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BLOOD-BASED MICRORNA PROFILES ENABLE EARLY DISCRIMINATION BETWEEN ISCHEMIC AND HEMORRHAGIC STROKE: EVIDENCE FROM INTEGRATED SEQUENCING AND QPCR VALIDATION

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Background and aims: Timely differentiation between acute ischemic stroke and intracerebral hemorrhage is essential for safe treatment. However, neuroimaging may delay care in resource-limited settings. Circulating microRNAs (miRNAs) are stable and linked to cerebrovascular injury, making them promising diagnostic markers.

Methods: Adults presenting within six hours of stroke onset were enrolled before neuroimaging, with STARD guidelines as reference. The diagnosis was confirmed with standard imaging. Blood samples were collected at presentation and analyzed via next-generation sequencing to identify miRNA, then validated by qRT-PCR. Participants included patients with acute ischemic stroke (n=15), intracerebral hemorrhage (n=15), and healthy controls (n=30). miRNA cycle thresholds were normalized. Diagnostic performance was evaluated using nonparametric analysis, ROC curves, PCA, and machine-learning classifiers. Pathway enrichment supported biological plausibility.

Results: Distinct circulating miRNA expression patterns were observed across stroke subtypes and controls. miR-21 and miR-146a exhibited significant downregulation, while miR-155 showed elevated expression in stroke cohorts relative to healthy individuals. Diagnostic performance analyses demonstrated robust discriminatory capacity, with miR-21 achieving the highest classification accuracy (AUC = 0.80). PCA revealed clear separation between ischemic, hemorrhagic, and control groups. Among machine-learning approaches, Random Forest models achieved superior predictive performance, particularly in differentiating intracerebral hemorrhage from controls (AUC = 0.79). Pathway analyses linked these miRNAs to inflammatory signaling, immune modulation, and cell survival mechanisms relevant to acute cerebrovascular injury.

Conclusions: Circulating miRNA signatures enable early discrimination between ischemic and hemorrhagic stroke before imaging confirmation. These findings support further validation of miRNA-based assays as adjunctive diagnostic tools to accelerate stroke triage and precision care.

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Figure 1 - belongs to Results

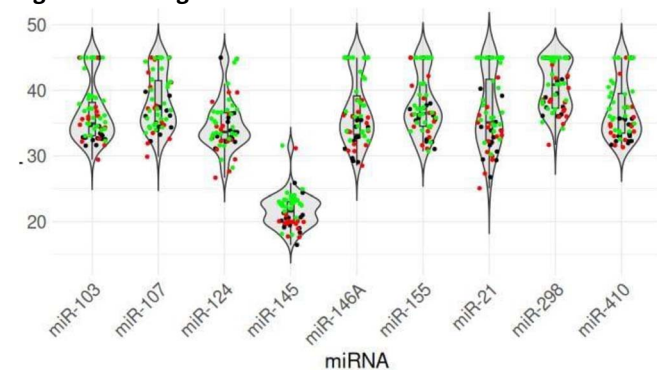


Figure 2 - belongs to Conclusions

