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BIOMARKERS AND GENETICS IN PERSONALIZING REHABILITATION

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Genetics and biomarkers are emerging as key tools in precision rehabilitation, enabling more accurate prediction of recovery and individualized therapeutic planning. Genetic factors such as polymorphisms in BDNF, ApoE, and genes related to dopaminergic and serotonergic systems significantly influence neuroplasticity, cognitive reserve, and functional outcomes after neurological injuries like stroke and traumatic brain injury. For example, the BDNF Val66Met variant is associated with reduced neural plasticity and poorer recovery, while the ApoE4 allele correlates with worse prognosis in brain injury. Biomarkers, including molecular, physiological, and neuroimaging indicators, provide measurable insights into disease mechanisms, treatment response, and prognosis. Proteins such as S100β, genetic/epigenetic markers, functional neuroimaging, and electrophysiological measures allow for patient stratification, early prognosis, dynamic monitoring, and real-time treatment adjustments. By integrating genetic insights with biomarker analysis, rehabilitation medicine can move from generalized protocols toward tailored, patient-centered interventions, improving efficiency, adherence, and long-term outcomes. Despite challenges such as high costs, limited standardization, and ethical concerns, combining genetics and biomarkers with digital health and artificial intelligence holds strong potential to transform rehabilitation into a fully personalized model of care.

Keywords: biomarkers, genetcis, precision rehabilitation, prognosis