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Antimicrobial Role of Glycosaminoglycans: Beyond Bacterial Adhesion to Host Cell

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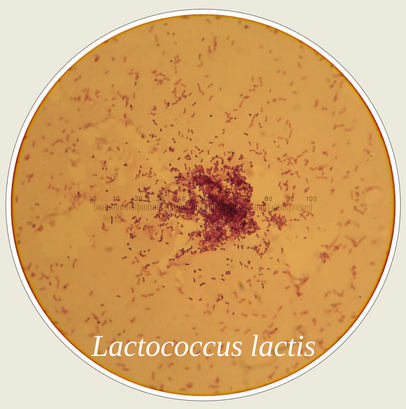
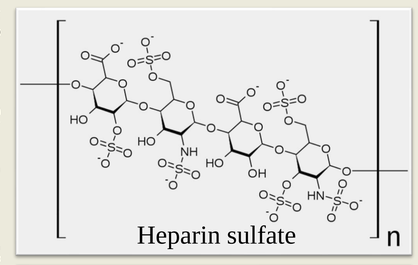
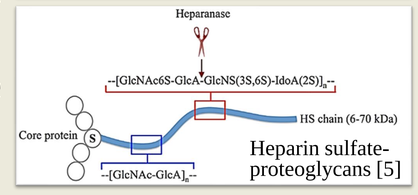
BACKGROUND



- Infectious diseases (IDs) are the top 10 leading causes of death worldwide and increasing prevalence of antibiotic resistance (ABR) complicated the management of IDs [1, 2].
- Glycosaminoglycans (GAGs) display remarkable structural diversity and have a potential role in pathogenesis, particularly in bacterial infections through facilitating pathogen attachment, invasion, or evasion of host defence mechanisms [3].
- However, at a specific concentration, GAGs, particularly heparan sulfate, one of the GAGs classes, capable of inhibiting bacterial adhesion to the cells [4].
- So, a question may arise, are GAGs valuable agents for treating IDs or only facilitator of the pathogenesis of infections?





OBJECTIVE

To discuss the current understanding of how microbes co-opt GAGs activities to bypass host defence mechanisms and to propose the reverse role of GAGS as antimicrobial agents for the inhibition of infections or treatment of infectious diseases by considering the con-tributing mechanisms to the anti-infective pharmacology of GAGs alone or GAGs-based experimental studies.

METHODOLOGY

This study was conducted using the published secondary data available in widely accessible databases like PubMed, Scopus, Web of Science, Google scholar and so on.

ANTIMICROBIAL ROLE OF GAGs

- Heparin significantly lowers the lethality of sepsis shocked rat induced by lipopolysaccharide was extracted from *Salmonella enteritidis*, *S. typhimurium*, and *Escherichia coli* compared to the untreated group.
- Heparin pretreatment maintained normal leukocyte levels after endotoxin treatment [6].
- Inhalation of heparin attenuates acute lung injury in sheep induced by *Pseudomonas pneumonia*; however, intravenous administration of heparin was not effective [7].
- Heparin-coated urinary catheter to resist encrustation by crystalline *Proteus mirabilis* biofilm. The heparinized nephrostomy tubes remained unaffected for the whole 6–8 weeks in-dwelling periods, whereas uncoated tubes got obstructed within 2–3 weeks [8].
- Heparin inhibits replication of Dengue virus-2 and Japanese encephalitis viruses in hepatoma and BHK-21 cells, respectively [9].
- GAGs have been shown to be effective to prevent infections caused by the measles virus, influenza virus, strain H5N1, Zika virus infections.

CONCLUSIONS

In general, the role of GAGs in pathogenesis is widely discussed in all levels of studies. Recent extensive research revealed the reverse role of GAGs in inhibiting the invasive microbes' attachment to the cell surface and their replication in the infected cells. Heparin is one of the potential GAGs that can compete with other GAGs to inhibit microbial binding and progression. Further studies are required to validate the target-specific inhibiting role of GAGs against infectious microbial agents.

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