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Optimizing Sepsis care in the Emergency Department: Integrating Nursing, Pharmacy, and Laboratory Sciences

Authors:

Adel Ali Jibril Al Jibril[1] Abdullah Mohsen Abdullah Shaeri[2] Ibrahim Ali Mossa Bahri [3] Halaym Hussain Alamri [4] Yasir Hazzaa Hawil Alharbi [5] Maryam Abdallah Ali Alsahw [6] Ali Mohamed Abomughayedh[7] Abdullah Ghanem Almutairi[8] Ahmed Sulaiman Muaytiq Alotaibi[9] Tariq Abdulaziz Alshehri[10] Ahmed Ali Ali Mesfer Alalyani[11] Salim Hassan Mohamed Sahari[12]

[1] Emergency medical services, Jazan Health

[2] Emergency medical services, Jazan Health

[3]Nurse technician, Jazan Health

[4] Radiology specialist, Al-Qunfudah South General Hospital

[5] Laboratory technician, Al-Qawara Hospital

[6] Pharmacy technician, Prince Muhammad bin Fahd General Hospital and hereditary blood diseases in Qatif

[7] Pharmacy, Aseer Central Hospital

[8] Nursing, Hotat Sudyer General Hospital

[9] Pharmacy technician, Uhud Hospital in Al-Madinah Al Munawwara

[10] Laboratory technician, Eradah (Al Amal) Mental Health Complex

[11]Laboratory technician, Althager Hospital

[12]Health care assistant (nursing) , Vector Borne and Zoonotic Diseases-Aseer Region

ABSTRACT

Introduction: Sepsis often prompts patients to seek immediate medical attention in the emergency room and then be admitted to the hospital. Given its frequency, it is accountable for a substantial number of deaths annually. The Surviving Sepsis Campaign has improved the results of sepsis by advocating for enhanced standards of identification and treatment.

Aim of work: To explore the role of integrating nursing, pharmacy, and laboratory in optimizing sepsis care in the emergency department.

Methods: We conducted a comprehensive search in the MEDLINE database's electronic literature using the following search terms: nursing, pharmacy, laboratory, optimizing, sepsis, care, emergency, and department. The search was restricted to publications from 2016 to 2024 in order to locate relevant content. I performed a search on Google Scholar to locate and examine academic papers that pertain to my subject matter. The selection of articles was impacted by certain criteria for inclusion.

Results: The publications analyzed in this study encompassed from 2016 to 2024. The study was structured into various sections with specific headings in the discussion section.
Conclusion: Research indicates that implementing treatments for sepsis can improve adherence to protocols and outcomes. However, determining the most beneficial interventions is challenging. A systematic and protocol-driven strategy is needed to manage sepsis patients in emergency departments. Artificial intelligence and machine learning are emerging in sepsis treatments, aiding in the detection of patients and developing appropriate treatment regimens. Future studies should employ randomized designs, incorporating process and patient outcome parameters, and have a long follow-up period. Cost-benefit evaluations are crucial, as the implementation and maintenance of these treatments require significant healthcare commitment. Treatments must demonstrate long-term viability and expand to other hospitals.
Keywords: nursing, pharmacy, laboratory, optimizing, sepsis, care, emergency, department.

INTRODUCTION

Sepsis is a pathological state marked by profound organ dysfunction that has the potential to be life-threatening. Sepsis is a condition characterized by the body's dysregulated and uncontrolled response to an infection (Caraballo and, 2019). Organ dysfunction, sometimes known as 'severe sepsis', is identified by an increase of two or more points in the Sequential (sepsis-related) Organ Failure Assessment score. This disease is associated with a hospitalization mortality rate above 10%. Septic shock is a medical condition characterized by the use of medicine to sustain a blood pressure of 65 mm Hg or above, or the presence of a serum lactate level over 4 mmol/L, in the absence of dehydration. It is characterized by profound issues related to circulation, cells, and metabolism, and is associated with a death rate over 40% for hospitalized patients (Cecconi et al., 2018).

Approximately 1.7 million individuals in the United States get sepsis annually, and a majority of these patients seek medical attention via the emergency department (ED) (Rhee et al., 2019). Approximately 75% of ED patients diagnosed with sepsis are hospitalized, and 25% of them need to be admitted to the intensive care unit (ICU). Although sepsis only makes up 6% of hospital admissions, it is responsible for one-third of all deaths that occur inside the hospital setting (Abe et al., 2018).

Prior to 2001, there was no standardized strategy for the first treatment of sepsis and septic shock, leading to a mortality rate of 40%–50% for instances of sepsis. The use of early goal-directed therapy led to the acceptance of bundled sepsis care and resulted in a significant decrease in sepsis mortality. The development of the Society of Critical Care Medicine Surviving Sepsis Campaign (SSC) guidelines was a direct outcome of the progress made in sepsis resuscitation and research over the course of the following two decades. The purpose of these recommendations is to streamline the timely identification and treatment of sepsis in patients (Evans et al., 2021). The guidelines from the Surviving Sepsis Campaign (SSC), which outline a series of therapeutic measures that must be carried out within a certain period upon identifying sepsis, have been associated with improved results, including reduced mortality rates. The

Centers for Medicare and Medicaid Services (CMS) have developed the Severe Sepsis/Septic Shock Early Management Bundle (SEP-1), which impacts the payment system for hospitals who treat patients with sepsis. This initiative establishes a higher standard of care that hospitals must meet. Multiple health departments, such as the New York State Department of Health, have implemented comparable management packages (Pepper et al., 2018).

However, there are still major obstacles to achieving complete adherence to the bundle protocol. These obstacles arise from variables such as patient characteristics, staffing limitations, the ED atmosphere, and training deficiencies. The hospitals participating in the SCC database have an overall compliance percentage of 21.5%. According to the latest figures, the New York State bundle has a compliance rate of 36.1%. Departmental quality improvement initiatives are often established as a result. A study revealed that 92% of the surveyed sites reported their participation in at least one effort pertaining to sepsis bundle care, indicating a substantial predisposition towards improvement (Young, 2021).

Multiple research detail the experiences of various EDs in quality improvement programs focused on enhancing compliance with sepsis bundle protocols and improving patient care. Prior interventions have included the introduction of electronic health record (EHR) based 'sepsis alerts', physician order sets in either electronic or printed format, printed guidelines or protocols for physicians, nursing narrators or protocols, sepsis huddles, improved screening, and training, education, feedback, or other methods of continuous communication (Prasad et al., 2020; Umberger et al., 2019). The implementation of these improvement processes is associated with various beneficial outcomes, such as improved administration of antibiotics as well as intravenous fluids in a timely manner, enhanced assessment of serum lactate, increased collection of blood cultures before administering antibiotics, greater overall adherence to sepsis bundles, decreased occurrence of sepsis-related rapid response teams in inpatient units, reduced dependence on vasopressors and mechanical ventilation, shorter hospital and intensive care unit stays, and lower in-hospital mortality rates (Uffen et al., 2021). The aim of this paper is to explore the role of integrating nursing, pharmacy, and laboratory in optimizing sepsis care in the emergency department.

AIM OF WORK

To explore the role of integrating nursing, pharmacy, and laboratory in optimizing sepsis care in the emergency department.

METHODS

A comprehensive search was conducted on recognized scientific platforms, including Google Scholar and Pubmed, using specific keywords such as nursing, pharmacy, laboratory, optimizing, sepsis, care, emergency, and department.

The aim was to gather all relevant research papers. The articles were chosen according to certain criteria. Upon conducting a comprehensive analysis of the abstracts and notable titles of each publication, we eliminated case reports, duplicate articles, and publications without full information. The reviews included in this research were published from 2016 to 2024.

RESULTS

The current investigation concentrated on the role of integrating nursing, pharmacy, and laboratory in optimizing sepsis care in the emergency department. between 2016 and 2024. As a result, the review was published under many headlines in the discussion area, including: Change in sepsis definitions, Sepsis screening, Automated triage systems, Sepsis teams and Clinical pathways.

DISCUSSION

1. Change in sepsis definitions

The scientific definition of sepsis has undergone changes throughout time. Before 2016, the definition of sepsis relied on the criteria of systemic inflammatory response syndrome (SIRS). Sepsis is diagnosed when there is a suspected or confirmed infection together with the presence of two or more Systemic Inflammatory Response Syndrome (SIRS) criteria (Napolitano, 2018). Nevertheless, it was soon discovered that the SIRS criteria were not specific enough for sepsis. They did not necessarily signify a pathological and possibly lethal response to infection, but might instead reflect a typical physiological reaction to infection. In addition, these requirements may also be seen in disorders that are not of infectious origin (Serafim et al., 2018). Therefore, a modified explanation was produced by using information from extensive clinical databases in the United States and was officially released in 2016. The Sepsis-3 consensus definitions state that sepsis is a condition when the body's reaction to infection causes life-threatening organ malfunction. Septic shock, on the other hand, is defined as low blood pressure that continues after receiving enough fluids to treat sepsis. The SOFA is used as a surrogate measure for organ failure. A clinical diagnosis of sepsis is determined by the presence of a suspected infection that causes a sudden rise in the SOFA score by at least 2 points (Fernando et al., 2018).

2. Sepsis screening

SOFA requires laboratory results and procedures that are not readily available in emergency department settings. Moreover, to identify a change in the SOFA score, previous data must be obtained. Therefore, in non-intensive care unit settings, a clinical bedside score called the quick Sequential Organ Failure Assessment (qSOFA) was used to evaluate the probability of adverse outcomes in patients with suspected infections. The qSOFA consists of three elements: a respiratory rate of 22 breaths per minute, a systolic blood pressure of 100 mm Hg, and an altered mental state (as evidenced by a Glasgow Coma Scale score below 15). (González Del Castillo et al., 2017). If a patient has a qSOFA score of 2, it is important for doctors to conduct a more

thorough evaluation of organ dysfunction and to start or increase treatment accordingly. Furthermore, it should alert doctors to consider the potential presence of infection in patients who were not previously suspected of harboring one. Before it was released, the qSOFA did not undergo a comprehensive external validation procedure. Later, when used in real clinical environments, it was shown to have a lack of sensitivity. Approximately 13% to 50% of patients who passed away within 30 days after contracting an illness had a qSOFA score of 2 upon their first arrival at the emergency room. Studies that evaluated in-hospital mortality as a measure of outcome reported a sensitivity ranging from 37% to 70% (Goulden et al., 2018).

It is important to mention that the criteria included in the SOFA and qSOFA scores are indicators of the likelihood of death and are not intended to forecast the cause of the disease. The responsibility of determining whether a patient is infected still relies on the discernment of the attending physician. Other frequently used indicators of illness severity are the National Early Warning Score (NEWS) and the Modified Early Warning Score (MEWS) (Brink et al., 2019). In addition, there are comorbidity-based scoring systems that may be used to assess the severity of sepsis in the emergency department. These include the Mortality in Emergency Department Sepsis score (MEDS) and the Predisposition, Insult, Response and Organ Failure (PIRO) model (Quinten et al., 2018) are also frequently employed. Studies assessing severity ratings often quantify the sensitivity and specificity for unfavorable outcomes, such as mortality or transfer to the ICU, at different thresholds. None of these measures have shown superior performance in identifying patients at risk for unfavorable outcomes, and each has its own limitations. NEWS and MEWS demonstrate a greater ability to identify unfavorable outcomes compared to qSOFA, albeit this comes at the cost of reduced specificity. A SIRS score of 2 is very sensitive but lacks specificity in predicting mortality. The MEDS and PIRO ratings demonstrate greater sensitivity in forecasting adverse outcomes in comparison to MEWS and NEWS. The variation may be ascribed to the inclusion of age and comorbidities in these ratings, rather than only representing the severity of the condition. The MEDS and PIRO grading systems need assessments that cannot be performed directly at the patient's bedside. Quinten et al. (2018) proposed the integration of MEDS calculation into the ED software to provide warnings.

3. Automated triage systems

In modern times, healthcare establishments often use electronic health records as a means to gather and retain patient information. Based on this data, electronic health records may use their features to automatically compute illness severity ratings and notify personnel when certain thresholds indicating the onset or development of sepsis or septic shock are met. Sepsis alerts usually trigger a timely evaluation of the patient. A previous study conducted quasi-experimental research to evaluate automated sepsis alert systems that depended on current screening technologies in the emergency room (Austrian et al., 2018). Current research on the identification and management of sepsis patients in the emergency department indicates that employing various tactics may improve adherence to sepsis guidelines and lead to improved outcomes for these patients. These include automated triage and alert systems, bundles, sepsis teams, and clinical pathways. However, the wide range of literature on the study populations'

characteristics, definitions of sepsis, interventions, and outcome measures, combined with the lack of studies comparing interventions and the absence of randomized studies or interrupted time series, hinders us from drawing definitive conclusions or offering strong recommendations for their implementation. Due to the inclusion of several treatments in most research, it is difficult to determine with certainty whether specific measures are responsible for a possibly positive outcome. The impact of staff knowledge resulting from an intervention may provide challenges in distinguishing it from the advantages of adhering to guidelines, despite conflicting findings in recent research about the benefits of sepsis guideline adherence (Abe et al., 2019). The majority of studies lacked sufficient statistical power to determine significant impacts on mortality and used protocol adherence as the primary outcome measure. It is important to mention that the studies that focused only on patients with septic shock found the greatest impact on mortality. These patients are the ones who would be anticipated to gain the most from early and sufficient therapies (Sherwin et al., 2017).

4. Sepsis teams

Studies have shown that Rapid Response Teams (RRTs) that prioritize the quick identification and treatment of high-risk patients, such as those with trauma or shock, may reduce hospital mortality and the occurrence of cardiopulmonary arrests (Custo and Trapani, 2020). Sepsis teams are RRTs that focus on conducting standardized assessments, promptly identifying, and swiftly implementing appropriate treatment for patients with sepsis. According to Ju et al. (2018), there have been reports indicating that they enhance patient outcomes, particularly in ICU environments. However, due to the intricate nature of sepsis detection, notifying these teams promptly poses a challenge. Seven pre- and post-intervention studies assessed the impact of introducing a specialized sepsis team in the Emergency Department on patient outcomes and/or care (Delawder and Hulton, 2020).

Sepsis teams often enhance compliance with protocols, and presumably, as a result, improve patient outcomes. Due to the requirement for active alerts and particular procedures, it is most effective to include these teams inside a clinical route. The impact of the makeup of sepsis teams has not been researched, therefore preventing the ability to provide a suggestion on which experts should be included. An analysis of RTs indicated that the presence of a specialized team may have more significance than the specific makeup of the team itself (Levin and Constas, 2020). It is uncertain if a standard RRT would be enough if a suitable plan for sepsis treatment is implemented. Because there is a lack of accurate identification methods, clinicians in the emergency room mostly rely on clinical assessments to diagnose infections. The existing sepsis screening scores lack adequate sensitivity, specificity, or both. The SIRS criteria have low specificity for sepsis, whereas qSOFA is not sensitive enough to be used as a screening tool. MEWS and NEWS demonstrate somewhat better performance in comparison to qSOFA, however they still have significant limitations. It is important to mention that there is no established benchmark for sepsis. The effectiveness of these screening techniques is often assessed by looking at patient outcomes, namely fatality rates, as indirect indications. Presenting employees with an excessive number of vague signals has the danger of causing alert fatigue

(Harrison et al., 2016), as shown in research studies that reported no improvement in following protocols with the introduction of SIRS-based screening tools (Austrian et al., 2018).

5. Clinical pathways

Clinical pathways in sepsis aim to optimize outcomes by providing protocol-driven multidisciplinary guidance for the management of patients with confirmed or suspected sepsis. The establishment of a clinical pathway depends on the detection of sepsis and may be established either by using a disease severity score or via a clinical assessment performed by a healthcare professional. Rhodes et al. offered many techniques in the 2017 Surviving Sepsis Campaign (SSC), including the 3-hour and 6-hour sepsis bundle, as documented in the literature. These pathways provide guidance on diagnostic and therapeutic techniques within certain time periods of 3 and 6 hours, respectively. The implementation and adherence to these two protocols were shown to be correlated with a reduced death rate in patients with sepsis (Grek et al., 2017). In 2018, the SSC implemented a change by replacing them with a solitary 'hour-1 bundle,' with the sole purpose of initiating resuscitation and prompt treatment (Levy et al., 2018). Nevertheless, this bundle lacks widespread acceptance since some medical organizations have raised concerns over the impact of implementing its recommendations and the little amount of data behind them (Freund et al., 2019).

Burrell et al. (2016) have found that making changes to these bundles may enhance sepsis therapy. The treatment approach developed by McDonald et al. (2018) was assessed by pre- and post-implementation studies. Different research strategies were used, such as identifying patients using International Classification of Diseases, 9th or 10th Revision, discharge codes, and then conducting a prospective assessment following adoption. Additional designs used included a prospective interventional cohort design or completely retrospective before-and-after trials. Most of the study has focused on tracking the changes in adherence to bundle components and/or mortality rates. The pathways included many combinations of sepsis management technology, including as scoring and alarm systems, management guidelines, treatment procedures, and sepsis teams. Executed several pragmatic elements of the SSC recommendations. As expected, the implementation of clinical pathways led to an increase in adherence to protocols, bundles, and/or particular components of these routes in all studies that evaluated compliance. Nevertheless, significant variations across the trials were noted, with a range of 8.9e60.2%. Additionally, adherence to the protocol might potentially be relatively poor. McDonald et al. reported a significant rise in total package compliance, increasing from a mere 3.5% to 12.4%. Additional research conducted a comparison of death rates within 28 days or during hospitalization, both before and after the introduction of the therapeutic approach. The studies revealed a significant reduction in death, with rates ranging from 11.5% to 49.4%. Additionally, three studies reported a decrease in mortality without providing specific figures. Three further trials did not see any difference in mortality before and after a certain event or intervention. Furthermore, studies were carried out to demonstrate a reduction in mortality among patients diagnosed with severe sepsis (as per the Sepsis-2 criteria) or septic shock. The most significant drop was seen in studies that only focused on patients with septic shock (Hernández et al., 2019;

De Backer and Dorman, 2017). This phenomenon was either not seen or was detected to a much lesser extent in studies that selected participants based on the presence of two systemic inflammatory response syndrome (SIRS) criteria or just on suspected infection or sepsis (Afshar et al., 2019).

CONCLUSION

Overall, the majority of research suggested that implementing treatments leads to improved adherence to protocols and perhaps better outcomes. However, it is not feasible to determine which interventions are the most beneficial. It is important to ensure strict adherence to procedure and to address the issue of alert fatigue. Nevertheless, due to the seriousness and unfavorable result of sepsis, together with its frequent occurrence in emergency departments, it is crucial to establish a systematic and protocol-driven strategy for managing these patients in the ED. The selection of an appropriate intervention or combination of treatments for a certain hospital is contingent upon its infrastructure and available financial resources.
An emerging area of focus in sepsis treatments is the use of artificial intelligence and machine learning. These technologies will aid in the detection of patients who have sepsis or are at risk of developing it, as well as in the development of appropriate treatment regimens for the emergency department. In order to enhance the effectiveness of current treatment procedures, it is essential for research conducted in the emergency department to concentrate on expediting the identification of infections, developing novel approaches to maintain organ function during septic shock, and refining personalized care. Nevertheless, significant progress may be achieved by enhancing the study design of treatments that are now being implemented. In order to maximize their usefulness, future studies should employ a randomized design and compare various interventions. These studies should also incorporate both process and patient outcome parameters to accurately assess the effects of implementing these interventions. Additionally, it is important for these studies to have a long follow-up period to ensure adherence to the study protocol. Furthermore, they should also address potential negative consequences such as excessive use of antibiotics and the overdiagnosis of sepsis. Incorporating thorough cost-benefit evaluations is essential in the planning and assessment of such research, since the implementation and upkeep of these treatments require a significant commitment from healthcare professionals. Ultimately, treatments may only be considered effective if they demonstrate long-term viability and the ability to be expanded to other hospitals.

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