

**Short Report**

# Intraoperative Hyperlactatemia during Facial Gender Affirmation Surgery

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## Introduction

Hyperlactatemia is defined as elevations in blood lactate >2 mmol above baseline without concurrent metabolic acidosis [1]. Prolonged hyperlactatemia can be an independent risk factor for worse outcomes as lactate is a byproduct of anaerobic metabolism and linked with tissue ischemia and/or organ dysfunction.

In head and neck surgical patients, normalization of hyperlactatemia is crucial to decrease mortality and postoperative complications [2]. However, even in critically-ill surgical patients, hyperlactatemia is not necessarily indicative of circulatory failure [3]. Our center has anecdotally noted hyperlactatemia in patients undergoing Facial Gender-Affirmation Surgery (FGAS), but it remains unclear whether it corresponds directly to adverse clinical outcomes. The present study sought to examine implications of intraoperative hyperlactatemia during FGAS.

## Methods

### Patients and procedures

The Institutional Review Board at the University of California, San Francisco (UCSF) approved this retrospective analysis of the UCSF Gender-affirming Facial Plastic Surgery Database. Patient consent was not required for this study which included de-identified patient data and was observational in nature. Inclu-

sion criteria were patients >18 years undergoing FGAS between 2015-2023 with documented intraoperative lactate levels. Exclusion criteria were patients <18 years or no documented intraoperative lactate levels.

### Data collection

Data collected included age, procedures, duration, estimated blood loss, complications, transfusions, and perioperative fluid volume.

### Data analysis

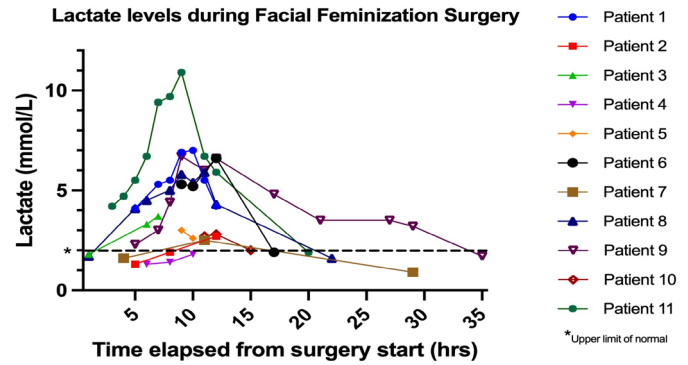
Primary outcome measures were peak lactate level and time to normalization (<2 mmol/L). Lactate levels and time points were plotted over time to create a trend graph. Data was extrapolated from a descriptive table to determine average ages, durations of surgery, estimated blood loss, volume resuscitation and lactate levels.

## Results

Of 130 patients evaluated, 17 met inclusion criteria, all of whom underwent comprehensive facial gender affirmation surgery. All patients analyzed were assigned males at birth who underwent facial feminization surgeries. Procedures included frontal bone contouring/cranioplasty, hairline advancement, brow, face, and neck lift, cheek and lip augmentation, rhinoplasty, alar

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base reduction, mandibular contouring, neck liposuction, chondrolaryngoplasty, and earlobe reduction. The average age of patients was 35. All 17 patients were on estradiol therapy with doses ranging from 1 mg oral daily to 40 mg/ml injections every 14 days. 4/17 patients held their estrogen medication 2 weeks prior to surgery. On average, surgeries lasted 710 minutes (95% Confidence Interval (CI): 650, 770) had an estimated blood loss of 427 mL (95% CI: 288, 567) (Table 1) and intraoperative fluid volume resuscitation of 2752 mL (95% CI: 1935, 3570) (Table 2). Intraoperative lactate levels ranged from 1.2-10.9 mmol/L with mean value of 3.8 (95% CI: 2.2, 5.4) (Figure 1). Nearly every patient demonstrated peak lactate around the end of surgery (~10h) with normalization by postoperative day one.



**Figure 1:** Lactate levels during facial feminization surgery. Patients with at least two lactate levels recorded are shown. \*Indicates upper limit of normal (<2 mmol/L).

**Table 1:** Characteristics of patients undergoing facial gender affirmation surgery.

Patient	Age	Surgery duration (mins)	Blood loss (mL)	Peak lactate level (mmol)	Length of hospital stay (days)
1	46	679	800	7	2
2	62	606	500	2.7	2
3	38	770	300	3.7	1
4	30	716	300	2	1
5	30	656	870	1.8	3
6	50	778	300	3	1
7	26	780	500	1.2	2
8	26	717	200	3.9	1
9	29	690	250	1.9	1
10	25	731	300	5.3	1
11	31	653	300	6.7	3
12	23	376 <sup>a</sup>	800	2.5	3
13	33	943	350	2.8	3
14	30	671	200	10.9	4
15	33	721	500	5.9	1
16	43	490	200	1.4	4
17	46	767	600	1.8	1

**Table 2:** Fluid resuscitation for patients undergoing facial gender affirmation surgery.

Patient	RBC (mL)	Intraoperative fluids								Postoperative fluids		
		PE (mcg)	Ephedrine (mg)	TXA (mg)	NE (mcg)	PL (mL)	Albumin (mL)	LR (mL)	NS (mL)	LR (mL)	PL (mL)	5% Dextrose, 0.9 NaCl (mL)
1		4335	12.5								3000	
2		6200										550
3		29780	25							375		
4		12485					500			1200		
5	307	10475				1700	500					350
6		4765			1738.4		1000	3000		60		1000
7		11850			1179			1800	500			
8		7635			1013	21.458		3000	500	1500		
9		11920			1405		500	2500				
10		11020						3850	500		300	
11	350	12055	40	1405.4	16	4000		2500	500	180	500	900

12	700	17595		710	16.65			2750			
13		14875		1292				2000		2700	500
14	350		30	1298				5000	700		
15		14545			1.511	1900	2000	1800			
16		14520		848							
17		23495	15	1491.9				3200	600		

Patient intraoperative and post-operative fluid requirements.

TXA: Tranexamic Acid; NS: Normal Saline; LR: Lactated Ringers; RBC: Red Blood Cell Transfusion; PL: Plasmalyte; NE: Norepinephrine; PE: Phenylephrine.

### Discussion

To our knowledge, no studies exist examining intraoperative lactatemia during FGAS. Normalization of intraoperative lactatemia could be explained by similar trends seen in head and neck surgeries [4]. During reconstructive head and neck surgery, intraoperative lactatemia was not influenced by vasopressors or blood transfusions, and typically normalized by 24 hours postoperatively [5]. In the present study, all patients were treated with intraoperative fluids and/or red blood cell transfusion with subsequent resolution of lactatemia, although a direct correlation between the two could not be made.

We speculate the etiology of lactatemia in FGAS patients may be due to influences of estrogen therapy superimposed on intraoperative hypoperfusion or physiologic stress response. Higher plasma lactate levels have been described in biological females with higher estradiol levels [4], and may be associated with exogenous administration. The peak around 10-12h in our data corresponds with the average duration of 11.8h (710 min) suggesting that downtrending began upon procedure completion, cessation of blood loss, and surgical closure.

### Limitations

Selection bias was a limitation; only patients with documented intraoperative lactate levels, typically drawn at the discretion of the anesthesiologist based on patient hemodynamic status, were included. Blood loss was estimated rather than measured which allowed for variability in reported data points. Though most patients underwent similar procedures, there was variability in the specific permutation of maneuvers performed.

### Conclusion

In our study, intraoperative lactatemia was transient and normalized during the surgery or shortly thereafter. Given these findings, we cautiously conclude that intraoperative lactatemia during facial gender affirmation surgery may be managed expectantly in the absence of end-organ damage or clinical deterioration.

### Keypoints

The impact of hyperlactatemia following Facial Gender Affirmation Surgery (FGAS) remains unclear. The present study sought to examine implications of intraoperative hyperlactatemia during FGAS.

This retrospective cohort study included patients undergoing FGAS between 2015 and 2023 with at least two intraoperative lactate levels. Intraoperative lactate levels were plotted against surgery duration.

The study included 17 patients with peak lactate levels ranging from 1.2-10.9 mmol/L. Lactate levels normalized by the end of surgery or on the first postoperative day.

This study highlights the reassuring lactate normalization within one day of surgery. We cautiously conclude that intraoperative lactatemia may be managed expectantly.

### Declarations

**Study design:** Retrospective cohort study.

**Data sharing & data availability:** The authors confirm that the data supporting the findings of this study are available within the article. Raw data that support the findings of this study are available upon reasonable request.

**Author's contributions:** **AS:** Conception, Methodology, Writing. **RMB:** Conception, Methodology, Data Analysis, Writing. **SM:** Conception, Methodology, Data Analysis, Writing. **AP:** Writing, Editing. **PKD:** Writing, Editing. **RS:** Writing, Editing.

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### References

- Godinjak A, Jusufovic S, Rama A, et al. Hyperlactatemia and the importance of repeated lactate measurements in critically ill patients. *Med Arch.* 2017; 71(6): 404-407; doi: 10.5455/medarh.2017.71.404-407.
- Souza SP, Serra MG, Oliveira NDS, et al. Arterial lactate as a predictor of postoperative complications in head and neck squamous cell carcinoma. *Braz J Otorhinolaryngol.* 2022; 88 (Suppl 1): S97-S101; doi: 10.1016/j.bjorl.2021.04.008.
- Bakker J, de Lima AP. Increased blood lactate levels: an important warning signal in surgical practice. *Crit Care.* 2004; 8(2): 96-98; doi: 10.1186/cc2841.
- Shen Y, Liu F, Li Q, et al. The gonadal hormone regulates the plasma lactate levels in type 2 diabetes treated with and without metformin. *Diabetes Technol Ther.* 2012; 14(6): 469-474; doi: 10.1089/dia.2011.0275.
- Roy PM, Bharti K, Sinha S, et al. Acute perioperative hyperlactatemia in oncoplastic reconstructive surgeries: What is the significance? *J Anaesthesiol Clin Pharmacol.* 2021; 37(3): 416-418; doi: 10.4103/joacp.JOACP\_297\_19.