

CYTOKINES FOR THE DIAGNOSIS AND IMMUNOTHERAPY AGAINST BOVINE MASTITIS

Reena Mukherjee and B.D. Sahu

Division of Medicine

Indian Veterinary Research Institute, Izatnagar (UP)-243122

ABSTRACT

The study of the bovine cytokine network has been made possible through the production of a wide range of bovine recombinant cytokines and these have been used as a new avenue in mastitis therapy and prophylaxis. Indiscriminate use of antibiotics for the treatment of mastitis, emerging strains of micro-organism resistant to antibiotics and formation of highly complex form of micro-organisms in bovine mammary gland, has prompted the scientists to regulate the mammary defence by immunotherapy through the use of cytokines against bovine mastitis. Studies on the adjuvant activity of interleukin-2 (IL-2) and interferon gamma (IFN- γ) have generated promising results on enhancing the immunity of normal and diseased glands. Cytokines could provide a swift, reliable and highly sensitive means of diagnosis. Cytokines are the signals that dictate immune responses in normal and mastitic udders. Hence, subtle changes in the cytokine network of mammary gland in health and disease could help in detecting early infection and in monitoring the effectiveness of the treatment.

KEY WORDS: Cytokine, Immunotherapy, Interferon gamma, Mastitis

INTRODUCTION

Cytokines are hormone like proteins which perform many immune responses (Pighetti and Sordillo, 1996). They are novel group of adjuvant that are available for therapy as well its research in the field of Medical and Veterinary in the form of recombinant cytokines. Cytokines are the glycoproteins synthesized mainly by T-lymphocytes, macrophages and other leukocytes (McInnes, 1993). After the advent of recombinant cytokine and identification of large number of cytokines and disclosure of their pathophysiological mechanisms has stimulated researchers throughout the globe for its efficient use in the diagnosis and treatment of diseases in man and animals.

Mastitis is the most prevalent diseases of cattle and buffaloes attributes to heavy financial losses due to poor quality and quantity of milk (Shem et al., 2002). It has been established that even after the advent of antibiotics there is no reduction in the prevalence of mastitis in dairy farms and further it contaminate the milk and also cause of drug resistant micro organism (Sandholm et al., 1990). Many cytokines have been detected in normal and mastitic udder; however the pathobiological role of *Staphylococcus aureus* and Coliform mastitis has been extensively studied (Pighetti and Sordillo, 1996). As an alternative to conventional methods of diagnosis and treatment of intramammary infections, cytokines are potential tool. The purpose of present review is to evaluate the role of recombinant cytokines in the diagnosis and treatment of bovine mastitis.

Interferon- γ

Bovine Interferon- γ (IFN- γ) could be detected in normal and mastitic glands (Taylor et al., 1997). Recombinant BoIFN- γ mobilizes activation of T cells and IL-2 production, enhances antigen specific memory cells and helps in recruitment of neutrophils and enhancement of their phagocytosis (Riollet et al., 2000). In Coliform mastitis IFN- γ levels are increased and are highly diagnostic (Hisaeda et al., 2001). Recombinant BoIFN- γ treatment of *E. coli* mastitis decreases the severity of the infection by inhibiting growth of pathogens and reducing the inflammation by checking tumor necrosis factor- α (TNF- α) in the infected quarters (Moore, 1996).

Tumor necrosis factor- α (TNF- α)

Tumor necrosis factor- α has been detected and monitored in normal and infected bovine mammary gland (Alluwaimi and Cullor, 2002). **TNF- α** could be a useful Indicator to monitor the severity of Coliform mastitis and generate a prognosis.

Interleukin-1 (IL-1)

Interleukin-1 α and 1 β have been detected in normal bovine milk cells. Monitoring the IL-1 level could be useful in defining the stage of Coliform mastitis and the efficacy of the therapeutic intervention. Interleukin-1 could serve as a suitable treatment adjuvant in *S. aureus* mastitis (Daley et al., 1993). Infusion with IL-1 β of mammary gland chronically infected with *S. aureus* enhances the neutrophil influx and up-regulates inducible oxygen radical formation.

Interleukin-2 (IL-2)

Interleukin-2 plays a central role in the immunoregulation of adaptive immune response. Bovine IL-2 has been detected in normal and mastitic cells of mammary gland (Alluwaimi, 2000; Alluwaimi and Cullor, 2002). The use of IL-2 as an adjuvant has been addressed extensively. Mammary gland infused with recombinant bovine IL-2 (rBoIL-2) expresses a higher antibody titer and MHC- II. The use of IL-2 immunotherapy alone for treatment of *S. aureus* mastitis or with adjunctive antibiotics could have a successful outcome if the cytokines are introduced when neutrophils are still intact.

Interleukin-6 (IL-6)

Interleukin-6 is one of the proinflammatory cytokine and increases in naturally occurring Coliform mastitis secreted in serum and milk.

Interleukin-8 (IL-8)

Interleukin-8 is a well-known neutrophil-chemotactic cytokine that enhances in Coliform and *S. aureus* mastitis (Shuster, 1997). Coliform mastitis treatment could be carried out through the use of IL-8 to increase the sCD14 pool in milk. Hence, IL-8 could act as an adjuvant through the activation of the anti-inflammatory process by sCD14 in the mammary gland. In general, diagnostic approaches based on measurement of IL-8 or sCD14 could provide invaluable information about the health of the udder during Coliform mastitis and could be used as a tool for forecasting the effectiveness of conventional therapy.

Interleukin-12 (IL-12)

The pathophysiological activity of IL-12 in bovine mammary gland suggests a role for this cytokine as an adjuvant and in immunotherapy of mastitis.

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