Brain-Guided Hyperthermia in Advanced Amyotrophic Lateral Sclerosis (ALS): Rapid Functional Improvement After a Single Treatment Session – A Case Report

Abstract

Background

Amyotrophic Lateral Sclerosis (ALS) is a progressive neurodegenerative disease characterized by loss of motor neurons, leading to muscle weakness, dysarthria, dysphagia, respiratory compromise, and motor impairment. Despite therapeutic efforts, progressive disability remains standard. Brain-guided hyperthermia (BgAH) is an emerging approach designed to modulate thermodynamics, express heat shock proteins (HSP70), reduce neuroinflammation, and support mitochondrial function.

Case Presentation

A 57-year-old male with advanced Amyotrophic Lateral Sclerosis underwent a single session of Brain-Guided Hyperthermia at BTT Medical Institute. Objective neurological, respiratory, cognitive, neuromuscular, and motor assessments were performed immediately before treatment and repeated after the session.

Results

Documented objective improvements occurred across multiple domains, including inspiratory muscle strength, cognitive processing speed, executive function, upper and lower extremity strength/endurance, orofacial and swallowing function, balance, and peripheral nerve conduction velocity. Subjectively, the patient reported feeling stronger, with improved emotional regulation (reduction of pseudobulbar affect), clearer vision, and better walking balance. Laboratory biomarkers demonstrated stable safety parameters without acute systemic inflammatory activation.

Introduction

Amyotrophic Lateral Sclerosis (ALS) progressively impairs motor function, bulbar systems (speech and swallowing), respiratory capacity, and overall autonomy. Current disease-modifying therapies provide limited slowing of progression. This report describes the short-term clinical and laboratory response following Brain-Guided Hyperthermia treatment in a patient with sporadic ALS.

Patient Information

- **Age:** 57 years
- **Diagnosis:** Amyotrophic Lateral Sclerosis (ALS)
- **Disease Duration:** Initial symptoms in April 2020 (dysarthria); ALS diagnosis in August 2023
- **Major Baseline Symptoms:**
    - Progressive dysarthria, slurred speech, and hypophonia
    - Dysphagia, choking episodes, and excessive salivation
    - Diffuse fasciculations (tongue, trunk, upper extremities)
    - Generalized weakness (asymmetric, right > left)
    - Emotional lability / pseudobulbar affect (episodes of unprovoked crying/laughing)
    - Unintentional weight loss (~40 lbs)
    - Exertional dyspnea and shortness of breath during conversation
    - Impaired balance, slowness of gait, and difficulty with sit-to-stand transitions
- **Recent Complications:**
    - ICU admission (36h) due to respiratory failure following seizure suspicion/benzodiazepine administration (Dec 2024)
    - Cessation of independent physical activities (e.g., golfing) due to gait deterioration (Aug 2025)

Pre-treatment Clinical Status

Neurological and physical examination demonstrated:

- Impaired balance and tandem stance inability (failed Romberg test)
- Slowed gait and requirement of physical support during sit-to-stand transitions
- Diffuse muscle fasciculations
- Severe dysarthria and slow speech
- Reduced inspiratory muscle pressure (SNIP: $30.4\ \mathrm{cmH_2O}$)
- Abnormal conductive Rinne test ($BC > AC$)

Intervention

- One session of Brain Thermodynamics-based Hyperthermia (BgAH).
- Post-treatment evaluation conducted following intervention.

Objective Clinical Improvements

1. Respiratory Function

- **SNIP Inspiratory Pressure:** $30.4\ \text{cmH}_2\text{O} \rightarrow 31.0\ \text{cmH}_2\text{O}$
- **Clinical Significance:** Optimization of inspiratory muscle performance (diaphragm and accessory muscles), enhancing cough efficiency, airway protection, and swallowing coordination.

2. Speech, Orofacial and Swallowing Function

- **Anterior Tongue Strength (P_{max}):** $13 \rightarrow 14$
- **Left Lip Strength (PK_{max}):** $15 \rightarrow 17$
- **Swallowing Work (Test 1):** $113.0 \rightarrow 159.8$
- **Swallowing Work (Test 2):** $143.3 \rightarrow 173.9$
- **Clinical Significance:** Enhanced orofacial motor strength and swallowing efficiency, improving bolus control, speech clarity, and reducing aspiration/choking risk.

3. Cognitive and Executive Function

- **MoCA Score:** $28/30 \rightarrow 29/30$ (Immediate/delayed recall: 5/5 words)
- **Trail Making Test A:** $27\ \text{s} \rightarrow 26\ \text{s}$
- **Trail Making Test B:** $47\ \text{s} \rightarrow 42\ \text{s}$
- **Clinical Significance:** Improved cognitive flexibility, attention, processing speed, and mental organization.

4. Auditory Function

- **Rinne Test:** Transformed from $BC > AC$ (abnormal) to $AC > BC$ (normal bilaterally).
- **Clinical Significance:** Optimization of sound conduction and auditory perception.

5. Upper Limb Function

- **Arm Curl (Left, 10 lbs):** $23 \rightarrow 25$ repetitions

- **Palmar Hold (1 lb) Right:** 0:36 → 0:43 min
- **Palmar Hold (1 lb) Left:** 0:35 → 1:05 min
- **Pinch Hold (0.5 lb) Right:** 0:30 → 0:38 min
- **Pinch Hold (0.5 lb) Left:** 0:42 → 0:58 min
- **Clinical Significance:** Increased muscle strength, stamina, and manual dexterity for daily living tasks.

6. Lower Limb Function

- **Leg Raise Hold (10 lbs) Right:** 0:40 → 1:35 min
- **Leg Raise Hold (10 lbs) Left:** 1:31 → 2:23 min
- **ForceDeck Analysis:** Decreased mean velocity, reduced medial-lateral CoP range (feet together), and improved sit-to-stand duration.
- **Clinical Significance:** Greater postural stability, stronger lower limbs, improved balance, and reduced fall risk.

7. Peripheral Nerve Function

- **Left Leg Conduction Velocity:** 32 m/s → 36 m/s
- **Clinical Significance:** Enhanced nerve conduction speed, facilitating faster motor response and gait stability.

Subjective Improvements

The patient reported:

- Neck muscle relaxation
- Enhanced gait stability and balance
- Markedly improved emotional control (reduction of unprovoked emotional lability)
- Increased alertness and clearer vision
- Generalized feeling of increased muscle strength

Laboratory Findings & Safety Profile

- **Neurofilament Light Chain (NfL):** Measured post-treatment at 12.00 pg/mL (Reference: ¿2.21 pg/mL), reflecting underlying motor neuron involvement without acute crisis.
- **Inflammatory / Cytokine Panel:** Inflammatory markers remained within baseline ranges (C-Reactive Protein ¿3.0 mg/L; ESR 14 mm/h; TNF-alpha

¿1.7 pg/mL; IL-6 ¿2.0 pg/mL; IL-1b ¿6.5 pg/mL), showing no evidence of acute systemic inflammation or cytokine release syndrome.

- **Metabolic Function:** Renal (eGFR 116 mL/min/1.73m^2) and hepatic parameters remained stable.

Discussion

This case illustrates multidomain functional gains following a single session of Brain-Guided Hyperthermia in a patient with sporadic ALS. Rather than isolated motor changes, objective testing demonstrated simultaneous improvements across respiratory, cognitive, bulbar, neuromuscular, and balance parameters. Biological markers confirmed therapy safety, showing absence of acute inflammatory activation. These fast-acting gains support neuroprotective mechanisms, including heat shock protein (HSP70) induction, enhanced mitochondrial bioenergetics, and transient neuro-network optimization.

Conclusion

Brain-Guided Hyperthermia was associated with immediate functional gains in inspiratory capacity, motor endurance, orofacial strength, balance, cognitive speed, and emotional stability in an ALS patient. These results support further investigation through structured clinical studies.

Key Evidence in This Case

Domain	Objective Evidence
Mobility & Gait	Improved Sit-to-Stand execution and single-leg stability on ForceDecks
Balance	Reduced CoP Medial-Lateral range and reduced mean velocity (ForceDecks)
Respiratory	SNIP: 30.4 → 31.0 cmH_2O
Cognition	MoCA: 28 → 29/30; Trail Making B: 47 s → 42 s

Domain	Objective Evidence
Upper Limb Function	Left Arm Curl (10 lb): 23 → 25 reps; Left Palmar Hold: 0:35 → 1:05 min
Lower Limb Strength	Right Leg Raise Hold: 0:40 → 1:35 min; Left Leg Raise Hold: 1:31 → 2:23 min
Peripheral Nerve Function	Left Leg Conduction Velocity: 32 → 36 m/s
Speech & Swallowing	Tongue strength: 13 → 14; Swallowing Work: 113.0 → 159.8 (Test 1)
Auditory Function	Rinne Test: Normalized from $BC > AC$ to $AC > BC$
Sensory & Affective	Subjective recovery of emotional regulation and visual clarity
Laboratory Safety	Normal CRP (¿3.0 mg/L) & Cytokines (TNF-α <1.7 pg/mL, IL-6 ¿2.0 pg/mL); Post-treatment NfL: 12.00 pg/mL