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PNEUMONIA IN PREGNANCY: CLINICAL FEATURES, DIAGNOSIS AND MANAGEMENT

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Abstract. *Pneumonia remains one of the most significant non-obstetric infections during pregnancy and is associated with increased maternal and fetal morbidity and mortality. Physiological and immunological changes during pregnancy may contribute to a more severe disease course. This review summarizes the etiology, clinical presentation, diagnosis, and management of pneumonia during pregnancy. The review also highlights hepatic involvement, an aspect less frequently discussed in current literature, which may complicate the clinical picture and require careful differentiation from pregnancy-specific liver disorders.*

Keywords: *pregnancy, pneumonia, clinical features, maternal outcomes.*

Introduction. Pneumonia during pregnancy continues to be a relevant cause of non-obstetric morbidity, despite advances in antimicrobial therapy and supportive care. Over the past decade, epidemiological data have shown that, although the incidence of pneumonia during pregnancy remains relatively low (approximately 0.5–1.5 per 1,000 pregnancies), the associated risks of maternal and fetal complications remain significant [1, 4].

Pathophysiology. Physiological changes that occur during pregnancy—including a decrease in functional residual capacity, elevation of the diaphragm, increased oxygen consumption, and relative suppression of cell-mediated immunity—contribute to increased susceptibility to respiratory infections and reduced tolerance to hypoxia [1, 2]. These changes are particularly pronounced in the third trimester, which may partly explain the greater severity of disease observed at this stage [2].

The pathogenesis of pneumonia in pregnant women is closely linked to pregnancy-induced immunomodulation. There is a shift from predominantly cell-mediated (Th1) immunity toward a more humoral (Th2) immune response to maintain fetal tolerance. Although essential for the continuation of pregnancy, this adaptation reduces the maternal ability to effectively eliminate intracellular pathogens, thereby increasing susceptibility to certain respiratory infections and potentially influencing disease progression [1, 4]. At the same time, maternal oxygen consumption increases by approximately 20%, further limiting the capacity to compensate for hypoxic conditions [1, 2]. Consequently, even relatively mild pulmonary infections can lead to clinically significant hypoxemia. In addition, airway mucosal edema and increased secretions, caused by hormonal changes, may impair mucociliary clearance and facilitate microbial colonization of the lower respiratory tract [2].

Another important mechanism in the pathogenesis of pneumonia during pregnancy is the increased risk of aspiration. Progesterone-induced relaxation of the lower esophageal sphincter, along with delayed gastric emptying, predisposes pregnant women to gastroesophageal reflux and potential aspiration of gastric contents, particularly during labor or in the presence of altered consciousness. Aspiration pneumonia, although less common, is often associated with a more severe clinical course due to its polymicrobial nature and the chemical injury caused by gastric acid [1].

The systemic inflammatory response triggered by pneumonia also plays a crucial role beyond the lungs. The release of pro-inflammatory cytokines, including interleukin-6 and tumor necrosis factor-alpha, not only contributes to lung tissue damage but can also impair placental function. This inflammatory environment, together with maternal

hypoxia, is believed to underlie the increased risk of adverse obstetric outcomes, such as preterm birth, intrauterine growth restriction, and hypertensive disorders of pregnancy [4].

Etiology. From an etiological perspective, the spectrum of pathogens responsible for pneumonia during pregnancy largely resembles that observed in the general adult population, although certain organisms have particular clinical relevance [6]. Community-acquired pneumonia remains the most common form, with *Streptococcus pneumoniae* identified as the primary causative agent. Other common bacterial pathogens include *Haemophilus influenzae* and *Staphylococcus aureus*, particularly in cases following viral respiratory infections. Atypical organisms, such as *Mycoplasma pneumoniae* and *Chlamydophila pneumoniae*, are also frequently implicated and may present with atypical clinical features [1, 6]. Over the past decade, studies have also highlighted the role of aspiration and influenza-associated secondary bacterial infections as factors contributing to severe cases, even outside the context of a pandemic [2].

In certain patient groups, particularly those with pre-existing immunosuppression, opportunistic infections should be considered. *Pneumocystis jirovecii* pneumonia, although rare, is associated with significant maternal morbidity and mortality if not promptly diagnosed and treated. Fungal pneumonias are rare but can occur in individuals with severely compromised immunity [3, 5]. In addition, aspiration pneumonia represents a distinct etiological category, usually involving anaerobic and mixed flora, and is often associated with a more severe disease course [1].

In addition to bacterial pathogens, viruses represent an important cause of pneumonia during pregnancy and may be associated with more severe clinical outcomes. Seasonal respiratory viruses, particularly influenza A and B, remain among the most clinically relevant, as pregnant women have been shown to be at increased risk of complications, including viral pneumonia, secondary bacterial infection, and respiratory failure [1, 2]. Other respiratory viruses, such as respiratory syncytial virus (RSV), parainfluenza viruses, and adenoviruses, are less frequently reported but can contribute to lower respiratory tract infections, particularly in the presence of comorbidities or altered immune responses [2].

Clinical Presentation and Diagnosis. Clinically, pneumonia during pregnancy presents largely in the same way as in non-pregnant adults, although the severity of symptoms may be increased due to reduced physiological reserve. Patients typically present with fever, cough, dyspnea, and pleuritic chest pain, accompanied by general symptoms such as fatigue and malaise. On physical examination, tachypnea, tachycardia, and auscultatory findings such as crackles or bronchial breath sounds may be noted. However, diagnosis can be challenging, as certain physiological features of normal pregnancy—such as mild dyspnea and increased heart rate—may overlap with the early manifestations of respiratory infection, potentially leading to delays in recognition and treatment [2].

The health status of the mother and fetus remains a major concern. Large-scale cohort studies and systematic reviews published over the past decade consistently demonstrate an increased risk of preterm birth, low birth weight, small-for-gestational-age infants, cesarean delivery and hypertensive disorders, including preeclampsia, among pregnant women diagnosed with pneumonia [4].

A population-based study conducted by Cheng-Hsiang Chen and colleagues demonstrated that pneumonia during pregnancy was associated with significantly higher risks of preterm birth and low birth weight, as well as increased rates of preeclampsia and cesarean section [4]. Further analyses confirmed these associations and highlighted the impact of disease severity on outcomes [2]. Severe pneumonia, although less common, is associated with significant maternal morbidity, including respiratory failure, the need for intensive care, and, in rare cases, maternal mortality [3, 7]. It is important to note that delayed diagnosis remains a constant challenge due to the overlap of symptoms with those of normal pregnancy and concerns regarding diagnostic imaging.

Among the risk factors identified in recent non-COVID-related literature are anemia, asthma, smoking, substance use, and pre-existing chronic conditions [1, 2]. In addition, immunosuppressed pregnant patients are at increased risk of opportunistic infections, such as Pneumocystis jirovecii pneumonia, which carries a high mortality rate if not promptly diagnosed and treated [7].

Diagnosing pneumonia during pregnancy requires a careful balance between timely identification of the maternal illness and minimizing the risk to the fetus. Clinical evaluation remains the cornerstone, although it can be complicated by the overlap between the physiological changes of pregnancy and the early symptoms of respiratory infection. Imaging plays an essential role in confirming the diagnosis. Chest radiography, when performed with adequate abdominal shielding, is considered safe during pregnancy and should not be delayed when pneumonia is suspected, as fetal radiation exposure is negligible and well below teratogenic thresholds [1, 4]. In cases of diagnostic uncertainty or suspected complications, chest computed tomography may be considered, although its use is generally reserved for severe or atypical presentations due to higher radiation exposure.

Laboratory tests are useful but non-specific. Leukocytosis may be present, but its interpretation can be challenging, as mild increases in white blood cell count are common during pregnancy. Inflammatory markers, such as C-reactive protein and procalcitonin, can help assess disease severity and guide antimicrobial treatment, although their routine use during pregnancy is not yet standardized [1]. Microbiological confirmation, including sputum culture and blood cultures in severe cases, should be performed whenever possible, particularly in hospitalized patients. Testing for atypical pathogens and selected viral agents may be indicated depending on the clinical context, although empiric therapy is often initiated before the pathogen is identified.

Overall, current data support early diagnosis, appropriate empirical antimicrobial treatment, and a multidisciplinary approach as key strategies for reducing maternal and fetal complications in cases of pneumonia complicating pregnancy [1, 2]

Treatment. Early and appropriate antimicrobial therapy is essential and should not be delayed due to pregnancy. The choice of antibiotics is based on both efficacy and fetal safety. Beta-lactam antibiotics, including penicillins and cephalosporins, are considered first-line drugs due to their well-established safety profiles during pregnancy. Macrolides, such as azithromycin, are frequently used to treat atypical pathogens and are generally considered safe. In contrast, certain classes of antibiotics, including fluoroquinolones and tetracyclines, are usually avoided due to potential adverse effects on fetal development, particularly on cartilage and bone formation [1, 2]. The therapeutic approach is similar to that used in non-pregnant adults, with adjustments made for drug safety and maternal physiological changes. Supportive therapy, including oxygen supplementation, fluid management, and thromboprophylaxis when indicated, plays a crucial role, particularly in cases of moderate to severe illness.

Hospitalization is recommended for pregnant patients with moderate to severe pneumonia, particularly in cases of hypoxemia, comorbid conditions, or advanced gestational age. Multidisciplinary care, involving obstetricians, pulmonologists, and infectious disease specialists, is essential for optimizing outcomes for both the mother and the fetus. In viable pregnancies, careful fetal monitoring may be necessary, especially in cases of severe maternal illness [4].

An area of growing interest is the potential for hepatic involvement in cases of pneumonia during pregnancy, which can complicate both diagnosis and management. Liver dysfunction in this context is usually multifactorial and may result from systemic inflammation, sepsis-associated cholestasis, hypoxic injury, or drug-induced hepatotoxicity. Pro-inflammatory cytokines released during infection can impair bile acid transport and hepatocellular function, leading to biochemical abnormalities such as elevated transaminases and cholestatic markers [7].

Conclusion. Pneumonia during pregnancy remains a major cause of maternal morbidity, influenced by physiological and immunological adaptations that increase susceptibility and reduce tolerance to hypoxia. Although the etiological spectrum is similar to that of the general population, clinical manifestations may be less specific, and the risk of rapid deterioration is higher, particularly in the later stages of pregnancy. Early diagnosis, appropriate imaging studies, and prompt initiation of safe antimicrobial therapy are essential for optimal outcomes.

Importantly, pneumonia is associated with increased risks of adverse obstetric outcomes, including preterm birth and low birth weight, likely mediated by maternal hypoxia and systemic inflammation. Liver involvement, although often secondary, represents an important diagnostic consideration and requires careful differentiation from pregnancy-specific liver conditions. A multidisciplinary approach remains essential for improving both maternal and fetal outcomes.

REFERENCES

1. Ashby, T., Staiano, P., Najjar, N., Louis, M. Bacterial pneumonia infection in pregnancy. Best Practice & Research Clinical Obstetrics & Gynaecology. 2022; 85:26-33.

2. Brito, V., Niederman, M.S. Pneumonia complicating pregnancy. Clinics in Chest Medicine. 2011;32(1):121-132.

3. Calderón-Baturone, I., Salsoso, R., Charpentier, E., de Armas, Y., Guadix, P., Morilla, R., Calderón, E.J., Friaza, V. Pneumocystis Infection in Pregnant Women: A Scoping Review. Journal of fungi (Basel, Switzerland). 2025; 11(4).

4. Chen, Y.H., Keller, J., Wang, I.T., Lin, C.C., Lin, H.C. Pneumonia and pregnancy outcomes: a nationwide population-based study. American Journal of Obstetrics and Gynecology. 2012; 207(4):288.e281-287.

5. Ibrahim, A., Chattaraj, A., Iqbal, Q., Anjum, A., Rehman, MEU., Aijaz, Z., Nasir, F., Ansar, S., Zangeneh, T.T., Iftikhar, A. Pneumocystis jiroveci pneumonia: a review of management in human immunodeficiency virus (HIV) and non-HIV immunocompromised patients. Avicenna Journal of Medicine. 2023; 13(01):023-034.

6. Tang, P., Wang, J., Song, Y. Characteristics and pregnancy outcomes of patients with severe pneumonia complicating pregnancy: a retrospective study of 12 cases and a literature review. BMC Pregnancy and Childbirth. 2018; 18:434.

7. Trusevici-Cojocaru, A., Mihalcean, L., Ostrofeț, C., Scutaru, E., Agop, S. Intrahepatic cholestasis of pregnancy: the influence of neonatal outcomes despite therapeutic approach on mothers. Medicus 2026.

REFERENCES

1. Ashby T., Staiano P., Najjar N., Louis M. Bacterial pneumonia infection in pregnancy. Best Practice & Research Clinical Obstetrics & Gynaecology. 2022; 85:26-33.

2. Brito V., Niederman M.S. Pneumonia complicating pregnancy. Clinics in Chest Medicine. 2011;32(1):121-132.

3. Calderón-Baturone I., Salsoso R., Charpentier E., de Armas Y., Guadix P., Morilla R., Calderón E.J., Friaza V. Pneumocystis Infection in Pregnant Women: A Scoping Review. Journal of fungi (Basel, Switzerland). 2025; 11(4).

4. Chen Y.H., Keller J., Wang I.T., Lin C.C., Lin H.C. Pneumonia and pregnancy outcomes: a nationwide population-based study. American Journal of Obstetrics and Gynecology. 2012; 207(4):288.e281-287.

5. Ibrahim A., Chattaraj A., Iqbal Q., Anjum A., Rehman MEU., Aijaz Z., Nasir F., Ansar S., Zangeneh T.T., Iftikhar A. Pneumocystis jiroveci pneumonia: a review of management in human immunodeficiency virus (HIV) and non-HIV immunocompromised patients. Avicenna Journal of Medicine. 2023; 13(01):023-034.

6. Tang P., Wang J., Song Y. Characteristics and pregnancy outcomes of patients with severe pneumonia complicating pregnancy: a retrospective study of 12 cases and a literature review. BMC Pregnancy and Childbirth. 2018; 18:434.

7. Trusevici-Cojocaru A., Mihalcean L., Ostrofeț C., Scutaru E., Agop S. Intrahepatic cholestasis of pregnancy: the influence of neonatal outcomes despite therapeutic approach on mothers. Medicus 2026.

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ПНЕВМОНИЯ ПРИ БЕРЕМЕННОСТИ: КЛИНИЧЕСКИЕ ОСОБЕННОСТИ, ДИАГНОСТИКА И ЛЕЧЕНИЕ

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Аннотация. *Пневмония остаётся одной из наиболее значимых внеакушерских инфекций во время беременности и ассоциируется с повышенным риском материнской и перинатальной заболеваемости и смертности. Физиологические и иммунологические изменения, происходящие во время беременности, могут способствовать более тяжёлому течению заболевания. В данном обзоре обобщены данные об этиологии, клинических проявлениях, диагностике и лечении пневмонии у беременных. Также рассматривается поражение печени, которое реже обсуждается в современной литературе и может усложнять клиническую картину, требуя дифференциальной диагностики с заболеваниями печени, специфичными для беременности.*

Ключевые слова: *беременность, пневмония, клинические проявления, материнские исходы*