

Sepsis Management and Nursing Practices: A Comprehensive Review with a Focus on Saudi Arabia

Salha Khalil Nasser Hamati¹
Safia Jaber Alshahrani²
Aisha Ali Alkanany³
Saleem Badawi Saeed Al Mujamil⁴
Abdulaziz Marie Mohd Aseri⁵
Alhussain Ahmed Hassan Alfalqi⁶
Safiaha Muhafia Assiri⁷
AfrAh Muhammad Qasim Buhais⁸

1. Nursing, Asser Central Hospital, Abha
2. Nursing, Aseer Central Hospital, Abha
3. Nursing, Aseer Hospital, Abha
4. Nursing, Aseer Central Hospital, Abha
5. Nursing, Aseer Central Hospital, Abha
6. Nursing, Aseer Central Hospital, Abha
7. Nursing, Aseer Hospital, Abha
8. Nursing Technician, Khamis Mushayt General Hospital, Khamis Mushayt

Abstract

Sepsis is a life-threatening condition resulting from an abnormal immune response to infection, leading to systemic inflammation, organ dysfunction, and high mortality rates. Globally, this disease poses significant challenges to healthcare, with increasing incidence associated with an aging population, surgical procedures, and antimicrobial resistance. In Saudi Arabia, demographic shifts and increasing demand for healthcare have highlighted sepsis as a critical public health issue. This review summarizes current knowledge on the epidemiology, pathology, and management strategies of sepsis, emphasizing the pivotal role of nurses in early detection, implementation of evidence-based protocols, and quality improvement initiatives. It proposes the integration of technological innovations and continuing education to enhance sepsis care delivery and patient outcomes.

Keywords: Sepsis, Sepsis-3, SOFA score, nursing, critical care, Saudi Arabia.

Introduction

Sepsis is a life-threatening condition resulting from a dysregulated immune response to infection, leading to systemic inflammation, tissue damage, and multi-organ dysfunction [1]. Despite significant advances in diagnostic and therapeutic strategies, sepsis remains a leading cause of death and morbidity worldwide, particularly in critically ill patients. The global burden of sepsis is significant, with its incidence increasing due to an aging population, invasive medical procedures, and rising rates of antimicrobial resistance [2,3].

In Saudi Arabia, where demographic changes and a growing healthcare infrastructure have highlighted sepsis as a critical public health challenge [4,5]. Globally, efforts such as the Sepsis-3 definitions have shifted the paradigm of sepsis diagnosis and management, with a focus on organ dysfunction through tools such as the Sequential Organ Failure Assessment (SOFA) and the Quick SOFA Score (qSOFA) [6]. These diagnostic frameworks have improved the identification of patients at risk, allowing for earlier interventions and better outcomes [7]. However, challenges remain, including delayed recognition, variability in protocol implementation, and resource disparities, especially in areas with constrained healthcare systems [8].

Nurses play a pivotal role in sepsis care, acting as frontline responders in early detection and management of the condition. Their responsibilities include monitoring vital signs, administering timely treatments, and ensuring adherence to evidence-based protocols [9]. Nurse-led initiatives, such as the implementation of sepsis care bundles, have been shown to significantly reduce mortality and improve outcomes in critical care settings [9,10].

This review focuses on synthesizing current knowledge on the epidemiology, pathology, management strategies, and challenges in sepsis care, with a particular focus on the healthcare context of Saudi Arabia. It highlights the role of nurses, the impact of technological advances, and the importance of global and regional research to address sepsis-related challenges.

Sepsis: Epidemiology and Pathophysiology

Epidemiology of Sepsis

Sepsis remains a critical public health challenge globally. In Saudi Arabia, sepsis accounts for approximately 16% of all hospital admissions and 40.3% of those cases were fatal, reflecting the significant burden on healthcare system [11]. The rise in sepsis incidence has been attributed to factors such as an aging population, the prevalence of invasive medical procedures, and the use of immunosuppressive therapies. Furthermore, advances in diagnostic criteria, such as the adoption of the Sepsis-3 guidelines, have enhanced the sensitivity of sepsis detection, thereby increasing the reported cases. These epidemiological trends underscore the need for context-specific strategies to address sepsis-related morbidity and mortality [12].

Pathophysiology of Sepsis

Sepsis arises from a dysregulated immune response to infection, resulting in systemic inflammation, tissue damage, and organ dysfunction. Initially, innate immune cells, such as macrophages and neutrophils, release pro-inflammatory cytokines to combat pathogens. However, this protective response becomes overactive in sepsis, leading to widespread inflammation and host tissue damage [13]. Key mediators such as nitric oxide, bradykinin, and thrombin exacerbate the condition. Nitric oxide causes vascular dysfunction and capillary leakage, bradykinin promotes vascular permeability and inflammation, and thrombin links inflammation to microvascular thrombosis, which compromises blood flow to organs [14]. The Sepsis-3 diagnostic framework shifts the focus from systemic inflammatory response syndrome (SIRS) criteria to organ dysfunction measured by the Sequential Organ Failure Assessment (SOFA) score [15]. This approach emphasizes the central role of organ dysfunction in the progression of sepsis, allowing for earlier and more accurate recognition of severe cases.

Assessment and Monitoring of Sepsis

The Sepsis-3 framework redefined sepsis as “life-threatening organ dysfunction resulting from a dysregulated host response to infection,” emphasizing organ dysfunction over systemic inflammation, removing the term “severe sepsis” from clinical terminology, and focusing on organ dysfunction rather than systemic inflammatory response syndrome (SIRS) criteria [16].

The Sequential Organ Failure Assessment (SOFA) and Quick SOFA (qSOFA) scores are essential for the assessment of sepsis. The SOFA scores assess dysfunction in all major organ systems, while the qSOFA, a simplified tool for use outside of intensive care units, focuses on respiratory rate, systolic blood pressure, and mental status. A qSOFA score of 2 or higher indicates increased risk of poor outcomes and warrants further investigation. These tools promote early identification of at-risk patients, facilitating timely and effective nursing interventions [17].

Monitoring Strategies

Effective management of sepsis relies on continuous monitoring of clinical and physiological parameters to guide therapeutic decisions and track patient progress.

- Lactate Levels

Serum lactate is an important biomarker in sepsis, reflecting decreased tissue blood flow and oxygen utilization. Elevated lactate levels (>2 mmol/L) are associated with increased mortality and indicate the need for aggressive resuscitation [18].

- Vital Signs

Regular monitoring of vital signs such as heart rate, respiratory rate, blood pressure, and oxygen saturation is essential. These parameters provide insight into the patient’s hemodynamic and respiratory status, allowing early detection of potential health risks to the patient [19].

- Hemodynamic Monitoring

Advanced techniques for assessing hemodynamic stability, such as dynamic measures of fluid responsiveness, are critical in guiding fluid therapy. Passive leg raises (PLR) and fluid challenges are widely used to predict response to fluid management [20]. These methods are more reliable than fixed parameters such as central venous pressure (CVP).

- Organ function assessment

Regular assessment of organ function, including renal output, liver enzymes, and neurological status, is essential for early detection and treatment of multiorgan dysfunction [21].

Management Strategies for Sepsis

Effective management of sepsis requires a multifaceted approach that targets hemodynamic stability, rapid infection control, and comprehensive supportive care. These strategies aim to mitigate the progression of organ dysfunction and improve patient survival.

Haemodynamic stabilization

Early goal-directed therapy (EGDT) and fluid resuscitation are cornerstones of management. Haemodynamic stabilization is a major focus of sepsis management. Fluid resuscitation with crystalloids is the initial treatment, with balanced crystalloids preferred due to the low renal complications. At least 30 ml/kg should be given within the first 3 hours [22].

Vasoactive Therapy

Vasopressors such as norepinephrine are initiated if fluids alone are insufficient to maintain a mean arterial pressure (MAP) ≥ 65 mmHg. Vasopressin or adrenaline may be added as adjunctive therapy in resistant cases [23].

Infection management

Timely administration of broad-spectrum antibiotics within the first hour of recognition of sepsis is critical to survival. Treatment should be reduced based on culture results to reduce resistance. Biomarkers such as procalcitonin can guide the duration of treatment, reducing unnecessary antibiotic exposure without increasing mortality [24].

Supportive care

Supportive measures include early enteral feeding to maintain bowel integrity and reduce the risk of infection, provided the patient is haemodynamically stable. The use of anticoagulants to prevent venous thromboembolism is essential in immobile patients. Additional interventions, such as glycemic control and stress ulcer prevention, are tailored to individual needs [25,26].

The Nursing Role in Sepsis Management

Nurses play a pivotal role in the management of sepsis. Their comprehensive responsibilities encompass the following:

- **Early recognition and screening**

Nurses play an active role in early detection of sepsis. Continuous monitoring of vital signs and application of sepsis screening tools enhance nursing to detect subtle clinical changes that indicate sepsis. Early recognition enables activation of sepsis response teams and implementation of standardized protocols, which are critical to improving patient outcomes [27].

- **Implementation of treatment protocols**

Nurses ensure timely administration of essential therapies, including antibiotics and intravenous fluids, within the recommended timeframe. Nurses also monitor critical markers such as lactate levels and tissue perfusion to assess the effectiveness of interventions and guide necessary adjustments [28].

- **Promoting quality improvement**

Nurses play an active role in improving the quality of sepsis care. Nurses contribute to sepsis care and ensure compliance with Surviving Sepsis Campaign (SSC) indicators. Nurses contribute to reducing ICU length of stay and overall mortality [29]. Their proactive involvement in quality improvement measures promotes better clinical outcomes.

- **Patient-Centered Care:**

Nurses advocate for the inclusion of patients and their families in the decision-making process. Nursing aligns care plans with the patient's goals and values. In addition, fosters a supportive environment that promotes awareness and understanding of sepsis, ultimately improving the patient's experience [30].

Challenges in sepsis management

- **Persistent barriers to sepsis care**

Nursing faces several challenges in sepsis management. These include the lack of access to advanced diagnostic tools, effective treatments, and adequately trained nurses. In addition, the absence of globally standardized protocols leads to inconsistent care practices, which undermines the effectiveness of sepsis management [27].

- **Continuing education and tailored interventions**

Continuing education for nurses is critical to addressing disparities in sepsis care. Studies focusing on cost-effective diagnostic tools and treatments can help bridge the gap in access to quality care. Furthermore, understanding the unique epidemiological and clinical characteristics of sepsis helps in designing interventions tailored to the needs of specific regions. These efforts will contribute to a more comprehensive and inclusive approach to sepsis management worldwide [31].

- **Promoting education and awareness**

Education remains the cornerstone for improving outcomes in sepsis management. Continuing education programs for healthcare providers, especially nurses, are essential to ensure timely recognition and management of sepsis. These programs should emphasize the use of diagnostic tools such as SOFA and qSOFA, implementation of evidence-based protocols, and integration of sepsis care bundles into daily clinical practice [28,31].

- **Multidisciplinary collaboration**

A collaborative approach involving different healthcare disciplines is vital to improving sepsis management. Physicians, nurses, researchers, and policymakers must work together to develop innovative diagnostic and therapeutic strategies. Promoting a team-based approach enhances the capacity of healthcare systems to improve the quality and efficiency of sepsis care [32].

Future directions in sepsis management

- Standardization of protocols

Developing globally adaptable protocols can standardize sepsis care practices, improving consistency and outcomes across healthcare systems. These guidelines must accommodate regional differences to effectively address disparities.

- Leveraging technology

Telemedicine and artificial intelligence offer transformative potential for sepsis care. Telemedicine enables access to expertise in remote areas, while AI-powered tools improve early detection, risk prediction, and personalized treatment.

- Research development

Targeted research can uncover innovative diagnostics and treatments, and address gaps in care. Studies that focus on regional trends will enable tailored interventions for diverse populations.

- Enhancing collaboration

Interdisciplinary collaboration between nurses, clinicians, researchers, and policymakers is vital to integrating advances into clinical practice. Partnerships across resource settings can enhance global capacity to manage sepsis.

Conclusion

Sepsis remains a global health challenge with significant morbidity and mortality. In Saudi Arabia, as in other regions, the increasing burden of sepsis underscores the need for improved diagnostic, therapeutic and preventive strategies. Nurses play a key role in the management of sepsis through early detection, adherence to evidence-based protocols and promotion of patient-centered care. Adoption of standardized global protocols, coupled with technological advances such as artificial intelligence and telemedicine, can enhance diagnostic accuracy and treatment efficiency.

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