

# Acute perioperative hyperlactatemia in oncoplastic reconstructive surgeries: What is the significance?

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## Abstract

**Background and Aims:** We aim to study the significance of intraoperative hyperlactatemia in reconstructive oncoplastic surgery.

**Material and Methods:** A retrospective observational study was conducted on a cohort of patients who underwent reconstructive oncoplastic surgery with free flap for oral cancer over a 6-month period. The study population was divided into two groups based on peak lactate levels. Group N with peak lactate level less than 2 mmol/L and Group H peak lactate level more than 2 mmol/L. The various parameter studied were patient's comorbidities; intraoperative events (vasopressor requirement, blood transfusion, and duration of surgery); postoperative parameters including the need for re-exploration and duration of stay in hospital and intensive care unit.

**Results:** The study demonstrates that intraoperative rise of lactate was not influenced by comorbidities. None of the intraoperative parameters studied influenced the lactate levels. Baseline lactate level was found to correlate with peak lactate level intraoperatively. But it was observed that there was normalization of lactate level within 24 hours postoperatively in both the groups. There was no difference in outcome parameters in the two groups.

**Conclusion:** Intraoperative hyperlactatemia is not a significant prognostic factor for outcome in oncoplastic reconstructive surgery.

**Keywords:** Free flap surgery, lactate, oncoplastic surgery, reconstructive

## Introduction

The normal blood lactate concentration is 0.5-1 mmol/L in unstressed patients.<sup>[1]</sup> Lactate concentration less than 2 mmol/L is considered to be normal in patients with critical illness.<sup>[1]</sup> Hyperlactatemia is defined as a mild-to-moderate persistent increase in blood lactate concentration (2-5 mmol/L) without metabolic acidosis.<sup>[1]</sup> Hyperlactatemia is an established marker of poor prognosis in cardiac surgery<sup>[2]</sup> and the status of lactate in noncardiac surgery is an extrapolation of the same. There is very little evidence in the literature to address the value of lactate in noncardiac surgery.<sup>[3,4]</sup>

Reconstructive oncoplastic surgery after cancer resection restores both cosmetic appearance and function. Free flap reconstruction is a long duration surgery and involves two different teams of surgeons operating simultaneously on the patient. The anaesthetic management of these patients covers a wide array of clinical situations from the management of difficult airways to very long duration anaesthesia (>8 hours). Hyperlactatemia is commonly observed in reconstructive oncoplastic surgery patients<sup>[5]</sup> and hence a study was designed to find any association of hyperlactatemia with patient profile and intraoperative factors. It was planned to establish the role of hyperlactatemia as a prognostic marker of outcome in oncoplastic surgeries. The primary objective of the study was to establish the relation between hyperlactatemia and

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outcome of surgery measured in terms of revision surgery, duration of intensive care unit stay and hospital admission. The secondary objectives were to establish the relation between hyperlactatemia and comorbidities. Association of various intraoperative events like hypotension, blood transfusion, and duration of surgery with hyperlactatemia was also studied.

## Material and Methods

Henault B *et al* studied capillary glucose and lactate of the free flap for monitoring and any adverse outcome. In this study the sample size was 37 patients and looking at the average numbers of cases done by the selected surgical team, duration of 6 months was decided. Only the patients with complete medical records were enrolled for the study and 49 patients were finally enrolled for the study.<sup>[6]</sup> A retrospective observational study was conducted on a cohort of patients who underwent reconstructive oncological surgery with free flap for oral cancer over a 6-month period after obtaining clearance from ethical committee, MICR - 842/2018. The technique of anesthesia was as per the institutional protocol. Moreover, cases done by one surgical team only were included to ensure that the variation in the surgical technique had no effect the outcome of the study.

Various parameters were obtained from the patient's records. Preoperative factors, which were captured included the comorbid illnesses and the nature of the disease (primary/recurrent). The various intraoperative factors studied were incidence of hypotension requiring vasopressors ( $\geq 2$  boluses or infusion), intraoperative blood transfusion, and duration of surgery. The postoperative outcome parameters captured included revision surgery, duration of stay in intensive care unit, and hospital admission.

The lactate data was retrieved from the anesthesia records. During the study period, arterial blood gas (ABG) analysis was performed at baseline and then every 4<sup>th</sup> hourly intraoperatively, as per institutional protocol. In the postoperative period ABG was done 12 hourly and data for the first 24 postoperative hours was collected. All blood lactate concentrations were measured by an arterial blood gas analyzer (ABL 800, Radiometer Co., Copenhagen, Denmark). The lactate data for this study was corrected to a pH of 7.40. The analyzer measured whole blood samples at 37° C. Laboratory in the hospital complied with standards of the National Association of Testing Authorities. Delta lactate was calculated by subtracting lactate level measured at the beginning of surgery from peak lactate value.

## Statistical analysis

A retrospective observational study was conducted on surgeries performed over the last 6-month period. Data of 52 patients

were compiled. Three patients were excluded from the study because of incomplete data. A total of 49 patients were included in the final analysis. Patients were divided into two groups based on their peak lactate values. Patients with peak lactate less than 2 mmol/L were assigned to group N and lactate more than 2 mmol/L were assigned to group H.

All statistical analyses were performed using commercially available statistical software (SPSS 19.0, SPSS Inc., Chicago, IL). Data are presented as mean  $\pm$  standard deviation or percentage where appropriate. A *P* value of less than 0.05 was considered statistically significant.

## Results

Patient characteristics (age, sex) and preoperative comorbidities (diabetes mellitus, hypertension, chronic kidney disease, coronary artery disease, and recurrent malignancy) were similar between the two groups. Intraoperative characteristics such as duration of surgery, administration of blood products, and need for hemodynamic support with vasopressors were similar in the two study groups [Table 1, all *P* > 0.05]. There was a statistically significant difference in the two groups between their first lactate and delta lactate values [Table 2, all *P* < 0.05]. Mean time to return of lactate to baseline was also calculated in group H. One patient was excluded from this calculation as the baseline value of lactate was very high. Time to return to baseline in group H was 16.4  $\pm$  14.1 hours. There was no difference in the outcome parameters of the two groups [Table 1, all *P* > 0.05].

Pearson's correlation coefficient was not found to be statistically significant (*P* > 0.05) between the peak lactate levels and duration of ICU stay and duration of hospital admission.

**Table 1: Comparison of intraoperative and outcome parameters**

	Group N (28)	Group H (21)	<i>P</i>
Blood transfusion <i>n</i> (%)	1 (3.57%)	1 (4.76%)	0.8349
Hypotension <i>n</i> (%)	17 (60.71%)	18 (85.71%)	0.11
Duration of surgery (hours)	8.40 $\pm$ 1.40	8.37 $\pm$ 1.37	0.31
ICU stay (days)	2.79 $\pm$ 1.13	3.05 $\pm$ 3.26	0.69
Revision surgery <i>n</i> (%)	7 (25%)	2 (9.52%)	0.16
Duration of hospitalisation (days)	10.6 $\pm$ (2.90)	12.1 $\pm$ (4.91)	0.20

**Table 2: Comparison of first lactate, peak lactate and delta lactate**

	Group N (28)	Group H (21)	<i>P</i>
First lactate	0.96 $\pm$ 0.30	1.39 $\pm$ 0.58162	0.0018
Peak lactate	1.36 $\pm$ 0.35	3.9 $\pm$ 1.95	<0.00001
Delta lactate	0.34 $\pm$ 0.39	2.52 $\pm$ 2.12	<0.00001

## Discussion

In our study, patient profile in terms of age, sex, and comorbidities was similar in both the groups. Need of vasopressors, blood transfusion, and duration of surgery was similar in both the groups, suggesting that these factors were not predictors of intraoperative higher blood lactate levels. Most of the patients had normalization of the lactate values within 24 hours and there was no difference in the outcome parameters of the two groups.

Although patients in the study were grouped based on peak lactate, even then there was a statistically significant difference in first lactate and delta lactate in the two groups. Patients with higher lactate at the start of surgery had a higher rise in lactate values intraoperatively. Baseline lactate level was only value found to correlate with peak lactate level intraoperatively. The probable etiology can be some abnormality in cellular oxidative process.

On analysis of the raw data, it was observed that 1 patient had prolonged ICU stay of 17 days and had elevated lactate levels with return to baseline only after 66 hours. This patient had a hospital admission of 28 days. It appears that sustained hyperlactatemia in the postoperative period may be a predictor of adverse outcome.

Attempts to correct serum lactate by fluid administration can be counterproductive. Excessive fluid administration can lead to reduced blood flow in the flap secondary to development of interstitial edema and venous engorgement.<sup>[7]</sup> Goal-directed therapy may provide a better parameter for the optimization of fluid therapy in this population group.

## Limitations

This is a retrospective study and hence the possibility of systematic error and bias. Secondly, the study was conducted in only one hospital. The findings might be different for studies conducted in other hospitals with different management.

However, it should be noted that there has been no multicentre study in which the association of lactate indices with outcomes of oncological surgery patients was assessed. There is scope for a multicentre study in the subject.

## Conclusion

Hyperlactatemia in noncardiac surgeries is not significant if lactate levels return to normal within 24 hours. Intraoperative hyperlactatemia is inconsequential, spontaneously reversible entity in noncardiac surgeries. Sustained hyperlactatemia may be a marker of adverse outcome.

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## Conflicts of interest

There are no conflicts of interest.

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