th and 8th month of gestation followed by the third dose within 2 weeks postpartum. Local swelling may occur occasionally and persist at the injection site. The cows should not be vaccinated 60 days before slaughter.

Presentation: 20 dose (100ml) and 50 dose (250 ml) vials.

(ii) **Master guard J5 (Agrilabs)**

This is also an Escherichia coli bacterin and contains chemically inactivated culture of J5 mutant E. coli and Suprimm® adjuvant. It is used as an aid in the prevention of endotoxemia caused by E. coli in healthy cattle 6 months of age or older.

Regimen: Three doses of 2 ml each at 3 weeks intervals administered intramuscularly or subcutaneously. Annual booster doses are recommended at dry-off and 2-3 weeks prior to calving.

Presentation: 10 doses (20ml) and 50 doses (100ml)

(iii) **J-Vac (Merial)**

It is an E. coli bacterin – toxoid. Recommended for vaccination of healthy cattle (cows, heifers) as

1 R refers to the amount of identifying O-side chains which still exist on a mutated bacterium cell wall

an aid in prevention of mastitis due to E. coli and effects of endotoxemia caused by Salmonella typhimurium. It contains gentamicin and nystatin as preservatives.

Regimen: 2ml (1 dose) injected intramuscularly or subcutaneously at 7 months of gestation or at dry-off and revaccinated 1-3 weeks before calving. Revaccination is done annually. Do not vaccinate within 21 days prior to slaughter. In rare instances, administration of vaccines may cause lethargy, fever and inflammatory or hypersensitivity reactions. Treatment may include antihistamines, anti-inflammatories and epinephrine.

(iv) **Endovac bovi (Immvac)**

It is a Salmonella typhimurium bacterin-toxoid, Re-17 derived mutagenically, this product contains an oil adjuvant. Formaldehyde is used as the preservative. It is used for vaccination of healthy cattle to prevent clinical mastitis due to E. coli and the effects of endotoxemia caused by Salmonella typhimurium, Pasteurella multocida and Pasteurella hemolytica.

Regimen: 2 ml intramuscular injection followed by another dose in 2 or 3 weeks. Revaccination is annually recommended for cows and heifers during the third trimester of pregnancy. It cannot be administered to cows with mastitis or showing signs of septicemia.

Presentation: 20 dose (40ml) and 50 dose (100ml) vials.

Vaccines against Staphylococcus aureus

There are two S. aureus bacterins marketed by U.S dairy producers but they are simply separate licensures of the same product. These are marketed as Somato-staph and Lysigin.

(i) **Lysigin (Boehringer Ingelheim)**

It is a S. aureus bacterin. It contains a lysed culture of highly antigenic polyvalent somatic antigen containing phage types I, II, III, IV and miscellaneous groups of S. aureus. The vaccines are recommended for vaccination of healthy susceptible cattle as an aid in the prevention of mastitis caused by S. aureus.

Regimen: 5ml injection intramuscularly, repeated in 14 days and followed by a single 5 ml booster dose each 5 – 6 months. All heifers can be vaccinated by 6 months of age.

Presentation: 10 doses (50ml) and 50 doses (250ml)

Vaccines against Mycoplasma bovis

(i) Mycomune mycoplasma bovis bacterin (Agrilabs)

Recommended for prevention of mastitis caused by Mycoplasma bovis in healthy cows and heifers. Dosage is 2ml given S/C in the neck region. It is recommended that animals be vaccinated 3 times at 2-4 week intervals prior to calving. The 3rd dose should be given at least 2-3 weeks prior to calving. Semi-annual revaccination is recommended.

Presentation: 10 doses, 50 doses

Other mastitis vaccines

The increased frequency of mastitis caused by environmental Streptococci has resulted in a number of attempts to produce vaccines against these pathogens. There has been a sustained focused research effort for vaccines directed against Streptococcus uberis. Repeated immunization with a killed S. uberis vaccine was effective reducing the number of bacteria in milk that were experimentally challenged with the same strain of S. uberis. A novel vaccine based on the plasminogen activator of Streptococcus uberis appears promising. Till date there are no commercial vaccines available that protect against Streptococcal mastitis.

Conclusion

Considering the present situation regarding vaccination against mastitis, it is concluded that vaccines are not widely used as a control measure, especially in developing countries like India, mainly because of the high cost. Attempts to immunize cows against mastitis are innumerable. In spite of this a vaccine which proves to be useful under field conditions is awaited.

Bovine mastitis can be likened in several immunological respects to human diseases caused by encapsulated bacteria. This presents the vaccine developer with the opportunity to benefit from the recent advances made in the field of [1] polysaccharide vaccines. The incorporation of novel immunomodulators such as CpG oligodeoxy nucleotides, and the employment of alternative vaccine delivery methods such as antigen microencapsulation have the potential to increase the magnitude and quality of the immune response. A successful mastitis vaccine will serve as an additional mastitis control tool in a comprehensive udder health management program. Immunization will complement, but not replace management practices that promote reduction of teat end exposure to pathogens.

References

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[1] like Salmonella typhi Vi vaccine, and Pasteurella haemolytica A1 capsular polysaccharide vaccine.