Amino Acid Profile and Inflammatory Marker Changes in Medulla Oblongata Tumor Patients: Patterns and Response to Arginine Supplementation

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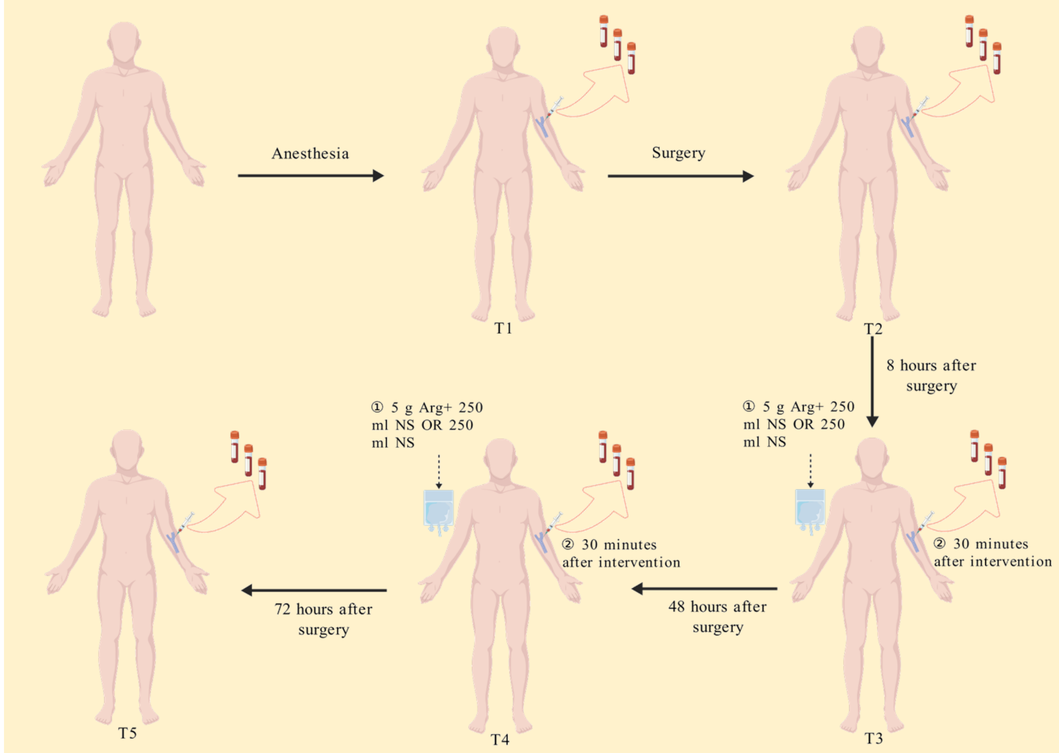

Figure 1. Schematic diagram of sample collection and arginine intervention.

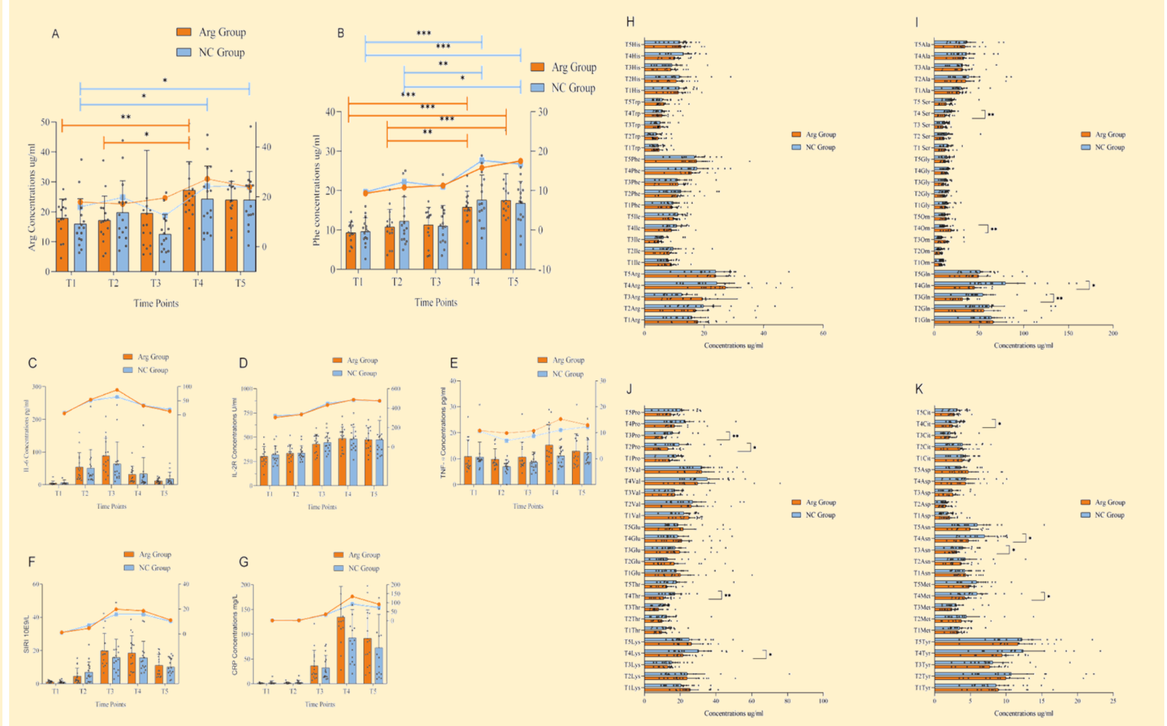

Figure 2. Temporal variations of 20 amino acid concentrations and inflammatory marker concentrations.

Introduction

Medulla oblongata tumor resection often triggers amino acid metabolic shifts and inflammatory activation[1,2]. This study characterized these dynamics over the 72-hour postoperative period and assessed the effect of exogenous arginine supplementation.

Methods and Materials

Study Population

- Total Cohort: 30 patients with medulla oblongata tumors
- Study Period: September 2023 – November 2024
- Randomization: 1:1 allocation to Arginine (Arg) or Normal Saline (NC) group

Specimen collection and detection

Blood samples were collected at five perioperative timepoints (T1: anesthesia induction; T2: surgery end; T3: 8h; T4: 48h; T5: 72h after surgery) (Figure 1). High-performance liquid chromatography-tandem mass spectrometry was utilized to detect 20 amino acid concentrations. Enzyme-linked immunosorbent assay (ELISA) kits were used to measure 3 cytokines (TNF-α, IL-6, IL2-R). C-reactive protein (CRP) and systemic inflammation response index (SIRI) in peripheral blood were also calculated. One-way repeated-measures ANOVA was used to compare concentrations at different perioperative time points.

Results

1. Amino Acid Dynamics

Biphasic Pattern: All patients showed initial decline → later recovery in amino acid levels postoperatively (Figure 2 H-K).

Arginine Group: Maintained stable arginine levels with no postoperative decline; T4 concentration was significantly higher than baseline (P = 0.009).

Control Group: Arginine showed a non-significant decrease at T3, followed by significant increases at T4 (P = 0.027) and T5 (P = 0.010) versus baseline (Figure 2 A).

2. Inflammatory Trajectories (Figure 2 C-G)

Consistent Pattern: TNF-α, IL-6, IL-2R, CRP, and SIRI all followed an early postoperative rise → subsequent decline in both groups.

No Group Differences: Inflammatory marker levels did not differ significantly between groups at any individual time point.

Cumulative Exposure: The Arg group showed higher area-under-curve (AUC) for inflammatory markers after intervention (post-T3) compared to controls.

3. Visual Summary

Metabolic Effect: Arginine supplementation prevents postoperative arginine depletion.

Inflammatory Effect: No attenuation of postoperative inflammatory response observed.

Discussion

1. Study Significance

First multi-timepoint profiling of amino acid & inflammation dynamics in medulla oblongata surgery.

Reveals interplay between metabolic fluctuations and inflammatory response postoperatively.

2. Rationale for arginine intervention

Arginine was selected for intervention based on its established immunomodulatory function through the arginase-NOS pathways[3,4], its neurotransmitter role in brainstem autonomic nuclei[5-7], and our prior clinical evidence linking its postoperative depletion to neurogenic pulmonary edema[8].

3. Unexpected Inflammatory Response

Arginine intervention in this study did not exhibit the anticipated anti-inflammatory effect, indicating that managing postoperative inflammation in medulla oblongata tumor patients may require multi-target strategies rather than sole arginine supplementation.

Conclusions

1. Metabolic Pattern: Peripheral amino acids show early decline → late recovery, while inflammatory markers exhibit early rise → subsequent decline after medulla oblongata tumor resection.

2. Intervention Effect: Arginine supplementation prevents postoperative arginine depletion but may prolong inflammatory exposure in the early recovery phase, though this trend did not reach statistical significance.

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