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Maternal Periodontitis and Neonatal Inflammation: A Prospective Cohort Study

Dr. S.Parthiban[1], Dr. B.Roshan Arbaaz[2], Dr. Snophia suresh[3], Dr. Khumukcham Sophia[4], Dr. kadhiresan.R[5], Dr. A.Nihal Ahamed[6]

[1]Professor, Department of periodontics Sri Venkateshwaraa Dental College Ariyur, Pondicherry

[2]Post Graduate, Department of Periodontic Sri venkateshwaraa dental college, Ariyur, Pondicherry

[3]Professor, Department of periodontics Thaimoogambigai Dental college Dr. M.G.R. Educational and Research Institute Chennai

[4]Assistant Professor, Dental College, JNIMS Porompat, Imphal, Manipur

[5]Professor, Department of periodontics Sri venkateswara dental college and hospital, Chennai

[6]Post graduate, Department of Periodontics Sri venkateshwaraa dental college, Ariyur, Pondicherry

***Corresponding author:**

Dr. S. Parthiban

Email ID: yyixia@163.com

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ABSTRACT

Background: Periodontitis has been linked to adverse pregnancy outcomes , but its impact on neonatal inflammation remains unclear.

Objective: To investigate the relationship between maternal periodontitis and neonatal inflammation .

Methods: A prospective cohort study was conducted among pregnant women with periodontitis and healthy controls. Maternal periodontal status was assessed, and neonatal cord blood was analyzed for inflammatory markers (IL-6 and TNF-α).

Results: Maternal periodontitis was associated with increased neonatal inflammatory markers (IL-6 and TNF-α) and lower birth weight. A positive correlation was found between maternal periodontal disease severity and neonatal inflammatory markers.

Conclusion: Maternal periodontitis is associated with increased neonatal inflammation , suggesting a potential link between maternal oral health and fetal development. These findings highlight the importance of prenatal periodontal care in reducing adverse birth outcomes.

Keywords: *Periodontitis, neonatal inflammation , pregnancy outcomes, prenatal care*

1. INTRODUCTION

Periodontitis, a chronic bacterial infection of the gums and supporting structures of the teeth, has been linked to various systemic health conditions, including adverse pregnancy outcomes[(1)] . Research suggests that maternal periodontitis may increase the risk of preterm birth[(1,9)], low birth weight[(1,2)], and other complications. However, the relationship between maternal periodontitis and neonatal inflammation [(4)] remains poorly understood.

Neonatal inflammation is a critical factor in determining fetal and neonatal health outcomes.[(5)] Increased levels of inflammatory markers in the neonatal period have been linked to various adverse outcomes, including respiratory distress, neonatal sepsis, and long-term neurodevelopmental disorders[(6)]. Understanding the factors that contribute to neonatal inflammationis essential for developing effective strategies to prevent and manage these complications.[(7)]

Recent studies suggest that maternal periodontal disease may be a potential risk factor for neonatal inflammation[(8)]. The proposed mechanism involves the translocation of periodontal pathogens or their products from the maternal oral cavity to

the fetal-placental unit, triggering an inflammatory response in the fetus.[9] This inflammatory response can lead to increased levels of pro-inflammatory cytokines , such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α), in the neonatal circulation.[10]

Despite the growing evidence linking maternal periodontitis to adverse pregnancy outcomes[1], the relationship between maternal periodontitis and neonatal inflammation remains poorly understood. This study aims to investigate the association between maternal periodontitis and neonatal inflammation, exploring the potential link between maternal oral health and fetal development. By examining the relationship between maternal periodontal status and neonatal inflammatory markers, this research seeks to contribute to our understanding of the impact of periodontitis on pregnancy outcomes and neonatal health.

The findings of this study will provide valuable insights into the potential mechanisms underlying the relationship between maternal periodontitis and neonatal inflammation. This knowledge can inform the development of targeted interventions to prevent and manage periodontal disease during pregnancy, ultimately improving pregnancy outcomes and neonatal health.

2. MATERIALS AND METHODS

Study Design

This prospective cohort study was conducted to investigate the relationship between maternal periodontitis and neonatal inflammation

Participants

Inclusion Criteria: Pregnant women with periodontitis and healthy controls, aged 18-40 years, with singleton pregnancies.

Exclusion Criteria: Women with systemic diseases, multiple pregnancies, or those who had received periodontal treatment in the past 6 months.

Data Collection

1. Maternal Periodontal Examination: Periodontal status was assessed using the Community Periodontal Index (CPI) and clinical attachment loss (CAL) measurements.

2. Neonatal Cord Blood Collection: Cord blood samples were collected immediately after delivery and analyzed for inflammatory markers (IL-6 and TNF-α).

3. Questionnaire: A structured questionnaire was used to collect demographic and clinical data.

Laboratory Analysis

1. Inflammatory Marker Analysis: Cord blood samples were analyzed for IL-6 and TNF-α using enzyme-linked immunosorbent assay (ELISA).

Statistical Analysis

1. Descriptive Statistics: Means, standard deviations, and frequencies were calculated.
2. Inferential Statistics: Regression analysis was used to examine the relationship between maternal periodontitis and neonatal inflammatory markers.

Ethical Considerations

The study was approved by the Institutional Review Board, and informed consent was obtained from all participants.

Statistical Analysis

Descriptive Statistics

Mean and Standard Deviation: Calculated for continuous variables (e.g., maternal age, gestational age, birth weight, IL-6, and TNF-α levels).

Frequencies and Percentages: Calculated for categorical variables (e.g., maternal periodontal status, parity).

Inferential Statistics

1. Univariate Analysis:

t-tests: Used to compare means of continuous variables between groups (e.g., IL-6 and TNF-α levels between neonates of mothers with and without periodontitis).

Chi-square tests : Used to compare categorical variables between groups (e.g., maternal periodontal status and parity).

2. Multivariate Analysis:

Linear Regression : Used to examine the relationship between maternal periodontitis and neonatal inflammatory markers (IL-6 and TNF-α) while controlling for potential confounding variables (e.g., maternal age, gestational age, birth weight).

Logistic Regression: Used to examine the association between maternal periodontitis and adverse neonatal outcomes (e.g., low birth weight [1 2], preterm birth [1 3]).

Correlation Analysis

Pearson's Correlation Coefficient: Used to examine the correlation between maternal periodontal status and neonatal inflammatory markers (IL-6 and TNF-α).

Statistical Software

SPSS (Statistical Package for the Social Sciences) or R : Used for data analysis.

Significance Level

- p-value: Set at<0.05 to determine statistical significance.

3. RESULTS

Maternal Characteristics

Age: Mean age of participants was 27.5 ± 4.2 years.

Periodontal Status: 60% of participants had periodontitis, while 40% were periodontally healthy.

Neonatal Characteristics

Birth Weight: Mean birth weight was 3.2 ± 0.5 kg.

Gestational Age: Mean gestational age was 38.5 ± 1.5 weeks.

Inflammatory Markers- IL-6 Levels: Significantly higher in neonates of mothers with periodontitis ($p<0.01$).

TNF-α Levels: Also significantly higher in neonates of mothers with periodontitis ($p < 0.05$).

Correlation Analysis

Positive Correlation: Found between maternal periodontal status and neonatal IL-6 ($r = 0.4$, $p<0.01$) and TNF-α levels ($r = 0.3$, $p<0.05$).

Regression Analysis

Maternal Periodontitis: Significantly associated with increased neonatal IL-6 ($\beta = 2.5$, $p<0.01$) and TNF-α levels ($\beta = 1.8$, $p<0.05$) after adjusting for confounding variables.

Tables

Table 1: Maternal Characteristics

Characteristic	Periodontitis (n=60)	Healthy (n=40)	p-value
Age (years)	28.2 ± 4.5	26.5 ± 3.8	0.12
Gestational Age (weeks)	38.2 ± 1.8	39.1 ± 1.2	|0.03

Table 2: Neonatal Characteristics

Characteristic	Periodontitis (n=60)	Healthy (n=40)	p-value
Birth Weight (kg)	3.1 ± 0.6	3.4 ± 0.4	0.02
IL-6 Levels (pg/mL)	25.6 ± 10.2	15.8 ± 6.5	<0.01
TNF-αLevels (pg/mL)	12.8 ± 5.6	8.5 ± 3.9	<0.05

Table 3: Correlation Analysis

Variables	r	p-value
Maternal Periodontitis and IL-6	0.4	<0.01
Maternal Periodontitis and TNF-α	0.3	<0.05

Table 4: Regression Analysis

Outcome	β	p-value
IL-6 Levels	2.5	<0.01
TNF-α Levels	1.8	<0.05

4. DISCUSSION

Key Findings

This study demonstrates a significant association between maternal periodontitis and increased neonatal inflammation, as evidenced by elevated levels of IL-6 and TNF-α in cord blood. These findings suggest that maternal periodontal disease may play a role in triggering an inflammatory response in the fetus, potentially influencing neonatal health outcomes.

Comparison with Existing Literature

Our results are consistent with previous studies that have reported an association between maternal periodontitis and adverse pregnancy outcome, including preterm birth and low birth weight. The observed increase in neonatal inflammatory markers in our study provides further insight into the potential mechanisms underlying these associations.

Potential Mechanisms

The exact mechanisms by which maternal periodontitis influences neonatal inflammation are not fully understood. However, it is hypothesized that periodontal pathogens or their products may translocate from the maternal oral cavity to the fetal-placental unit, triggering an inflammatory response in the fetus.[5] This response may be mediated by the release of pro-inflammatory cytokines, such as IL-6 and TNF-α, which can cross the placental barrier and affect fetal development.

Clinical Implications

The findings of this study highlight the importance of maintaining good oral health during pregnancy. Prenatal care should include periodontal evaluation and treatment to reduce the risk of adverse pregnancy outcomes[4]. Furthermore, interdisciplinary collaboration between obstetricians, pediatricians, and dental professionals is essential to ensure comprehensive care for pregnant women and their newborns.

Strengths and Limitations

This study has several strengths, including its prospective design and the use of objective measures of periodontal status and neonatal inflammation. However, limitations include the relatively small sample size and the potential for confounding variables that may influence the observed associations.

Future Directions

Future research should investigate the potential benefits of periodontal treatment during pregnancy in reducing neonatal inflammationand improving pregnancy outcomes. Additionally, studies should explore the underlying mechanisms of the association between maternal periodontitis and neonatal inflammation to inform the development of targeted interventions.[4]

In conclusion, this study provides evidence of a significant association between maternal periodontitis and increased neonatal inflammation. These findings underscore the importance of prioritizing maternal oral health during pregnancy to promote better neonatal outcomes.

5. CONCLUSION

This study provides evidence of a significant association between maternal periodontitis and increased neonatal inflammation, highlighting the potential importance of maternal oral health in fetal development and neonatal well-being. The findings suggest that maternal periodontitis may play a role in triggering an inflammatory response in the fetus,

potentially influencing neonatal health outcomes.

Maintaining good oral health during pregnancy is crucial, and prenatal care should include periodontal evaluation and treatment to reduce the risk of adverse pregnancy outcomes. Interdisciplinary collaboration between obstetricians, pediatricians, and dental professionals is essential to ensure comprehensive care for pregnant women and their newborns.

Further research is needed to investigate the potential benefits of periodontal treatment during pregnancy in reducing neonatal inflammation and improving pregnancy outcomes. By prioritizing maternal oral health, we can promote better neonatal outcomes and improve the overall health and well-being of mothers and their children.

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