

Improving Diagnosis and Management of Sepsis in Emergency Care: The Role of Rapid Laboratory Testing and Pharmacological Intervention

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Abstract

Sepsis is a life-threatening condition that requires prompt recognition and treatment to improve patient outcomes. This study, conducted in a tertiary hospital, aimed to evaluate the impact of rapid laboratory testing and pharmacological interventions on sepsis management, with a focus on early diagnosis, treatment initiation, and patient survival. A retrospective observational design was employed, analyzing patient records from January 2017 to December 2017. The findings indicate that early administration of antibiotics, facilitated by rapid point-of-care testing (POCT), significantly improved survival rates and reduced in-hospital mortality. Pharmacist involvement in optimizing antimicrobial therapy further reduced hospital stays and improved patient outcomes. These results highlight the importance of interdisciplinary collaboration in the effective management of sepsis.

Keywords: Sepsis, Rapid Laboratory Testing, Pharmacological Intervention, Early Diagnosis, Point-of-Care Testing, Interdisciplinary Collaboration

Introduction

Sepsis is a life-threatening condition resulting from the body's extreme response to infection, often leading to organ dysfunction and a significant risk of mortality if not promptly addressed (Singer et al., 2016). Early recognition and treatment are critical in improving outcomes for sepsis patients, particularly within emergency care settings where time is of the essence. Paramedics often serve as the first point of contact, and their ability to initiate early intervention can have a profound impact on patient prognosis (Fleischmann-Struzek et al., 2018). Rapid laboratory testing, combined with timely pharmacological management, can facilitate early identification and treatment, thus potentially reducing the severity and progression of sepsis.

The use of rapid point-of-care laboratory tests in pre-hospital and emergency settings has emerged as a valuable tool in identifying biomarkers indicative of sepsis, such as lactate and procalcitonin (Liu et al., 2017). This approach not only aids in assessing the severity of the patient's condition but also provides crucial data for subsequent decision-making upon hospital arrival. The integration of laboratory findings with effective pharmacological intervention—often involving broad-spectrum antibiotics and fluid resuscitation—can be vital in mitigating the effects of sepsis and improving patient outcomes (Levy et al., 2018).

Pharmacists play a pivotal role in ensuring that appropriate antimicrobial therapy is administered swiftly and safely, while minimizing the risk of resistance or adverse reactions. The collaboration between paramedics, laboratory specialists, and pharmacists is essential in developing a streamlined approach to sepsis management, bridging pre-hospital care and in-hospital treatment to optimize patient outcomes (Rhodes et al., 2017). This research aims to explore how rapid laboratory testing and pharmacological interventions can be integrated into emergency care workflows to enhance the early diagnosis and effective management of sepsis, ultimately improving patient survival rates and quality of care.

Literature Review

Sepsis management is a complex process that requires timely and coordinated efforts to improve patient outcomes. The importance of early intervention in sepsis is well-documented, with studies showing that early recognition and treatment can significantly reduce mortality rates (Kumar et al., 2006). Rapid administration of antibiotics within the first hour of sepsis recognition is associated with better survival rates, emphasizing the critical role of early pharmacological intervention (Levy et al., 2018). This is particularly important in emergency care settings, where paramedics can play a crucial role in initiating treatment before hospital admission (Fleischmann-Struzek et al., 2018).

Rapid point-of-care testing (POCT) is an essential component of early sepsis detection. Biomarkers such as lactate and procalcitonin have been widely used to assess the severity of sepsis and guide treatment decisions (Liu et al., 2017). Studies have shown that elevated lactate levels are associated with increased mortality, highlighting the importance of lactate monitoring in sepsis management (Mikkelsen et al., 2009). Procalcitonin, another important biomarker, has been used to differentiate between bacterial and non-bacterial infections, aiding in targeted antibiotic therapy (Fung et al., 2017). The implementation of POCT in pre-hospital and emergency settings can expedite the diagnosis and initiation of appropriate treatment, ultimately improving patient outcomes (Jones et al., 2010).

Pharmacists are integral to optimizing antimicrobial therapy in sepsis management. Their expertise in selecting appropriate antibiotics, dosing, and monitoring for adverse reactions is crucial in ensuring effective treatment while minimizing the risk of antibiotic resistance (Rhodes et al., 2017). The Surviving Sepsis Campaign guidelines emphasize the importance of antimicrobial stewardship in sepsis care, which is where pharmacists play a vital role (Levy et al., 2018). Studies have demonstrated that pharmacist involvement in sepsis management leads to improved adherence to treatment protocols and better patient outcomes (MacLaren and Bond, 2009).

Collaboration between paramedics, laboratory specialists, and pharmacists is essential for effective sepsis management. Paramedics are often the first healthcare providers to encounter sepsis patients, and their ability to recognize the condition and initiate treatment can significantly impact patient survival (Smyth et al., 2016). Laboratory specialists contribute by providing timely and accurate diagnostic information, which is critical for guiding treatment decisions. Pharmacists, in turn, ensure that the appropriate medications are administered and that dosing is optimized to maximize efficacy and minimize harm (Rhodes et al., 2017). The integration of these roles creates a seamless transition of care from pre-hospital to in-hospital settings, which is crucial for improving sepsis outcomes (Jones et al., 2010).

Despite the benefits of early intervention and interdisciplinary collaboration, challenges remain in the implementation of sepsis management protocols. Delays in the identification of sepsis and initiation of treatment are common, particularly in pre-hospital settings where access to diagnostic tools may be limited

(Seymour et al., 2016). Education and training for paramedics on the early recognition of sepsis, combined with the availability of POCT, can help overcome these challenges and improve patient outcomes (Singer et al., 2016). Furthermore, effective communication between paramedics, laboratory specialists, and pharmacists is essential to ensure that critical information is conveyed accurately and in a timely manner (Rhodes et al., 2017).

This literature review highlights the importance of early intervention, rapid diagnostic testing, and interdisciplinary collaboration in the management of sepsis. By integrating rapid laboratory testing and pharmacological interventions into emergency care workflows, healthcare providers can enhance the early diagnosis and effective management of sepsis, ultimately improving patient survival rates and quality of care.

Methodology

This study was conducted in a tertiary hospital with a dedicated emergency department (ED) and intensive care unit (ICU). The research employed a retrospective observational design, utilizing patient records from January 2017 to December 2017. The aim was to assess the impact of rapid laboratory testing and pharmacological interventions on sepsis outcomes, specifically focusing on early diagnosis, treatment initiation, and patient survival rates.

Study Setting and Population

The study included patients who were admitted to the ED with suspected sepsis and subsequently diagnosed with sepsis or septic shock. Inclusion criteria were adult patients (aged 18 years and older) who presented with symptoms of sepsis, including fever, tachycardia, hypotension, and elevated lactate levels. Patients were excluded if they were transferred from another hospital or had a documented do-not-resuscitate (DNR) order.

Data Collection

Data were collected from the hospital's electronic health records (EHR) system. Key variables included demographic information (age, gender), clinical parameters (vital signs, lactate levels, procalcitonin levels), timing of laboratory testing, timing of antibiotic administration, and patient outcomes (length of hospital stay, ICU admission, mortality). Data on the involvement of paramedics, laboratory specialists, and pharmacists were also recorded to assess interdisciplinary collaboration.

Intervention and Measurements

The primary intervention assessed was the use of rapid point-of-care testing (POCT) in the ED to identify biomarkers such as lactate and procalcitonin. The timing of POCT and subsequent pharmacological interventions, including the administration of broad-spectrum antibiotics, were recorded. Pharmacist involvement in reviewing and optimizing antimicrobial therapy was also documented. Outcome measures included the time from ED admission to antibiotic administration, lactate clearance, length of hospital stay, and in-hospital mortality.

Data Analysis

Descriptive statistics were used to summarize patient characteristics and clinical parameters. Continuous variables were presented as means with standard deviations, while categorical variables were presented as

frequencies and percentages. Kaplan-Meier survival analysis was used to estimate survival rates, and Cox proportional hazards regression was employed to assess the impact of early intervention on patient outcomes. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the ethics committee. Given the retrospective nature of the study, informed consent was waived. Patient confidentiality was maintained by de-identifying data during analysis, and all data were stored securely in compliance with hospital data protection policies.

Findings

The study included a total of 250 patients diagnosed with sepsis or septic shock. The mean age of the patients was 65.4 years (SD = 14.8), with 58% being male and 42% female. The average time from ED admission to antibiotic administration was 1.8 hours (SD = 0.9 hours). Rapid point-of-care testing (POCT) was performed in 72% of cases, and pharmacists were involved in optimizing antimicrobial therapy in 65% of cases.

Table 1: Patient Demographics and Clinical Characteristics

Characteristic	Value
Total Patients	250
Mean Age (years)	65.4 (SD = 14.8)
Male (%)	58
Female (%)	42
POCT Performed (%)	72
Pharmacist Involvement (%)	65

Table 2: Timing and Outcome Measures

Measure	Mean (SD) / Percentage
Time to Antibiotic Administration	1.8 hours (SD = 0.9)
Lactate Clearance Achieved (%)	68
Length of Hospital Stay (days)	10.3 (SD = 5.2)
ICU Admission (%)	45
In-Hospital Mortality (%)	18

Kaplan-Meier survival analysis showed that early administration of antibiotics (within the first 2 hours of ED admission) was associated with a significantly higher survival rate compared to delayed administration ($p < 0.01$). Patients who received rapid POCT had a 30% higher likelihood of lactate clearance within the first 24 hours compared to those who did not receive POCT ($p = 0.02$).

Pharmacist involvement in the optimization of antimicrobial therapy was associated with a reduced length of hospital stay (mean 9.1 days vs. 12.2 days, $p = 0.03$) and lower in-hospital mortality (14% vs. 24%, $p = 0.04$). The results indicate that interdisciplinary collaboration, involving paramedics, laboratory specialists, and pharmacists, is crucial in improving outcomes for sepsis patients.

Table 3: Impact of Interventions on Outcomes

Intervention	Length of Stay (days)	In-Hospital Mortality (%)
Early Antibiotic (<2 hrs)	8.7 (SD = 4.3)	12
Delayed Antibiotic (>2 hrs)	13.5 (SD = 5.7)	28
POCT Performed	9.5 (SD = 4.8)	15
No POCT	11.8 (SD = 5.5)	21
Pharmacist Involvement	9.1 (SD = 4.5)	14
No Pharmacist Involvement	12.2 (SD = 6.0)	24

Discussion

The findings from this study emphasize the importance of rapid intervention and interdisciplinary collaboration in the management of sepsis. Early administration of antibiotics, facilitated by rapid POCT, was shown to significantly improve survival rates and reduce in-hospital mortality. The involvement of pharmacists in optimizing antimicrobial therapy further contributed to shorter hospital stays and better patient outcomes. These results are consistent with existing literature highlighting the importance of early intervention and teamwork in managing sepsis effectively (Levy et al., 2018; Rhodes et al., 2017).

The study also highlighted some challenges, including the need for better access to POCT in pre-hospital settings and improved training for paramedics in the early recognition of sepsis. Addressing these challenges could further enhance the effectiveness of sepsis management protocols and improve patient outcomes.

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الملخص

إن الإنتان حالة تهدد الحياة وتتطلب التعرف السريع والعلاج لتحسين نتائج المرضى. تهدف هذه الدراسة، التي أجريت في مستشفى ثالثي، إلى تقييم تأثير الاختبارات المعملية السريعة والتدخلات الدوائية على إدارة الإنتان، مع التركيز على التشخيص المبكر وبدء العلاج وبقاء المريض على قيد الحياة. تم استخدام تصميم مراقبة بأثر رجعي، وتحليل سجلات المرضى من يناير 2017 إلى ديسمبر 2017. تشير النتائج إلى أن ، أدى إلى تحسين معدلات البقاء على قيد (POCT) الإعطاء المبكر للمضادات الحيوية، الميسر من خلال الاختبار السريع في نقطة الرعاية الحياة بشكل كبير وخفض معدل الوفيات في المستشفى. كما أدى مشاركة الصيدلي في تحسين العلاج بالمضادات الحيوية إلى تقليل فترات الإقامة في المستشفى وتحسين نتائج المرضى. تسلط هذه النتائج الضوء على أهمية التعاون بين التخصصات في الإدارة الفعالة للإنتان.

الكلمات المفتاحية: الإنتان، الاختبارات المعملية السريعة، التدخل الدوائي، التشخيص المبكر، الاختبار في نقطة الرعاية، التعاون بين التخصصات