

Cognitive impairment: Diagnosis, risk, management.

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Introduction

The landscape of cognitive impairment diagnosis and management is evolving, with significant research dedicated to identifying early markers and effective interventions. Neurofilament light chain (NfL) has emerged as a promising biomarker for early diagnosis and prognosis of various cognitive impairments, including Alzheimer's disease and mild cognitive impairment (MCI). Elevated NfL levels in cerebrospinal fluid and plasma are indicative of neuronal damage and correlate with cognitive decline severity, suggesting its utility in non-invasive monitoring [1].

Similarly, a comprehensive review of biomarkers for MCI emphasizes the critical role of cerebrospinal fluid, blood, and neuroimaging markers in differentiating MCI from normal aging and early Alzheimer's disease, advocating for a multimodal diagnostic approach to enhance accuracy and predict dementia progression [4].

Understanding the underlying mechanisms and risk factors is crucial for prevention. Several key risk factors contribute to cognitive impairment in older adults, such as hypertension, diabetes, obesity, smoking, and insufficient physical activity. Identifying and managing these modifiable factors early on is vital for preventing or delaying cognitive decline, underscoring the need for targeted public health interventions [3]. Vascular cognitive impairment (VCI), particularly microvascular disease, involves complex pathological processes like chronic cerebral hypoperfusion, blood-brain barrier dysfunction, and neuroinflammation. Research into these mechanisms offers insights into potential therapeutic targets for VCI prevention and treatment [7]. Furthermore, subjective cognitive decline (SCD) is recognized as a crucial early indicator, with individuals reporting SCD facing an increased risk of progressing to MCI and dementia, highlighting its importance for clinical attention and early intervention strategies [8]. The intricate relationship between sleep disturbances and cognitive impairment also reveals that poor sleep quality, insomnia, and sleep-disordered breathing are significantly associated with increased risk and severity of cognitive decline. This emphasizes the critical role of adequate sleep in maintaining cognitive health and suggests potential benefits from interventions addressing sleep problems [10]. A more recent concern, long COVID, has also been linked to persistent cognitive impairment, or 'brain fog.' A significant number of individuals recovering from COVID-

19 experience lasting difficulties with memory, attention, and executive functions, necessitating comprehensive post-COVID care and further investigation into the underlying causes [5].

In response to the growing challenge of cognitive decline, various interventions are being explored. Digital interventions, including mobile apps, virtual reality, and brain training programs, offer new avenues for addressing cognitive impairment. While these technologies show potential for supporting cognitive health, the need for more rigorous, long-term studies to assess their effectiveness and usability is evident [2]. Lifestyle interventions, encompassing diet, physical activity, cognitive training, and social engagement, also demonstrate a positive impact on cognitive function. A combination of these holistic approaches can mitigate cognitive decline, particularly in at-risk populations, emphasizing comprehensive brain health strategies [6]. Specifically, cognitive training interventions have proven efficacious for older adults with MCI, significantly improving domains like memory and executive function, positioning them as valuable non-pharmacological strategies to alleviate cognitive decline in vulnerable populations [9].

Conclusion

Recent research offers a comprehensive understanding of cognitive impairment, covering its diagnosis, risk factors, underlying mechanisms, and various intervention strategies. Biomarkers like neurofilament light chain (NfL) and multimodal approaches using cerebrospinal fluid, blood, and neuroimaging are proving vital for early and accurate diagnosis of conditions like Alzheimer's disease and Mild Cognitive Impairment (MCI) [1, 4]. Several modifiable risk factors in older adults, including hypertension, diabetes, obesity, smoking, and lack of physical activity, are strongly linked to cognitive decline, emphasizing the importance of early management and public health interventions [3]. Intricate mechanisms, such as those in vascular cognitive impairment (VCI) involving microvascular disease, chronic cerebral hypoperfusion, and neuroinflammation, are being explored for potential therapeutic targets [7].

Subjective cognitive decline (SCD) is recognized as a crucial early indicator for dementia progression, warranting clinical attention [8].

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Moreover, sleep disturbances and long COVID ('brain fog') are identified as significant contributors to cognitive impairment, highlighting the need for specialized care and interventions in these areas [5, 10]. On the intervention front, digital tools, lifestyle changes encompassing diet, exercise, and social engagement, and specific cognitive training programs demonstrate efficacy in supporting cognitive health and mitigating decline, particularly in individuals with MCI [2, 6, 9]. This body of work underscores the multifaceted nature of cognitive impairment and the necessity for integrated approaches in its prevention, diagnosis, and management.

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