Brain-Guided Hyperthermia in Amyotrophic Lateral Sclerosis: Functional and Biomarker Profile Following Brain-Guided Hyperthermia Treatment – A Case Report

Abstract

Background

Amyotrophic Lateral Sclerosis (ALS) is a progressive neurodegenerative disorder characterized by motor neuron loss leading to motor impairment, muscle atrophy, dysphagia, respiratory compromise, and functional decline. Despite therapeutic options, patients frequently experience progressive disability. Brain-Guided Hyperthermia (BgAH) is an emerging therapeutic approach designed to modulate brain thermodynamics and neuronal physiology.

Case Presentation

A 61-year-old female with ALS (Patient ID: 701) underwent treatment with Brain-Guided Hyperthermia at BTT Medical Institute (Sessions 4, 5, and 6 performed in April/May 2026). Objective neurological, neuromuscular, motor, cognitive, and laboratory assessments were performed to evaluate post-treatment outcomes.

Results

Objective functional improvements were documented across several domains. Notably, the patient demonstrated significant recovery of upper extremity motor control (including regaining left-hand pinch capability), increased left arm strength, improved swallowing efficiency, and enhanced cognitive processing speed. Laboratory evaluations demonstrated stable systemic cytokine profiles and inflammatory markers without evidence of hyperinflammation, while neurodegenerative biomarkers provided baseline tracking of disease activity.

Introduction

Amyotrophic Lateral Sclerosis (ALS) is a neurodegenerative condition that progressively affects motor control, upper and lower extremity strength, swallowing, speech, and functional independence. Current therapies aim to slow progression or manage symptoms. This report describes the objective clinical and biomarker profile of a 61-year-old female with ALS following sessions 4, 5, and 6 of Brain-Guided Hyperthermia treatment.

Patient Information

- **Age:** 61 years
- **Sex:** Female
- **Diagnosis:** Amyotrophic Lateral Sclerosis (ALS)
- **ALSFRS-R Score:** 23 / 40

Major Baseline Symptoms & Pre-treatment Status

- Upper limb weakness and impaired motor control
- Inability to perform left-hand pinch maneuver
- Impaired swallowing and prolonged swallow duration
- Difficulty with bed mobility (turning in bed)
- Reduced muscle strength and endurance

Intervention

- **Procedure:** Brain Thermodynamics-based Hyperthermia (BgAH)
- **Treatment Timeline:** Sessions 4, 5, and 6 completed in April/May 2026

Objective Clinical Improvements

1. Executive Function & Processing Speed

- **Trail Making Test (Part A):** $1\ \text{min}\ 27\ \text{sec} \rightarrow 1\ \text{min}\ 12\ \text{sec}$

Clinical Significance:

- Faster visuomotor coordination and visual search performance.
- Maintenance of cognitive processing efficiency.

2. Upper Limb Function & Fine Motor Control

- **Left Arm Curl (3 lb):** $42 \rightarrow 50$ repetitions
- **Left Arm Hold (1 lb):** $3\ \text{min}\ 57\ \text{sec} \rightarrow 5\ \text{min}\ 00\ \text{sec}$
- **Left Hand Pinch:** Unable at baseline $\rightarrow 0.6$ lbs (Functional recovery)
- **Left Hand Loaded Pinch (1 lb Hold):** $0\ \text{min}\ 10\ \text{sec} \rightarrow 0\ \text{min}\ 12\ \text{sec}$

Clinical Significance:

- Regained key fine motor control in the left hand (pinch capability restored).
- Increased local muscle endurance and capacity to manipulate small objects.

3. Bulbar Function & Swallowing

- **Anterior Tongue Strength (IOPI):** 34 → 37 kPa
- **Posterior Tongue Endurance (IOPI):** 0 min 04 sec → 0 min 06 sec
- **Swallow Test Speed:** Swallow task completed **75 seconds Faster**

Clinical Significance:

- Enhanced lingual strength and endurance.
- Substantially improved swallowing efficiency, aiding oral bolus transit and reducing aspiration risk.

4. Mobility & Bed Independence

- **Bed Mobility (Turning):** Reduced difficulty in executing lateral bed turns.

Laboratory Findings & Safety Profile

Laboratory Biomarkers

Category	Biomarker / Test	Result	Reference Interval	Status / Clinical Interpretation
Neurodegeneration & Muscle	**Neurofilament Light (NfL)**	**4.64 pg/mL**	¿3.86 pg/n	Slightly elevated; consistent with ongoing neuroaxonal activity.
	Creatine Kinase (CPK)	**410 U/L**	20 – 243 U	Elevated; reflects muscle denervation/turnover secondary to ALS.
Hematology	**Hemoglobin**	**10.3 g/dL**	11.7 – 15.5	Mild normocytic anemia.
	Hematocrit	**34.8%**	35.9 – 46.0	Below reference range.
Renal /	**Creatinin**	**0.43**	0.50 – 1.05	Mildly low;

Category	Biomarker / Test	Result	Reference Interval	Status / Clinical Interpretation
Metabolic	**e**	**mg/dL**		reflects decreased muscle mass.
	BUN / Creatinine Ratio	**35**	6−22 \(cal	Elevated.
Inflammatory / Coagulation	**D-Dimer**	**1.38 mcg/mL FEU**	¿0.50 mcg	Mildly elevated.
	hs-CRP	¿3.0 mg	¿8.0 mg/L	Normal (No acute systemic inflammation).
	ESR	**9 mm/h**	≤30 mm/h	Normal.
Cytokine Profile	**TNF-α, IL-1$ \beta$, IL-2, IL-6, IL-8, IL-10, IL-12, IL-17, IFN-γ**	**All within reference ranges**	Standard reference ranges	No systemic cytokine release or storm detected.
	Soluble IL-2 Receptor (sIL-2R)	**332.8 pg/mL**	175.3−858	Normal.

Safety Profile

- No evidence of acute systemic inflammatory reaction or cytokine activation.
- Systemic inflammatory markers (hs-CRP, ESR) and cytokine panel remained entirely within stable limits.

Discussion

In this 61-year-old patient with ALS, treatment with Brain-Guided Hyperthermia was accompanied by measurable functional gains. Most notably, the patient regained left-hand pinch strength—a functional capability previously absent—and improved swallowing speed by 75 seconds.

Biomarker assessments revealed elevated serum NfL (4.64 pg/mL) and CPK (410 U/L), expected findings in ALS that reflect underlying neuroaxonal stress and denervation-related muscle turnover. Importantly, normal acute-phase reactants (hs-CRP, ESR) and a unremarkably stable cytokine profile support the overall systemic safety of the intervention.

Conclusion

Brain-Guided Hyperthermia sessions were associated with motor, bulbar, and fine motor functional improvements in a 61-year-old patient with ALS, accompanied by a reassuring systemic safety profile. These findings encourage continued investigation into brain thermodynamics as an adjunct therapeutic approach in neurodegenerative conditions.

Key Evidence Summary

Domain	**Objective Evidence**
Fine Motor Control	Left hand pinch restored from 0 (incapable) to **0.6 lbs**.
Upper Limb Endurance	Left Arm Curl: 42 → 50 reps; Arm hold: 3:57 → 5:00 min.
Bulbar / Swallowing	Swallow task completed **75 seconds faster**; Anterior tongue strength: 34 → 37 kPa.
Cognition	Trail Making Test A: 1:27 → 1:12 min.
Laboratory	Inflammatory markers (hs-CRP, ESR) and full cytokine

Domain	Objective Evidence
Safety	panel remained within normal limits.
Disease Biomarkers	Baseline NfL (4.64 pg/mL) and CPK (410 U/L) documented for longitudinal monitoring.