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Unveiling the Hidden Impact of Oral Diseases on Adverse Pregnancy Outcomes

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Review Article

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ABSTRACT

As oral health's systemic implications gain recognition, various research has been done to identify significant associations between oral diseases and pregnancy complications. It has been stated that the oral bacteria may increase the systemic inflammatory markers which may adversely impact pregnancy outcomes, encompassing preterm birth, low birth weight, and gestational complications. It explores potential biological mechanisms, emphasizing the role of inflammation, infection, and systemic immune responses in shaping pregnancy. This comprehensive review emphasises the significance of recognizing and addressing oral diseases in the context of maternal health. By shedding light on the hidden impact of oral diseases on adverse pregnancy consequences, this article contributes valuable insights to the broader discourse on women's health and prenatal care.

Keywords: Adverse Pregnancy Outcomes, Dental Caries, Inflammation, Maternal Health, Oral Diseases, Prenatal Care, Periodontitis.

Introduction

Researchers have focused an array of emphasis in the recent past on the potential association of periodontal disease and other systemic conditions ranging from diabetes, cardiovascular disease, and preterm birth. A consensus report on periodontitis and systemic disorders was released in 2013 by the American Academy of Periodontology and the European Federation of Periodontology.[1] Adverse pregnancy outcomes were the focus of Professors Mariano Sanz and Kenneth Kornman's research.[2] A notion that periodontal disease might increase the risk of preterm delivery was initially mentioned in 1996.[3] Subsequently, the correlation between

periodontal diseases and adverse pregnancy outcomes has been one of the major domains of research in dentistry. This manuscript reviews the biological plausibility linking periodontitis to pregnancy.

Classification of Adverse Pregnancy Outcomes

Adverse pregnancy outcomes have been classified into the following subgroups based on previous studies:[4]

Preterm birth: Defined as delivery before 37 completed weeks (< 259 days).[4]

Pre-eclampsia: A multisystem disorder of pregnancy characterized by maternal hypertension and proteinuria after the 20th gestational week.[4]

Low and very low birthweight, are defined depending on whether the weight of the baby is < 2,500 g or < 1,500 g, respectively.[5]

Mechanisms of Adverse Pregnancy Outcomes

Two major pathways have been established to be contributing to unfavourable pregnancy outcomes.[1]

i. **Direct Mechanisms:** Oral bacteria or associated components infiltrating the fetal-placenta unit through the genitourinary tract or through hematogenous dispersion.

ii. **Indirect Mechanisms:** Caused by locally induced inflammatory mediators in periodontal tissues, which has a direct influence on the foetal-placental unit.

Haematological dissemination of oral microorganisms and their products

The subgingival environment contains several microbial species, such as P. gingivalis, F. nucleatum, P. intermedia, A. actinomycetemcomitans, and T. denticola, which interact with the host immune and result in periodontal diseases, such as gingivitis and periodontitis.[6] These periodontal bacteria enter the bloodstream through small blood vessels such as arterioles into the systemic circulation and get lodged in various organs of the body including the placenta. Hence the most plausible route is hematogenous transmission through dental bacteremia. In 2006, the first concrete proof of oral-utero translocation was published when an uncultivated oral Bergeyella was shown to be the only pathogenic agent in the placenta of a woman who had an intrauterine infection and gave birth prematurely at 24 weeks gestation.[7]

Inflammatory mediators affecting the fetoplacental unit

Bacterial biofilm-induced periodontal inflammation results in the generation of inflammatory mediators. Inflammatory mediators and cytokines, such as TNF-α, PGE2, IL-1β, and IL-6, have been produced due to periodontal disease within the subgingival region and then eventually circulate into the bloodstream.[8] The levels of inflammatory mediators in gingival crevicular fluid, an inflammatory exudate from the gingival sulcus or within the gingival sulcus, have proven to be positively correlated with Adverse Pregnancy outcomes.[9]

Preterm Birth and Periodontal Disease

It has been established that periodontal disease elevates the risk of developing cardiovascular disease, rheumatoid arthritis, and other illnesses, possibly via increasing systemic inflammation. In 1996 Offenbacher et al. found a substantial correlation between periodontal disease and the likelihood of preterm delivery.[3] Gingival ulceration in the periodontal pocket facilitates bacterial transit and systemic dissemination in periodontitis. Additionally, locally produced proinflammatory cytokines have the ability to enter the bloodstream and cause an acute-phase response in the liver, which is marked by an elevation in C-reactive protein, that influences pregnancy and contributes to the induction of inflammation-induced preterm birth.[10] Jeffcoat M et al in their randomised controlled clinical trial concluded that the beneficial effect on Preterm Birth was dependent on the success of periodontal treatment.[11]

Pre-eclampsia and Periodontal Disease

Preeclampsia is a pregnancy-specific condition marked by proteinuria and an elevated systolic and/or diastolic blood pressure after 20 weeks of gestation. Both the mother and the foetus might be at risk from this illness. Along with HIV infection, malaria, and Chlamydia pneumoniae infection, Periodontal Disease is considered as another potential risk factor for preeclampsia.[12] Early angiogenic and inflammatory dysregulation causes placental breakdown which has been termed as pre-eclampsia.[13] Periodontopathogens can infiltrate and colonize the vaginal microbiota through the gastrointestinal tract.[14] Bacterial adhesion proteins have the ability to attach to placental cell receptors and induce an inflammatory reaction.[15] Placental microbiome dysbiosis seems to be a major risk factor for pre-eclampsia, even if its precise aetiology is still uncertain.[16]

Periodontopathogen can also be pathogens of the placenta bed. The placenta of pre-eclamptic women with periodontitis expressed more TLR-4 and NF-κB when P. gingivalis and P. intermedia were present.[16] P. gingivalis was isolated in the umbilical cord or villous stroma. There was a substantial correlation between its presence in the umbilical cord and pre-eclampsia.[18] Many in vitro and in vivo investigations have proven that P. gingivalis can influence uterine spiral artery remodelling.[13-18]

Low birthweight and Periodontal Disease

A birth weight of less than 2,500 grams is the worldwide definition of low birth weight, which was established by the 29th World Health Assembly in 1976. If the baby weighs less than 2,500 grams at birth, the risk of infant mortality increases substantially.[20] Reduced intrauterine growth or an unusually short gestational period might cause low birth weight. Around the latter stages of the gestation period, hormonal changes cause the tissue to release proinflammatory cytokines, which in turn cause the myometrium to start producing prostaglandins, which cause the uterus to contract.[21] Microbiological products such as endotoxins can initiate the host immune response, eventually resulting in inflammation and the activation of pro-inflammatory mediators like interleukin-1, TNF-α, and MMPs. These mediators then diffuse through the placenta and cause foetal toxicity, which can result in preterm birth and low birth weight babies.[22] A randomized, controlled trial undertaken by López and associates, demonstrated that periodontal therapy significantly reduces the rates of Preterm Low Birth Weight in women with periodontal disease.[23] According to Budaneli and associates Periodontal infections may cause Preterm Low Birth weight by the following routes such as the fetoplacental unit can be affected by periodontal pathogens, lipopolysaccharide from the periodontal reservoir can negatively impact the fetoplacental unit, and Inflammatory mediators like prostaglandins, interleukins, and tumour necrosis factor (TNF) can afflict the fetoplacental unit.[23] One of the most significant etiological factors for preterm birth tends to be intrauterine infections. A possible hypothesis is that the organisms linked to the development of periodontal disease could allow other organisms access to the systemic propagation. We conclude that confounding variables, especially those related to health behaviour, may account for the majority of the connection between periodontal diseases and adverse pregnancy outcomes, but periodontopathogens may also play a direct or indirect role.[23]

Conclusion

In conclusion, while the relationship between periodontitis and adverse pregnancy outcomes is complex and multifaceted, the existing evidence suggests a potential association. Addressing oral health as an integral part of prenatal care may contribute to overall maternal well-being and potentially reduce the risk of certain adverse pregnancy outcomes. Further research is needed to elucidate the underlying mechanisms and establish causality, but the current knowledge

underscores the importance of oral health in the context of maternal and foetal health.

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