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Evaluation of the lactate levels in the patients undergoing the emergency abdominal surgeries

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Abstract
Elevated lactate levels are frequently found in critically ill patients and often correlate with the disease severity. Because of its prognostic role, lactate has been widely used as a biomarker for screening, diagnosis, risk stratification, and monitoring in critically ill patients. Multiple studies have evaluated the prognostic value of lactate in heterogeneous groups of critically ill patients, in the intensive care unit (ICU) and emergency department settings. Most of those studies involved patients with sepsis, trauma, shock, or severe respiratory failure. On the other hand, data on the significance of lactate monitoring in a relatively homogeneous population of patients undergoing elective major abdominal surgery is scarce.
The present study was planned in the Department of General Surgery; Katihar Medical College. Total 25 patients diagnosed with the acute abdomen requiring emergency abdominal surgeries were enrolled in the present study. The details of patients who presented from Nov 2011 to march 2012 were enrolled in the present study. Preoperative Lactate levels measured in all patients and were compared among survivor and mortality group.
These findings are of value in clinical practice as it may be possible to use the initial post-operative lactate concentration to determine the patient pathway in the early post-operative period. In addition the correlation of post-operative lactate with subsequent organ dysfunction and mortality may allow its use as a single measure of the impact of innovations in operative technique or peri-operative care. However, further studies are required to indicate which strategies aimed at resolving hyperlactatemia improve postoperative outcomes.

Keywords: Emergency abdominal condition, wound dehiscence, wound discharge, etc.

Introduction
The term abdominal surgery broadly covers surgical procedures that involve opening the abdomen. Surgery of each abdominal organ is dealt with separately in connection with the description of that organ (see stomach, kidney, liver, etc.) Diseases affecting the abdominal cavity are dealt with generally under their own names (e.g. appendicitis).
The most common abdominal surgeries are described below.
Appendectomy-Surgical opening of the abdominal cavity and removal of the appendix. Typically performed as definitive treatment for appendicitis, although sometimes the appendix is prophylactically removed incidental to another abdominal procedure.
Caesarean section (also known as C-section) is a surgical procedure in which one or more incisions are made through a mother's abdomen (laparotomy) and uterus (Hysterotomy) to deliver one or more babies, or, rarely, to remove a dead fetus.
Inguinal hernia surgery-This refers to the repair of an inguinal hernia.
Exploratory laparotomy-This refers to the opening of the abdominal cavity for direct examination of its contents, for example, to locate a source of bleeding or trauma. It may or may not be followed by repair or removal of the primary problem.
Laparoscopy-A minimally invasive approach to abdominal surgery where rigid tubes are inserted through small incisions into the abdominal cavity. The tubes allow introduction of a small camera, surgical instruments, and gases into the cavity for direct or indirect visualization and treatment of the abdomen. The abdomen is inflated with carbon dioxide gas to facilitate visualization and, often, a small video camera is used to show the procedure on a monitor in the operating room. The surgeon manipulates instruments within the abdominal cavity to perform procedures such as cholecystectomy (gallbladder removal), the most common laparoscopic procedure. The laparoscopic method speeds recovery time and reduces blood loss and infection as compared to the traditional "open" method.
Complications of abdominal surgery include, but are not limited to:
Adhesions (also called scar tissue): Complications of postoperative adhesion formation are frequent, they have a large negative effect on patients' health, and increase workload in clinical practice [1]: Bleeding, Infection, Paralytic ileus (sometimes called ileus): short-term paralysis of the bowel, Perioperative mortality (death), Shock.
Sterile technique, aseptic post-operative care, antibiotics, use of the WHO Surgical Safety Checklist, and vigilant post-operative monitoring greatly reduce the risk of these complications. Planned surgery performed under sterile conditions is much less risky than that performed under emergency or unsterile conditions. The contents of the bowel are unsterile, and thus leakage of bowel contents, as from trauma, substantially increases the risk of infection.
Globally, there are few studies comparing perioperative mortality following abdominal surgery across different health systems. One major prospective study of 10,745 adult patients undergoing emergency laparotomy from 357 centres in 58 high-, middle-, and low-income countries found that mortality is three times higher in low- compared

with high-HDI countries even when adjusted for prognostic factors [2]. In this study the overall global mortality rate was 1·6 per cent at 24 hours (high 1·1 per cent, middle 1·9 per cent, low 3·4 per cent; *P*< 0·001), increasing to 5·4 per cent by 30 days (high 4·5 per cent, middle 6·0 per cent, low 8·6 per cent; *P*< 0·001). Of the 578 patients who died, 404 (69·9 per cent) did so between 24 h and 30 days following surgery (high 74·2 per cent, middle 68·8 per cent, low 60·5 per cent). Patient safety factors were suggested to play an important role, with use of the WHO Surgical Safety Checklist associated with reduced mortality at 30 days.

Taking a similar approach, a unique global study of 1,409 children undergoing emergency laparotomy from 253 centres in 43 countries showed that adjusted mortality in children following surgery may be as high as 7 times greater in low-HDI and middle-HDI countries compared with high-HDI countries, translating to 40 excess deaths per 1000 procedures performed in these settings. Internationally, the most common operations performed were appendectomy, small bowel resection, pyloromyotomy and correction of intussusception. After adjustment for patient and hospital risk factors, child mortality at 30 days was significantly higher in low-HDI (adjusted OR 7.14 (95% CI 2.52 to 20.23), *p*<0.001) and middle-HDI (4.42 (1.44 to 13.56), p=0.009) countries compared with high-HDI countries [3].

A lactic acid test is a blood test that measures the level of lactic acid made in the body. Most of it is made by muscle tissue and red blood cells. When the oxygen level in the body is normal, carbohydrate breaks down into water and carbon dioxide. When the oxygen level is low, carbohydrate breaks down for energy and makes lactic acid. Lactic acid levels get higher when strenuous exercise or other conditions-such as heart failure, a severe infection (sepsis), or shock-lower the flow of blood and oxygen throughout the body. Lactic acid levels can also get higher when the liver is severely damaged or diseased, because the liver normally breaks down lactic acid. Very high levels of lactic acid cause a serious, sometimes life-threatening condition called lactic acidosis. Lactic acidosis can also occur in a person who takes metformin (Glucophage) to control diabetes when heart or kidney failure or a severe infection is also present. A lactic acid test is generally done on a blood sample taken from a vein in the arm but it may also be done on a sample of blood taken from an artery (arterial blood gas) [18].

Elevated lactate levels are frequently found in critically ill patients and often correlate with the disease severity. Because of its prognostic role, lactate has been widely used as a biomarker for screening, diagnosis, risk stratification, and monitoring in critically ill patients. Moreover, lactate levels can be used for outcome prediction and as a surrogate endpoint to guide treatment. The rationale for lactate monitoring in critically ill patients is based on the fact that hyperlactatemia is most often caused by tissue hypoperfusion and increased anaerobic glycolysis. Elevated lactate might also be due to an increased aerobic glycolysis, i.e., pyruvate production is higher than the capacity of pyruvate dehydrogenases, which occurs as a response to cytokine release, increased circulating catecholamines, or the accumulation of leukocytes at the site of inflammation [4].

Multiple studies have evaluated the prognostic value of lactate in heterogeneous groups of critically ill patients, in the intensive care unit (ICU) and emergency department settings [5-6]. Most of those studies involved patients with sepsis, trauma, shock, or severe respiratory failure. On the other hand, data on the significance of lactate monitoring in a relatively homogeneous population of patients undergoing elective major abdominal surgery is scarce.

Methodology

The present study was planned in the Department of General Surgery; Katihar Medical College. Total 25 patients diagnosed with the acute abdomen requiring emergency abdominal surgeries were enrolled in the present study. The details of patients who presented from Nov 2011 to march 2012 were enrolled in the present study. Preoperative Lactate levels measured in all patients and were compared among survivor and mortality group.

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.

All the patients were informed consents. The aim and the objective of the present study were conveyed to them. Approval of the institutional ethical committee was taken prior to conduct of this study.

Following was the inclusion and exclusion criteria for the present study.

Inclusion Criteria: Patients coming in surgical OPD and emergency as acute abdomen requiring emergency abdominal surgeries and Patients willing to enrol in the present study.

Exclusion Criteria: Patients with Palliative surgery, low life expectancy, liver failure and not willing to enrol in the present study.

Results and Discussion

Lactate levels are often elevated in critically ill patients and can be used as an indicator of clinical outcome. In this study, higher serum lactate levels in the early postoperative period after the elective major abdominal surgery were associated with an increased risk of mortality. Higher lactate was also associated with a longer duration of hospital stay, despite similar postoperative care in all patients.

Table 1: Age & Sex Distribution

Age	No. of Patients
21-30	2
31-40	5
41-50	8
51-60	5
>60	5
Total	25
Sex	No. of Patients
Male	18
Female	7
Total	25
ASA Grade	
Grade I	4
Grade II	15
Grade III	6
Surgery Time	2.4 – 5.3 hrs
ICU Stay	2 – 4 days
Hospital Stay	6 – 16 days

Table 2: Association of Preoperative lactate levels with operative outcomes

	No of patients	No. of patients in which complication present	Lactate clearance <2.5 mmol/l	Lactate clearance > 2.5 mmol/l
Mortality	30	6	1	5
Wound discharge	27	9	5	4
Wound dehiscence	27	7	4	3
Respiratory complication	28	7	1	6
Prolonged ileus	25	3	1	2
Fecal fistula	25	1	1	0
Anastomotic leak	25	1	1	0

Same results were assessed by Nguyen *et al*. study, they proved that higher lactate clearance associated with better outcome for the patient [7]. 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 [8]. Arnold RC had similar results and they found higher mortality rates in those patients having percentage decrease in lactate 6 hourly is below 10% [9]. 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 [10].

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 [11].

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. Present results supported by study of Billeter A *et al*. on 1757 consecutively admitted trauma patients [8]. They found association of septic and non-septic complication with impaired 24-hour lactate clearance. Early monitoring of lactate levels can reduce these complications.

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 [12]. 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 [13].

These findings support and extend those of an earlier study [14]. By demonstrating the association of post-operative lactate with renal and hepatic dysfunction and length of hospital stay in addition to mortality. Pre-operative diabetes mellitus, the surgeon's assessment of the liver at laparotomy, the extent of liver resection, blood loss and the number of units of blood transfused are also shown to be associated with post-operative serum lactate concentration

Meregalli *et al*. [15]. Have shown that a postoperative 3.1 mmol/L lactate level in hemodynamically stable surgical patients failed to discriminate patients who didn't survive to the first 12 hours from admission, by the other hand the clearence determined the prognosis. In heart surgery, a postoperative 3 mmol/L value determined increased morbidity and mortality risks [16]. Almeida *et al*. [17]. Only found ICU admission values above 3.2 mmol/L to discriminate mortality, and did not evaluate the marker trends.

Conclusion

These findings are of value in clinical practice as it may be possible to use the initial post-operative lactate concentration to determine the patient pathway in the early post-operative period. In addition the correlation of post-operative lactate with subsequent organ dysfunction and mortality may allow its use as a single measure of the impact of innovations in operative technique or peri-operative care. However, further studies are required to indicate which strategies aimed at resolving hyperlactatemia improve postoperative outcomes.

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