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Inflammatory Conditions Aggravate COVID Outcomes

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Abstract

Provenance: Circulating toxins like endotoxin, in the cardiovascular system, may predispose vulnerable people to more severe morbidity and mortality from other cytokine producing infections like COVID. Recent studies show relationship between periodontitis and severity of morbidity from COVID infections.

Aim: This appraisal puts forward a hypothesis that explains this relationship.

Discussion: Periodontal disease may develop after chronic gingivitis. Bacterial ecosystems in climax biofilms prevalent in advanced cases of periodontitis releases acids, enzymes, antigens, mitogens and inflammatory cytokines. Periodontitis and COVID both release inflammatory cytokines.

Conclusion: The presence of Periodontitis may seriously affect morbidity, mortality derived from COVID infection, and impacts decisions on treatment options.

Keywords: COVID; Cytokines; Inflammation; periodontitis

Introduction

Oral bacteria inhabit the oral cavity as commensal in health. Stagnation allows the formation of biofilms which are responsible for the formation of tooth decay and gum disease. In vulnerable people, gingivitis leads to the development of periodontitis. All biofilms are not the same; early biofilms change from being mostly gram positive, immobile, anaerobic non-invasive bacteria producing exotoxins, change over time, with stagnation, to mostly gram negative, mobile, aerobic, endotoxin producing invasive ecosystems. Gram-negative, climax communities of bacteria produce acids, toxins, enzymes antigens and cytokines, which cause destruction of the periodontal ligament and consequently attachment loss of teeth to alveolar bone [1]. Gum diseases affect the health of the cardiovascular system [2]. Both COVID infection and periodontitis are deemed to be inflammatory diseases. COVID is a RNA viral infection which attacks capillary rich organs and in the advanced stages of COVID infection, causes severe inflammation with organ failure [3]. Periodontitis progresses with tissue destruction mediated by severe inflammation and consequently also deemed an inflammatory disease.

Aim

This appraisal deconstructs the pathogenesis of Periodontitis and COVID infection and provides a rationale as to why sufferers of periodontitis, who have endotoxemia from oral pathogenic biofilms, may well be predisposed to more severe morbidity and mortality outcomes from a COVID infection.

Discussion

The major toxin produced by anaerobic bacteria is endotoxin. Gastro-Intestinal Toxic Shock Syndrome (GITSS) is a well described condition, in which there is pyrexia (progressive hyperthermia), marked drop in blood pressure, heart failure and often mortality associated rampant endobacterial infection [4]. The condition is mediated mainly by the gram-negative bacteria production of endotoxin. Periodontitis is also mediated mainly by endotoxin, with inflammation releasing molecules like histamine, IL-1, IL-2, IL-6, TNF-alpha, and interferon-gamma C-Reactive Protein (CRF) and many other inflammatory cytokines [3-6]. Accordingly, periodontitis has been putatively associated with other endotoxin mediated conditions like GITSS [7]. Diabetics are prone to developing infections with frequent consequent onset of spreading inflammation, and sufferers of diabetes mellitus are notorious for developing severe periodontitis [8]. Although COVID infections are frequently associated with pulmonary morbidity, COVID is an RNA viral infection will attack capillaries in well reticulated organs like the brain, liver and lungs. COVID effects inflammation on the endothelial cells, [the myocytes and pericytes] of these organs and micro-clots compromises

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through mini-infarcts, healthy function of these organs. Transient cerebral ischemic attacks and the possibility of a stroke may manifest if the brain is affected by the COVID infection. COVID morbidity is aggravated by anoxia and any organ with rich capillaries may be affected [9-11]. The lungs, which have a rich reticulated capillary network for oxygen exchange and CO_2-release, are particularly prone to fluid accumulation and with a COVID infection; the virus aggravates the anoxic condition. This cellular exudate provides a fertile field for bacterial infection, and an exacerbated huge release of inflammatory cytokines follows referred to as a "Cytokine storm', overwhelms the body's defenses with resultant mortality [11]. People suffering from periodontitis have higher levels of circulating endotoxins and cytokines than healthy non-sufferers, and consequently are more prone to COVID mortality. Recent research confirms this theory [12]. There is a higher risk from periodontitis being causatively associated with increased risk of ICU admission, the necessity for assisted ventilation and increased morbidity of COVID-19 infected patients [13].

Concluding remarks: There are similarities and implications which are important that arise from this explanation.

Similarities: Ever since the last century periodontitis, regarded as an inflammatory disease, has been associated with systemic illness [9,10]. Not all cases of gingivitis progress to periodontitis. Severe cases of periodontitis are associated with predisposing conditions and concomitant Herpes viral infection. Ever since the twentieth century serious illnesses have been associated with viral infections. Not all cases of COVID infection progress to debilitating morbidity or mortality. Severe outcomes of COVID infection are associated with pre-existing periodontal disease.

Implications: Taking care of gum disease becomes vitally important as a prophylaxis against predisposing people to reacting badly should they ever become infected with a virus, like COVID. Checking to see whether COVID infected patients admitted to hospital have periodontitis, will influence the immediacy, speed and selection of urgent treatment options available for managing COVID positive cases. Vaccines may prevent acquiring a COVID infection, and drug treatments focusing on moderating release of cytokines will reduce the severity of Covid infections.

Conclusion

Prevalent endotoxemia and increased blood levels of inflammatory cytokines from diseases like periodontitis may predispose and worsen disease outcomes from COVID infection.

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