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Hyperlactatemia and Lactic Acidosis Results in Longer Stay in Intensive Care Units (ICUs) and Development of Co-morbid in Post-operative Cardiac Surgery Patients

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Abstract: ***Pathology of Hyperlactatemia and lactic acidosis is convoluted, including tissue hypoxia, pulmonary abnormalities, Ischemic shock, hypohemoglobinemia and generalized an-aerobic conditions. All or any one of these conditions may have occurred due to surgical intervention, long-term cardiogeneic syndromes or after long Intensive care stay. Present study described the assessment and correlation of post-operative Hyperlactatemia in cardiac surgery patients to the longer length of stay in Intensive care units (ICUs). Pre-operative and Post operative blood samples were analyzed in seventy five (Males = 59, females = 16) cardiac surgery patients for Lactate and other biochemical parameters were according to the prescribed methods. Post-operative blood sample analyses were also performed 4-6 hrs after surgery and after 24 hrs post-operatively. Six hours postoperative assessment of lactate, showed alerted levels, manifesting post-operative complications and development of co-morbid. It was also noted that patients (n = 21) with higher lactate >20mg/dl had to stay longer in ICUs (12-18 days stay, average 16.15 ± 2.50 days) as compared to those (n = 54) with normal range of lactate level (5-9 days stay, average 7.20 ± 2.10 days). It is thus concluded that post-operative Hyperlactatemia and lactic acidosis in cardiac surgery patients is a significant condition to detect poor outcome. Additionally post-operative lactate level can predict length of stay in ICUs and any prospect of developing adverse outcome and co-morbid.***

Keywords*: Hyperlactatemia, lactic acidosis, Intensive care units (ICUs)*

1. Introduction

Lactic acidosis or Hyperlactatemia are distinguished and potential conditions of inadequate oxygen perfusion in patients of cardiac and critical care surgeries [1]. It was also documented that elevated production of lactate doesn't always meant hypoxic conditions; thus even under non-hypoxic condition, lactate overproduction can also induce co-morbid and adverse outcome [2]. Pathology of Hyperlactatemia and lactic acidosis is intricate, such as tissue hypoxia, pulmonary abnormalities, Ischemic shock, low levels of hemoglobin and generalized an-aerobic conditions that may have occurred due to surgical intervention or long-term cardiogeneic syndromes [3-7]. As a routine, human body continues to receive oxygen through an-aerobic glycolytic pathway even in hypoxic condition, which in-turn induces the over-production of lactate [8].

Lactate or lactic acid which is also known an acute critical care marker, is mostly analyzed to assess better or worsening outcome in patients undergoing cardiac surgeries [3,9-11]. Moreover, patients with Hyperlactatemia or those with slow normalizing lactate levels reported mortality and 100% post-operative complication [12]. Furthermore, cessation or slow normalization of elevated lactate levels known to be associated with longer Intensive Care Units (ICUs) stay, frequently in critical care or cardiac surgery patients [9-11].

Present study described the assessment and correlation of post-operative Hyperlactatemia in

cardiac surgery patients to the longer length of stay in Intensive care units (ICUs).

2. Materials and Methods:

2.1 Patient's selection and Research Protocols: This observational retrospective study was conducted at Departments of Biochemistry Laboratory services and Chemical Pathology, Liaquat National Hospital, Karachi and Department of Pathology, Govt Lyari General Hospital, Karachi, for the period Jan 2011 to Jan 2016. Demographic data of all patients undergone cardiac surgeries and admitted to ICUs were collected and documented through review of patients' files. Inclusion criteria is dependent on history of cardiac surgeries over the age >30 yrs and <65 years. Patients with indigenous multiple surgeries other than cardiac, <30 yrs and >65 yrs, missing history of co-morbid and patients on dialysis were excluded from the study. Data of a total of 156 patients were reviewed, out of which only seventy five (n = 75, males = 59 and females = 16)) were documented as per availability of all analytical data, and pre and post-operative information.

2.2 Analytical methods and lactate estimation: Pre-operative and Post operative blood samples were analyzed for lactate and other biochemical parameters such as uric acid, creatinine, albumin, magnesium, calcium, phosphorus, lactate dehydrogenase and sugar according to the methods described earlier [13-15]. Post-operative blood sample analyses were performed 4-6 hrs after surgery and after 24 hrs post-operatively. Normal ranges for biochemical parameters are; lactate 4.5-19.8 mg/d, urea < 50 mg/dl; creatinine 0.5-1.5 mg/dl; albumin 3.4-4.8 gm/dl; magnesium 1.70-2.55 mg/dl; calcium 8.6-10.2 mg/dl; phosphorus 2.5-4.5 mg/dl; sugar 80-160 mg/dl. Data is reported as mean ± SD.

2.3 Statistical analysis: Biochemical parametric data of Pre, post-operative and during ICUs stay were compared and analyzed by SPSS ver 13.0. Results were considered significant when $P < 0.05$.

3. Results

Results are summarized in Table 1 and 2. A total of 75 patients, males = 59 and females = 16, were selected for cardiac surgeries with average age of 52.05 ± 18.65 years. Six hours postoperative assessment of biochemical parameters inclusive of lactate, showed alerted levels, manifesting post-operative complications and development of co-morbid (Table 2). This confirms the correlation of elevated lactic acidosis with slow normalizing of body functions. It was also noted that patients (n = 21) with higher lactate >20mg/dl (Table 2) had to stay longer in ICUs (12-18 days stay, average 16.15 ± 2.50 days) as compared to those (n = 54) with normal range of lactate level (5-9 days stay, average 7.20 ± 2.10 days). Four mortalities were also noted in patients with strong lactic acidosis (>20 mg/dl) as compared to none in group with normal lactate levels. Thirty two patients (42.66%), that were underwent cardiac surgeries had previous history of cardiac diseases. Average post-operative (after 6 hours) lactate levels were measured to be 24.55 ± 18.35 mg/dl as compared to Pre-operative Lactate levels of 4.15± 1.4 mg/dl.

Table 1: Post-Operative (6 hrs) demographic and lactate levels of cardiac surgery patients

Parameters	**Data, Mean ± SD**
Patients	*n* = 75
Age	52.05 ± 18.65 yrs
Gender	--
Males	59 (78.66%)
Females	16 (21.33%)
History of previous cardiac diseases	32/75 (42.66%)
Lactate levels (Post-Operative) mg/dl	24.55 ± 18.35 *

Results are expressed in mean ± SD
*Pre-operative Lactate levels = 4.15± 1.4 mg/dl

4. Discussion:

Earlier studies reported correlation of post-operative mortality with intra and post Hyperlactatemia, mostly in patients that underwent cardiac and critical care surgeries and developed serious co-morbid [6,12,16]. Previously reported research studies also suggested that post-operative development of Hyperlactatemia during ICUs stay was a significant indicator of poor outcome in such patients [17-19]. Moreover, onset of Hyperlactatemia as occurred mostly 4-24 hrs post-operatively in some cardiac surgeries results in onset of co-morbid such as hyperglycemia, elevated catecholamine and altered biochemical parameters [1, 8] in addition to inducing mortality [20]. Our data also suggested similar correlation as mortality occurred in four patients, all males, which had prolonged ICU stays and lactate greater than 20 mg/dl. Furthermore, those with normalized lactate levels, although did admitted in ICU, recovered early and showed no adverse outcome or mortality.

Table 2: Post-Operative length of stay in hyperlactatemic and normo-lactate cardiac surgery patients

Parameters	Lactate > 20 mg/dl (hyperlactatemia) n = 21	Lactate 10-18 mg/dl (normo-lactate) n = 54	P < 0.05
Length of stay	16.15 ± 2.50 (12-18) days	7.20 ± 2.10 (5-9) days	0.002
Admission in ICU	n = 17 (80.95%)* [17/21]	n = 10 (18.51%)** [10/54]	0.01
Duration in ICU	9.55 ± 3.65 days	4.65 ± 1.05 days	0.001
Mortality (ICU admitted)	N = 4 (23.52%)*	None	--
Morbidity (ICU admitted)	N = 15 (88.23%)*	n = 6 (60.00%)**	0.001

Results are expressed in mean ± SD
*Percentage w.r.t n = 17 patients admitted in ICU
**Percentage w.r.t n = 10 patients admitted in ICU

5. Conclusion:

Our presented study described the correlation of Hyperlactatemia, 6 hrs post-operatively in cardiac surgery patients with adverse outcomes and lengthy stays in ICUs. In some cardiac surgery patients, that exhibited Hyperlactatemia (>20 mg/dl), ICUs stay extended upto 18 days, with sever co-morbid and four mortalities. Normo-lactatemia patients stayed less in ICUs, recovered better, and manifested less co-morbidity. It is thus concluded that post-operative Hyperlactatemia and lactic acidosis in cardiac surgery patients is a significant condition to detect poor outcome and post-operative lactate level can predict length of stay in ICUs and any prospect of developing adverse outcome and co-morbid.

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