Machine-based algorithm: a revolution we need for early sepsis diagnosis in hospitals

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Madam, Sepsis is a life-threatening medical emergency and one of the fundamental causes of early mortality within hospitals. WHO report of 2020 shows that nearly 11 million people worldwide die from sepsis yearly[1]. It commonly affects neonates and children; however, pregnant women, the elderly, cancer patients, and bed-bound individuals are particularly at high risk of developing sepsis as well due to the immunosuppressant state of their condition. Sepsis is a clinical diagnosis; thus majorly depends upon a multitude of symptoms, clinical examinations, baseline investigations, and the expertise of the clinicians. Unfortunately, all these methods are highly non-specific, making the diagnosis difficult.

Owing to its high mortality, the key to survival lies in the timely initiation of the therapy. Therefore, sepsis requires early diagnosis to help save the life of an affected individual. In this search, multiple systems and methods have been developed previously and used in various hospitals. It includes evaluating by SIRS criteria, detecting the levels of pro-inflammatory markers in the serum, and by newer techniques like diagnosing using electrochemical sensors like PCT (procalcitonin), optical and fluorometric sensors, and microfluidic sensors. These detect different biomarkers in the serum of the patients and thus help in rapid diagnosis. Regardless, the sensitivity and specificity of these systems remain low.

Newer trials have now shifted their focus to Machine-based algorithms currently being developed to help clinicians screen for sepsis as early as possible. It includes Sequential Organ Failure Assessment (SOFA), quick SOFA (qSOFA), Modified Early Warning Score (MEWS), National Early Warning Score (NEWS), and Targeted Real-time Early Warning System (TREWS)[2]. To increase the precision and early detection, these Machine-Learned early warning systems are deployed in hospitals and have shown to be more efficient than the contemporary methods.

A recent multi-centre study by Adam et al showed the efficacy of the Targeted Real-time Early Warning System (TREWS)[3]. According to the trial, TREWS more accurately predicts which patient is more likely to develop sepsis. TREWS achieved a sensitivity and specificity score of 85%. Moreover, unlikely it uses data that has been put into the Electronic Health Record (EHR) without relying on the clinician's orders or notes to indicate suspicion of infection, in contrast to many other systems. Another machine-learned algorithm, MEWS, has a sensitivity score of 76%. In contrast, routine screening methods based on SIRS criteria and other biochemical markers have shown to have a sensitivity of 74%. Furthermore, in-hospital mortality prediction of these systems is found to be precise. A study found the predictions of TREWS, NEWS, MEWS, and REMS for in-hospital mortality to be 90%, 87%, 85%, and 84%, respectively[4]. Another algorithm, Artificial Intelligence Sepsis Expert (AISE), can even predict the onset of sepsis 4-12 hours before its clinical manifestation.

Employment of Machine-Based Algorithms is further linked with early initiation of treatment as well, as usage of TREWS can nearly shorten two hours on average, from the presentation of the patient to the first antibiotic administration within the hospital, in comparison to the routine methods. Furthermore, it is linked with shorter stay-time within ICU.

TREWS and MEWS are also applicable and beneficial in the setting of the COVID-19 crisis, as they predict early mortality among COVID-19 patients, having a sensitivity of 63.2% and 77.2%, respectively. They further help in assessing the prognosis of the disease initially in the emergency departments[5].

Despite all the aforementioned benefits, every newer technology comes at a price. Although Machine-Based Learning in Sepsis is getting its due recognition with time, there are a few related setbacks. The functioning, as well as a result interpreting capability of the Machine-based algorithms, is unique and advanced as compared to the

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contemporary methods; therefore, it can get difficult to understand by clinicians who do not have any prior training and experience with the system. Moreover, there are variations in the available data of every patient; thereby, multiple categories within the input data need to be designed to diagnose sepsis in each patient accordingly. However, these issues can be addressed by organizing professional training within the hospitals to effectively equip doctors with the expertise to handle this newer technology. Awareness among the Health care professionals should be aware about the algorithms so that better outputs can be achieved.

Sepsis is one of the conditions that require urgent treatment. Proper diagnostics must be built within the hospitals for critically ill patients. Instead of relying solely on conventional methods, Machines-based algorithms must be employed for timely treatment. Timely diagnosis aids in timely treatment commencement. The early interventions are important in preventing mortality, improving survival rates, and showing fast recovery among the affected patients. Hence, the use of more sensitive and specific equipment is necessary.

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