# **Original Research Article**

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# Effect of CRP and lactate clearance in predicting outcome of emergency abdominal surgeries

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#### **ABSTRACT**

Background: Emergency abdominal condition had good prognosis if they diagnosed early and had better prognosis. Many biological parameters were considered to reduce postoperative complications. This study aims to study the effects of CRP and 24-hour lactate clearance on morbidity and mortality of patients undergoing emergency abdominal surgery.

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.

**Results:** In the present study of 86 patients, patients whose preoperative CRP level <150 mg/dl and preoperatively CRP > 150 mg/dl had mortality of 1 and 9 patients respectively (p = 0.049), wound discharge among 12 and 9 patients respectively (p = 0.113), wound dehiscence among 7 and 9 patients respectively (p = 0.909) and respiratory complications among 2 and 11 patients respectively (p = 0.049). In the present study of 86 patients, patients whose 24 hour lactate clearance of <10% and >10% had mortality of 4 and 3 patients respectively (p = 0.0003), wound discharge among 5 and 16 patients (p = 0.119), wound dehiscence among 5 and 11 patients (p = 0.023), respiratory complication among 5 and 8 patients (p = 0.002), prolonged ileus among 3 and 3 patients respectively (0.007).

Conclusions: Preoperative CRP level >150 mg/l associated with higher chances of mortality, respiratory complication and postoperative ileus. 24-hour lactate clearance < 10 % associated with higher chances of mortality, wound dehiscence, respiratory complication and postoperative ileus.

Keywords: 24-hour lactate clearance, CRP, Emergency abdominal condition, Wound dehiscence, Wound discharge

# INTRODUCTION

Wiliam Tillett and Francis first discovered C-reactive protein at the Rockefeller University in 1930.1 CRP was the first acute-phase protein to be described as sensitive systemic marker of inflammation and tissue damage.<sup>2</sup> CRP levels normally rise within 2 to 6 hours of tissue damage and then go down by the third day after tissue damage.<sup>3</sup> Normal range of CRP is less than 3mg/dl, but following an acute-phase stimulus i.e. in infection or trauma, values may increase up to 10,000-fold. The plasma half-life of CRP is about 19 hours.4 Few studies have assessed the diagnostic role of CRP in patients in the broad category of an acute abdomen.<sup>5,6</sup> 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 1970-1980.7 Normally lactate levels in blood are 0.5-2.5 mmol/L.8 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 used as a marker for mesenteric ischemia and appendicitis. 9,10 Blood lactate levels had shown to have greater prognostic value than oxygenderived variables like oxygen delivery or oxygen uptake. Obtaining a lactate level is essential to identifying tissue hypo perfusion 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 hypo perfusion. 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.7 Role of lactate clearance and CRP in abdominal emergency is questioned. In present study, we will be studying the impact of lactate clearance and preoperatively CRP in evaluating the surgical outcomes of the patients of acute abdomen and complication.

#### **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 CRP and lactate measured in all patients and after 24 hour of surgery lactate levels were measured in those patients who after during that time period. Lactate clearance and Preoperative CRP were compared among survivor and mortality group. Patients coming in surgical OPD and emergency as acute abdomen requiring emergency abdominal surgeries were entertained in present study. To study the effect of CRP all the patients in this study divided in the following groups:

- Patients had pre-operative CRP level ≤150 mg/l
- Patients had pre-operative CRP level >150 mg/l.

To study the effect of lactate clearance all the patients in the study were divided in the following groups:

- Patients had 24-hour lactate clearance ≤10%.
- Patients had 24-hour lactate clearance <10%.

Parameters that will be assessed to help determine predictive value of CRP and lactate clearance:

- Mortality
- Surgical site problems: discharge (serous or purulent), dehiscence
- Respiratory complication: breathlessness, dyspnea, pleural effusion
- Prolonged post-operative hospital stays
- 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 CRP and lactate clearance. Chi square test was applied for the evaluation of statistical significance.

#### **RESULTS**

In the present 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, and 7 patients excluded for prolonged ileus, fecal fistula and anastomotic leak as they expired before this complication can be seen.

Table 1: Association of CRP with operative outcomes.

	No. of patients included	No. of patients in which complication present	CRP <150 mg/dl	CRP >150 mg/dl	p value
Mortality	86	10	1	9	0.049
Wound discharge	80	21	12	9	0.113
Wound dehiscence	80	16	7	9	0.909
Respiratory complication	85	13	2	11	0.049
Prolonged ileus	79	6	0	6	
Fecal fistula	79	1	0	1	
Anastomotic leak	79	1	0	1	

In our study of 86 patients, Preoperative CRP level  $\leq$ 150 mg/dl and preoperatively CRP >150 mg/dl had mortality of 1patient and 9 patients respectively (p = 0.049), wound

discharge among 12 patients and 9 patients respectively (p = 0.113), wound dehiscence among 7 patients and 9 patients respectively (p = 0.909) and respiratory

complications among 2 patients and 11 patients respectively (p = 0.049). Prolonged ileus, fecal fistula and anastomotic leak was present in 6 patients and all had preoperative CRP level >150 mg/dl. These findings are briefly explained in Table 1. In the present study of 86 patients, patients whose 24 hour lactate clearance of  $\leq$ 10% and >10% had mortality of 4 patients and 3

patients respectively (p = 0.0003), wound discharge among 5 patients and 16 patients (p = 0.119), wound dehiscence among 5 patients and 11 patients (p = 0.023), respiratory complication among 5 patients and 8 patients (p = 0.002), prolonged ileus among 3 patients and 3 patients respectively (0.007).

	No of patients included	No. of patients in which complication present	No. of patients included with complication	Lactate clearance <10%	Lactate clearance >10%	p value
Mortality	83	10	7	4	3	0.0003
Wound discharge	80	21	21	5	16	0.119
Wound dehiscence	80	16	16	5	11	0.023
Respiratory complication	85	13	13	5	8	0.002

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Table 2: Association of lactate clearance with operative outcomes.

Fecal fistula and anastomotic leak were found among 1 patient whose lactate clearance  $\leq 10$  %. These findings are briefly explained in Table 2.

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79

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## **DISCUSSION**

Prolonged ileus

Anastomotic leak

Fecal fistula

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 the present study of 86 patients, 76 patients were included in survivor group and 10 patients included in mortality group.

## Mortality

In the present study of 86 patients, 33 patients had preoperative CRP level of ≤150 mg/l and 53 patients had preoperative CRP level of >150 mg/l. Patients had preoperative CRP level ≤150 mg/l, 1 patient expired, and 32 patients discharged. In rest 53 patients, 9 patients were expired during course of treatment and rest 44 patients were discharged. These results were statistically significant (p = 0.049). Present results can be corroborated by study of Lobo SM et al.<sup>11</sup> As they also confirmed that, if CRP level in critically ill patients at the time of admission >10 mg/dl then it is associated with a significantly higher mortality rates than CRP levels of <1mg/dl. Green JP et al did study among urban teaching hospitals considering CRP level 10 mg/dl, found higher mortality rates among those groups with 28 days inpatient mortality.<sup>12</sup> They also compared Lactate levels with CRP during their study to predict short-term mortality.

In the present study of 86 patients, 3 patients were expired within 24 hours. 83 patients were taken into study, 11 patients had  $\leq$ 10 % lactate clearance, in which 7 patients were in survivor group and 4 patients were in mortality group. 72 patients having lactate clearance more than 10% in which 69 patients were in survivor group and 3 patients in mortality group. These results were statistically significant (p = 0.0003).

3

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Same results were assessed by Nguyen et al study, they proved that higher lactate clearance associated with better outcome for the patient. Billeter A et al 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 24 hour lactate clearance, increased procalcitonin level and IL-6. Arnold RC had similar results and they found higher mortality rates in those patients having percentage decrease in lactate 6 hourly is below 10%. Bhat SR et al did an retrospective study among 207 patients and they revealed that ability to clear lactate is predictor for mortality among emergency admissions.

#### Post-operative complications

Post-operative complication after surgery will be discussed under following headings

#### Surgical site infection

This complication discussed under these headings

- Wound discharge
- Wound dehiscence

#### Wound discharge

In the present 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 did not have wound discharge.

Out of these, 12 patients had preoperative CRP level of ≤150 mg/l and 9 patients had preoperative CRP level of >150 mg/l. Rest 59 patients did not develop wound discharge, out of which 22 patients had preoperative CRP ≥150mg/l and 37 patients had >150 mg/L.

These results were statistically insignificant (p = 0.113). Present results matched with study of Kingsley A et al, as they rejected their hypothesis that CRP can be used as an diagnostic tool for wound healing and found insignificant and cannot differentiate between local, colonial and critical colonization.<sup>17</sup>

In the present study of 86 patients, 21 patients developed wound discharge, in which 5 patients had lactate clearance found to be of  $\leq$ 10% and 16 patients had lactate clearance of >10%. Rest 59 patients did not develop wound discharge, out of which, 6 patients had lactate clearance  $\leq$ 10% and 53 patients had >10%. These results were statistically insignificant (p = 0.119).

# Wound Dehiscence

In the present 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.

Out of these 16 patients, 7 patients had preoperative CRP level was  $\leq$ 150 mg/l and 9 patients had preoperative CRP level >150 mg/l. Rest 64 patients did not develop wound dehiscence, out of which 27 patients had preoperative CRP  $\leq$ 150mg/l and 37 patients had >150 mg/l. These results were statistically insignificant. (p = 0.909). Present results can be explained by study of Kingsley A et al, they rejected their hypothesis that CRP can be used as a diagnostic tool for wound discharge and they found association between CRP and wound infection to be insignificant.

In the present study of 86 patients, 16 patients developed wound dehiscence, in which 5 patients had lactate clearance found to be of  $\leq$ 10% and 11 patients had lactate clearance of >10%. Rest 64 patients did not develop wound dehiscence, out of which, 6 patients had lactate clearance of  $\leq$ 10% and 58 patients had >10%. These results were statistically significant (p = 0.023). Present results supported by study of Billeter A et al on 1757 consecutively admitted trauma patients. They found association of septic and non-septic complication with

impaired 24-hour lactate clearance. Early monitoring of lactate levels can reduce these complications.

In the present study, 10 patients developed burst abdomen, in which 5 patients had preoperative CRP level and 3 patients had lactate clearance of  $\leq 150$  mg/l and  $\leq 10\%$  respectively, 5 had preoperative CRP level >150 mg/l and 7 had lactate clearance of >10%. Rest 70 patients did not develop burst abdomen, out of which 29 had preoperative CRP  $\leq 150$  mg/l and 8 had lactate clearance <10%, 41 patients had >150 mg/l and 62 patients had >10%. Both results were statistically insignificant (p = 0.608 for CRP and p = 0.110 for lactate clearance).

#### Respiratory complication

In the present 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 the present study of 86 patients, 85 patients were included, out of which 13 patients developed respiratory complication, in which 2 patients had preoperative CRP level was  $\leq$ 150 mg/l and 11 patients had preoperative CRP level >150 mg/l. Rest 72 patients did not develop respiratory complication, out of which 32 had preoperative CRP  $\leq$ 150 mg/l and 40 had >150 mg/l. These results were statistically significant (p = 0.049).

Present study can be validated by Örtqvist A et al study on CRP and Interleukin-6 on community-acquired pneumonia they support that CRP had diagnostic and prognostic importance to diagnose community-acquired pneumonia. Present results matched by study of Daga MK et al they support that patients having CRP >50 can have increase chances of respiratory tract infection and CRP can also use to differentiate among parenchymal and endobronchial infections.

In the present study of 86 patients, 85 patients were included out of which 13 patients developed respiratory complication, in which 5 patients had lactate clearance of  $\leq$ 10% and 8 patients had lactate clearance of >10 %. Rest 72 patients did not develop respiratory complication, out of which, 6 patients had lactate clearance  $\leq$ 10% and 66 had >10%. These results were statistically significant. (p = 0.002)

#### 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. Patients who develop prolonged ileus, all had preoperative CRP level > 150 mg/l. Present study results can be corroborated with study of Fujii T et al as

they did study among 383 patients of colorectal cancer out of which, 35 patients developed postoperative ileus having raised CRP levels but they also add that some other parameters were also contributed to prolonged ileus included which were not counted during their study.<sup>20</sup>

In the present study of 86 patients, 7 patients were excluded as they expired before this complication can be seen. 6 patients developed prolonged ileus, in which 3 patients had lactate clearance of  $\leq$ 10% and 3 patients had lactate clearance of >10%. Rest 73 patients did not develop prolonged ileus, out of which,8 patients had lactate clearance  $\leq$ 10% and 65 patients had >10%. These results were statistically significant (p = 0.007).

#### 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 CRP > 150 mg/l and lactate clearance of 13.64%.

#### Anastomotic leak

In the present 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 CRP level >150 mg/l but lactate clearance >10%. Present results can be correlated by study of Almeida AB et al which supports that increased CRP levels were associated with more chances of anastomotic leakage and CRP cutoff level for postoperative day 3 is >140 mg/l with 78% sensitivity and 86% specificity. Another study performed by Scepanovic MS et al suggest that patients having CRP less than 135 mg/l on post-operative day 3 having minimal chances of leakage. However, this parameter did not show any concordance with lactate clearance levels.

# CONCLUSION

From the present study, we concluded that

- In the present study, mortality is more among patients having preoperative CRP level >150 mg/l as compared to those patients having preoperative CRP level ≤150 mg/l.
- In the present study, mortality is more among patients with 24-hour lactate clearance of ≤10% than those patients having 24-hour lactate clearance >10%.

- In the present study, no association was found between preoperative CRP level and wound discharge and 24-hour lactate clearance and wound discharge.
- In the present study, wound dehiscence found to be less in patients with 24-hour lactate clearance of >10%, while no association was found between preoperative CRP levels and wound dehiscence.
- In the present study, respiratory complications found to be more associated with preoperative CRP level >150 mg/l and 24-hour lactate clearance ≤10%. Respiratory complication showed more association with 24-hour lactate clearance levels.
- In the present study, postoperative ileus found to be more among patients having preoperative CRP level >150 mg/l. However, not all patients were affected by ileus who had preoperative CRP level >150 mg/l. Postoperative ileus is more among patients having 24-hour lactate clearance ≤10%.
- No correlation could be drawn between the anastomotic leak and fecal fistula whose preoperative CRP level >150 mg/l and 24-hour lactate clearance was >10%. As complication is seen in only 1 patient no conclusion can be made on this data and further study is needed.

By the present study, we can conclude that preoperative CRP level >150 mg/l associated with higher chances of mortality, respiratory complication and postoperative ileus. 24-hour lactate clearance ≤10 % associated with higher chances of mortality, wound dehiscence, respiratory complication and postoperative ileus.

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Institutional Ethics Committee

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