Potential Role of Biofilms in Deep Cervical Abscess

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Abstract

Objective: Neck abscesses are relatively common problems that are recalcitrant to antimicrobial therapy. The underlying pathogenesis of deep neck space abscess is poorly understood and drainage of these abscesses remains the cornerstone of treatment. Recently numerous infectious diseases have been linked to biofilm phenotypes.

Study Design: Biofilms are unique lifestyle of microorganisms defined as an assemblage of microbial cells enclosed in an exopolysaccharide matrix and are recalcitrant to antimicrobial therapy. Biofilms due to their resistance to antimicrobial and host defenses are considered a model for chronic and recalcitrant infections. Recent work in other labs has demonstrated biofilm pods embedded intracellularly in adenoid specimens of patients with recurrent acute otitis media and chronic otitis media with effusion. This study sought to investigate the possible role of biofilms in deep neck space abscess.

Setting: Academic practice

Main outcome measures: Scanning electron microscopy was performed on biopsies taken from the abscess wall of deep cervical abscesses at time of incision and drainage.

Results: 5 out of 7 samples showed evidence of biofilm formation on the abscess wall. Evidence of rods and cocci within the biofilm matrix were visualized on SEM.

Conclusion: These findings suggest that biofilm phenotypes may play a role in the etiology of deep neck abscess. This may provide some explanation to the recalcitrant nature of deep neck abscess. It should be noted that this is the first identification of biofilm phenotypes in deep neck space abscess.

Introduction

Deep neck abscess presents significant morbidity and mortality. Surgical drainage remains the cornerstone of treatment. Without drainage, significant life-threatening complications such as airway compromise, sepsis, jugular vein thrombosis can result.

Biofilms are unique lifestyle of microorganisms defined as an assemblage of microbial cells enclosed in an exopolysaccharide matrix and are recalcitrant to antimicrobial therapy. A transition in thinking is occurring regarding chronic and recalcitrant infection. Bacteria are no longer thought to exist in planktonic form. Bacteria are thought to exist in a well-organized ecosystems within human hosts. These ecosystems give bacteria advantages to withstanding environmental stresses.

Biofilms have been implicated in chronic infectious disease. Recent studies have demonstrated biofilms on adenoid tissue in patients with acute otitis media and chronic otitis media with effusion.

This study sought to investigate the possible role of biofilms in deep neck space abscess.

Results

Biopsies were taken from abscess wall of deep cervical abscess at time of incision and drainage. 7 samples were collected from 4 girls and 3 boys. Their ages ranged from 18 months to 32 years. The samples were visualized using scanning electron microscopy.

Biopsies: 5 out of 7 abscesses walls showed evidence of biofilm matrix. SEM showed microcolonies on the surface of these specimens. SEM showed individual bacteria consisting of both rods and cocci embedded in the biofilm matrix. These images clearly demonstrated bacteria embedded within a 3 dimensional matrix. This type of architecture is consistent with mature biofilms.

Methods and Materials

Sample

All samples were obtained via biopsy of abscess wall at time of incision and drainage of cervical abscess performed by us. The ages of the patients ranged from 18 months to 32 years. Seven samples were collected from 4 girls and 3 boys.

Scanning Electron Microscopy and Imaging

All samples were prepared for SEM using techniques previously described by our lab. The samples were imaged at our lab using a microscope (JSM-6400, JEOL Ltd, Tokyo, Japan). Biofilm architecture consistent with the extant literature was easily distinguishable from the barren surface of abscess wall lacking biofilm.

Conclusions

Deep cervical abscess is an infection often recalcitrant to medical therapy. As such, surgical drainage remains the foundation of treatment. Recent studies have pointed to biofilms as a common source of chronic and recalcitrant infections. Other labs have shown evidence of biofilm pods embedded intracellularly in adenoid specimens in patients with acute otitis media and chronic otitis media with effusion. Biofilms have numerous mechanisms to avoid antibiotics and host defenses.

This study showed evidence of biofilm formation on the abscess wall of deep cervical abscess in 5 out of 7 specimens. The identification of biofilms in deep cervical neck abscess may help to explain several observations. Deep cervical infection is best treated with extended IV antibiotics if detected prior to abscess formation. Also, once abscess has formed, surgical drainage is the primary treatment modality. Both of these observations agree with preferred treatment outlined in previous studies.

Deep neck abscesses are a common clinical problem with previously poorly understood pathophysiology. The identification of resistant biofilm phenotypes in deep neck abscess suggests that this lifestyle may provide a distinct advantage in allowing the microorganism to overwhelm normal human host immune response. This is the first identification of a possible role of biofilm phenotypes in deep neck space abscess.

References


