

Amygdala Volume and Psychological Outcomes in Patients

With Relapsing-Remitting Multiple Sclerosis Initiating Anti-CD20 Therapy

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INTRODUCTION

Cognitive impairment, fatigue, and mood disturbances are common in multiple sclerosis (MS), yet their structural correlates remain incompletely understood. Limbic structures, particularly the amygdala, may link neurodegeneration with emotional and cognitive outcomes.

OBJECTIVES

To identify brain atrophy patterns associated with cognitive performance, fatigue, mood, quality of life, and coping in patients with relapsing-remitting MS (RRMS) initiating anti-CD20 therapy.

METHODS

Patients with RRMS underwent prospective baseline assessment before anti-CD20 therapy. Measures included ARR, EDSS, MRI T2/Gd+ lesions (FreeSurfer), SDMT, PASAT, MoCA, BDI, MFIS, 9HPT, T25FW, and MusiQoL. MRI-clinical/cognitive associations were assessed using Spearman's ρ ($p < 0.05$).

CONCLUSION

Amygdala volume was associated with impaired coping and reduced quality of life in early RRMS, highlighting a key role of limbic structures. Cerebellar and subcortical volumes were linked to cognition and perceived disease impact. Associations were strongest for patient-reported outcomes, suggesting that neurodegeneration may be better captured by subjective than clinical measures.

RESULTS

32 patients were included (71.9% female; mean age 36.1 years). EDSS positively correlated with slower gait (T25FW; $p=0.0499$) and negatively with daily activity (MusiQoL ADL; $p=0.0001$). MRI data were available for 17 subjects. Amygdala volume negatively correlated with coping ability ($p=0.0049$) and quality of life ($p=0.0090$) (Figure 1). Higher MoCA scores positively correlated with cerebellar cortex ($p=0.0455$), putamen ($p=0.0167$), and corpus callosum ($p=0.0145$) (Figure 2). Cerebrospinal fluid volume positively correlated with PASAT errors ($p=0.0027$) (Figure 3). Longer 9HPT time positively correlated with subcortical gray matter atrophy ($p=0.0403$), hippocampal volume loss ($p=0.0432$), and white matter hypointensities ($p=0.0093$).

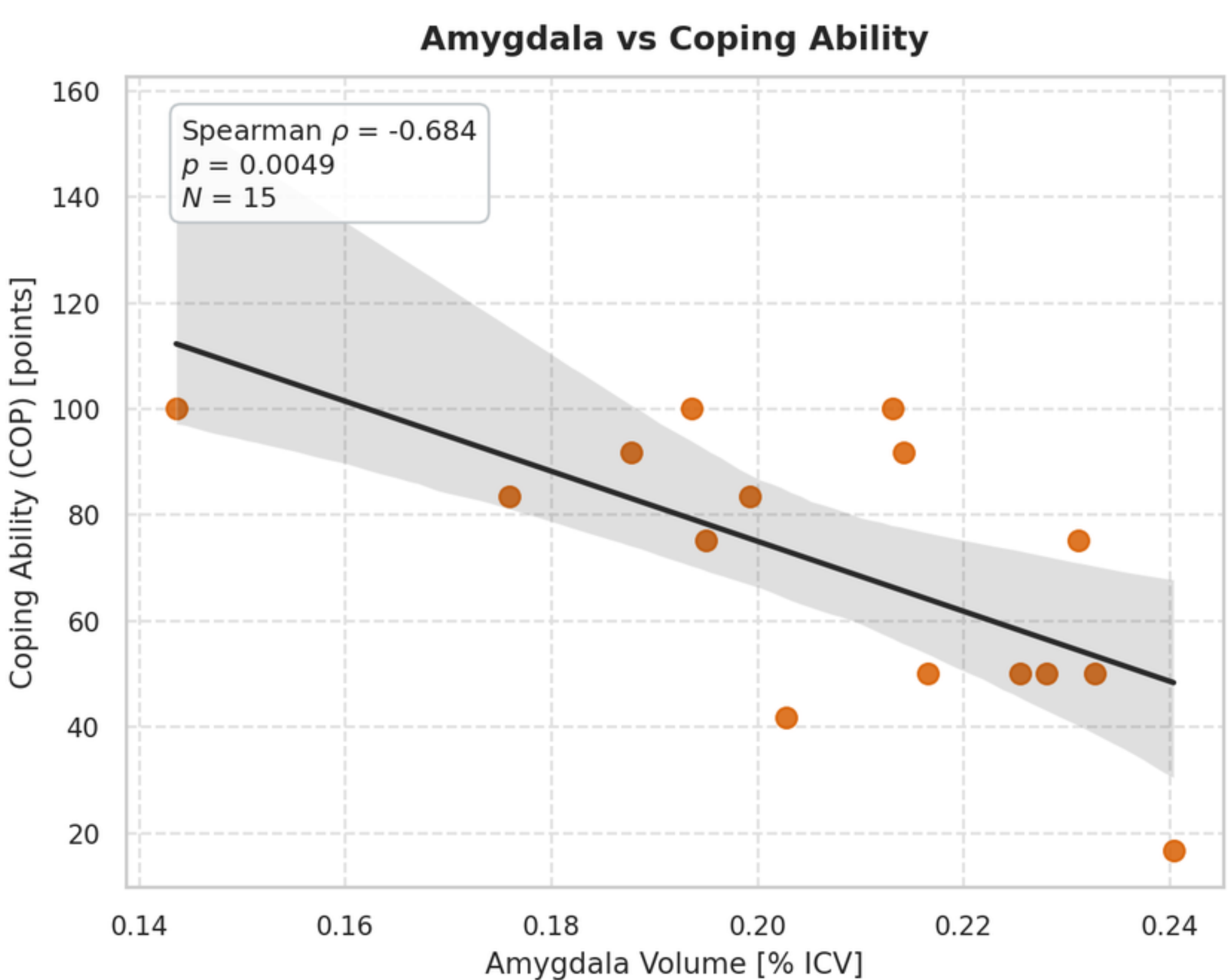
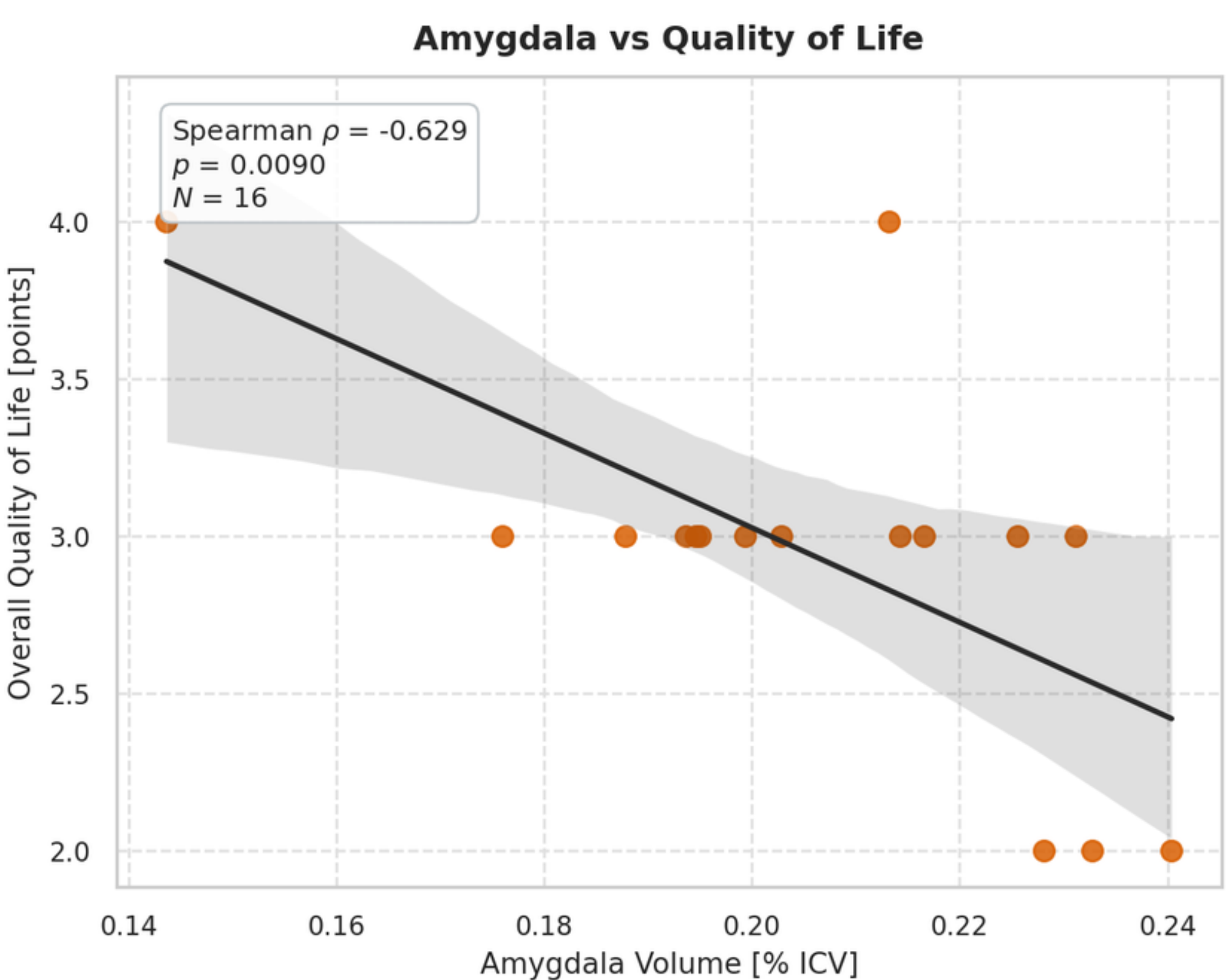
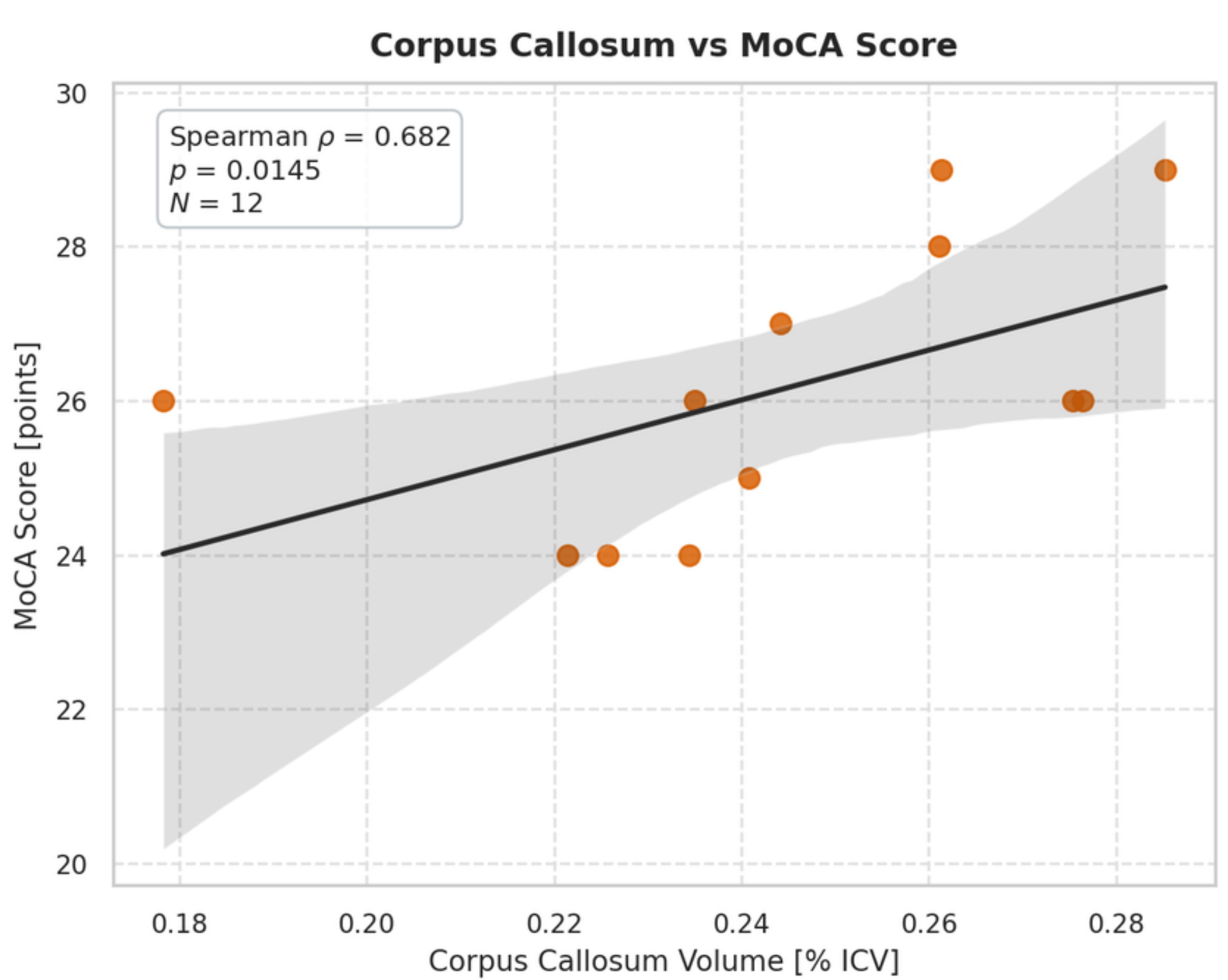
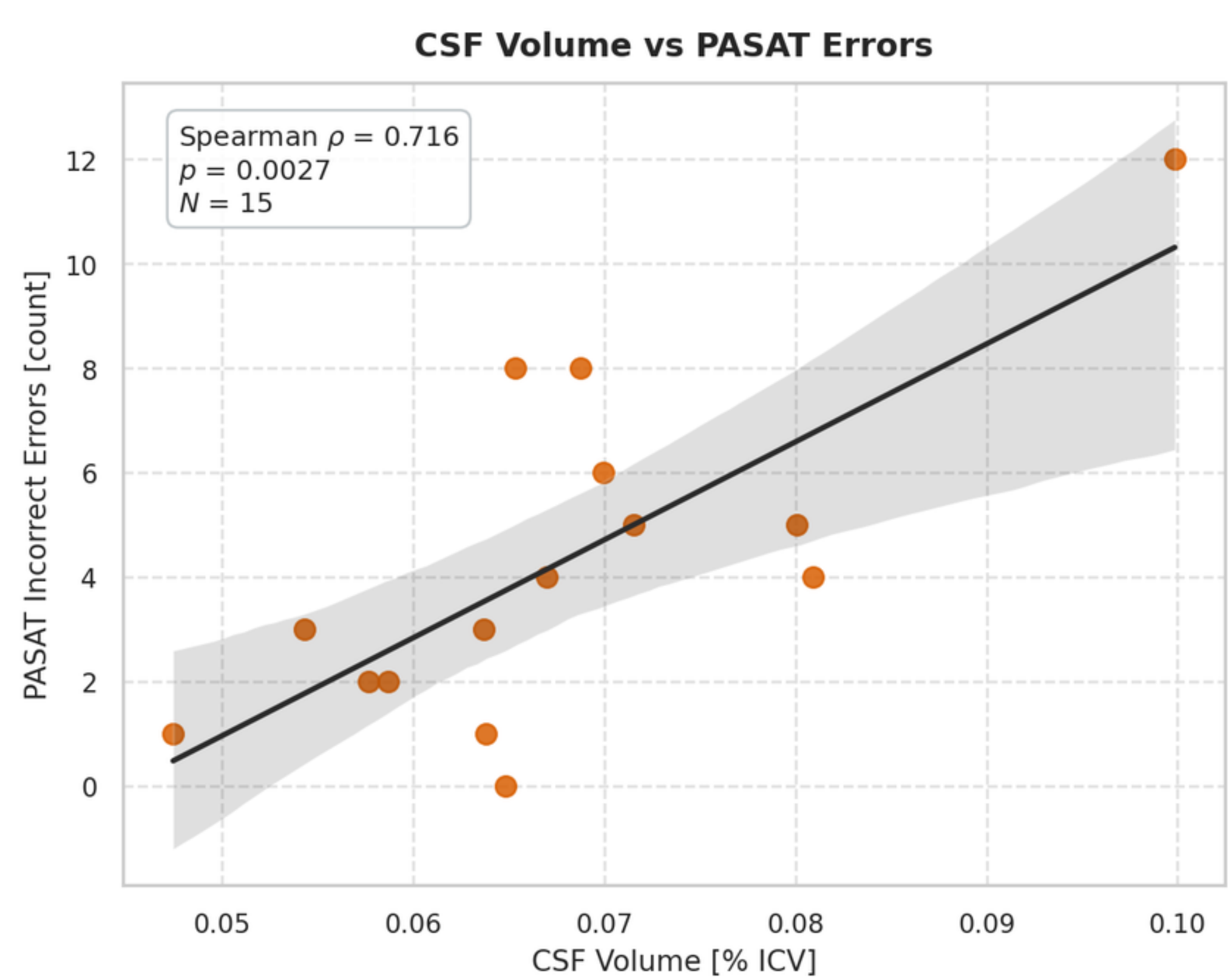


Figure 1. Associations between amygdala volume (% of intracranial volume [ICV]) and (A) coping ability (COP; $n = 15$; Spearman's $\rho = -0.684$, $p = 0.0049$) and (B) overall quality-of-life score ($n = 16$; Spearman's $\rho = -0.629$, $p = 0.0090$). Higher amygdala volume was associated with lower scores in both domains.

Figure 2. Correlation between corpus callosum volume (% of intracranial volume [ICV]) and Montreal Cognitive Assessment (MoCA) score ($n = 12$; Spearman's $\rho = 0.682$, $p = 0.0145$).

Figure 3. Correlation between cerebrospinal fluid (CSF) volume (% ICV) and the number of incorrect responses on the Paced Auditory Serial Addition Test (PASAT; $n = 15$; Spearman's $\rho = 0.716$, $p = 0.0027$).

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ABBREVIATIONS

9HPT, Nine-Hole Peg Test; anti-CD20, anti-cluster of differentiation 20; ARR, annualized relapse rate; BDI, Beck Depression Inventory; EDSS, Expanded Disability Status Scale; Gd+, gadolinium-enhancing; MFIS, Modified Fatigue Impact Scale; MRI, magnetic resonance imaging; MoCA, Montreal Cognitive Assessment; MusiQoL, Multiple Sclerosis International Quality of Life questionnaire; PASAT, Paced Auditory Serial Addition Test; RRMS, relapsing-remitting multiple sclerosis; SDMT, Symbol Digit Modalities Test; T25FW, Timed 25-Foot Walk.