



# An Unusual Case of Alarming Lactic Acidosis: Brain Metabolic Cross-Talk

Sivakumar R.<sup>1</sup> Sumit Roy Chowdhury<sup>1</sup> Karma Ongmu Bhutia<sup>1</sup> Suman Sokhal<sup>1</sup>

<sup>1</sup> Department of Neuroanaesthesiology and Critical Care, All India Institute of Medical Sciences, New Delhi, India

Asian J Neurosurg

**Address for correspondence** Suman Sokhal, MD, DM, Department of Neuroanaesthesiology and Critical Care, All India Institute of Medical Sciences, New Delhi 110029, India (e-mail: sumansokhal82@gmail.com).

## Abstract

A 39-year-old male with a BMI of 30.8 kg/m<sup>2</sup> and a normal medical history underwent excision of a left orbito-cavernal hemangioma (4 × 2 × 2 cm) under general anesthesia. Balanced anesthesia and fluid management guided by pulse pressure variation (kept below 12%) were employed. Despite stable hemodynamics and normal blood sugar levels, arterial blood gas (ABG) analysis revealed a progressive rise in lactate levels, reaching 10.6 mmol/L, accompanied by acidemia. Systemic hypoperfusion was ruled out by maintaining mean arterial pressure between 70-80 mm Hg, ensuring a capillary refill time of less than 3 seconds, and confirming a central venous oxygen saturation of 72%. With a total blood loss of 800 mL, one unit of packed red blood cells was transfused due to concerns about decreased microcirculation and tissue hypoxia. After 10 hours of surgery, sodium bicarbonate (NaHCO<sub>3</sub>) was administered to mitigate metabolic acidosis and its potential impact on intracranial pressure. Postoperatively, lactate levels remained elevated (8-9 mmol/L), but with continued NaHCO<sub>3</sub> infusion, lactate reduced to 6.4 mmol/L, allowing extubation. The patient's lactate normalized by the evening, and recovery was uneventful. This case highlights the significant metabolic disturbances, particularly lactic acidosis, that can arise during brain tumor surgery due to prolonged operative times, large tumor size, higher BMI, and stress-induced metabolic derangements. Awareness and prompt management of these disturbances are crucial for successful patient outcomes.

## Keywords

- brain metabolic cross-talk
- brain tumors
- craniotomy
- hyperlactatemia
- lactic acidosis

A 39-year-old male, body mass index (BMI) 30.8 kg/m<sup>2</sup>, with normal medical history and examination was posted for excision of left orbito-cavernal hemangioma (4 × 2 × 2 cm) under general anesthesia. Balanced anesthesia technique was used and fluid management was guided by pulse pressure variation, to keep it below 12%. Baseline arterial blood gas

(ABG) analysis showed normal pH 7.36, lactate level 3 mmol/L (► **Table 1**).

Subsequent ABG revealed gradual elevation of lactate with acidemia despite stable hemodynamics and normal blood sugar levels. Lactates kept rising to 10.6 mmol/L (► **Table 1**). Systemic hypoperfusion was ruled out by maintaining mean arterial pressure within 70 to 80 mm Hg, repeatedly checking the capillary refill time (< 3 seconds), and central venous oxygen saturation of 72% (► **Fig. 1**). As the total blood loss was 800 mL, one unit of packed red blood cells was transfused in view of continuous increasing lactate

*The manuscript has been read and approved by all the authors, the requirements for authorship, as stated earlier in this document, have been met, and each author believes that the manuscript represents honest work.*

DOI <https://doi.org/10.1055/s-0044-1791999>.  
ISSN 2248-9614.

© 2024. Asian Congress of Neurological Surgeons. All rights reserved.

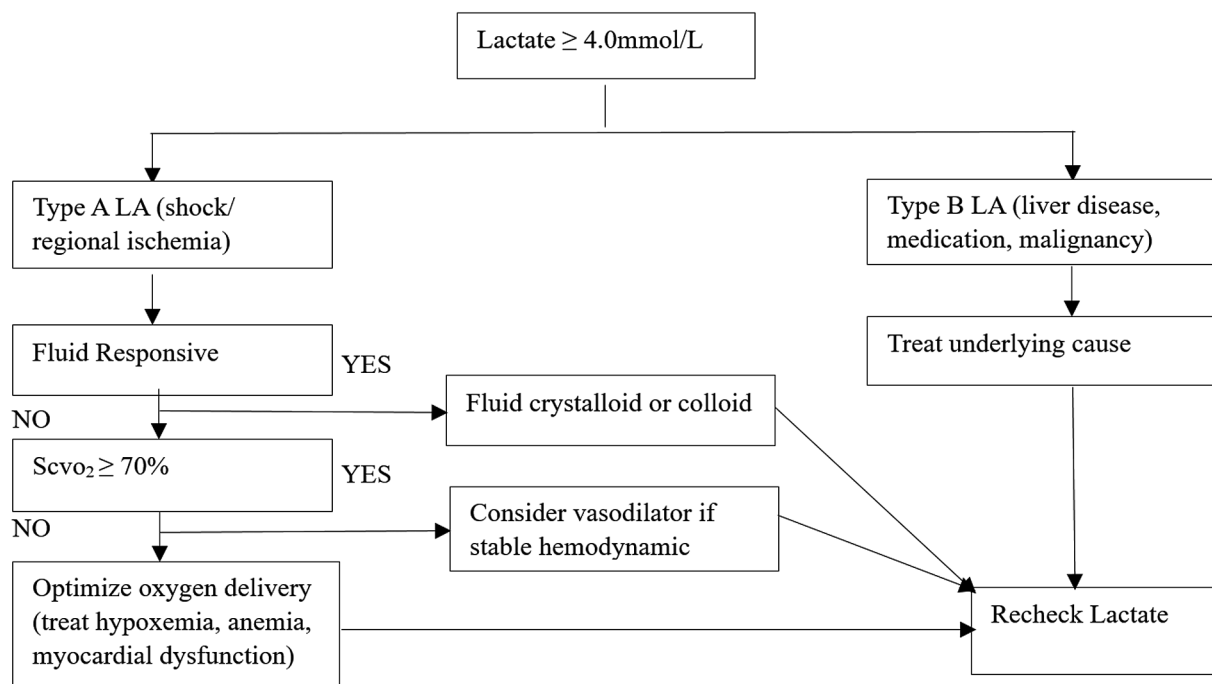
This is an open access article published by Thieme under the terms of the Creative Commons Attribution-NonDerivative-NonCommercial-License, permitting copying and reproduction so long as the original work is given appropriate credit. Contents may not be used for commercial purposes, or adapted, remixed, transformed or built upon. (<https://creativecommons.org/licenses/by-nc-nd/4.0/>)

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

**Table 1** Arterial blood gas values perioperative period

ABG	1 (baseline postinduction)	2 (after 4 hour of baseline)	3 (after 6 hour of baseline)	4 (postblood transfusion)	5 (post-NaHCO <sub>3</sub> in OT)	6 (in ICU)	7 (before extubation)	8 (after extubation)
pH	7.360	7.289	7.272	7.256	7.356	7.256	7.301	7.353
pCO <sub>2</sub>	41.8	40.5	35.6	33.0	29.9	39.3	38.8	36.2
pO <sub>2</sub>	131.6	103.2	169.5	160.7	106.0	117.5	120	118
HCO <sub>3</sub>	22	19.6	16.6	14.8	16.9	17.7	19.3	20.3
BE	-2	-6	-8.8	-10.7	-6.8	-8.3	-5.9	-4
Lactate	3.6	7.7	9.1	10.6	9.6	6.9	6.4	6.9
Na	138.6	138.4	139.4	141.7	143.3	142.9	140	139.6
K	3.61	3.98	5.21	5.52	5.06	3.30	5.12	3.82
Cl	108.4	107.6	107.9	107.7	107.5	111.9	110.7	108.5
Ca	1.19	1.14	1.07	1.19	1.07	0.99	1.09	1.08
Hb	11	15.2	11.2	12.7	12.3	12.3	13.3	12.3
Glucose	95	161	167	130	106	138	145	161

Abbreviations: ABG, arterial blood gas; BE, base excess; ICU, intensive care unit; OT, operation theatre.

**Fig. 1** Systemic approach for intraoperative management of hyperlactatemia. LA, lactic acidosis; Scvo<sub>2</sub>, central venous oxygen saturation.

and doubt of decreased microcirculation and tissue hypoxia; surgery concluded after 10 hours.

To avoid effect of metabolic acidosis on intracranial pressure, injection sodium bicarbonate (NaHCO<sub>3</sub>) 140 mEq was administered over 3 hours and the patient was shifted to the intensive care unit for mechanical ventilation. Postoperatively, ABG showed persistent elevation in lactate, 8 to 9 mmol/L, with acidemia (pH 7.20–7.25), for which NaHCO<sub>3</sub> was infused overnight. After gaining consciousness, trachea was extubated in the morning at lactate 6.4 mmol/L and pH

7.30. Lactate levels decreased to 3 mmol/L by evening. Further course of recovery was uneventful.

Brain tumors surgery can significantly deteriorate metabolic parameters. Prolonged surgery, large tumor, corticosteroids, diuretics, higher BMI, mannitol, and stress-induced lactic acidosis (LA) are pertinent to neurosurgery.<sup>1</sup> Tumors may itself produce lactate to acidify the periphery and promote invasion by Warburg effect.<sup>2,3</sup> We emphasize that even shocking LA may occur during brain tumor excision. Strict vigilance and judicious management is the key of

patient recovery, by always keeping in mind this brain metabolic-cross talk.

#### Authors' Contributions

All authors contributed to the study in several key areas. They participated in the literature search, data acquisition, and data analysis. Each author was actively involved in the preparation, editing, and review of the manuscript. Furthermore, all authors assume responsibility as guarantors, ensuring the accuracy and integrity of the work.

#### Conflict of Interest

None declared.

#### References

- 1 Lawton TO, Quinn A, Fletcher SJ. Perioperative metabolic acidosis: the Bradford Anaesthetic Department Acidosis Study. *J Intensive Care Soc* 2019;20(01):11–17
- 2 Romero-Garcia S, Moreno-Altamirano MM, Prado-Garcia H, Sánchez-García FJ. Lactate contribution to the tumor microenvironment: mechanisms, effects on immune cells and therapeutic relevance. *Front Immunol* 2016;7:52
- 3 Reuss AM, Groos D, Buchfelder M, Savaskan N. The acidic brain-glycolytic switch in the microenvironment of malignant glioma. *Int J Mol Sci* 2021;22(11):5518