

Bacterial enzymes – Hyaluronidase

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Abstract

Bacterial enzyme 'Hyaluronidase' is a complex polysaccharide degrading enzyme that cleaves α -GlcNAc-(1 \rightarrow 4) glycosidic linkage of Hyaluronate (HA) by α -elimination process. It is synthesized by a spectrum of gram positive bacteria which serve as potential contributors to a multitude of infectious diseases in human beings. Especially, group A streptococcus bacteria (GAS) have evolved several orders of magnitude to attack the host organism and establish infection. Hyaluronidase led pathogenic/ infectious cycle is accomplished through a cascade of events where an escape from the host's immunity is very important. In this regard, a variety of factors are utilized by hyaluronidases which determine the successful bacterial penetration into hosts, like the use of substrate HA and/or its enveloping capsule as energy source during HA lysis, genetic variation among the bacterial strains in the form of allelic polymorphisms, hyaluronidase enzyme structure-driven substrate binding properties etc. Previous studies have furnished better insights on nucleotide sequences of hyaluronidase genes and immunopathogenesis. However, for a better understanding of hyaluronidase association with bacteria and overall host-pathogen interaction, much investigation and literature support is still needed.

Keywords: Enzyme, Hyalloronidase, Bacteria, Substrate

Introduction:

Enzymes of certain pathogenic bacteria constitute special biochemical entities that often facilitate a link between the bacteria

and the host organism. This mode of establishment is essential for completing the infection cycle and contributing to an adverse health outcome. One of the most successful candidates of such enzyme driven pathogenesis is Hyaluronidase or Hyaluronate lyase. (EC 4.2.2.1).¹ These are polysaccharide degrading enzymes that mostly cleave β -GlcNAc-(1 \rightarrow 4) glycosidic linkage of Hyaluronate (HA) by β -elimination process.² HA, the targeted substrate of Hyaluronidase, is a high molecular weight glycosaminoglycan polymer produced by Hyaluron synthases and is essential for maintaining the integrity of extracellular matrix.³

The biology of HA is very important for a detailed functional understanding of hyaluronidase activity. HA is mainly localized in body tissues and fluids of higher organisms like umbilical cord, synovial fluid, cartilage, brain, and muscles with an equivalent proportion predominating in the skin region.⁴ However, its presence in soft connective tissues has good significance. Hyaluronidase is functionally involved in biological processes with an increased role during embryogenesis, cell movement, tissue repair, malignant transformation, and tissue turnover.⁵

Hyaluronidase synthesis:

Hyaluronidases are chiefly produced by a wide range of gram positive bacteria. These are streptococci groups A, B, C and G,⁶ Streptococcus pneumonia and Streptococcus constellatus,⁷ Streptococcus dysgalactiae,⁸ and Streptococcus uberis.⁹ Similarly, Staphylococcus aureus and Staphylococcus hyicus subsp. hyicus,¹⁰ Clostridium perfringens (Mu toxin),¹¹ Clostridium difficile,¹² Clostridium