

The Impact of Pregnancy Associated Hormonal Changes on Sinusitis and Rhinitis: A Narrative Review

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Abstract

Background: Hormonal changes during pregnancy significantly affect various physiological systems, including the respiratory tract, contributing to the onset and progression of sinusitis and rhinitis. These conditions can impact the quality of life of pregnant women and pose potential risks to maternal and fetal health.

Aim: To explore the prevalence, risk factors, pathophysiology, clinical manifestations, diagnostic challenges, and management strategies for sinusitis and rhinitis during pregnancy, emphasizing the role of hormonal fluctuations.

Methods: A narrative review was conducted by analyzing and synthesizing data from relevant studies, focusing on the impact of pregnancy-related hormonal changes on the nasal and sinus mucosa. Peer-reviewed articles published in reputable medical journals were reviewed, emphasizing prevalence, pathophysiology, clinical challenges, and treatment options.

Results: Pregnancy-associated rhinitis affects approximately 10% of pregnant women, with nasal obstruction, rhinorrhea, and sneezing being common symptoms. Elevated estrogen and progesterone levels contribute to increased vascular permeability, mucosal edema, and immune modulation, predisposing women to sinus inflammation and infection. These hormonal changes complicate the differentiation between physiological nasal changes and pathological conditions, creating diagnostic and management challenges. Most cases are mild, but complications such as obstructive sleep apnea and adverse fetal outcomes have been reported.

Conclusions: Hormonal fluctuations during pregnancy play a pivotal role in the development and progression of sinusitis and rhinitis. Management strategies focus on conservative approaches, such as saline nasal sprays and humidification, to ensure safety for both mother and fetus. Pharmacological interventions are considered only when necessary and must have established safety profiles. Further research is needed to understand long-term outcomes and optimize treatment approaches for these conditions.

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Introduction

Hormonal changes during pregnancy significantly impact the occurrence and severity of sinusitis and rhinitis, often leading to a condition known as "rhinitis of pregnancy." This issue is a significant clinical concern, as

these conditions can adversely affect both maternal health and fetal development. Understanding the prevalence and management of pregnancy-related nasal issues is crucial for healthcare providers to ensure optimal outcomes for both mothers and their babies.

Pregnancy rhinitis (PR) affects approximately 30% of pregnant women, is characterized by nasal congestion, rhinorrhea, and, in some cases, exacerbation of sinusitis, with symptoms typically resolving after delivery (1, 2). These symptoms are primarily attributed to hormonal fluctuations, particularly the increased levels of estrogen and progesterone, which cause nasal mucosal swelling, vascular permeability, and relaxation of nasal vascular smooth muscles (3). Additionally, elevated blood volume during the third trimester contributes to nasal vascular engorgement, further exacerbating congestion (4).

Unmanaged rhinitis can severely impact quality of life, contributing to sleep disturbances and potential complications such as hypertension and intrauterine growth retardation (5). The incidence of sinusitis in pregnant women is about 4.7%, often linked to inadequate treatment of chronic rhinitis. Effective management requires careful diagnosis and individualized treatment plans, as standard allergic rhinitis treatments may not be effective (6). A stepwise therapeutic approach is recommended, focusing on safety for both the mother and fetus (7).

While the focus is often on the physical symptoms of rhinitis and sinusitis, the psychological impact on pregnant women should not be overlooked, as it can lead to increased stress and anxiety during pregnancy. Hormonal changes during pregnancy contribute to mucosal edema, leading to nasal congestion and impacting quality of life. This condition can result in various clinical outcomes, including sleep disorders and hypertension, due to the associated discomfort and breathing difficulties (8). PR is characterized by long-lasting nasal congestion without signs of infection or allergy, often starting at any time during pregnancy. Sinusitis may also occur, complicating the clinical picture and requiring careful management (6). The symptoms of PR and sinusitis can lead to significant disruptions in daily activities, sleep disturbances, and

increased stress levels (9). Poorly managed sinonasal conditions can exacerbate existing health issues, such as asthma, further affecting maternal health (10). Despite the challenges posed by these conditions, some studies suggest that the impact of PR and sinusitis may be underreported, indicating a need for better recognition and management strategies during pregnancy (8).

Pregnancy-induced rhinitis (PIR) significantly impacts maternal quality of life, frequently leading to sleep disturbances, fatigue, and discomfort. (11) Despite its prevalence, PIR is often misdiagnosed or confused with allergic rhinitis, hindering effective treatment. (8) Accurate diagnosis is paramount, as poorly managed sinusitis can adversely affect overall well-being and pregnancy outcomes (9).

Managing these conditions presents significant challenges, primarily due to the limited availability of safe treatment options during pregnancy. While older medications with well-established safety profiles, such as Cromones, are preferred, conservative management strategies are often recommended to balance symptom relief with fetal safety. (9, 10). Non-pharmacological interventions also play a critical role in optimizing maternal health when pharmacological treatment is deemed risky or unnecessary. Although some experts argue that PIR and related conditions are self-limiting and may not require aggressive management, their impact on maternal health and quality of life necessitates a tailored and cautious approach.

This narrative review explores the impact of hormonal changes during pregnancy on sinusitis and rhinitis, providing an in-depth analysis of the underlying mechanisms, prevalence, clinical implications, and challenges associated with the management of these conditions. By examining the interplay between hormonal influences and nasal symptoms, this review seeks to inform clinical practice and highlight the importance of individualized care for pregnant women experiencing sinonasal conditions.

2. Hormonal Changes in Pregnancy

Hormonal fluctuations during pregnancy play a pivotal role in the development and exacerbation of sinonasal conditions, particularly pregnancy-induced rhinitis (PIR) and sinusitis. Elevated levels of estrogen and progesterone are central to these changes, significantly influencing nasal physiology and respiratory function. These hormonal shifts are not only vital for maternal and fetal health but also contribute to discomfort and potential complications, necessitating careful clinical attention.

The rise in estrogen levels, particularly during the third trimester, contributes to increased nasal mucosal swelling and vascular permeability, which are hallmark features of PIR (2). This vascular response heightens nasal congestion, exacerbating pre-existing nasal conditions and creating new challenges for expectant mothers. Similarly, progesterone-induced relaxation of nasal vascular smooth muscles intensifies nasal resistance and congestion, further impacting maternal respiratory function (1, 3).

The contributions of other factors, such as placental growth hormone and insulin-like growth factor, while less well-defined, highlight the complexity of endocrinology during pregnancy. These hormonal effects, compounded by increased blood volume and potential allergic responses, underscore the multifactorial nature of PIR and its impact on maternal health (4).

In addition to their effects on the nasal mucosa, hormonal changes influence respiratory physiology, reducing functional residual capacity due to diaphragmatic elevation and anatomical shifts (12). These adaptations, while essential for accommodating the growing fetus, may compromise respiratory efficiency and increase susceptibility to infections. The reduction in arterial carbon dioxide levels, driven by changes in respiratory drive, further complicates respiratory management during pregnancy (13).

The clinical implications of these changes are profound. Conditions like PIR can disrupt maternal quality of life by impairing sleep and overall well-being, and in some cases, they may contribute to complications such as hypertension (5). Moreover, the interplay of hormonal changes and immune modulation during pregnancy may offer some protection against infections (14), but this protective effect is not sufficient to mitigate the burden of PIR and sinusitis entirely.

3. Pregnancy-Associated Rhinitis

Pregnancy-associated rhinitis (PAR) is a prevalent condition characterized by nasal congestion, rhinorrhea, sneezing, and postnasal drip arising from the hormonal changes that occur during pregnancy. The condition significantly impacts the quality of life for many pregnant women. Studies report varying prevalence rates of PR among pregnant women. A study reported to affect between 10% and 32% of pregnant women (15). Approximately 39% in another study on respiratory disorders during pregnancy (16). 11.65% in a study conducted at Tikrit General Hospital, with PR mostly observed in the first trimester (17). Other studies indicate prevalence rates ranging from 18% to 30% (18). The mean age of affected women in studies is around 24.62 years (19). Despite its common occurrence, PAR is often underdiagnosed or misclassified, which can lead to untreated symptoms, further complications, and reduced maternal well-being (20).

PAR is defined as a non-allergic form of chronic rhinitis that occurs exclusively during pregnancy and resolves within a few weeks postpartum (7). The incidence of PR appears to increase as pregnancy progresses: 10% in the first trimester, 18.4% in the second trimester, 46.87% in the third trimester (21). Hormonal changes, particularly fluctuations in estrogen, progesterone, and placental growth hormone, play a pivotal role in the pathophysiology of this condition. Elevated levels of estrogen and placental growth hormone contribute to

increased vascular permeability, nasal mucosal edema, and enhanced blood flow, leading to nasal congestion (5, 22). Progesterone further exacerbates these effects by promoting the relaxation of nasal vascular smooth muscles, which heightens nasal resistance and congestion (23).

The symptoms of PAR are not only bothersome but also have broader implications for maternal and fetal health. Common symptoms such as nasal obstruction, rhinorrhea, and postnasal drip are associated with disrupted sleep, fatigue, and reduced overall well-being (15). In some cases, PAR has been linked to complications such as maternal hypertension and impaired fetal growth, underscoring the importance of its recognition and management (5, 22).

Despite the significant impact of PAR on quality of life, there is a lack of standardized treatment protocols tailored to this condition. Non-pharmacological interventions, such as saline nasal douching, exercise, and positional adjustments, are often recommended as first-line therapies due to their safety and ease of use (24). Pharmacological options are more limited, with topical corticosteroids such as budesonide and certain second-generation antihistamines like loratadine and cetirizine being considered safe during pregnancy. However, the use of oral decongestants is generally discouraged, particularly in the first trimester, due to potential risks to fetal development (25).

Although hormonal changes are a primary driver of PAR, environmental factors and pre-existing sinonasal conditions may exacerbate its symptoms, highlighting the need for a comprehensive and individualized approach to diagnosis and management (26). Enhanced awareness and education about PAR among healthcare providers and pregnant women are critical for improving diagnosis rates and ensuring appropriate care.

Future research should focus on understanding the complex interactions between hormonal fluctuations and nasal physiology during pregnancy. This includes investigating potential

genetic or environmental predispositions to PAR and evaluating the efficacy and safety of novel therapeutic options for managing this condition. By addressing these gaps, clinicians can better support maternal and fetal health outcomes, ultimately improving the quality of life for expectant mothers.

4. Sinusitis in Pregnancy

Sinusitis during pregnancy is closely linked to the hormonal fluctuations that occur during gestation, leading to various symptoms and complications. These hormonal changes, particularly in estrogen and progesterone, contribute to nasal mucosal edema, which can predispose pregnant women to sinusitis. Sinusitis occurs six times more frequently in pregnant women compared to the general population (27). Among pregnant women presenting with nasal congestion and/or nasal discharge, the frequency of sinusitis is reported at 4.7%(28). These symptoms often worsen in the later stages of pregnancy, particularly in the third trimester, when blood volume and mucosal swelling are at their peak (20). The impact on maternal health is significant, with approximately two-thirds of affected women reporting a marked decline in their quality of life. Additionally, complications such as obstructive sleep apnea and potential adverse fetal outcomes necessitate careful monitoring and management of these conditions (29).

Hormonal changes during pregnancy, particularly the elevated levels of estrogen and progesterone, play a pivotal role in the pathophysiology of sinusitis. These hormones contribute to increased vascular permeability and mucosal edema, leading to nasal congestion and sinus inflammation. Furthermore, hormonal shifts can modulate immune responses, potentially increasing the risk of infections, including sinusitis, as the body adapts to protect the fetus (30). Pregnancy induces increased blood flow to the nasal mucosa, which exacerbates symptoms of sinusitis by promoting swelling and inflammation (28). Additionally, changes in

mucus production and viscosity, driven by hormonal fluctuations, can lead to blockages in sinus drainage pathways, further aggravating the condition (31).

Despite the hormonal influence on sinusitis, the clinical presentation of sinusitis during pregnancy presents diagnostic challenges. Symptoms such as nasal obstruction, rhinorrhea, and ear fullness can overlap with normal pregnancy-related changes, complicating the diagnosis of sinusitis. The variability of symptoms and the overlap with other pregnancy-related conditions such as pregnancy rhinitis can lead to confusion in clinical practice. Moreover, the safety of pharmacological interventions during pregnancy is a concern, which makes treatment options limited (25, 32).

Given the complexities of sinusitis during pregnancy, conservative management strategies are generally preferred. Non-pharmacological interventions, such as saline nasal sprays, humidifiers, and nasal irrigation, are commonly employed to alleviate symptoms. These approaches are regarded as safe and effective in alleviating congestion and promoting sinus drainage without compromising maternal or fetal health. However, in instances where pharmacological intervention becomes necessary, treatments with established safety profiles during pregnancy, such as specific corticosteroids or antihistamines, are considered. (24). The emphasis remains on minimizing intervention to ensure safety for both mother and fetus.

While the majority of sinusitis cases in pregnancy are benign and resolve postpartum, the potential complications associated with the condition, such as obstructive sleep apnea and adverse fetal outcomes, warrant careful monitoring. Researchers have suggested that the physiological adaptations during pregnancy, such as increased mucosal blood flow, may also provide some protective mechanisms against severe infections, including sinusitis (33, 34). However, these

protective effects remain an area for further investigation.

5. Overlapping Features of Sinusitis and Rhinitis in Pregnancy

5.1 Shared pathophysiological mechanisms

Sinusitis and rhinitis are common conditions during pregnancy, often overlapping in symptoms and underlying mechanisms. Their shared pathophysiological features, influenced by hormonal changes and physiological adaptations, contribute to significant diagnostic and management challenges. Both conditions primarily manifest as nasal congestion, yet their causes and implications differ, underscoring the need for tailored approaches during pregnancy. Increased levels of pregnancy-related hormones, particularly estrogen and placental growth hormone, lead to nasal mucosal edema, vascular engorgement, and increased secretions. These hormonal changes exacerbate pre-existing nasal conditions and contribute to the development of both rhinitis and sinusitis symptoms (35-38). Additionally, the physiological increase in blood volume during pregnancy further aggravates nasal vascular engorgement, exacerbating congestion (39).

Chronic rhinitis, if left untreated, can serve as a precursor to sinusitis, with approximately one-third of sinusitis cases in pregnant women attributed to untreated rhinitis (40). Although maternal immunity alterations during pregnancy do not directly predispose individuals to infections, they can modulate the inflammatory response in nasal passages, making the mucosa more susceptible to viral damage and secondary bacterial infections as common pathways for sinusitis development (37).

Clinically, both rhinitis and sinusitis primarily manifest with nasal congestion, a symptom that can lead to complications such as poor sleep quality and maternal hypertension (5, 36). However, distinguishing between the two can be challenging, as sinusitis symptoms may overlap with pregnancy rhinitis but often lack systemic features like fever or pronounced

facial pain (40). Furthermore, pregnancy-induced rhinitis is distinct in its etiology and may not respond to treatments effective for allergic rhinitis or sinusitis, necessitating tailored management strategies (5).

In conclusion, understanding the overlapping features of rhinitis and sinusitis during pregnancy is essential for improving the diagnosis and management, ultimately enhancing maternal health outcomes. Future research should prioritize the development of therapeutic strategies that consider these shared mechanisms while addressing the unique needs of pregnant women.

5.2 Diagnostic overlap and differentiation

The overlapping features of sinusitis and rhinitis during pregnancy pose significant diagnostic challenges due to their similar symptoms and underlying mechanisms. Both conditions can greatly affect the quality of life for pregnant women, making accurate differentiation crucial for effective management.

Both conditions share common symptoms such as nasal congestion, rhinorrhea, and facial pressure, which complicates diagnosis (40, 41). However, sinusitis may present with distinct features like facial pain and fever, which are often absent in rhinitis, particularly in cases of "rhinitis of pregnancy" (39, 42).

The diagnosis often relies on clinical history and physical examination. In pregnant women, the absence of systemic symptoms such as fever is more indicative of rhinitis rather than sinusitis (40, 42). Laboratory tests can also aid in differentiation; for example, an elevated erythrocyte sedimentation rate (ESR) and neutrophil counts may suggest sinusitis, while these markers remain normal in rhinitis (40).

Treatment approaches vary depending on the condition. Rhinitis is often managed with intranasal corticosteroids and antihistamines, while sinusitis may require more aggressive interventions, particularly if complications arise (43). Physiological changes during pregnancy can exacerbate rhinitis symptoms,

making it critical to distinguish between pregnancy-induced rhinitis and pre-existing conditions (39, 42).

Although the overlap in symptoms makes diagnosis challenging, recognizing the distinct clinical features and treatment strategies for sinusitis and rhinitis during pregnancy is essential for providing optimal care. However, the lack of extensive research on the safety of treatment options during pregnancy remains a concern, underscoring the need for further studies in this area (42).

5.3 Combined management strategies

The overlapping features of sinusitis and rhinitis during pregnancy create unique challenges in management, influenced by physiological changes and the potential impact on both maternal and fetal health. Effective strategies must prioritize symptom relief while ensuring safety for both mother and fetus.

Both conditions can present with common symptoms, including nasal congestion, facial pain, and postnasal drip, which complicate diagnosis (41). These conditions affect approximately 18-30% of pregnant women, with higher prevalence among those with pre-existing allergies (39).

Management strategies often include nasal corticosteroids, which are recommended for maintaining chronic rhinosinusitis (CRS) (44). Pregnancy-safe antibiotics are utilized for acute rhinosinusitis and exacerbations of CRS (44). In cases of acute purulent sinusitis, immune correction has been suggested as an approach to account for immunological changes during pregnancy (45).

Management is complicated by several considerations. Safety concerns arise due to the lack of controlled trials evaluating treatment options during pregnancy (42). Additionally, physiological changes such as increased blood volume and hormonal fluctuations can exacerbate nasal symptoms, further complicating treatment (39).

While effective management strategies are critical for addressing these conditions, the

absence of robust evidence demands a cautious approach that balances symptom relief with the safety of both mother and child.

6. Difference Between Pregnancy Rhinitis and Allergic Rhinitis

The distinction between pregnancy rhinitis (PR) and allergic rhinitis (AR) is essential for understanding their respective impacts on maternal health during pregnancy. PR arises due to hormonal fluctuations, primarily increased estrogen and progesterone levels, leading to nasal congestion without signs of infection or allergy, whereas AR is an IgE-mediated immune response triggered by specific allergens. This differentiation is crucial for diagnosis and management to ensure maternal comfort and fetal well-being.

Hormonal changes play a pivotal role in PR, causing nasal mucosal swelling and congestion (46). Studies indicate that pregnancy-induced rhinitis (PIR) is a non-allergic condition manifesting during pregnancy and resolving shortly postpartum (5). The pathophysiology of PR involves increased vascular permeability and smooth muscle relaxation, contributing to persistent nasal obstruction. These physiological alterations can disrupt sleep and overall quality of life, underscoring the importance of symptom management (36).

Conversely, AR involves allergen sensitization, triggering mast cell activation and histamine release (11). Symptoms such as nasal congestion, rhinorrhea, sneezing, and itchy eyes differentiate AR from PR. Moreover, while PR resolves after childbirth, AR persists irrespective of pregnancy and may even worsen due to hormonal influences (47). Thus, an accurate differential diagnosis is critical, as PR does not respond to antihistamines or allergen avoidance strategies commonly used for AR (31).

Management of PR primarily involves conservative measures to alleviate symptoms while ensuring maternal and fetal safety. Saline nasal irrigation, humidifiers, and positional adjustments during sleep are commonly

recommended interventions. Pharmacological treatment is generally avoided unless symptoms significantly impair quality of life (26). In contrast, AR treatment often requires antihistamines, intranasal corticosteroids, and allergen avoidance, highlighting the need for an accurate diagnosis to tailor therapeutic approaches appropriately (30).

Despite these distinctions, some studies suggest that hormonal changes during pregnancy may exacerbate AR, complicating the clinical picture. Increased estrogen levels can enhance nasal inflammation, leading to overlapping symptoms between PR and AR. This overlap necessitates careful evaluation, particularly when considering treatment options that balance efficacy with safety during pregnancy (5).

Overall, distinguishing PR from AR is fundamental for optimizing maternal health during pregnancy. While PR is driven by hormonal fluctuations and self-resolves postpartum, AR persists and requires targeted immunologic management. Given the impact of both conditions on maternal well-being, future research should explore potential interactions between hormonal changes and allergic responses to refine diagnostic and treatment strategies for pregnant women experiencing rhinitis-related symptoms.

7. Clinical Implications

7.1 Challenges in diagnosing and treating ENT conditions during pregnancy

Pregnancy introduces significant physiological changes that complicate the diagnosis and treatment of ear, nose, and throat (ENT) conditions. Altered hormonal levels, increased vascularity, and medication safety concerns for both mother and fetus create unique challenges that necessitate a tailored approach to management.

Hormonal changes during pregnancy can lead to Eustachian tube dysfunction, often resulting in conditions like serous otitis media and hearing loss, which typically resolve postpartum (48). Increased estrogen levels

contribute to nasal mucosal swelling, causing rhinitis and epistaxis common complaints among pregnant women (48, 49). These physiological alterations underscore the complexity of managing ENT conditions during this period.

The lack of comprehensive safety data for diagnostic imaging and treatments complicates clinical decision-making (50). Additionally, the overlap of ENT symptoms, such as nasal congestion or dizziness, with normal pregnancy symptoms can make accurate diagnosis challenging (51).

In terms of treatment, while many medications for ENT conditions are considered safe, caution is advised, particularly with NSAIDs and certain antibiotics (52). Severe cases may require timely intervention to prevent adverse outcomes for both the mother and fetus, emphasizing the importance of clinical vigilance (50).

Although many ENT conditions during pregnancy are benign and self-limiting, some may persist postpartum, requiring continued treatment and follow-up. Careful monitoring during pregnancy, coupled with a nuanced understanding of physiological changes and treatment safety, is essential for optimizing maternal and fetal outcomes.

7.2 Safety considerations for medications and interventions

Hormonal changes during pregnancy significantly impact sinusitis and rhinitis, affecting up to 30% of pregnant women. These changes, primarily driven by increased levels of estrogen and progesterone, lead to nasal mucosal edema, vascularization, and relaxation of smooth muscles, contributing to nasal congestion and rhinitis of pregnancy. This condition, characterized by nasal congestion without infection or allergy, often resolves shortly after delivery but can exacerbate pre-existing nasal issues, affecting the quality of life and pregnancy outcomes if left unmanaged (10, 42, 53). Estrogen increases vascularization and edema in the nasal mucosa, while progesterone

contributes to nasal congestion through its effects on blood volume and vasodilation (54, 55). Additional factors, such as increased blood volume and the influence of vasoactive intestinal peptides, further exacerbate nasal blockage (53). Pregnancy rhinitis is commonly reported in 20-32% of pregnant women, with symptoms more prevalent in the later stages (56).

The management of sinusitis and rhinitis during pregnancy necessitates careful consideration of medication safety to minimize risks to the fetus. Cromones are considered the safest option, requiring frequent administration (10). Antihistamines are generally a second choice but are discouraged during the first trimester (56). Topical steroids such as beclometasone can be effective for moderate to severe rhinitis (10). Continuous use of topical vasoconstrictors is avoided due to the risk of pharmacological rhinitis, while infective rhinitis may require antibiotics such as beta-lactams, cephalosporins, or macrolides (10).

Non-pharmacological interventions like saline nasal sprays, humidifiers, and patient education are essential components of management, offering relief without medication-related risks (50, 56). Short-term use of topical nasal decongestants may alleviate symptoms but should be limited to avoid rhinitis medicamentosa (56). Despite the availability of these interventions, the lack of controlled safety data for many treatments poses challenges, underscoring the need for cautious and informed decision-making by healthcare providers. Ongoing research is required to identify effective and safe therapeutic strategies for managing nasal conditions during pregnancy while ensuring optimal outcomes for both the mother and fetus (50, 57).

7.3 Importance of patient education and multidisciplinary care

Pregnancy is a period marked by significant hormonal changes that can impact various physiological systems, including the respiratory system. These changes can lead to conditions

such as sinusitis and rhinitis, which are common during pregnancy. Understanding the impact of these hormonal fluctuations and the importance of patient education and multidisciplinary care is crucial for managing these conditions effectively.

Estrogen and progesterone levels increase during pregnancy, which can lead to nasal congestion by increasing vascularity in the nasal mucosa. This congestion can contribute to conditions like rhinitis and sinusitis (10, 53). Estrogen is thought to inhibit acetylcholinesterase activity, leading to increased cholinergic effects, which result in swelling and congestion of the nasal mucosa (58). Placental growth hormone levels also rise during pregnancy and have been associated with nasal mucosal changes, potentially contributing to pregnancy rhinitis (54, 59).

Pregnancy rhinitis is characterized by nasal congestion without other signs of respiratory infection, affecting approximately 20-30% of pregnancies. It is thought to be influenced by hormonal changes, particularly increased levels of estrogen and placental growth hormone (10, 53). Symptoms of pregnancy rhinitis are similar to those of allergic rhinitis, including daytime fatigue and decreased concentration (54). Long-standing nasal congestion during pregnancy can lead to sinusitis, as the congestion may block sinus drainage channels, increasing the risk of infection (54, 58).

Hormonal changes during pregnancy also lead to mucosal swelling and vascular pooling, causing nasal obstruction and exacerbating congestion. Women with pre-existing nasal conditions may experience worsened symptoms during pregnancy (53). These physiological alterations highlight the importance of effective management strategies to mitigate symptoms and prevent complications.

Educating patients about the potential for nasal congestion and sinusitis during pregnancy is crucial. Awareness of the nature of pregnancy rhinitis can alleviate anxiety and improve

management (42). Patients should be informed about safe treatment options, such as the use of saline nasal washings and nasal alar dilators, which are safe during pregnancy (10, 59). Additionally, they should be cautioned against overusing nasal decongestants to prevent rhinitis medicamentosa (58).

A multidisciplinary approach involving obstetricians, otolaryngologists, and other healthcare providers can ensure comprehensive care for pregnant women experiencing rhinitis and sinusitis (42, 54). This collaborative approach allows for tailored treatment plans that consider both the safety of the mother and the fetus. Non-pharmacological strategies, such as environmental modifications and lifestyle changes, also play a vital role in managing symptoms effectively. While pharmacological interventions are often emphasized, these non-pharmacological approaches should not be overlooked as they can significantly enhance maternal well-being.

In conclusion, hormonal changes during pregnancy significantly impact conditions like sinusitis and rhinitis. Patient education and a multidisciplinary care approach are essential for effective management, ensuring both maternal and fetal well-being. Future research could further explore the mechanisms of hormonal influence on nasal physiology and develop targeted therapies for pregnancy-related nasal conditions.

8. Future Directions

8.1 Gaps in current knowledge and research

Pregnancy induces significant hormonal changes that can affect the nasal mucosa, leading to conditions such as rhinitis and sinusitis. Understanding these impacts is crucial for managing respiratory symptoms in pregnant women.

The hormonal changes during pregnancy significantly impact the development of sinusitis and rhinitis, particularly through mechanisms that lead to nasal congestion and inflammation. Hormonal fluctuations, particularly increased levels of progesterone

and estrogen, contribute to nasal mucosal edema and vascular changes, leading to rhinitis of pregnancy (ROP) (10, 53). Increased levels of estrogen and progesterone during pregnancy can lead to nasal congestion due to enhanced vascularization of the nasal mucosa (54). These hormones may also increase H1 receptor expression, contributing to nasal symptoms (54).

Approximately 22-30% of pregnant women experience nasal symptoms, with pregnancy-induced rhinitis (PIR) being a common manifestation (10, 60). PIR often presents as nasal congestion without other respiratory infection signs (54, 61). Symptoms typically resolve within two weeks postpartum, indicating a direct link to hormonal changes (61). However, the distinction between PIR and other rhinitis types is crucial for effective treatment, yet misclassification is common (60, 62).

Current treatment options for PIR are limited, with a focus on conservative management due to potential risks to the fetus from medications (10, 62). Patients are often advised to use saline nasal washings and nasal alar dilators, which are considered safe during pregnancy. Non-pharmacological strategies, such as environmental modifications and lifestyle changes, are also emphasized to alleviate symptoms (59).

Despite the prevalence of these conditions, gaps in knowledge regarding their pathophysiology and optimal management remain. There is limited research on the efficacy of treatments for pregnancy-related rhinitis and sinusitis, particularly regarding the safety of pharmacological interventions (61). Further studies are needed to explore the long-term effects of hormonal changes on nasal conditions and the potential for developing chronic issues post-pregnancy. Investigating the long-term effects of untreated rhinitis on both maternal and fetal health could provide insights into better management strategies (36).

In conclusion, while substantial progress has been made in comprehending pregnancy-related nasal conditions, the intricacy of hormonal interactions and their clinical implications necessitate further research to address the existing knowledge gaps. By bridging these gaps, we can enhance the management of nasal symptoms during pregnancy and thereby improve maternal health outcomes.

8.2 Recommendations for future studies on hormonal influences and ENT health

Pregnancy induces significant hormonal changes that can affect various physiological systems, including the ear, nose, and throat (ENT). These changes are particularly relevant to conditions such as sinusitis and rhinitis, which are common during pregnancy.

Hormonal Influences on Nasal Symptoms
Estrogen increases vascularity in the nasal mucosa, potentially leading to nasal congestion and rhinitis (54). This vascularization can also contribute to Eustachian tube dysfunction, resulting in ear blockage and related symptoms. Hormonal changes may also suppress the immune system, increasing susceptibility to infections that can exacerbate sinusitis (54).

Future research should focus on understanding these hormonal influences more comprehensively, particularly regarding their mechanisms and effects on ENT health. Investigating the specific roles of estrogen and progesterone in nasal congestion and rhinitis is crucial, as is exploring how hormonal fluctuations correlate with the severity of symptoms in pregnant women. Additionally, conducting studies to assess the safety and efficacy of various treatments for rhinitis and sinusitis during pregnancy could provide valuable insights. Evaluating the long-term effects of medications on both maternal and fetal health, particularly focusing on older drugs with established safety profiles (10), is also recommended.

Longitudinal studies are needed to assess the impact of rhinitis and sinusitis on quality of life

during and after pregnancy. These studies should analyze how untreated sinonasal conditions may affect pregnancy outcomes and maternal well-being (50). Larger cohort studies are also essential to better understand the relationship between hormonal fluctuations and ENT health during pregnancy (63).

While the focus on hormonal influences is crucial, it is equally important to consider the psychosocial aspects of managing chronic conditions during pregnancy. These factors can significantly affect overall health outcomes. Implementing a multidisciplinary approach that includes patient education and tailored management strategies can enhance maternal health and pregnancy outcomes.

In conclusion, understanding the hormonal impacts on ENT health during pregnancy is crucial for developing effective management strategies and improving maternal health outcomes.

8.3 Potential improvements in clinical practice

The hormonal changes during pregnancy significantly impact conditions like sinusitis and rhinitis, necessitating improvements in clinical practice. Understanding these changes can enhance diagnosis and treatment strategies, ultimately improving maternal quality of life and pregnancy outcomes. Pregnancy rhinitis affects up to 30% of women, characterized by nasal congestion without infection or allergy (53, 62). Hormonal fluctuations, particularly increased progesterone and estrogen, lead to mucosal edema and nasal vascular changes, exacerbating symptoms (64).

Current management focuses on conservative treatment, as no definitive cure exists (62). Safe pharmacological options include topical corticosteroids and second-generation antihistamines, while continuous use of topical vasoconstrictors is discouraged due to potential rebound congestion (10). Education on distinguishing pregnancy-induced rhinitis from other types is crucial for effective treatment (62).

Enhanced awareness and training for healthcare providers on pregnancy-related rhinitis can improve diagnosis and management (42). Research into the safety and efficacy of treatments during pregnancy is essential to develop better therapeutic guidelines (62). While the current understanding of pregnancy-related rhinitis is limited, ongoing research may reveal more effective treatments and management strategies, ultimately benefiting both mothers and their unborn children.

9. Conclusion

9.1 Recap of hormonal impacts on sinusitis and rhinitis

Hormonal changes during pregnancy significantly impact sinusitis and rhinitis, primarily through the influence of sex hormones like estrogen and progesterone. These hormonal fluctuations can exacerbate nasal congestion and inflammation, leading to conditions such as pregnancy-induced rhinitis (PIR) and rhinosinusitis. The exact mechanisms remain partially understood, but the effects on maternal quality of life and potential pregnancy outcomes are well-documented.

Pregnancy-induced rhinitis is characterized by nasal congestion that typically resolves after delivery. This condition is distinct from allergic rhinitis and may not respond to typical treatments for allergies (5). Hormonal changes, particularly elevated levels of estrogen and progesterone, are linked to increased nasal congestion. Estrogen can cause nasal mucosa congestion, while progesterone may lead to nasal vascular pooling and increased nasal resistance (53).

Nasal congestion during pregnancy can lead to poor sleep quality, which may result in maternal hypertension, pre-eclampsia, and intrauterine growth retardation (5). The management of rhinitis and sinusitis during pregnancy is challenging due to the limited safety data on treatment options, which can affect both maternal health and pregnancy outcomes (50). Elevated levels of estradiol and progesterone are associated with increased inflammation,

contributing to moderate to severe rhinitis and uncontrolled asthma in some cases (65). The role of hormones in exacerbating rhinitis and sinusitis symptoms is supported by evidence of increased nasal congestion during the menstrual cycle, similar to pregnancy (53).

While hormonal changes during pregnancy can exacerbate rhinitis and sinusitis, the precise pathophysiological mechanisms remain unclear. The management of these conditions requires careful consideration of both maternal and fetal health, emphasizing the need for early diagnosis and tailored treatment strategies.

9.2 Summary of clinical relevance and recommendations

Hormonal fluctuations during pregnancy, particularly increases in progesterone and estrogen, can lead to nasal mucosal edema and congestion, affecting up to 30% of pregnant women (10, 53). These hormonal changes are often associated with pregnancy-induced rhinitis (PIR), which is commonly misdiagnosed, resulting in suboptimal treatment approaches (62). The management of PIR typically focuses on conservative strategies to relieve symptoms, with an emphasis on minimal intervention to ensure fetal safety (50, 62). For moderate to severe cases, topical corticosteroids are recommended, while older antihistamines, due to their established safety profiles, are considered appropriate for use (10).

Accurate diagnosis is crucial to distinguish PIR from other types of rhinitis, allowing for the administration of the correct treatment (62). Regular monitoring and individualized interventions are key to effectively managing symptoms without compromising fetal health (50). Although hormonal changes during pregnancy can worsen rhinitis and sinusitis, some studies suggest that these conditions may improve after delivery, opening possibilities for more effective management strategies in the future (65).

9.3 Final remarks on improving maternal health outcomes

Hormonal fluctuations during pregnancy, particularly elevated levels of estrogen and progesterone, significantly impact the prevalence and severity of sinusitis and rhinitis, conditions that can negatively affect maternal health outcomes. These hormones contribute to nasal congestion and rhinitis, especially in the third trimester, with the incidence reaching up to 53.3% among pregnant women (53, 55). Understanding the effects of these hormonal changes is vital for developing effective management and treatment strategies.

Elevated estrogen and progesterone levels lead to congestion of the nasal mucosa and increased vascular permeability, which exacerbates rhinitis symptoms (53). Rhinitis of pregnancy affects approximately 30-53% of pregnant women, with symptoms often peaking in the third trimester (36, 55).

Management strategies emphasize conservative treatments with minimal intervention, focusing on symptom relief through nasal saline washes and mechanical dilators (36). Caution is advised when using systemic medications due to potential risks to the fetus (50).

Although pregnancy-induced rhinitis is temporary, its significant impact on quality of life underscores the need for improved recognition and management strategies. Effectively addressing these conditions can enhance maternal health outcomes and overall pregnancy experiences.

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Conflicts of Interest

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