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Analytical study of preoperative lactate level in predicting outcome of emergency abdominal surgeries

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Abstract

Objectives: This study aims to study the effects of Preoperative lactate levels on morbidity and mortality of patients undergoing emergency abdominal surgeries.

Material and methods: All the patients undergone surgery for emergency abdominal conditions over a period of 1 year were included. Patient age of below 15 years and above 70 years were excluded.

Result: In our study of 86 patients, patients whose Preoperative lactate levels of ≤ 2.5 mmol/L and > 2.5 mmol/L had mortality of 1 and 9 patients respectively ($p=0.016$), wound discharge among 11 and 10 patients ($p=0.698$), wound dehiscence among 9 and 7 patients ($p=0.502$), respiratory complication among 2 and 11 patients ($p=0.016$), prolonged ileus among 1 and 7 patients respectively (0.955).

Conclusion: Preoperative lactate levels > 2.5 mmol/L associated with higher chances of mortality and respiratory complication.

Keywords: Preoperative lactate levels, wound dehiscence, wound discharge

1. Introduction

Lactic acid or lactate was first isolated from sour milk in the 18th century. Lactic acid levels to be associated with metabolic acidosis in shock. Lactic acidosis first described by Huckabee and Cohen in 1970-1980 [1]. Normally lactate levels in blood are 0.5–2.5 mmol/L [2]. The raised lactate level is an early sign of tissue hypoxia. Serum lactate levels had shown to increase in acute abdominal conditions like appendicitis and mesenteric ischemia and can be used as a marker for mesenteric ischemia and appendicitis [3, 4]. Blood lactate levels had shown to have greater prognostic value than oxygen-derived variables like oxygen delivery or oxygen uptake. Obtaining a lactate level is essential to identifying tissue hypoperfusion in patients who are not yet hypotensive but who are at risk for septic shock. The strategy of clearing lactate to normal values was assessed in the 2012 Surviving Sepsis Campaign Guidelines. The Campaign suggests targeting resuscitation to normalize lactate in patients with elevated lactate levels as a marker of tissue hypoperfusion. Lactate clearance is percentage change in lactate level since admission. High lactate clearance to be associated with better outcome in critically ill patients and low mortality in comparison to low lactate clearance.¹ Role of Lactate levels is questioned. In present study, we will be studying the impact of lactate in evaluating the surgical outcomes of the patients of acute abdomen.

2. Material and methods

The present study was conducted during the study period from September 2016 to August 2017. Total 86 patients, who satisfied the inclusion criteria, were included in our study. Out of which 76 patients were discharged and 10 patients expired. Preoperative Lactate levels measured in all patients and were compared among survivor and mortality group. Patients coming in surgical OPD and emergency as acute abdomen requiring emergency abdominal surgeries were entertained in this study.

To study the effect of Lactate clearance all the patients in the study were divided in the following groups-

- Patients had Preoperative lactate levels ≤ 2.5 mmol/L.
- Patients had Preoperative lactate levels > 2.5 mmol/L.

Parameters that will be assessed-

- Mortality.

- Surgical site problems- Discharge (serous or purulent), Dehiscence
- Respiratory complication- Breathlessness, dyspnea, pleural effusion
- Prolonged post-operative hospital stay
- Prolonged post-operative ileus
- Anastomosis leak

These parameters were recorded for each case and the results compared to determine the effect in the groups. Randomization was not required in the study as all patients were listed and groups were sub classified in view of disease progression relative to the measured parameters. Chi Square test was applied for the evaluation of statistical significance.

3. Results

In our study of 86 patients, all patients met criteria for mortality,

while for wound complications 6 patients were excluded as they not met criteria because they expired within 48 hours. For respiratory complication, 1 patient was excluded, 6 patients were excluded for wound complication and 7 patients excluded for prolonged ileus, fecal fistula and anastomotic leak as they expired before this complication can be seen.

In our study of 86 patients, patients whose preoperative lactate levels of ≤ 2.5 mmol/l and >2.5 mmol/l had mortality of 1 patients and 9 patients respectively ($p=0.016$), wound discharge among 11 patients and 10 patients ($p=0.698$), wound dehiscence among 9 patients and 7 patients ($p=0.502$), respiratory complication among 2 patients and 11 patients ($p=0.016$), prolonged ileus among 1 patients and 5 patients respectively (0.955). Fecal fistula and anastomotic leak was found among 1 patient whose lactate clearance < 2.5 mmol/l. These findings are briefly explained in table 1.

Table 1: Association of Preoperative lactate levels with operative outcomes

	No of patients included	No. of patients in which complication present	Lactate clearance ≤ 2.5 mmol/l	Lactate clearance > 2.5 mmol/l	p value
Mortality	86	10	1	9	0.0168
Wound discharge	80	21	11	10	0.698
Wound dehiscence	80	16	9	7	0.502
Respiratory complication	85	13	2	11	0.0165
Prolonged ileus	79	8	1	5	0.955
Fecal fistula	79	1	1	0	
Anastomotic leak	79	1	1	0	

4. Discussion

Patients included in this study, divided into Survivor group and Mortality group after the completion of the surgery. Survivor group consisted of patients who discharged after operation. Mortality group consisted of patients who expired within 28 days from the day of surgery. In our study of 86 patients, 76 patients were included in Survivor group and 10 patients included in Mortality group.

4.1. Mortality

In our study of 86 patients, 39 patients had ≤ 2.5 mmol/l Preoperative lactate level, in which 38 patients were in survivor group and 1 patients were in mortality group. 47 patients having Preoperative lactate level > 2.5 mmol/l in which 38 patients were in survivor group and 9 patients in mortality group. These results were statistically significant ($p=0.016$). Adrian Billeter *et al.* (2009) [5] did an prospective study among 1757 patients over a period of 10 years and they reached on conclusion of increased infection and mortality among patients having impaired Preoperative lactate levels, increased procalcitonin level and IL-6. Ryan C. Arnold *et al.* (2009) [6] found higher mortality rates in those patients having percentage decrease in lactate 6 hourly is below 2.5 mmol/l. Mikkelsen *et al.* (2009) [7] studied on association of serum lactate with mortality in severe sepsis independent of organ failure and shock among 830 patient over a period from 2005 to 2007 in emergency department of academic tertiary care center. Their primary outcome was 28-day mortality and divided into 3 groups: low (<2 mmol/l), intermediate (2–3.9 mmol/l), or high (≥ 4 mmol/l) and group divided into shock and nonshock subgroups. They found mortality at 28 day was 22.9% and median serum lactate was 2.9 mmol/l. They compared mortality among shock and nonshock subgroup of intermediate and high group. They finally reached on conclusion that serum lactate at the time of admission was associated with mortality independent of any organ dysfunction

and shock in patients admitted to the emergency department with severe sepsis. Both intermediate and high serum lactate levels were independently associated with mortality.

4.2. Post-operative Complications

Post-operative Complication after surgery will be discussed under following headings.

4.3. Surgical site infection

This complication discussed under these headings

4.4. Wound Discharge

In our study of 86 patients, 6 patients were excluded as they expired before this complication can be seen. Rest 80 patients taken into study out of which 21 patients developed wound discharge while 59 patients do not had wound discharge.

In our study of 86 patients, 21 patients developed wound discharge, in which 11 patients had Preoperative lactate level found to be of ≤ 2.5 mmol/l and 10 patients had Preoperative lactate level of > 2.5 mmol/l. Rest 59 patients did not develop wound discharge, out of which, 28 patients had Preoperative lactate level ≤ 2.5 mmol/l and 31 patients had > 2.5 mmol/l. These results were statistically insignificant. ($p=0.698$). Farah A. Hussain *et al.* (2002) [8] concluded based on their study that lactate may be predictive of certain morbidities and patient outcome at discharge.

4.4.1. Wound Dehiscence

In our study of 86 patients, 6 patients were excluded as they expired before this complication can be seen. Rest 80 patients taken into study out of which 16 patients developed wound dehiscence while 64 patients do not had wound dehiscence.

In our study of 86 patients, 16 patients developed wound dehiscence, in which 9 patients had Preoperative lactate level found to be of ≤ 2.5 mmol/l and 7 patients had Preoperative

lactate level of > 2.5 mmol/l. Rest 64 patients did not develop wound dehiscence, out of which, 30 patients had lactate clearance of ≤ 2.5 mmol/l and 34 patients had > 2.5 mmol/l. These results were statistically insignificant. ($p=0.502$). Our results supported by study of Farah A. Hussain *et al.* (2002)^[8] as they concluded that lactate may be predictive of certain morbidities and patient outcome at discharge.

4.5. Respiratory complication

In our study of 86 patients, 1 patient was excluded as they expired before this complication can be seen. Rest 85 patients were taken into study out of which 13 patients developed respiratory complication while 72 patients did not have this complication.

In our study of 86 patients, 85 patients were included out of which 13 patients developed respiratory complication, in which 2 patients had Preoperative lactate level of ≤ 2.5 mmol/l and 11 patients had Preoperative lactate level of > 2.5 mmol/l. Rest 72 patients did not develop respiratory complication, out of which, 37 patients had Preoperative lactate level ≤ 2.5 mmol/l and 35 had >2.5 mmol/l. These results were statistically significant. ($p=0.0165$). Matthew R.Dettmer (2015)^[9] concluded that Serial lactate monitoring is associated with a decrease in major pulmonary complications in severe sepsis and septic shock. This result provide potentially variables to be targeted in future studies to prevent pulmonary complications in this patient.

4.6. Prolonged Ileus

In our study of 86 patients, 7 patients were excluded as they expired before this complication can be seen. Rest 79 patients were taken into study out of which 6 patients developed Prolonged ileus while 73 patients did not have this complication. In our study of 86 patients, 7 patients were excluded as they expired before this complication can be seen. 6 patients developed prolonged ileus, in which 1 patients had Preoperative lactate level of < 2.5 mmol/l and 5 patients had Preoperative lactate level of > 2.5 mmol/l. Rest 73 patients did not develop prolonged ileus, out of which, 38 patients had Preoperative lactate level ≤ 2.5 mmol/l and 35 patients had >2.5 mmol/l. These results were statistically insignificant. ($p=0.955$).

4.7. Fecal Fistula

In our study of 86 patients, 7 patients were excluded as they expired before this complication can be seen. Rest 79 patients were taken into study out of which 1 patient developed this complication while 78 patients did not have this complication. However, this parameter had no significance as the CRP and lactate clearance values did not corroborate with the presence or absence of fecal fistula. This patient had preoperative lactate level of < 2.5 mmol/l.

4.8. Anastomotic Leak

In our study of 86 patients, 7 patients were excluded as they expired before this complication can be seen. Rest 79 patients were taken into study out of which 1 patient developed this complication while 78 patients did not have this complication. That 1 patient had preoperative lactate level of <2.5 mmol/l.

5. Conclusion

From our study, we concluded that.

1. In our study, mortality is more among patients with Preoperative lactate levels of ≤ 2.5 mmol/l than those patients having Preoperative lactate levels >2.5 mmol/l.
2. In our study, Respiratory complications found to be more

associated with Preoperative lactate levels > 2.5 mmol/l.

3. Postoperative ileus had no association with Preoperative lactate levels > 2.5 mmol/l.
4. No correlation could be drawn between the anastomotic leak and fecal fistula whose preoperative CRP level > 150 mg/l and Preoperative lactate levels was >2.5 mmol/l. As complication is seen in only 1 patient no conclusion can be made on this data and further study is needed. By our study, we can conclude that Preoperative lactate levels > 2.5 mmol/l associated with higher chances of mortality, and respiratory complication.

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