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Evaluation and Management of Suspected Sepsis and Septic Shock in Adult Patients

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ABSTRACT

Introduction: Sepsis and septic shock represent critical medical emergencies with persistently high global mortality, ranging from 20% to 40% in severe cases. Prompt evaluation and early, time-sensitive management are essential to improve outcomes. This review highlights a pragmatic, evidence-based approach to the evaluation and management of suspected sepsis and septic shock in adults, aligned with current international guidelines and key clinical trials.

Case Description: A 68-year-old man with a history of diabetes mellitus presented with fever, hypotension (mean arterial pressure 58 mmHg), tachycardia, and altered mental status. Laboratory investigations revealed leukocytosis and markedly elevated serum lactate levels (4.8 mmol/L). A urinary tract infection was identified as the potential source. Peripheral blood cultures were obtained from two sites prior to antimicrobial therapy. Broad-spectrum antibiotics (piperacillin–tazobactam and vancomycin) were initiated within 45 minutes, followed by resuscitation with 30 mL/kg balanced crystalloid solution. Persistent hypotension necessitated norepinephrine infusion, achieving a target mean arterial pressure ≥65 mmHg. Serial lactate monitoring guided ongoing resuscitation. Procalcitonin levels supported antibiotic de-escalation after seven days. The patient recovered without requiring organ support.

Conclusion: Effective evaluation and management of suspected sepsis rely on early identification, rapid diagnostic assessment, prompt antimicrobial therapy, and timely hemodynamic resuscitation. Although early goal-directed therapy initially demonstrated benefit, contemporary trials indicate that individualized, high-quality usual care yields comparable outcomes in well-resourced settings. Procalcitonin-guided antibiotic stewardship may reduce treatment duration without adversely affecting survival. Early, tailored intervention remains pivotal in reducing sepsis-related mortality.

Keywords

Sepsis, Septic Shock, Evaluation, Management, Early Goal-Directed Therapy, Surviving Sepsis Campaign, Lactate Clearance, Empiric Antibiotics, Fluid Resuscitation, Procalcitonin

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INTRODUCTION

Sepsis is a life-threatening clinical syndrome arising from a dysregulated host immune response to infection that leads to acute organ dysfunction [1]. It represents a continuum of disease severity, ranging from sepsis to septic shock, the latter of which is characterized by profound circulatory, cellular, and metabolic abnormalities associated with a substantially increased risk of death [2]. Despite advances in critical care, sepsis remains a significant global health burden. Reported mortality rates vary according to patient characteristics, comorbidities, and healthcare resources; however, contemporary estimates suggest an in-hospital mortality rate of approximately 10–20% for sepsis overall, increasing to 40% or more among patients with septic shock [3,4].

This review focuses on the evaluation and management of sepsis and septic shock in adults, largely reflecting recommendations from established international guidelines and consensus statements [3–6]. The discussion primarily adopts the definitions proposed by the Society of Critical Care Medicine (SCCM) and the European Society of Intensive Care Medicine (ESICM), collectively known as the Sepsis-3 criteria [1]. These definitions emphasize organ dysfunction, operationalized by an increase in the Sequential Organ Failure Assessment (SOFA) score, as a defining feature of sepsis. Nevertheless, the Sepsis-3 framework has not achieved universal acceptance in all clinical and regulatory settings.

Notably, the Centers for Medicare and Medicaid Services (CMS) in the United States continue to endorse earlier sepsis definitions that incorporate systemic inflammatory response syndrome (SIRS) criteria to classify sepsis, severe sepsis, and septic shock for quality reporting and reimbursement purposes [6]. In addition, the Infectious Diseases Society of America (IDSA) has cautioned that while strict application of the Sepsis-3 definitions is critical and potentially lifesaving in patients with septic shock, their broader application in less severe infections may inadvertently promote excessive use of broad-spectrum antimicrobial therapy [7]. Detailed discussions of sepsis definitions, epidemiology, diagnosis, pathophysiology, and emerging or investigational pharmacologic therapies are beyond the scope of this review and have been addressed comprehensively elsewhere [8–10]. Similarly, the clinical features, diagnostic evaluation, and management of fever in patients with impaired or absent splenic function have been discussed in a separate dedicated review [11].

CASE DESCRIPTION

A 68-year-old man with a history of type 2 diabetes mellitus presented to the emergency department with acute-onset fever, progressive weakness, and altered mental status. On arrival, he was hypotensive with a mean arterial pressure (MAP) of 58 mmHg, tachycardic, and febrile. Initial laboratory evaluation revealed leukocytosis and an elevated serum lactate level of 4.8 mmol/L, which was consistent with tissue hypoperfusion. A urinary tract infection was suspected based on the clinical presentation and preliminary urinalysis.

The initial priorities focused on the stabilization of the airway, breathing, and circulation. Supplemental oxygen was administered to correct hypoxemia with continuous pulse oximetry monitoring. Adequate peripheral venous access was established promptly to facilitate early fluid resuscitation and antimicrobial therapy. Peripheral blood cultures were obtained from two separate venipuncture sites before antibiotic administration. Broad-spectrum intravenous antibiotics (piperacillin–tazobactam plus vancomycin) were initiated within 45 min of presentation. Concurrently, rapid fluid resuscitation with a 30 mL/kg balanced crystalloid solution was administered in accordance with the international sepsis guidelines. Despite fluid loading, hypotension persisted, necessitating the initiation of norepinephrine infusion to maintain a target MAP ≥65 mmHg. Serial serum lactate measurements were used to guide ongoing resuscitation and to assess the response to therapy. Over the subsequent hours, lactate levels progressively cleared, accompanied by hemodynamic stabilization and improvement in mental status.

Table 1. Emergency Management Priorities During the First Hour of Severe Sepsis / Septic Shock

Priority / Intervention	Key Action	Rationale
Serum lactate measurement	Obtain baseline lactate; repeat if >2 mmol/L	Marker of tissue hypoperfusion and illness severity
Blood cultures	≥2 sets from separate sites before antibiotics	Pathogen identification and targeted therapy
Broad-spectrum antibiotics	Initiate IV therapy within 1 hour	Strongly time-dependent survival benefit
Fluid resuscitation	30 mL/kg crystalloid if MAP <65 mmHg or lactate ≥4 mmol/L	Restore intravascular volume and perfusion
Vasopressor therapy	Start norepinephrine if hypotension persists	Maintain MAP ≥65 mmHg

A focused history, physical examination, laboratory testing, microbiological cultures, and imaging studies were performed concurrently to identify the source of infection and assess the severity of organ dysfunction. Blood cultures subsequently yielded a uropathogen sensitive to the empirical regimen. Procalcitonin levels were monitored to support antimicrobial stewardship, allowing safe de-escalation of antibiotics after seven days. The patient recovered without requiring invasive mechanical ventilation, renal replacement therapy, or other forms of organ support.

Table 2. Essential Initial Investigations in Suspected Sepsis

Category	Key Components	Purpose
History	Onset, symptoms, comorbidities, infection risk factors	Identify likely source
Physical examination	Vitals, mental status, skin, lungs, abdomen	Detect infection focus and organ dysfunction
Laboratory tests	CBC, renal and liver function, coagulation, lactate	Assess severity and organ failure
Microbiology	Blood cultures, urine culture, site-specific cultures	Guide definitive antimicrobial therapy
Imaging	Chest radiograph, targeted CT/ultrasound	Confirm infection source

DISCUSSION

Early recognition and prompt initiation of evidence-based interventions are central determinants of outcomes in sepsis and septic shock. This case highlights the importance of rapid diagnostic evaluation performed in parallel with resuscitative measures, ensuring that critical laboratory investigations do not delay the timely administration of intravenous fluids and empiric antimicrobial therapy. Current international guidelines emphasize that initial laboratory testing, including complete blood count, metabolic panel, liver function tests, coagulation parameters, and serum lactate, should ideally be performed within the first 45 min of presentation, provided that this does not postpone treatment initiation [12].

Serum lactate measurement plays a pivotal role in the early assessment of sepsis severity and tissue hypoperfusion. Elevated lactate levels, even in the absence of overt hypotension, are strongly associated with increased mortality and serve as valuable markers to guide resuscitation and monitor therapeutic response [13–15]. In the present case, serial lactate clearance paralleled hemodynamic improvement, supporting its utility as a dynamic resuscitation endpoint rather than as a single diagnostic value. Microbiological evaluation remains a cornerstone of sepsis management. Obtaining peripheral blood cultures from at least two separate venipuncture sites prior to antibiotic administration significantly enhances the diagnostic yield while minimizing contamination [16]. A multicenter prospective study involving adults with severe sepsis demonstrated a substantial reduction in pathogen recovery when blood cultures were drawn after antimicrobial exposure, with sensitivity falling to approximately 50% compared with pre-treatment samples [17]. These findings reinforce the guideline recommendations that microbiologic sampling should precede antibiotic therapy whenever feasible, without causing clinically significant delays [12].

Adjunctive investigations, including targeted imaging and arterial blood gas analysis, when indicated, provide additional insight into infection source localization and the extent of organ dysfunction. While routine arterial blood gas testing is not universally required, selective use can aid in identifying metabolic acidosis, hypoxemia, or ventilatory failure in patients with respiratory compromise [18]. PCT-guided antibiotic stewardship represents an important advancement in the management of sepsis, particularly in reducing unnecessary antimicrobial exposure. Meta-analyses and large randomized controlled trials have demonstrated that procalcitonin-guided de-escalation strategies are associated with shorter antibiotic duration without adversely affecting mortality, especially in patients with lower respiratory tract infections [19,20]. In contrast, C-reactive protein–based protocols have not consistently shown similar benefits. The hemodynamic management of sepsis is continuously evolving. Early fluid resuscitation with crystalloids at a dose of approximately 30 mL/kg within the first three hours remains a central component of the initial therapy aimed at restoring adequate tissue perfusion [21–24]. Empiric antimicrobial therapy should be initiated as early as

possible—ideally within the first hour—with beta-lactam agents prioritized when combination regimens are required [25].

Evidence from landmark randomized trials evaluating early goal-directed therapy (EGDT) has substantially influenced contemporary practices. While the original single-center EGDT trial demonstrated a mortality benefit with protocolized resuscitation targeting central venous oxygen saturation, central venous pressure, mean arterial pressure, and urine output [26]. subsequent large multicenter trials, including ProCESS, ARISE, and ProMISe, failed to show the superiority of EGDT over optimized usual care [27–29]. These findings likely reflect improvements in baseline sepsis care, widespread implementation of sepsis bundles, and earlier recognition and treatment in the control groups. Importantly, data from resource-limited settings suggest that aggressive protocolized resuscitation may not be universally beneficial and may be associated with harm in certain contexts [30,31]. Variability in patient populations, monitoring capabilities, vasopressor selection, and fluid volumes likely contribute to these divergent outcomes, underscoring the need for individualized, context-sensitive resuscitation strategies. Overall, this case illustrates that timely, coordinated evaluation combined with early antimicrobial therapy, judicious fluid resuscitation, and individualized hemodynamic support remain the foundation of effective sepsis management in contemporary clinical practice.

CONCLUSION

Effective management of suspected sepsis and septic shock depends on early recognition and rapid, coordinated interventions. Prompt diagnostic evaluation, including serum lactate assessment, timely microbiologic sampling prior to antibiotic administration, and early source identification, combined with immediate fluid resuscitation using 30 mL/kg crystalloid and early initiation of appropriate broad-spectrum antimicrobials, remains fundamental to improving outcomes. While early goal-directed therapy demonstrated benefits in initial studies, subsequent multicenter trials have shown that high-quality, individualized usual care achieves comparable outcomes in well-resourced settings. Procalcitonin-guided antibiotic stewardship is an effective strategy for safely reducing antimicrobial exposure without compromising survival. Ultimately, timely and individualized resuscitation is critical for reducing morbidity and mortality in patients with sepsis and septic shock.

DECLARATIONS

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The Authors agree to be published in the Journal of Society Medicine.

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The authors declare no conflicts of interest in this case report.

AUTHORS' CONTRIBUTIONS

The authors have made substantial contributions to this case report. AI was responsible for patient management, data collection, and the initial drafting of the manuscript entitled "Evaluation and Management of Suspected Sepsis and Septic Shock in Adult Patients." The author reviewed and approved the final version of the manuscript, ensuring its accuracy and integrity, and is accountable for all aspects of this work.

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