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HYPERACUTE BLOOD-BASED PROTEOMIC AND MACHINE LEARNING SIGNATURES FOR STROKE SUBTYPE DIFFERENTIATION: A TRANSLATIONAL POINT-OF-CARE DIAGNOSTIC FRAMEWORK

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Background and aims: Quickly distinguishing between ischemic stroke, intracerebral hemorrhage, transient ischemic attack, and stroke mimics during the hyperacute phase remains a vital unmet need in stroke treatment. This issue is especially significant in settings where immediate neuroimaging is unavailable or delayed, hindering timely reperfusion and proper triage.

To validate blood-based protein biomarkers for early stroke subtype differentiation using targeted proteomics and machine learning, and to translate the most informative biomarkers into a rapid point-of-care diagnostic assay.

Methods: In this prospective, multi-center diagnostic study, patients presenting within 6 hours of symptom onset with suspected stroke (ischemic stroke, intracerebral hemorrhage), transient ischemic attack, or stroke mimics will be recruited. Serum samples will undergo multiple reaction monitoring–based targeted proteomics to quantify 22 candidate proteins identified in prior high-throughput discovery studies. Supervised machine learning models—including logistic regression, random forest, support vector machines, gradient boosting, and deep neural networks—will be trained to differentiate stroke subtypes and predict 90-day functional outcomes. Temporal profiling of top-performing biomarkers will be conducted in a predefined patient subset. The most informative biomarkers will undergo ELISA validation and be integrated into a gold nanoparticle–based multiplex point-of-care biosensor designed for prehospital and emergency department deployment.

Results: We hypothesize that a multi-protein biomarker panel combined with machine learning will show high diagnostic accuracy for distinguishing ischemic stroke from hemorrhagic stroke, transient ischemic attack, and stroke mimics within 6 hours of onset. Currently, proteomics studies are underway and the prototype for the point-of-care biosensor device is being developed with several iterations underway.

Conflict of interest: Manabesh Nath: nothing to disclose, Deepti Vibha: nothing to disclose

Figure 1 - belongs to Methods

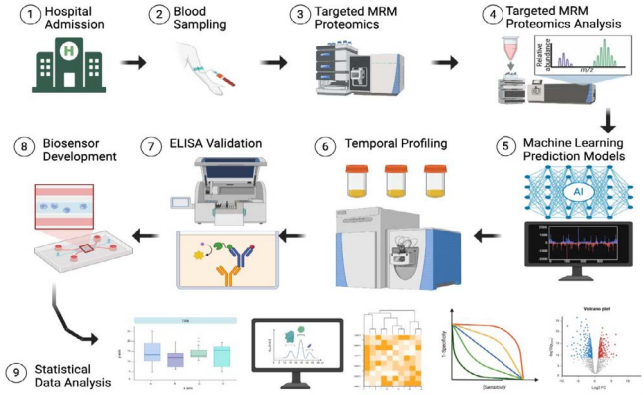

Figure 2 - belongs to Results