Assiut Scientific Nursing Journal
http://asnj.journals.ekb.eg *http://www.arabimpactfactor.com*
DOI: 10.21608/asnj.2024.288486.1818 *http://olddrji.lbp.world/indexedJournals.aspx*
https://vlibrary.emro.who.int/journals/assiut-scientific-nursing-journal

Lactic Acidosis as Predictor for Postoperative Outcomes in Patients Undergoing Cardiac Surgery

Taha Hussein Mohamed Ibrahim[1], Asmaa Atiaa Tolba Darwish[2], Mona Aly Mohammad Mohammad[3], Ahmed Mohamed Fathy Ghoneim[4] & Ghada Shalaby khalaf Mehran[5]

[1.] Demonstrator of Nursing Critical Care and Emergency, Faculty of Nursing, Assuit University, Egypt
[2.] Associate Professor of Nursing Critical Care and Emergency, Faculty of Nursing, Assuit University, Egypt
[3.] Professor of Nursing Critical Care and Emergency, Faculty of Nursing, Assuit University, Egypt
[4.] Professor of Cardiothoracic Surgery, Faculty of Medicine, Assuit University, Egypt
[5.] Associate Professor of Nursing Critical Care and Emergency, Faculty of Nursing, Assuit University, Egypt

Abstract:

Background: Lactic acidosis is still a serious concern for patients undergoing cardiac surgery. Lactic acidosis presents a challenge to be managed and controlled by health care personnel, and it is contributing to an increase in morbidity and mortality rates among patients postoperatively. **Aim of study:** to investigate whether lactic acidosis in patients undergoing cardiac surgery is a predictor of negative postoperative outcomes.. **Research design:** A descriptive exploratory research design. **Setting:** Cardio-thoracic intensive care unit at assuit university heart hospital. **Patients:** 80 Patient of cardiac surgery assigned to two groups (39 patient in non-lactic acidosis group and 41 patients in lactic acidosis group) **Tools:** Tool one: Open-heart surgery patient assessment tool , Tool two: Preoperative assessment tool, Tool three: Postoperative assessment tool and Tool four: Assessment the outcome of lactic acidosis among patients undergoing open -heart surgery. **Results:** Cardiac surgery patients with lactic acidosis have higher incidence of mortality **(34.1% vs 7.7%)** long length of stay in **(75.6% vs 0%)** with Mean± SD (**10.20±4.291 vs 4.05±1.099**) and high incidence of complication. **Conclusions:** The occurrence of lactic acidosis among cardiac surgery patients was linked with a negative outcome and a high mortality rate postoperatively. **Recommendation:** Reduce the occurrence of lactic acidosis intra- and postoperatively, resulting in a decrease the occurrence of complications and negative outcomes postoperatively, Further research studies are need to conduct for deepen our understanding for relationship betwwen postoperative lactic acidosis and negative outcome among cardiac surgery patients

Keywords: Cardiac surgery, lactic acidosis, Mortality rate & Negative outcome.

Introduction:

Lactate level is powerful diagnostic and potent indicator of clinical outcomes in critically ill individuals and those having cardiac surgery **(Algarni, 2020**) . Important physiological processes such as heart and liver function, venous saturation, catecholamine administration, and hyperglycemia are reflected by blood lactate levels **(Bakker et al., 2020)**. Blood lactate levels are normally between 0 and 2 mmol/L **(Masevicius & Dubin, 2023**). A serum lactate level of 2 mmol/L or more is considered hyperlactatemia, and hyperlactatemia combined with Acidosis is (pH less than 7.35 in arterial blood) is known as lactic acidosis **(Gómez & Mizock, 2019**).

There are two main categories of lactic acidosis: A and B, Most clinical manifestations are related to type A lactic acidosis is situations where there is inadequate oxygen supply, such as in septic shock, hypovolemia, cardiogenic shock, and hemorrhage **(Cotter et al., 2020**). Reportedly the most prevalent type of lactic acidosis, type A occurs when tissue ischemia is brought on by systemic or local inadequate perfusion, higher glycolysis, decreased blood oxygen carrying ability, or reduced transportation of oxygen. Both are hyperlactatemia and lactic acidosis conditions linked to morbidity and death and Traditionally, Type B has been considered hyperlactataemia in the absence of tissue hypoxia linked to many causes as medications and toxins **(Seheult et al., 2017**).

Heart surgery patients frequently develop lactic acidosis, which can have a variety of causes. For instance, systemic inflammatory response syndrome and global tissue hypoxia, which are linked to fast metabolism and poor cardiac output after cardiopulmonary bypass surgery, can both be brought on by epinephrine. Limb ischemia (as a result of an intra-aortic balloon pump) is another reason **(Minton & Sidebotham, 2017**).

Nursing Collaborative management of lactic acidosis include manage perfusion first, implement additional monitoring for tissue hypoxia, supplemental measures may be used in patients who are critically ill for evaluation of tissue hypoxia **(Baird, 2015**). Both are hyperlactatemia and lactic acidosis conditions linked to morbidity and death **(Smith et al., 2019**).

Significance of the study

During cardiac surgery with cardiopulmonary bypass in adult patients, hyperlactatemia is detectable at a considerable rate (10%-20%) and is associated with postoperative complications and mortality. More attention must be given to correct the common abnormalities conditions inherent of CPB in order to conduct adequate tissue perfusion and reduce the risk of **(Seghrouchni et al., 2022**). It is found that approximately (296) adult cardiac surgeries was performed annually in Assiut cardiothoracic surgery department at heart hospital.

Aim of the study: -

To investigate whether lactic acidosis in patients undergoing cardiac surgery is a predictor of negative postoperative outcomes.

Operational definition

Patient's outcomes: Any information on the outcomes of health care obtained directly from patients without modification by clinicians or other health care professionals. For purposes of this monograph, we use this term broadly to include any patient input, whether or not it is standardized or gathered with a structured questionnaire.**(Cella et al., 2015**)

Research question:

Does the lactic acidosis affect the outcomes patients undergoing of cardiac surgery?

Patients and Methods:

Study design:

A descriptive exploratory research design was utilized to conduct this study.

Setting:

This study was conducted in the cardio-thoracic intensive care unit at Assiut University Heart Hospital, which has 12 beds, 9 head nurses, and 29 nurses.

Sampling:

A convenience sampling of both adult male and female patients undergoing cardiac surgery (CABG and valve replacement surgeries) with age groups ranging from 18–65 years. The study sample will be divided to two groups group one (non-lactic acidosis group) and group two (lactic acidosis group) within six months.

Exclusion criteria

This study was excluded those who had the following criteria:

1- Preoperative lactic acidosis
2- Off pump operation
3- Liver cirrhosis
4- End stage renal disease
5- Uncontrolled diabetes mellitus type 1

Tools for data collections

Tool one: Open-heart surgery patient assessment tool:

This tool developed by the researcher after reviewing of the related literatures **(Govender et al., 2020**). It used to assess the studied patients regarding demographic and clinical data, this tool comprised of two parts.

Part I: socio-demographic tool:

This part included patient's code, patient name .age, and gender.

Part II: clinical data tool:

This part included current medical diagnosis, type of surgical operation, past medical history, patient body mass index and smoking status.

Tool two: Preoperative assessment tool:

This tool developed by the researcher after reviewing of the related literatures **(Matteucci et al., 2020**). It used to assess the studied patients regarding preoperative hemodynamic state, hematological assessment and physical examination to form base line data, this tool comprised two main parts.

Part I: preoperative hemodynamic tool:

This part included pulse, systolic blood pressure, diastolic blood pressure, mean blood pressure, respiration and oxygen saturation. In addition to patient temperature.

Part II: preoperative Hematological assessment tool:-

This part referred to data related to the results of laboratory investigations included arterial blood gases, complete blood count, coagulation profile; renal function test, liver enzymes, serum albumin, electrolytes (potassium, sodium and random blood glucose).

Tool three: Postoperative assessment tool:-

This tool developed by the researcher after reviewing of the related literatures **(Matteucci et al., 2020**) It used to assess the studied patients regarding postoperative hemodynamic state, hematological assessment and postoperative fluid balance, This tool comprised two main parts.

Part I: postoperative hemodynamic tool:

This part included pulse, blood pressure, mean blood pressure respiration and oxygen saturation. In addition to patient temperature.

Part II: postoperative Hematological assessment tool:-

This part referred to data related to the results of laboratory investigations included arterial blood gases, complete blood count , coagulation profile, renal function test, liver enzymes, serum albumin, , electrolytes (potassium, sodium and random blood glucose).

Tool four: Assessment the outcomes of lactic acidosis among patients undergoing open -heart surgery:

The researcher developed this tool after reviewing the related literature **(Govender et al., 2020**)). It included assessment patient duration on mechanical ventilation (MV), weaning trial success or failure, incidence of complications, length of stay in ICU which classify it into short (0– 7 days) and long stays (>7 days) **(Wen et al., 2022**), and morality rate.

Method:

This study was carried out in two phases:

Preparatory phase:

Tools development:

Data collection tools were developed based on reviewing the current, past, local and international related literature in the various aspects using books, articles, periodicals, magazines, and references were done.

Pilot study:

Pilot study was conducted on 10 % of the study subjects over one month in the selected setting to test the tools' applicability and clarity. The data from the pilot study were analyzed; no changes were made to the tools used, so the 10% of subjects chosen for the pilot study were included in the study.

Ethical consideration

- The Research was approved from Ethical Committee in the Faculty of Nursing with serial number 112024065.
- There is no risk for study patients during application of the research .
- The study was followed common ethical principles in clinical research .
- Oral consent was obtained from patient or guidance that is willing to participate in the study, after explaining the nature and purpose of the study .
- Confidentiality and anonymity was assured.
- Study patients have the right to refuse to participate and or withdraw from the study without any rational any time .
- Study patient's privacy was considered during collection of data

Assessment phase:

This phase of data collection started once official permission granted to proceed with the proposed study; the researcher approached the head nurses of the Cardiothoracic department to obtain lists of patients, and reviewed those patients as considering the exclusion criteria to select eligible patients. Patients whom agreed to participate in the proposed study were interviewed individually to explain the purpose, benefits and the nature of the study and to establish rapport and cooperation. Then oral consent was obtained from each of the subjects.

Data collections:

- The researcher was assessed the studied patients 24 hours preoperatively and postoperatively in the first 48 hours of admission to the cardiothoracic ICU. Data collected over a period of six months.
- The researcher assessed the studied patients from the first day of admission and record patient demographic data before any collection by taking this information from his/her sheet use tool 1 (Part I).
- The researcher assessed clinical data by use tool 1 (Part I I).
- The researcher was assessed preoperative hemodynamic state of the studied patients systolic, diastolic and mean blood pressure. Heart rate, respiration, oxygen saturation, temperature, and temperature using tool 2 (part I) preoperatively for 24 hours.
- The researcher was assessed preoperative laboratory investigations of the studied patients by using tool 2 (part II).
- The researcher was assessed postoperative hemodynamic state of the studied patients systolic, diastolic and mean blood pressure. Heart rate, respiration, oxygen saturation, temperature, and temperature using tool 3 (part I) preoperatively for 48 hours and take it is mean.
- The researcher was assessed postoerative laboratory investigations of the studied patients by using tool 3 (part II).
- The researcher was assessed patient outcomes in first 48 hours postoperative by using tool four.

Statistical analysis:-

The researcher entered the data by using a personal computer. All data were entered into statistical packages for the social sciences (SPSS) version 26.0 software for analysis and figures were created in Excel. The researcher analyzed, categorized, and then coded the content of each tool. Categorical variables were described by number and percent, whereas continuous variables were described by the mean and standard deviation (Mean, SD). Chi-square test was used to compare between categorical variables, where compare between continuous variables by T-test. (P value < 0.05) was considered statistically significant.

Result:

Table (1): Distribution of Socio-demographic characteristics and medical information of the studied sample, N (80)

	N	%
Age group		
20-39	21	26.3 %
40-59	36	**45.0 %**
60 AND above	23	28.7 %
Mean ± SD	47.69±12.65	
Sex		
Male	46	**57.5 %**
female	34	42.5 %
Patient diagnosis		
Ischemic heart disease	31	38.8 %
Valvular disorder	39	**48.8 %**
Ischemic heart with valvular disorder	10	12.5 %
Surgical operation		
CABG	31	38.8 %
Valve replacement	39	**48.8 %**
CABG and valve replacement	10	12.5 %
Smoking status		
smoker	26	32.5 %
Non smoker	43	**53.8 %**
Ex-smoker	11	13.8 %
Body mass index		
18.5 - 24.9	12	15.0 %
25-29.9	40	**50.0 %**
30 and above	28	35.0 %

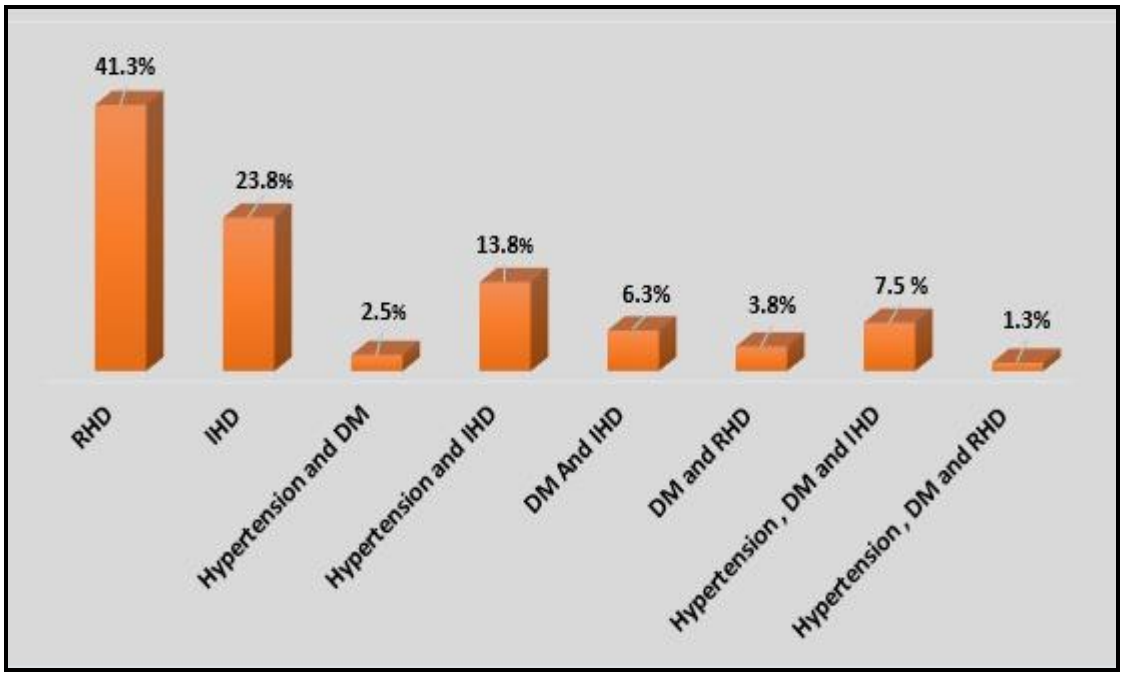

Figure (1): Percentage distribution of past medical history among the studied sample (n=80)

Table (2): Association between lactic acidosis among studies sample and socio-demographic Characteristics, N= 80.

Socio-demographic characteristic		Non Lactic and Lactic group		P-V
		N (%)	N (%)	
		non lactic acidosis 39 (48.8%)	lactic acidosis 41 (51.2%)	
Age group	**20-39**	17(43.6%)	4 (9.8%)	**.001***
	40-59	**21(53.8%)**	15 (36.6%)	
	60 and above	1(2.6%)	**22 (53.7%)**	
Gander	**Male**	18 (46.2%)	**28 (68.3%)**	.045
	Female	**21 (53.8%)**	13 (31.7%)	
patient diagnosis	**IHD**	12 (30.8%)	**19 (46.3%)**	**.002***
	Valvular disorder	**26 (66.7%)**	13 (31.7%)	
	IHD and valvular disorder	1 (2.6%)	9 (22.0 %)	
Surgical operation	**CABG**	12 (30.8%)	**19 (46.3%)**	**.002***
	Valve replacement	**26 (66.7%)**	13 (31.7%)	
	CABG and Valve replacement	1 (2.6%)	9 (22.0%)	
Patient past medical history	**RHD**	**25 (64 %)**	8 (19.5%)	**.001***
	IHD	12 (30.8%)	7 (17 %)	
	Hypertension and DM	1 (2.6%)	1 (2.6%)	
	Hypertension and IHD	1 (2.6%)	**10 (24.4%)**	
	DM And IHD	0 (0.0%)	5 (12%)	
	DM and RHD	0 (0.0%)	3 (7.3%)	
	Hypertension , DM and IHD	0 (0.0%)	6 (14.6%)	
	Hypertension , DM and RHD	0 (0.0%)	1 (2.6%)	
BMI	18.5 - 24.9	9 (23.1%)	3 (7.3%)	**.004***
	25-29.9	**23 (59.0%)**	17(41.5%)	
	30 and above	7(17.9%)	**21 (51.2%)**	

Chi-Square Test ** statistically significant difference (P-Value < 0.05)*
Non-significant difference (P-Value > 0.05).

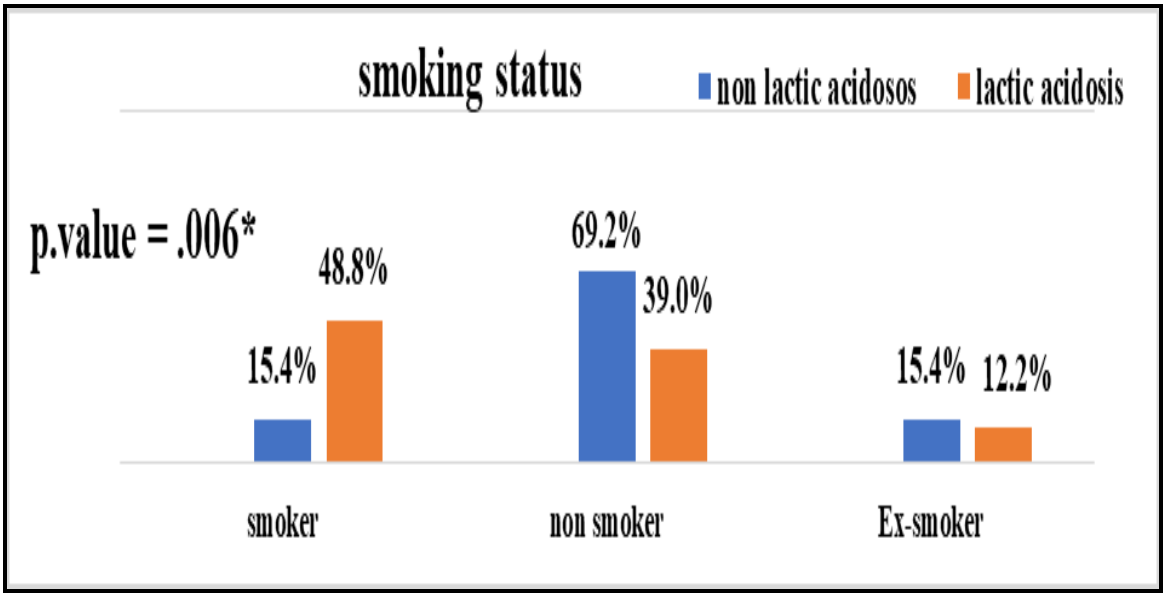

Figure (2): Incidence of lactic and non-lactic acidosis in relation to smoking status.

Table (3): Association between preoperative and postoperative hemoadynamic and hematological status among studies sample, N= 80.

hemoadynamic and hematological status		Preoperative	postoperative	
		Mean± SD		p.v
vital signs	**Temperature**	36.918±.1828	37.507±.2514	**.001***
	SBP	120.75±9.315	106.64±13.043	**.001***
	DBP	74.53± 5.077	64.11± 8.621	**.001***
	MAP	87.61±7.406	76.50±9.261	**.001***
	Respiratory rate	15.15±2.907	15.83±2.539	**.**151
	Heart rate	78.79±11.000	82.71±11.365	**.001***
	SPO2	97.73±2.081	97.44±5.141	.664
complete blood count	**White blood cells**	7.013±.1.6341	11.580±2.8164	**.001***
	Red blood cells	4.484±1.1762	3.129±1.3972	**.001***
	Hematocrit level	38.79±11.125	31.78±12.658	**.001***
	Hemoglobin	11.977±2.7817	10.872±1.6920	**.001***
	Platelet	183.84±14.415	181.33±12.433	.211
coagulation profile	**INR**	1.179±.8477	1.307±.9493	.358
	Prothrombin time	12.272±.6140	13.013±.1.5189	**.001***
	Prothrombin concentration	94.00±8.229	88.113±15.8075	**.005***
kidney function test	**Urea**	27.448± 8.3636	48.93±25.909	**.001***
	Creatinine	.934± .1942	1.265 ± .6357	**.001***
liver function test	**Serum albumin**	4.469± .5240	4.067± 1.1465	**.007***
	ALT	30.68± 5.461	43.18± 24.961	**.001***
	AST	21.54±4.415	31.99±18.439	**.001***
	Bilirubin	2.009±.6905	3.702±1.6660	**.001***
Electrolytes	**Sodium**	141.38±2.735	140.51±6.100	.256
	Potassium	4.001±.2857	4.808±.7037	**.001***
	RBG	114.34±6.912	149.29±36.979	**.001***

SBP: Systolic blood pressure, DBP: diastolic blood pressure, MAP: mean arterial pressure, Spo2: peripheral oxygen saturation, INR: international normalised ratio, ALT: Alanine transaminase, AST: Aspartate transaminase, RBG: random blood glucose.
Paried T Test
** Statistically significant difference (P-Value < 0.05), Non-significant difference (P-Value > 0.05).*

Table (3): Outcome among Non-lactic and lactic patient groups N= 80.

Outcome		Non lactic acidosis	Lactic acidosis	P.V
		N (%)	N (%)	
Mortality rate	Survival	36 (92.3%)	27 (65.9%)	**.004***
	Died	3 (7.7%)	**14 (34.1%)**	
first weaning trial	Success	39 (100.0%)	21 (51.2%)	**.001***
	Failure	0 (0.0%)	**20 (48.8%)**	
number of weaning trial	First trial	39 (100.0%)	21 (51.2%)	**.001***
	Second trial	0 (0.0%)	9 (22.0%)	
	Third trial	0 (0.0%)	11 (26.8%)	
length of stay In ICU	Short	39(100.0%)	10(24.4%)	**.001***
	Long	0(0.0%)	31(75.6%)	
	Mean± SD	4.05±1.099	10.20±4.291	

*Chi-Square Test * statistically significant difference (P-Value < 0.05), Non-significant difference (P-Value > 0.05).*
Independent-Samples T Test * statistically significant difference (P-Value < 0.05), Non-significant difference (P-Value > 0.05).

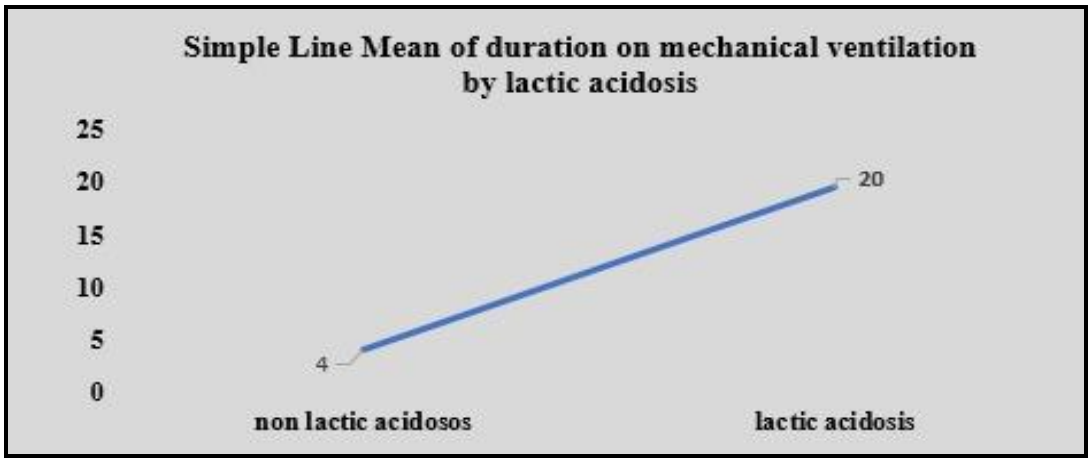

Figure (3): Duration on mechanical ventilation for lactic acidosis patient.

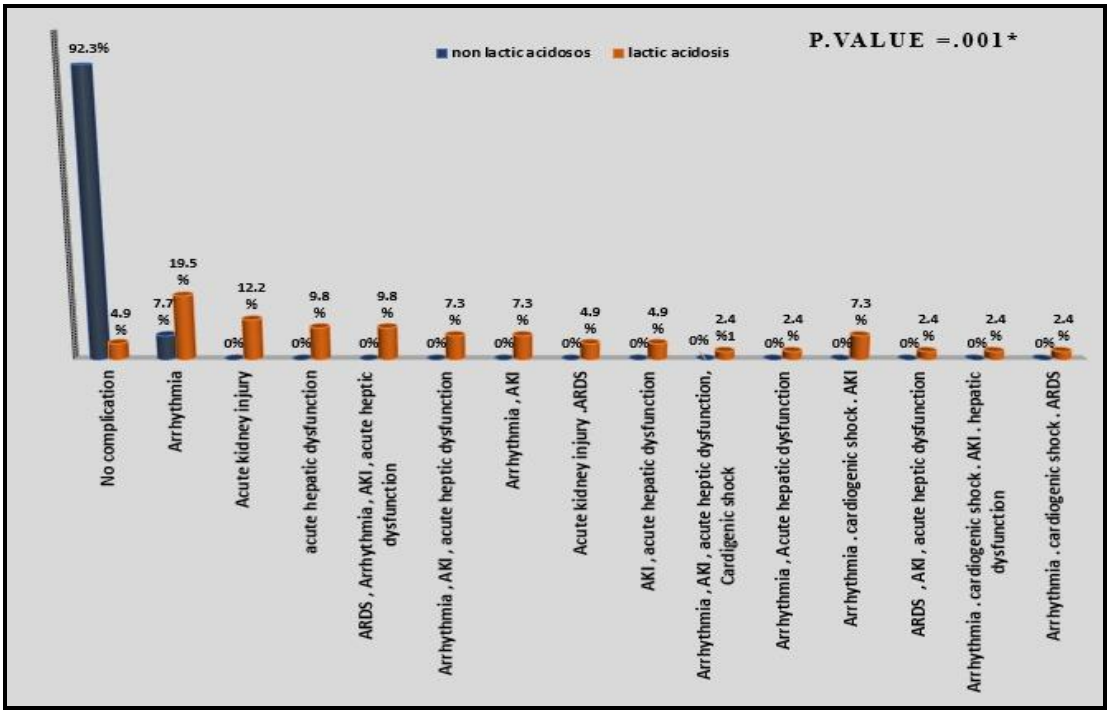

Figure (4): Occurrence of complication among lactic acidosis patient groups

Table (1): This table Illustrates that (45.0 %) of studied sample their age ranged from 40-59 years within mean±SD (47.69±12.65), (57.5 %) of patients were males, (48.8 %) suffered from Valvular disorder, (48.8 %) performed Valve replacement surgery, (53.8 %) of patients were non-smoker , and (50.0 %) of patients BMI range form 25-29.9.

Figure (1): This figure shows that the highest percentages of studied sample **(41.3%)** had Rheumatic heart disease, **(23.8%)** have ischemic heart disease and **(34.9%)** of them had more than on comorbidities

Table (2): Regarding age groups result show that **(53.7%)** in lactic acidosis patients 60 years and above with p.value **(.001*)**. Regarding patient diagnosis **(46.3%)** of lactic acidosis, patients have IHD with p.value **(002*)**. In relation to type of surgical operation **(46.3%)** of patients with lactic acidosis performed CABG operation with p.value **(.002*)**. For the past medical history result revealed that (**24.4%)** of patient with lactic acidosis have hypertension with IHD with p.value **(.001*)**. for body mass index **(51.2%)** from lactic acidosis group with 30 and above with p.value **(.004*)**.

Figure (2): In relation to smoking status figure present that **(48.8%)** of lactic acidosis patients are smoker with p.value **(.006*)**.

Table (3): Regarding preoperative and postoperative hemodynamic status and hematological test result show that high postoperative temperature and heart rate with mean±SD **(37.507±.2514, 82.71±11.365)**, low postoperative systolic, diastolic, and mean blood pressure with mean±SD **(106.64±13.043, 64.11± 8.621, 76.50±9.261))** and all were statistically significance with p.value **(.001*)**. In hematological test result revealed that postoperative high white blood cells and prothrombin time with mean±SD **(11.580±2.8164, 13.013±.1.5189)** and low postoperative red blood cells, hematocrit level, hemoglobin level and prothrombin concentration with mean±SD **(3.129±1.3972, 31.78±12.658, 10.872±1.6920, 88.113±15.8075)** and all were statistically significance with p.value **(.001*)(.005*)**. High postoperative kidney function test (urea and creatinine) with mean±SD **(48.93±25.909, 1.265 ± .6357)**, liver function test (ALT, AST, bilirubin) with mean±SD **(43.18± 24.961, 31.99±18.439, 3.702±1.6660)**, electrolytes (Potassium and random blood glucose) with mean±SD **(4.808±.7037, 149.29±36.979)** and postoperative low Serum albumin with mean±SD **(4.067± 1.1465)** and all were statistically significance with p.value **(.001*), (.007*).**

Table (4):- in relation to mortality rate study result show that **(34.1%)** of lactic acidosis patients died with p.value **(.004*)**. Regarding first weaning trail **(48.8%)** of lactic acidosis patient group failed to weaned from first trial with p.value **(.001*)**. Number of weaning trial **(26.8%)** of lactic acidosis patient weaned after third trial. Long length of stay showed in lactic acidosis group in **(75.6%)** of lactic acidosis group with Mean± SD (**10.20±4.291)** and p.value **(.001*)**.

Figure (3): Demonstrate that lactic acidosis patient have long duration on mechanical ventilation with mean±SD **(21.03±18.394)** and p.value **(.001*)**.

Figure (4): Show that most common complication in lactic acidosis patient is arrhythmia, it is observed in (19.5%) of lactic acidosis patient followed by acute kidney injury occurred in (12.2%) of lactic acidosis patients with p.value (.001*)

Discussion:

In the light of the patient's demographic data, the incidence of lactic acidosis occurred in more than half of patients present in the age group 60 and above, and this result is supported by **Musso & Vilas (2019),** who found that lactic acidosis is one of the acid-base imbalances that occur in elderly patients due to the aging process occurring in the kidney.

Regarding the patient diagnosis study, it shows that patients with ischemic heart disease are more likely to increase their lactic level postoperatively in less than half of patients. This result is explained by **Monteiro (2021**) who reported that increased secretion of catechol amines accelerates glycolysis and raises lactic acid and lactate concentrations in blood and tissues for the following reasons: In advanced plaques, the existence of hypoxic areas in the arterial wall, along with the accumulation of lactic acid in atherosclerotic lesions, appears to be related to a decreased oxygen diffusion capacity and increased oxygen consumption by foam cells.

In relation to the type of surgical operation, more than one-third of patients with postoperative lactic acidosis had CABG operations. The study result is supported by **Jabbari et al. (2013**) who reported that epinephrine increases cardiac output by increasing contractility and heart rate, and it is frequently employed in patients with moderate or severe impaired cardiac contractility. It may be administered during CABG as a continuous or bolus injection to increase ventricular contractility. Epinephrine and other potent beta-adrenergic agonists may cause lactic acidosis. At high continuous infusion doses, they could cause considerable vasoconstriction and raise serum acetate.

Regarding past medical history, a study revealed that ischemic heart disease and hypertension are estimated to affect one-half of lactic acidosis patients, and the associated factor between IHD and hypertension is arteriosclerosis**. Li et al. (2022**) reported that glucose uptake and glycolysis significantly increased in the atherosclerotic plaques, and the anaerobic metabolism of glycolysis resulted in the occurrence of lactic acidosis.

In relation to body mass index, the study shows that more than half of lactic acidosis patients have a high body mass index (30 and above). Our study result was confirmed by **Lambert & Abramowitz (2021**) noted that a higher BMI is associated with a greater risk of developing anion gap elevation and anion gap metabolic acidosis (like lactic acidosis). Obesity, which is often indicated by a high BMI, is associated with an increased risk of various health complications that can contribute to the development of lactic acidosis, as they impair the body's ability to produce and utilize energy efficiently. In other points of view, some studies demonstrate that obese patients with high body mass index and without cardiopulmonary diseases are associated with the obesity-related reduction in ERV and are independent of hypoventilation. **Littleton & Tulaimat (2017**) and hypoxic status. In anaerobic metabolism, then lactic acidosis.

Regarding smoking status, the results show that less than half of lactic acidosis patients are smokers. In addition, this result is interpreted by **Malenica et al. (2017**) as indicating that nicotine helps release catecholamine and steroid hormones from the core of the adrenal gland. It is known that an increase in the level of certain endogenic hormones, such as epinephrine and cortisol, and, as mentioned previously, an increase in the epinephrine level might result in the occurrence of lactic acidosis among smokers. In other words, **Nazeer (2017**) found that the two main ingredients of cigarette smoke potentially reduce oxygen supply to all tissues of the body that contain nicotine and carbon monoxide by combining themselves to transport proteins such as hemoglobin and myoglobin, and that tobacco smoking has a negative impact on the oxygen saturation of hemoglobin.

In relation to hemodynamic status result show increase in postoperative heart rate dur to occurance of tachyarrthymia among patient postoperativly related to several factors. **(Peretto et al., 2014**) report that arrhythmias are very common complications after cardiac surgery due to Trauma and Inflammation, Hemodynamic Stress and Ischemic Injury. Low systolic, diastolic and mean blood pressure postoperatively due to systematic inflammatory response. **(Busse et al., 2020)** reported that As many as 50 percent of the patients after heart surgery may develop vasoplegic syndrome, which is thought to be precipitated by an inflammatory reaction to CPB in addition to patient-specific risk factors.

Regarding white blood count result present high white blood count postoperatively in patient this occur as result of systematic inflammatory response after cardiopulmonary bypass. Our view supported by **(Nguyen et al., 2023)** reported that Leucocyte counts significantly changed after heart operation containing cardiopulmonary bypass, indicating that white blood cells were activated in sterile inflammation.

Regarding red blood cells, hematocrit level and hemoglobin level it is showed that low red blood cells, hematocrit level , and hemoglobin level postoperativly due to blood loss in operation , hemolysisi from cardiopulmonary bypass and hemolytic effect intraoperativly. This result is supported by **(Nelson et al., 2018)** who found that Operational bleeding is the reason of the hemoglobin and hematocrit fail seen in heart procedures patients

Regarding kidney function and liver function test study result show disturbance in kidney and liver function test in patients postoperativly due to occur of postoperative acute kidney injury and acute hepatic dysfunction as result of low cardiac output after surgery. **(Wang & Bellomo, 2017**) reported that AKI is frequently brought on by poor cardiac output in the early postoperative phase. **Mercado et al. (2019**) Serum creatinine or urine output can be used for the diagnosis of acute kidney injury. Elevation of liver enzymes such as ALT and AST and decrease of albumin and hyperbilirubinemia in lactic acidosis patients are used as indicators for hepatic dysfunction. **(Biegus et al., 2016**) reported that low albumin concentration may not only reflect hepatic dysfunction but also elevated AST and ALT, which are markers of hepatocellular injury.

Regarding mortality rate, study show that more than one-third of patients with lactic acidosis do not survive and die postoperatively. The mortality rate in lactic acidosis patient's results from several factors, such as postoperative complications, increased length of stay, and hepatic and liver dysfunction. **Lopez-Delgado et al. (2015**) support our study result and report that there is an association between mortality and higher arterial lactic production. Arterial levels can be influenced by several factors. Poorer liver function before surgery or an exacerbation of liver dysfunction in the setting of CPB may reduce AL clearance. **Drolz et al. (2019)** reported that lactate levels appropriately reflect the severity of disease and organ failure and were independently associated with short-term mortality in critically ill patients with liver cirrhosis.

Regarding the first weaning trial and number of weaning trials, it was noted that less than half of lactic patients failed to wean from the first trial and half of those patients weaned from the third trial. This is a consequence of the patient needing oxygen and the occurrence of hypoxia after weaning. This process resulted from the inflammatory response of prolonged CBP. **Gómez & Mizock (2019)** who found That patients with acute lung injury, or ARDS, lactate production by recruited leukocytes and alveolar macrophages plays a significant role.

Duration on mechanical ventilation lactic acidosis patients have a longer period on mechanical ventilation than non-lactic patients; this is due to the prolonged need for oxygen therapy to manage hypoxia. **Jin et al. (2017**) reported that postoperative hyperlactatemia indicates a severe imbalance of tissue oxygen supply and consumption, and a higher serum level of lactate at the end of surgery is identified as another risk factor for prolonged duration on mechanical ventilation.

The length of stay in the ICU study result show that patients with lactic acidosis have a long period of stay in the ICU. Support our result that patients with high lactate levels require a long stay in intensive care. **Brallier et al. (2017**) found that elevated intraoperative serum lactate in craniotomy patients is associated with new neurological deficits and a longer length of stay.

Regarding the occurrence of complications, researchers find that patients with lactic acidosis may suffer from one or more comorbidities. **Algarni (2020)** found that several studies have examined and confirmed the prognostic value of postoperative lactate levels in predicting mortality and morbidity after cardiac surgery. First, we found that the most common comorbidity was arrhythmia, which occurs in less than half of lactic acidosis patients. **Zheng et al. (2024**) reported that the incidence of hyperlactatemia (blood lactate levels ≥ 4 mmol/L) was 42.7%, and these patients had an increased incidence of postoperative atrial fibrillation. **Hu et al. (2019)** who suggested that abnormal glycol metabolism, anaerobic glycolysis, and metabolic stress are associated with atrial fibrillation. An acute kidney injury occurs in many patients with lactic acidosis. **Connelly et al. (2017**) who suggested that there is the strongest relationship between lactic acidosis and the occurrence of AKI.

Conclusion:

Based on our study result, It is concluded that occurrence of lactic acidosis among open-heart surgery patient is associated with increased rate of mortality, morbidities, and negative outcome among patients postoperative in intensive care unit.

Recommendation:

Based on our finding the recommendation include reduce occurrence of lactic acidosis intraoperative by decrease time of operation maintain adequate perfusion to body tissue by provide adequate flowrate by CPB and postoperative by decrease use of catecholamine and used it only when needed, observe kidney and renal function, well hydration of patient and maintain adequate perfusion postoperative to decrease occurrence of complication and negative outcome postoperatively and perform Further research studies are need to conduct for deepen our understanding for relationship betwwen postoperative lactic acidosis and negative outcome among cardiac surgery patients.

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