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Recent advances in biosensors for diagnosis and detection of sepsis: A comprehensive overview

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The condition of dysregulated immune response causing a lethal organ dysfunction as a result of infection is known as sepsis. The hyperactivation of macrophages, neutrophils and monocytes following the release of cytokines is the primary mechanism of this. As pathogen infection is the primary cause for the raised sepsis mortality rate, early diagnosis of the same is required utmost. The conventional methods of diagnosis comprise blood cultures, molecular diagnostic methods, PCR-based methods, mass spectrometry, hybridization and microarray but these methods have some limitations, such as multi-step analysis, uneconomical time-consuming, etc. Hence, the development of highly sensitive biosensors detecting very low concentrated multiple sepsis biomarkers provides a friendly hand in sepsis diagnosis. Biomarkers are the biomolecules that are the indicators of pathological or physiological processes. Some of the sepsis prognostic biomarkers include procalcitonin (PCT), C-reactive protein (CRP), neutrophil surface receptor expression (CD64), interleukin-6 (IL-6), tumour necrosis factor-alpha (TNF-α) and high-mobility group box-1 protein (HMGB-1). Among these, CRP and PCT are used clinically in a wide range; proteins, such as HMGB-1 and CD64 and cytokines, such as IL-6 and TNF-α are applied in molecular techniques. A biosensor is an analytical device that converts biological reactions into electrical signals in proportion to the analyte concentration. The elements of these include a target compound (sample and sepsis marker), recognition element (antibodies), signal transducers (nanoparticles) and display for diagnosis. Electrochemical sensors, optical biosensors, immunosensors and microfluidic-based lab-on-chip biosensors are developed for high sensitive sepsis detection making them an essential device in sepsis diagnosis and management.

Keywords: Sepsis, Organ dysfunction, Dysregulated immune response, Biomarkers, Biosensors

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