Maternal sepsis: why vital sign patterns in pregnancy often mislead

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Sepsis remains a leading cause of maternal morbidity and mortality worldwide, a stark reality that highlights the persistent challenges in its early detection during pregnancy. The physiological adaptations of pregnancy, while essential for fetal development, fundamentally alter a woman's baseline vital signs, creating a diagnostic minefield for clinicians. What might be a clear red flag in a non-pregnant adult can appear within the normal range for an expectant mother, leading to dangerous delays in recognition and treatment.

KEY TAKEAWAYS

- The Pivot: Standard sepsis screening tools, designed for the general population, frequently fail to identify maternal sepsis due to pregnancy-induced physiological changes.
- The Data: Maternal heart rate, respiratory rate, and blood pressure often deviate from non-pregnant norms, making traditional thresholds unreliable for early sepsis detection.
- The Action: Clinicians must adopt a heightened index of suspicion for infection in pregnant patients, integrating a comprehensive clinical picture with nuanced interpretation of vital signs.

The diagnosis of sepsis in pregnant and postpartum individuals presents a unique clinical conundrum. Pregnancy induces a series of profound physiological changes that can mimic or obscure the early signs of systemic infection, making the application of standard sepsis criteria problematic. A clinician relying solely on the established thresholds for heart rate, respiratory rate, and blood pressure risks missing important early indicators of deterioration, potentially delaying life-saving interventions.

These physiological adaptations begin early in gestation and persist throughout pregnancy and the puerperium. Cardiac output increases significantly, often by 30% to 50% above pre-pregnancy levels, driven by an increased heart rate and stroke volume. This compensatory mechanism means that a heart rate that would be considered tachycardic in a non-pregnant adult might be within the normal physiological range for a pregnant woman, even in the absence of infection. Similarly, peripheral vascular resistance decreases, leading to a physiological drop in blood pressure, particularly during the second trimester. A blood pressure reading that appears normal in a pregnant patient could, in fact, represent relative hypotension if her baseline was higher, masking the early stages of hypoperfusion associated with sepsis.

The altered baseline

Respiratory physiology also undergoes significant changes. Tidal volume increases, leading to a compensatory decrease in arterial partial pressure of carbon dioxide ($PaCO_2$) and a mild respiratory alkalosis. The respiratory rate may increase

slightly, but often remains within what is considered a normal range for non-pregnant individuals, even when a pregnant patient is developing respiratory compromise. This means that a subtle increase in respiratory rate, which might be an early warning sign in a non-pregnant patient, could be dismissed as within normal limits for a pregnant woman, particularly if the clinician is not specifically attuned to the specific considerations of maternal sepsis vital signs. Temperature regulation also shifts during pregnancy. While fever remains a critical indicator of infection, the baseline body temperature can fluctuate, and a low-grade fever might be more significant than it appears. Conversely, some pregnant patients with severe sepsis may present with hypothermia, a sign of profound physiological decompensation that can be easily overlooked if not specifically sought. The Oxford Handbook of Obstetrics and Gynaecology provides a comprehensive overview of these physiological changes and their implications for clinical assessment.

Beyond the numbers

The challenge extends beyond vital signs to other common sepsis markers. White blood cell counts are physiologically elevated in pregnancy, often reaching 12,000-15,000 cells/mm³ in the absence of infection, and even higher during labour and the immediate postpartum period. This physiological leukocytosis can obscure the diagnostic utility of a rising white blood cell count as an indicator of infection. A clinician must consider the overall trend and the presence of immature forms, rather than relying on an absolute number alone. Inflammatory markers like C-reactive protein (CRP) also show some physiological elevation in pregnancy, though typically less pronounced than in active infection. Procalcitonin, while less affected by pregnancy, is not universally available and its interpretation still requires clinical context.

The clinical presentation of sepsis in pregnancy is often insidious, beginning with non-specific symptoms that can be attributed to common pregnancy discomforts. Nausea, vomiting, malaise, and generalised aches are frequent complaints in healthy pregnancies. When these symptoms are the initial manifestation of a severe infection, they can be easily dismissed, delaying the window for early intervention, which is essential for preventing severe outcomes. For example, a pregnant patient presenting with abdominal pain might be experiencing anything from round ligament pain to preterm labour, or a life-threatening intra-abdominal infection. The clinician's ability to differentiate these conditions relies heavily on a high index of suspicion and a thorough clinical assessment, rather than isolated vital sign abnormalities.

Early recognition of maternal sepsis therefore demands a change in clinical assessment from a reactive to a proactive approach. Instead of rigid adherence to non-pregnant vital sign thresholds, clinicians must interpret vital signs within the context of pregnancy-specific physiological norms and trends. A sustained elevation in heart rate, even if within the 'normal' range for pregnancy, or a subtle but persistent drop in blood pressure, should prompt further investigation. The presence of any new or worsening symptoms, particularly those that are out of proportion to typical pregnancy discomforts, warrants immediate attention. This includes changes in mental status, persistent chills, or localised signs of infection.

The diagnostic imperative

The lack of specific, validated, pregnancy-adapted sepsis screening tools contributes significantly to diagnostic delays. Existing tools, such as the Modified Early Warning Score (MEWS) or the National Early Warning Score (NEWS), are not specifically designed for pregnant populations and may not accurately reflect the severity of illness in this group. Their application without adjustment can lead to both false negatives and false positives, complicating clinical decision-making. The development and widespread implementation of pregnancy-specific early warning scores are

essential to improving outcomes. These scores would incorporate the unique physiological changes of pregnancy, providing more accurate risk stratification.

A comprehensive approach to maternal sepsis involves not only vital sign monitoring but also a detailed history, physical examination, and judicious use of laboratory investigations. Clinicians should actively inquire about potential sources of infection, such as urinary tract symptoms, vaginal discharge, or recent invasive procedures. A thorough physical examination, including assessment for localised tenderness, skin changes, and respiratory effort, can provide important clues. When suspicion is high, broad-spectrum antibiotics should be initiated promptly, even before definitive culture results are available. The management of complex conditions in pregnancy often requires a multidisciplinary approach, and sepsis is no exception.

The challenge of maternal sepsis is not merely about identifying a single abnormal vital sign, but about recognising a pattern of subtle changes that, when viewed holistically, point towards a deteriorating clinical state. This requires clinical vigilance, an understanding of pregnancy physiology, and a willingness to act on suspicion rather than waiting for overt signs of shock. The consequences of delayed diagnosis are severe, ranging from prolonged hospitalisation and organ dysfunction to maternal death. Therefore, a proactive, pregnancy-aware approach to sepsis screening is not just good practice, it is essential for patient safety. This is particularly relevant given broader concerns about maternal risks in vulnerable populations.

The ongoing efforts to refine sepsis definitions and screening protocols must explicitly address the unique physiological context of pregnancy. Without such adaptations, maternal sepsis will continue to be a silent killer, masked by the very processes that sustain new life. Clinicians need better tools and enhanced training to navigate this complex diagnostic environment effectively. The goal is not to over-diagnose, but to ensure that no pregnant patient succumbs to an infection that could have been identified and treated earlier. This demands a shift from a reactive approach to a proactive, pregnancy-specific one, ensuring that every healthcare professional involved in maternal care is equipped to recognise and respond to the subtle, yet important, signs of sepsis.

CLINICAL IMPLICATIONS

The persistent challenge of maternal sepsis highlights a fundamental flaw in our current diagnostic paradigms. Relying on vital sign thresholds established for non-pregnant adults is a recipe for disaster, leading to missed diagnoses and preventable maternal deaths. Clinicians must internalise the profound physiological shifts of pregnancy and adjust their interpretative lens accordingly.

This means moving beyond a checklist mentality. A 'normal' heart rate in a pregnant patient with other concerning symptoms should be viewed with suspicion, not dismissed. The onus is on the individual practitioner to integrate an understanding of pregnancy physiology with a high index of suspicion for infection, rather than waiting for a computer algorithm to flag a problem.

Industry and guideline bodies have a clear mandate here. We need validated, pregnancy-specific early warning scores that account for these physiological changes. Until then, the responsibility falls to frontline clinicians to exercise heightened vigilance and clinical judgment, understanding that the absence of overt vital sign derangement does not equate to the absence of sepsis in a pregnant patient.

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