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Advanced biomarkers: enhancing neurological prognosis in out-of-hospital cardiac arrest

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[Letter to the Editor]

ADVANCED BIOMARKERS: ENHANCING NEUROLOGICAL PROGNOSIS IN OUT-OF-HOSPITAL CARDIAC ARREST

[Short title: Biomarkers in OHCA]

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To the Editor,

In recent years, there has been a significant focus on using biomarkers to predict neurological outcomes in patients who suffer from out-of-hospital cardiac arrest (OHCA) [1, 2]. Biomarkers can provide valuable information about the severity of brain damage and the expected neurological recovery of patients after cardiac arrest. This information can help guide medical decision-making and enhance patient outcomes.

Glial fibrillary acid protein (GFAP) is a significant biomarker that is extensively researched in this particular setting. Research has repeatedly linked increased concentrations of GFAP to unfavourable neurological outcomes in patients who have experienced OHCA. After a brain injury, astrocytes in the central nervous system secrete GFAP into the bloodstream. Research has shown that patients with unfavourable results have notably elevated levels of GFAP compared to those with favourable outcomes — GFAP biomarker had an area under the receiver operating characteristic curve (AUC) of 0.86 12 hours after admission. This means that it was very good at predicting negative neurological outcomes [3].

Neuron-specific enolase (NSE) is a significant biomarker. People commonly use NSE levels to evaluate neuronal injury. Researchers have linked higher levels of NSE in the blood to poor neurological outcomes [4]. This makes them useful markers for determining the early prognosis of people who have had an OHCA. According to a study, the AUC for predicting negative outcomes using NSE was consistently higher than 0.85 at different periods following cardiac arrest, obtaining the maximum predictive value 24 hours after the return of spontaneous circulation (ROSC) [5, 6].

S100B, a calcium-binding protein predominantly located in astrocytes, serves as an additional biomarker for forecasting neurological outcomes. Increased S100B levels are indicative of damage to astroglial cells and disruption of the blood-brain barrier. Researchers have found that testing S100B in the first 24 to 48 hours after an OHCA significantly improves its ability to predict adverse neurological outcomes. The authors observed the maximum AUC for S100B 24 hours after the ROSC, with a sensitivity of 79.0% and a specificity of 93.3% [7].

Researchers have also investigated the utilization of tau protein and neurofilament light chain (NFL) as biomarkers. Microtubules connect to the protein known as tau. An increase in its levels indicates damage to the axons and degeneration of nerve cells. The injury

of neurons releases the protein NFL, a fundamental part of neurons, into both the cerebrospinal fluid and blood. Both tau and NFL have demonstrated the potential to predict neurological consequences. Research suggests that these markers possess substantial predictive efficacy, especially when assessed 48 to 72 hours after the arrest. For example, the levels of tau showed an AUC of 0.906 at 72 hours, indicating its strong predictive powers for prognosis [8].

It is recommended to incorporate diverse biomarkers into prediction models to improve neurological prognosis accuracy. GFAP, NSE, S100B, Tau, and NFL can all be used together to get a full picture of brain damage, including damage to neurons and astrocytes. Multiple marker techniques have demonstrated enhanced predictive accuracy for neurological outcomes in comparison to single biomarkers [9].

Furthermore, advancements in artificial intelligence and machine learning have enabled the creation of intricate predictive models that integrate clinical factors and biomarker data. These models possess the capability to examine intricate datasets in order to detect patterns and forecast events with a high degree of accuracy. An artificial neural network method was created to predict the neurological outcomes of OHCA patients after six months. This system showed enhanced predictive performance by using biomarkers such as NSE, S100B, GFAP, tau, neutrophil gelatinase-associated lipocalin (NGAL), and NFL, in addition to clinical data [9, 10].

Overall, biomarkers are essential for forecasting neurological outcomes in patients who have experienced OHCA. GFAP, NGAL, NSE, S100B, tau, and NFL are well-researched biomarkers that offer useful insights into various facets of brain injury. Utilizing machine learning techniques, the incorporation of various biomarkers into predictive models has the potential to greatly increase the accuracy of neurological prognostication and guide clinical decision-making in order to enhance patient outcomes after OHCA.

Article information and declarations

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Author contributions

The authors contributed equally to the preparation of the manuscript.

Conflict of interest

All authors declare no conflict of interest.

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