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Sepsis: early detection, laboratory investigations, nursing interventions, and documentation process

Naif Lahiq Mohsen Alotaiby
KSA, National Guard Health Affairs

Awadh Awaadh Saad Alotaiby
KSA, National Guard Health Affairs

Tariq Abdulaziz Al-Falih
KSA, National Guard Health Affairs

Ali Khalil Hassan Khader
KSA, National Guard Health Affairs

***Abstract*---Background:** Sepsis is a life-threatening condition resulting from infection, with significant mortality and morbidity, particularly in neonates. The diagnosis of neonatal sepsis is challenging, as clinical signs often overlap with other life-threatening conditions, and blood culture methods have low sensitivity, especially in neonates. Sepsis is associated with significant healthcare costs, and rapid, accurate diagnosis is crucial to improving patient outcomes. **Aim:** This article aims to explore the early detection, laboratory investigations, nursing interventions, and documentation processes for neonatal sepsis, with a focus on identifying gaps and proposing improvements to enhance clinical outcomes. **Methods:** A comprehensive review of current diagnostic methods for neonatal sepsis, including blood cultures, biomarkers, and emerging diagnostic technologies, was conducted. The analysis includes the limitations of conventional diagnostic approaches, the role of nursing interventions in early detection, and the importance of accurate documentation in the management of neonatal sepsis. **Results:** Traditional blood culture methods are limited by slow results, low sensitivity, and the emergence of antibiotic-resistant organisms. Biomarkers like C-reactive protein (CRP) and procalcitonin (PCT) show promise but lack sufficient accuracy for early sepsis detection. Recent advances in molecular diagnostic technologies may significantly reduce diagnostic delays and improve pathogen identification, allowing for more targeted

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Corresponding email: *akk29337@gmail.com*
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antibiotic treatment. **Conclusion:** The early detection of neonatal sepsis remains a major challenge, with current diagnostic methods being slow and often ineffective. Rapid diagnostic tests, incorporating new biomarkers and molecular technologies, are needed to improve sepsis management. Additionally, nursing interventions and comprehensive documentation processes play critical roles in ensuring timely recognition and treatment. Further research is required to optimize diagnostic protocols and enhance neonatal care.

***Keywords*---**Sepsis, Neonatal Sepsis, Blood Cultures, Biomarkers, Molecular Diagnostics, Nursing Interventions, Documentation, Antibiotic Resistance, Early Detection.

Introduction

Sepsis represents a critical and potentially fatal clinical condition typically resulting from a primary bacterial infection, though fungal and/or viral infections are less common causes. Affecting approximately 1 in every 23 hospitalized patients, sepsis ranks as the sixth most prevalent reason for hospitalization (1–5). It currently represents the most costly condition managed in U.S. hospitals, with a total expenditure of US$15.4 billion in 2009 (4, 5), while nonspecific sepsis diagnoses account for an additional US$23.7 billion annually (6, 7). Alarmingly, the incidence of sepsis is on the rise, with documented cases increasing by 17% from 2000 to 2010 (5), and sepsis-related mortality rising by 31% between 1999 and 2014 (8). Annually, approximately 30,000 sepsis-related deaths occur, with particularly high mortality rates observed in critically ill patients admitted to intensive care units (ICUs) (5, 9, 10). Neonates, defined as infants within the first 28 days of life, are especially vulnerable to infection due to underdeveloped immune responses, both adaptive and innate. These deficiencies are directly linked to gestational age and a lack of antigen exposure in utero. In the United States, sepsis is the fifth leading cause of neonatal mortality, following preterm birth and intrapartum complications (11–13). Additionally, infection is a known contributor to preterm birth (14–16). Tragically, 25% of all neonates admitted to a neonatal intensive care unit (NICU) are diagnosed with sepsis, and 18 to 35% (approximately 21,000 neonates per year) succumb to the infection (11, 17, 18). Premature infants with low birth weight face a tenfold increased risk of serious infections, including sepsis, compared to their full-term counterparts, with a 30% mortality rate (19–21).

Septic patients typically present with symptoms such as malaise, fever, chills, and leukocytosis, prompting healthcare providers to assess the presence of bacteremia through blood culture analysis. Sepsis is considered a medical emergency that can quickly escalate to organ dysfunction and death, even with immediate, aggressive medical intervention (10). In the absence of reliable diagnostic tools, the widespread use of broad-spectrum antibiotics in suspected sepsis cases has contributed to the emergence of drug-resistant organisms and atypical pathogens (22, 23). Sepsis survivors often face significant long-term complications, leading to extended hospital stays or transfers to long-term care facilities (6). Neonatal sepsis survivors are at an elevated risk for adverse

neurodevelopmental outcomes, including cerebral palsy, hearing loss, blindness, and cognitive delays (11, 24). Due to the high mortality rates associated with sepsis, concerns about underdiagnosing infections or administering inappropriate antibiotics lead physicians to frequently order blood cultures (10). However, blood cultures yield bacterial isolation in only 4 to 12% of cases, although the positivity rate can be significantly higher in settings where blood cultures are more selectively ordered. Regardless, results are typically available only hours or days after treatment has already commenced (25–29).

Detection of pathogens through blood culture is more challenging in neonates than in older children and adults, primarily because clinical signs of sepsis often overlap with symptoms of other life-threatening noninfectious conditions such as perinatal asphyxia, respiratory distress syndrome, and complications related to severe prematurity. Although over 60% of sepsis evaluations occur within the first 3 days of life, fewer than 1% of blood cultures yield positive results. In symptomatic neonates, blood culture methods identify the causative organism in only 10 to 15% of cases, even after excluding contaminants (30, 31). The situation is even more challenging in underserved populations, with black preterm neonates in the U.S. exhibiting the highest incidence and mortality rate from neonatal sepsis (32). Globally, neonates in low- and middle-income countries experience the highest rates of sepsis (33), where resistant bacterial strains are often implicated in the majority of cases, underscoring the urgent need for rapid susceptibility testing. Delayed diagnosis, failure to recognize illness, the emergence of resistant pathogens, and limited access to or the inability to afford specialized care all contribute to the high mortality and morbidity associated with sepsis (34). Prompt initiation of appropriate antibiotic therapy has been shown to save more lives than any other intervention (35–38), and studies suggest that there is a critical 1- to 3-hour window from symptom recognition to antimicrobial treatment initiation, beyond which mortality increases (39). The Surviving Sepsis Campaign recommends administering antibiotics within 1 hour of sepsis recognition and obtaining blood cultures prior to antibiotic administration (35). However, inappropriate antibiotic use within the first 6 hours after sepsis recognition has been linked to a fivefold reduction in survival (40). A recent editorial called into question the indiscriminate use of antibiotics, advocating instead for the targeted use of antimicrobial therapy, ideally following pathogen detection (41). Therefore, rapid diagnostic tests capable of detecting antimicrobial resistance or ruling out bacterial infections as the cause of sepsis must be integrated into the first 1 to 3 hours of clinical evaluation to guide appropriate antibiotic use and improve patient outcomes.

Unfortunately, results from standard diagnostic tests are not available within this critical timeframe to facilitate focused, life-saving medical interventions. Other commonly used hematological tests have low sensitivity and specificity, particularly in neonatal populations (42). Recently, biomarkers such as C-reactive protein (CRP), procalcitonin (PCT), and the neutrophil marker CD64 have been incorporated into sepsis evaluations, albeit with limited success. Current diagnostic approaches mainly rely on individual biomarkers offering binary results, which fail to provide a comprehensive understanding of the host's response. An integrative diagnostic strategy employing a broader array of biomarkers could potentially identify infection, quantify pathogens, and predict

antimicrobial resistance. Such a diagnostic approach is crucial for distinguishing truly septic patients and optimizing antibiotic therapy.

The Optimal Sepsis Diagnostic Test

Given the prevailing clinical challenges and the imperative to influence clinical management through targeted treatment, the ideal diagnostic technology should encompass the following attributes (43, 44):

1. **Rapid Detection**: Pathogen identification should occur within a time frame of under 3 hours (35, 39).
2. **Broad Detection Range**: The test should cover a wide spectrum of pathogens, including bacteria, viruses, and fungi.
3. **Minimal Invasiveness**: Clinical samples should require small volumes (less than 1 ml of blood for pediatric patients, including neonates, and 5 to 10 ml for adults) (45–47).
4. **High Sensitivity and Specificity**: The diagnostic tool must allow for the immediate initiation of targeted antibiotic therapy upon the onset of signs and symptoms of systemic inflammation, without compromising sensitivity even when pathogen levels are low.
5. **Polymicrobial Detection**: It should be capable of detecting multiple pathogens, even in the presence of contaminants, across a broad range of pathogen loads (approximately 1 to 100,000 CFU/ml blood).
6. **Antibiotic Resistance Detection**: The ability to identify resistance to antibiotics should be included.
7. **Clinical Workflow Integration**: The technology should be user-friendly, requiring minimal technical expertise for sample processing and result interpretation. To maximize impact, it should be suitable for use in non-centralized, low-resource settings.
8. **Emerging Pathogen Detection**: The system must have the ability to detect unknown and emerging pathogens, with scalability that maintains robust detection capabilities without increasing specimen volume.
9. **Differentiation of Inflammatory Response**: The diagnostic test should distinguish between host-driven and pathogen-driven inflammation (48, 49).

Limitations of Conventional Blood Culture Methodologies ("Gold Standard")

Despite its status as the "gold standard" for diagnosing infection and sepsis through pathogen isolation from sterile body fluid specimens (50), traditional blood culture methods are encumbered by significant limitations. Routine blood cultures may take anywhere from 6 hours to 5 days to grow detectable levels of organisms, with additional time needed for pathogen identification (24 hours) and antibiotic susceptibility testing (48 hours) (28, 51, 52). Moreover, these tests face several complicated factors. For instance, the microbial load in bloodstream infections (BSI) is often minimal, ranging from 1 to 1 × 10^4 CFU/ml (24, 53–55). In older children and adults, blood cultures are often conducted in multiple timed sequences, with up to four separate blood samples of 20 to 30 ml each. This approach improves detection rates to 73-95% (35, 55–58). However, smaller sample volumes increase the risk of false-negative results (59–61). In neonates, especially very-low-birth-weight (VLBW) infants (<1,500 g), blood collection is

restricted to a single sample with a minimal volume of 1 ml, which can hinder pathogen detection, especially when bacteremia levels are low (45–47). Neonatal sepsis often results in pathogen concentrations of 1 to 1,000 CFU/ml, and some studies report that 68% of culture-positive cases have concentrations below 10 CFU/ml (62, 63).

False-negative results are also common when blood cultures are performed after the initiation of antibiotic therapy, as seen in 28 to 63% of adult sepsis cases (35, 55, 61, 64, 65). This issue is exacerbated in neonates, with an estimated 30 to 35% of laboring women receiving empirical intrapartum antibiotics for neonatal group B Streptococcus (GBS) prevention (21). Following adherence to CDC GBS guidelines, approximately 65% of VLBW infants are exposed to antibiotics before birth (66–68). Delayed pathogen identification and antibiotic susceptibility testing unnecessarily expose neonates to broad-spectrum antibiotics, contributing to bacterial resistance in non-infected neonates and delaying targeted therapy in septic infants. Prolonged exposure to these antibiotics can also lead to fungal infections (e.g., Candida), necrotizing enterocolitis, and even death (17, 18, 69).

Inadequate adherence to antiseptic procedures during sample collection can also result in blood culture contamination, yielding false-positive results. A 2005 report by the College of American Pathologists identified an average contamination rate of 2.89% across 356 institutions, with neonatal patient rates at 2.08% and non-neonatal rates at 2.92% (70). These contamination rates can lead to substantial financial and clinical costs, including an estimated extra US$5,506 per patient due to false-positive results (70). In the U.S., contaminated blood cultures result in additional hospital stays of 1,372 to 2,200 days and up to US$1.9 million in medical expenses annually (71, 72). For pediatric patients, contaminated samples contribute to readmission rates of 14 to 26% and increased lengths of stay ranging from 1 to 5.4 days (61, 72, 75). In low- and middle-income countries, where healthcare resources are limited, contamination may have even more dire consequences. Notably, nearly half of patients with false-positive blood cultures receive inappropriate antimicrobial therapy, a situation more frequent than in cases of true-positive results (61, 76–78). Additionally, approximately 40 to 50% of adult bacteremia patients (and 70% of those with fungemia) are incorrectly treated with antimicrobials before microbiology culture results are available (1, 5, 79). This inappropriate use of antibiotics and delays in pathogen identification lead to extended exposure to broad-spectrum antibiotics, resulting in increased risks of Clostridium difficile infections, allergic reactions, drug toxicity, antibiotic resistance, longer hospital stays, and rising medical costs (5, 61, 80–82). Strategies to reduce contamination, such as using clinical judgment, evaluating the number of positive culture sets, and implementing adjunct laboratory tests like CRP and PCT measurements, have shown some promise (83).

In conclusion, conventional blood culture methods are far from ideal as a gold standard due to their delayed results, incomplete sensitivity, and the potential for misleading outcomes, compounded by their labor-intensive nature. There remains a significant unmet need to refine and accelerate existing laboratory processes for microorganism detection and identification. Recent innovations in engineering have led to promising diagnostic technologies that incorporate advances in

sample preparation, molecular detection, automation, miniaturization, multiplexing, and high-throughput analysis, paving the way for more effective, rapid, and cost-efficient pathogen detection systems. The following sections explore the current and emerging technologies for diagnosing bloodstream infections with increased sensitivity and efficiency.

Towards Direct Detection From The Whole Blood

Currently in the United States, most FDA-approved molecular diagnostic tests for sepsis are based on post-culture technologies, meaning that microbial detection depends on the initial growth of organisms in blood cultures. This growth step, while critical for ensuring sensitive detection, significantly prolongs the diagnostic timeline, making it less impactful for immediate patient management. Additionally, these tests have limitations in their detection capacity, as they rely on a single culture medium that cannot support the growth of all microorganisms or may obscure the identification of certain microbial susceptibilities [84–87]. Although molecular diagnostic tests themselves can provide results within 20 minutes to 2 hours, the culture process can take several hours to days and may not always succeed. Moreover, determining the antibiotic susceptibility of pathogens also relies on further culturing techniques, which delays the decision-making process. These delays limit the effectiveness of antibiotic stewardship programs, which aim to reduce unnecessary empirical antibiotic use and promote timely, targeted treatments. Recent reviews by Opota et al. [55, 88], Kothari et al. [89], Afshari et al. [90], and Ecker et al. [91] provide comprehensive overviews of these diagnostic challenges. This review specifically focuses on emerging technologies that bypass the need for initial microbial growth..

Emerging Molecular Diagnostics for Pathogen Detection from Whole Blood

Several promising molecular diagnostics are emerging for the direct detection of pathogens from whole blood without the need for initial culture. These technologies aim to offer faster results, broader detection capabilities, and the ability to guide treatment more effectively. The Iridica Plex ID (Abbott Molecular) uses multiplex broad-range PCR combined with electrospray ionization mass spectrometry (ESI-MS). It requires a sample volume of 5 ml and delivers results within 6 hours, with a detection limit of 0.25–128 CFU/ml. It provides sensitivity between 45–83% and specificity between 69–94%. This system can detect over 780 bacterial species and Candida, with high expandability for future pathogens. It is capable of polymicrobial detection and offers semiquantification of pathogen load, including antimicrobial resistance markers like mecA, vanA, vanB, and blaKPC. The SeptiFast assay (Roche Diagnostics) utilizes multiplex target-specific real-time PCR, in situ hybridization, and melt analysis. This test requires 1.5 ml of blood and provides results within 4–6 hours. Its detection limit ranges from 3 to 100 CFU/ml, with sensitivity from 63% to 83% and specificity from 83% to 95%. It can identify more than 16 bacteria, as well as Candida and *Aspergillus fumigatus*, though it has low expandability. Like the Iridica Plex ID, SeptiFast detects polymicrobial infections and allows semiquantification of pathogen load. It also includes antimicrobial resistance detection for mecA after identifying *Staphylococcus aureus*. The SepsiTest (Molzyme) employs universal PCR and sequencing for pathogen detection, requiring 1 ml of blood and offering results in

8–10 hours. It has a detection limit of 10–80 CFU/ml and sensitivity ranging from 11% to 87%, with specificity from 83% to 96%. This test can detect over 345 bacteria and 13 fungi, and it is highly expandable. It can also detect polymicrobial infections, though it does not include load quantification, and it currently does not offer antimicrobial resistance markers.

The MinION system (Oxford Nanopore Technologies) uses nanopore sequencing and requires a 10 ng high-molecular-weight DNA sample. This test offers results in 4–6 hours, with a detection limit of approximately 100 copies per ml. While its sensitivity and specificity are not fully validated for whole blood, the MinION is highly expandable and has the potential for polymicrobial detection with load quantification. Antimicrobial resistance detection may be incorporated in future versions. The U-dHRM (Digital PCR/High-Resolution Melt) test requires 1 ml of blood and provides results in less than 4 hours. It has an exceptional sensitivity, capable of detecting single cells, and can identify over 37 bacterial species with high expandability to include additional bacteria, viruses, and fungi. This test also offers absolute quantification of pathogen load and can potentially include antimicrobial resistance markers in future iterations. The SeptiCyte assay (Immunexpress) uses RT-qPCR to quantify host response biomarkers and applies machine learning algorithms. This test requires 2.5 ml of blood and provides results within 1–6 hours, although it does not offer specific pathogen identification. It is highly sensitive for distinguishing sepsis from systemic inflammatory response syndrome (SIRS) and provides a 95% specificity rate. SeptiCyte is designed to detect a broad range of pathogens and does not include antimicrobial resistance markers.

LAMP technology (Loop-Mediated Isothermal Amplification) is a rapid diagnostic tool that requires between 30 µl and several milliliters of blood, depending on the specific technique used. Results are available in 1 hour, and the test can detect individual pathogens at a single-cell level. However, it lacks an integrated platform for broad detection and is limited to detecting one pathogen per sample. It can identify a single antimicrobial resistance gene at a time in a separate sample. Finally, the Integrated Comprehensive Droplet Digital Detection Technology (IC 3D) (Velox Biosystems) utilizes a DNAzyme-based sensor for droplet microencapsulation and 3D particle counting. This test requires microliter to milliliter volumes of blood and delivers results within 1–4 hours. It is capable of detecting pathogens at a single-cell level, but it does not have an integrated platform for broad-based detection, and its use is limited by the number of fluorescence channels. It can potentially include antimicrobial resistance markers in future iterations. These emerging technologies represent a significant shift toward rapid, broad, and direct detection of pathogens in blood, offering improvements in diagnostic timelines, detection sensitivity, and the potential for enhanced antimicrobial resistance monitoring. As these technologies evolve, they hold the promise of transforming the management of sepsis and other bloodstream infections, moving away from traditional culture-based methods toward more efficient, real-time diagnostic solutions.

Modern Nucleic Acid Amplification Technologies

Nucleic acid amplification technologies (NAATs) have long been anticipated as a solution to the challenge of bypassing the need for bacterial growth in diagnostic testing. These technologies operate by rapidly amplifying DNA or RNA from pathogen or host cells through biochemical reactions, increasing the nucleic acid concentration to detectable levels. Once amplified, these sequences are used for pathogen identification or to assess the immune response. Despite the initial promise of NAATs revolutionizing sepsis diagnostics, their potential has not yet been fully realized. This can largely be attributed to difficulties in efficiently extracting and amplifying pathogen nucleic acids from complex biological samples such as blood. Blood samples typically contain pathogens at low concentrations, often in polymicrobial mixtures, all while being overwhelmed by the presence of human DNA. As a result, traditional NAATs struggle to meet the demanding requirements for sensitive, specific, and broad-based pathogen detection. Emerging technologies, as discussed here, represent novel integrations of NAATs with advanced techniques, offering solutions to many of the limitations faced by current diagnostic methods. These advancements suggest that synergistic integrations could ultimately pave the way for the development of an optimal sepsis diagnostic test.

Iridica Plex ID

The Iridica Plex ID platform (Abbott Molecular, Des Plaines, IL) is notable for its broad detection capabilities, identifying an impressive range of 780 bacterial species and Candida, with a relatively quick turnaround time of 6 hours [55]. Despite this broad detection, it identifies only four antimicrobial resistance markers: mecA, vanA, vanB, and blaKPC. The system achieves this through a combination of multiplexed PCR amplification of pathogen DNA and electrospray ionization mass spectrometry (ESI-MS) for sequence identification. The process begins with automated DNA extraction from a 5-ml whole blood sample, followed by distribution across several PCR reactions. Each reaction contains primers that target conserved regions of the genomes of bacteria and Candida, such as the 16S and 23S rRNA genes. These primers and reaction components are carefully optimized to minimize interference from human DNA, which could otherwise cause nonspecific amplification or lower amplification efficiency. Following amplification, human DNA is removed, and the pathogen DNA is analyzed by ESI-MS, which generates nucleotide base composition data. This data is then compared to a pre-established library to identify the pathogen species [54].

While the Iridica Plex ID offers impressive detection breadth, clinical studies reveal variability in its performance. Sensitivity ranges from 45% to 83%, specifically from 69% to 94%, and negative predictive value (NPV) from 80% to 97%, compared to conventional culture methods. However, sensitivity and specificity can improve, ranging from 77% to 91% and from 87% to 99%, respectively, when results are refined using test replicates or confirmed by clinical chart and culture data. This improvement suggests that sample heterogeneity and sampling errors, especially during blood collection, nucleic acid extraction, and splitting the sample across multiple PCR reactions, are significant sources of error. Addressing these errors is critical for improving the reliability of the

detection process. Furthermore, polymicrobial samples may present additional challenges, as amplification competition and sample complexity can hinder the accuracy of pathogen identification. Although some evidence indicates that the Iridica platform can detect mixed pathogen populations, its effectiveness in clinical settings remains inconclusive. A study of blood culture-positive polymicrobial infections showed that the Iridica platform was only able to identify a single causative organism in four out of nine cases.

Nursing Care Plan for Sepsis

A comprehensive nursing care plan for sepsis aims to promptly recognize and manage the condition to improve patient outcomes. The first step involves the assessment phase, where nurses monitor vital signs closely, especially temperature, heart rate, respiratory rate, and blood pressure, as these are indicators of sepsis. Early identification of symptoms such as fever, chills, confusion, and organ dysfunction is critical for timely intervention. Interventions should focus on initiating IV access for fluid resuscitation and administering antibiotics as soon as sepsis is suspected, per the Surviving Sepsis Campaign guidelines, ideally within the first hour. Nurses should ensure continuous monitoring of the patient's condition, assessing the response to interventions and any changes in vital signs. Collaborative care with physicians is crucial to modify the treatment plan as necessary, particularly in the case of antimicrobial resistance. Education should be provided to the patient's family, informing them about the nature of sepsis, the importance of early treatment, and the expected recovery process. Evaluation of the plan involves assessing the patient's response to treatments, ensuring stability of vital signs, and observing signs of signs of organ recovery or failure. Adjustments to the care plan should be made based on continuous assessment and collaboration with the healthcare team.

Documentation Process in Sepsis Management

The documentation process is essential for effective sepsis management and continuity of care. Accurate and timely documentation facilitates communication among healthcare providers, ensuring that all interventions, assessments, and patient responses are clearly recorded. The process should begin with the initial assessment, where nurses document any early symptoms of sepsis, such as fever, hypotension, tachycardia, and changes in mental status. Blood culture results, laboratory values such as C-reactive protein (CRP) and procalcitonin (PCT) levels, and the initiation of antibiotic therapy must be promptly noted. The administration of antibiotics is documented with precise time stamps to ensure timely treatment, particularly the critical first hour of therapy. Fluid resuscitation efforts and the administration of vasopressors should also be recorded meticulously. As the patient's condition progresses, updates regarding vital signs, organ function, and response to treatment should be documented continuously. Documentation should also include any complications, such as septic shock or multi-organ failure, and subsequent interventions. Patient education about sepsis should be documented, noting discussions about risks, treatment, and recovery. Finally, documentation of the care plan's ongoing evaluation allows for adjustments based on the patient's progress. This thorough documentation

supports clinical decision-making, ensures compliance with care protocols, and facilitates effective communication within the healthcare team.

Conclusion

Sepsis, particularly neonatal sepsis, continues to be a major clinical challenge due to its high mortality and morbidity rates. Despite advancements in healthcare, the timely and accurate detection of neonatal sepsis remains elusive, with existing diagnostic methods like blood cultures often yielding delayed results or false negatives. Blood culture, while considered the "gold standard," takes several hours to days to provide meaningful results, which severely limits its ability to guide immediate therapeutic decisions. This delay contributes to the widespread, though necessary, use of broad-spectrum antibiotics, which increases the risk of antibiotic resistance and adverse clinical outcomes such as fungal infections and other complications. Biomarkers like C-reactive protein (CRP) and procalcitonin (PCT) have shown potential in aiding early diagnosis but still lack the sensitivity and specificity needed for reliable detection in neonatal populations. Their use in isolation often fails to provide a complete understanding of a patient's infection status, making them insufficient for critical decision-making in neonatal care. Furthermore, the overlap of sepsis symptoms with other neonatal conditions complicates diagnosis and requires a more integrative approach to identifying true septic cases. New diagnostic technologies that incorporate molecular detection, automation, and high-throughput analysis offer a promising solution to these challenges. These methods have the potential to provide pathogen identification within hours, facilitating timely and targeted antibiotic therapy. For neonates, where early treatment is crucial, the availability of such tests could significantly reduce the window of mortality associated with delayed diagnosis. In addition to technological advancements, nursing interventions and the documentation process play pivotal roles in the early recognition and management of neonatal sepsis. Nurses are often the first to notice subtle signs of infection, and their timely reporting, combined with proper documentation, can trigger the necessary diagnostic tests and therapeutic interventions. Enhancing documentation practices ensures that sepsis risk factors are properly recorded and communicated, allowing healthcare teams to respond swiftly. In conclusion, there is a pressing need to improve neonatal sepsis diagnosis and treatment. Current methods are inadequate for timely and accurate pathogen detection, and improvements in diagnostic technology and clinical practices are essential for better patient outcomes. With advances in molecular diagnostics and a renewed focus on nursing interventions, there is hope for reducing sepsis-related mortality in neonates and improving the overall quality of neonatal care. Further research and the implementation of innovative diagnostic tools are critical to achieving these goals.

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التسمم الدموي: الكشف المبكر، الفحوصات المخبرية، التدخلات التمريضية، وعملية التوثيق

الملخص

الخلفية: التسمم الدموي هو حالة تهدد الحياة ناتجة عن العدوى، وتسبب معدلات وفيات وممراضة عالية، خاصة لدى حديثي الولادة. يعد تشخيص التسمم الدموي في حديثي الولادة تحديًا، حيث تتداخل العلامات السريرية في كثير من الأحيان مع حالات مهددة للحياة أخرى، وتتميز طرق زراعة الدم بحساسية منخفضة، خصوصًا في حديثي الولادة. يرتبط التسمم الدموي بتكاليف صحية مرتفعة، ويعد التشخيص السريع والدقيق أمرًا بالغ الأهمية لتحسين نتائج المرضى.

الهدف: يهدف هذا المقال إلى استكشاف الكشف المبكر، الفحوصات المخبرية، التدخلات التمريضية، وعملية التوثيق للتسمم الدموي في حديثي الولادة، مع التركيز على تحديد الفجوات واقتراح التحسينات لتعزيز النتائج السريرية.

الطرق: تم إجراء مراجعة شاملة للأساليب الحالية لتشخيص التسمم الدموي في حديثي الولادة، بما في ذلك زراعة الدم، العلامات البيولوجية، والتقنيات التشخيصية الناشئة. تشمل التحليل قيود الأساليب التشخيصية التقليدية، دور التدخلات التمريضية في الكشف المبكر، وأهمية التوثيق الدقيق في إدارة التسمم الدموي لدى حديثي الولادة.

النتائج: تقتصر طرق زراعة الدم التقليدية على بطء النتائج، الحساسية المنخفضة، وظهور الكائنات المقاومة للمضادات الحيوية. تظهر العلامات البيولوجية مثل البروتين المتفاعل (CRP) C-والبروكالسيتونين (PCT) وعدًا، لكنها تفتقر إلى الدقة الكافية للكشف المبكر عن التسمم الدموي. قد تؤدي التقدمات الحديثة في تقنيات التشخيص الجزيئي إلى تقليل التأخيرات في التشخيص بشكل كبير وتحسين تحديد مسببات المرض، مما يسمح بعلاج أكثر استهدافًا بالمضادات الحيوية.

الخلاصة: لا يزال الكشف المبكر عن التسمم الدموي في حديثي الولادة يمثل تحديًا كبيرًا، حيث أن الأساليب التشخيصية الحالية بطيئة وغالبًا ما تكون غير فعالة. هناك حاجة إلى اختبارات تشخيصية سريعة، تتضمن العلامات البيولوجية الجديدة والتقنيات الجزيئية، لتحسين إدارة التسمم الدموي. بالإضافة إلى ذلك، تلعب التدخلات التمريضية وعملية التوثيق الشاملة أدوارًا حاسمة في ضمان التعرف والعلاج في الوقت المناسب. هناك حاجة إلى مزيد من البحث لتحسين بروتوكولات التشخيص وتعزيز رعاية حديثي الولادة.

الكلمات المفتاحية: التسمم الدموي، التسمم الدموي في حديثي الولادة، زراعة الدم، العلامات البيولوجية، التشخيص الجزيئي، التدخلات التمريضية، التوثيق، مقاومة المضادات الحيوية، الكشف المبكر