



ORIGINAL RESEARCH PAPER

General Medicine

COMPARATIVE STUDY OF TRADITIONAL VITAL SIGNS WITH BLOOD LACTATE LEVELS AS A PROGNOSTIC INDICATOR FOR TRAUMA PATIENT IN THE ED

KEY WORDS: Vital signs, Blood lactate, Prognostic indicator & Trauma patient

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ABSTRACT

BACKGROUND:Traumatic injuries are a major causer of life threatening hemorrhage. Early recognition and assessment of the degree of hypoperfusion remains a challenge. Traditional vital signs are often used to help determine a trauma patient's hemodynamic status. Current hospital trauma triage systems are based mainly on physiological parameters, but in compensated shock injury severity may not be immediately obvious, as the physiological parameters remain normal for some time. Recent studies have demonstrated lactate as a biomarker capable of identifying high risk trauma patient.

OBJECTIVE:The purpose of this study was to determine if blood lactate levels in patients with normal systolic blood pressure have better predictive value for identifying patients with an elevated risk of significant transfusion and mortality.

METHODOLOGY:A prospective observational study was undertaken at a tertiary teaching hospital in Navi Mumbai from January 2018 to May 2018. Baseline vital signs and lactate were recorded in all patients for whom the trauma team was activated. Informed consent was taken from subjects/attendants.

RESULTS:40 patients were selected for the study. Analysis showed that 50% of the patients having high lactate levels needed aggressive care i.e. transfusion and/or surgery. Study also revealed that since p-value for the chi-square and Fisher's exact test is less than that of 0.05 indicates significance of association between Lactate Level and Transfusion and surgery needed.

CONCLUSION:These findings suggest that blood lactate measurements could improve trauma triage when used with early triage vitals like SBP and HR in predicting the need for aggressive care (requiring significant transfusion). A significant association was also found between blood lactate concentration and mortality in trauma patients. Blood lactate testing demonstrates that it is now capable of providing clarity in the often challenging ED environment. Further studies using blood lactate measurement are warranted.

INTRODUCTION

Many patients who appear to be haemodynamically stable based on normal vital signs have increased blood lactate levels ('occult hypoperfusion' or 'compensated shock'), as a result, lactate levels are often considered to be better resuscitation endpoints than standard vital signs.¹ Increased blood lactate levels in critically ill patients are generally associated with increased morbidity and mortality.^{2,3} Even haemodynamically stable patients with raised lactate levels, a condition referred to as compensated shock, are at increased risk of dying. This not only applies to patients admitted to the intensive care unit; also early in the course of illness, increased blood lactate levels are related to increased morbidity and mortality.^{4,5} Howell et al.⁶ evaluated the prognostic value of one single venous lactate measurement shortly after admission to the ED in patients with clinically suspected infection. Their study is a follow-up on a preliminary report, where they did not take into account possible confounding factors such as co-morbidities and vital signs.⁷ Initial triage, trauma team activation, and early resuscitation of trauma patients is often directed by the presence of abnormal traditional vital signs (TVS) such as systolic blood pressure (SBP) and heart rate (HR), as these measures are physical signs of circulatory hemodynamic instability (cHI). The shock index (SI), a composite of TVS, may be a more sensitive and accurate predictor of hypoperfusion and early shock than its individual components.^{8,9} However, these markers may not be a sign of cHI in all patients following traumatic injury.¹⁰

Elevated lactate levels have been consistently shown as a marker of severe injury and mortality in trauma patients, particularly in patients older than 55 years. Despite this knowledge, few activation and resuscitation guidelines include VL as a measure of cHI, rather focusing on TVS like SBP and HR.¹¹

AIMS AND OBJECTIVES:

- (1) To study if low systolic blood pressure is associated with aggressive care.
- (2) To determine if blood lactate levels in patients with normal systolic blood pressure (N-SBP) have better predictive value for identifying patients with an elevated risk of significant transfusion and mortality.

MATERIALS & METHOD:

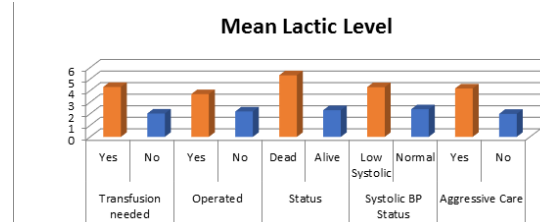
The present study was set up at the MGM Hospital, Kalamboli, Navi-Mumbai. 40 trauma patients admitted between January to May 2018 were considered for the study. Baseline vital signs and lactate were recorded in all patients for whom the trauma team was activated. Informed consent was taken from subjects/attendants. Low systolic blood pressure (L-SBP) was defined as ≤ 90 mmHg, raised blood lactate level (R-BL) was defined as >2.5 mmol/L, Aggressive care (AC) was defined as the need for a major blood transfusion ≥ 4 with 24 hours of admission, urgent surgery to stop bleeding, or death within 6 hours of arrival to the emergency department.

STATISTICAL ANALYSIS:

DESCRIPTIVE STATISTICS:

| | | Lactate levels | | |
|--------------------|-------|----------------|--------------------|------------------|
| | | Mean | Standard Deviation | t-test (p-value) |
| Transfusion needed | Yes | 4.32 | 1.83 | 6.059 (0.0000) |
| | No | 2.02 | .62 | |
| Operated | Yes | 3.70 | .92 | 3.164 (0.003) |
| | No | 2.20 | 1.33 | |
| Status | Dead | 5.33 | 2.97 | 4.393 (0.000) |
| | Alive | 2.31 | .95 | |
| Aggressive Care | Yes | 4.19 | 1.78 | 5.967 (0.0000) |
| | No | 1.99 | .60 | |

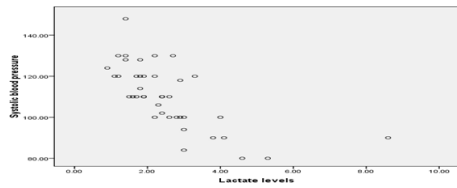
p-value less than 0.05 indicates significance of difference.



CORRELATION BETWEEN SYSTOLIC BLOOD PRESSURE AND LACTIC LEVELS:

| | |
|---------------------|-------------------------|
| | Correlation Coefficient |
| Pearson Correlation | -0.672** |
| p-value | .000 |
| N | 40 |

** . Correlation is significant at the 0.01 level (2-tailed).

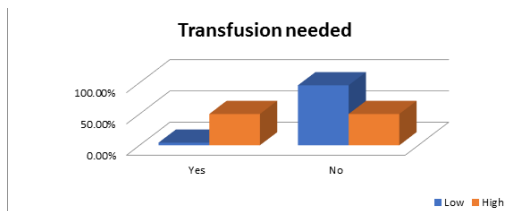


Interpretation: The negative correlation coefficient value (-0.672) with p-value < 0.05 indicates that the higher lactic level is associated with lower systolic blood pressure.

Also, we tried to check the association by categorising the lactic level into two categories as High and Low.

TRANSFUSION NEEDED:

| | | | | |
|--------------------|----------------|------------|-------|------------|
| | Lactate Levels | | | |
| | Low | High | | |
| Transfusion needed | Count | Column N % | Count | Column N % |
| Yes | 1 | 4.2% | 8 | 50.0% |
| No | 23 | 95.8% | 8 | 50.0% |



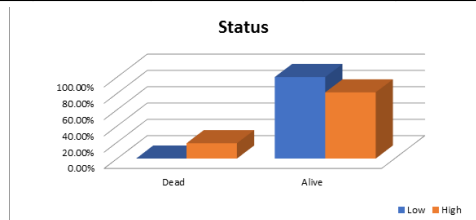
CHI-SQUARE TEST RESULT:

| | |
|-------------------------------|--------|
| | Value |
| Chi-square | 11.565 |
| df | 1 |
| p-value (Chi-Square) | .001* |
| p-value (Fisher's Exact test) | .001 |

Interpretation: Since p-value for the chi-square and Fisher's exact test is less than that of 0.05 indicates significance of association between Lactate Level and operated.

STATUS (DEAD / ALIVE):

| | | | | |
|--------|----------------|------------|-------|------------|
| | Lactate Levels | | | |
| | Low | High | | |
| Status | Count | Column N % | Count | Column N % |
| Dead | 0 | .0% | 3 | 18.8% |
| Alive | 24 | 100.0% | 13 | 81.2% |



CHI-SQUARE TEST RESULT:

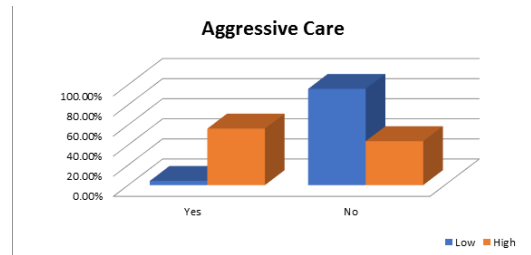
| | |
|-------------------------------|---------|
| | Value |
| Chi-square | 4.865 |
| Df | 1 |
| p-value (Chi-Square) | .027*,a |
| p-value (Fisher's Exact test) | .057 |

Interpretation: Since p-value for the chi-square is less but Fisher's exact test is greater than that of 0.05 indicates no significance of association between Lactate Level and status (Dead/Alive).

AGGRESSIVE CARE:

OPERATED:

| | | | | |
|-----------------|----------------|------------|-------|------------|
| | Lactate Levels | | | |
| | Low | High | | |
| Aggressive Care | Count | Column N % | Count | Column N % |
| Yes | 1 | 4.2% | 9 | 56.25% |
| No | 23 | 95.8% | 7 | 43.75% |



CHI-SQUARE TEST RESULT:

| | |
|-------------------------------|--------|
| | Value |
| Chi-square | 13.889 |
| Df | 1 |
| p-value (Chi-Square) | .000 |
| p-value (Fisher's Exact test) | .000 |

Interpretation: Since p-value for the chi-square and Fisher's exact test is less than that of 0.05 indicates significance of association between Lactate Level and Aggressive Care.

RESULTS & DISCUSSION:

The analysis shows that there is a significant association between Blood Lactate level and the transfusion needed for the trauma patients. Analysis also revealed that there is a significant association between Blood lactate levels and the patient being operated. The negative correlation coefficient value (-0.672) with p-value < 0.05 indicates that the higher lactic level is associated with lower systolic blood pressure. The analysis showed that association between Blood Lactate Level and Systolic Blood Pressure is significant. The same is supported by the study conducted by Westphalen, J. (2015).¹² They mentioned that the Lactate is a biomarker that serves as a predictive tool for identifying high-risk trauma patients and provides information beyond that of vital signs and mechanism of injury. This study hypothesized that point-of-care lactate (P-LAC) is superior to systolic blood pressure (SBP) in predicting the need for early resuscitative care (RC) after injury. Vandromme MJ et al (2010)¹³ also supported resuscitative care (RC) after injury. Vandromme MJ et al (2010) also supported the same through their study which concluded that ED-BL is a better predictor than SBP in identifying patients requiring significant transfusion and mortality in this cohort with in determinant SBP. These findings suggest that point-of-care BL measurements could improve trauma triage and better identify patients for enrolment in interventional trials.

Since p-value for the chi-square and Fisher's exact test is less than that of 0.05 indicates significance of association between Lactate Level and Transfusion needed. Since p-value for the chi-square and Fisher's exact test is less than that of 0.05 indicates significance of association between Lactate Level and operated. The analysis revealed that there is a significance association between the Lactate Level and the Aggressive Care to be given to the patient.

CONCLUSION:

The study concluded that the Blood Lactate levels in trauma patients could be an important marker in Emergency Department. The trauma patient having normal systolic blood pressure may have significantly high lactate levels so it becomes equally important for the Emergency Department team to check lactate level of the trauma patient even if the patient has normal systolic blood pressure. Also, there are likely chances that the patients who

have increased Blood Lactate level, they need to be given aggressive care i.e. Blood transfusion & surgery.

REFERENCES

1. Jansen TC, van Bommel J, Mulder PG, Rommes JH, Schieveld SJ, Bakker J: The prognostic value of blood lactate levels relative to that of vital signs in the pre-hospital setting: a pilot study. *Crit Care*. 2008.
2. Bakker J, Gris P, Coffernils M, Kahn RJ, Vincent JL (1996) Serial blood lactate levels can predict the development of multiple organ failure following septic shock. *Am J Surg* 171:221–226.
3. Smith I, Kumar P, Molloy S, Rhodes A, Newman PJ, Grounds RM, Bennett ED (2001) Base excess and lactate as prognostic indicators for patients admitted to intensive care. *Intensive Care Med* 27:74–83.
4. Blow O, Magliore L, Claridge JA, Butler K, Young JS (1999) The golden hour and the silver day: detection and correction of occult hypoperfusion within 24 hours improves outcome from major trauma. *J Trauma* 47:964–969.
5. Merigalli A, Oliveira RP, Friedman G: Occult hypoperfusion is associated with increased mortality in hemodynamically stable, high-risk, surgical patients. *Crit Care*. 2004, 8: R60-R65. doi:10.1186/cc2423.
6. Howell M, Donnino M, Clardy P, Talmor D, Shapiro N (2007) Occult hypoperfusion and mortality in patients with suspected infection. *Intensive Care Med*.
7. Shapiro NI, Howell MD, Talmor D, Nathanson LA, Lisbon A, Wolfe RE, Weiss JW (2005) Serum lactate as a predictor of mortality in emergency department patients with infection. *Ann Emerg Med* 45:524–528.
8. Allgower M, Burri C. ["Shock index"] *Dtsch Med Wochenschr*. 1967;92:1947–1950. doi:10.1055/s-0028-1106070.
9. Paladino L, Subramanian RA, Nabors S, Sinert R. The utility of shock index in differentiating major from minor injury. *Eur J Emerg Med*. 2011;18:94–98. doi:10.1097/MEJ.0b013e32833f212b.
10. Zarzaur BL, Croce MA, Magnotti LJ, Fabian TC. Identifying life-threatening shock in the older injured patient: an analysis of the National Trauma Data Bank. *J Trauma*. 2010;68:1134–1138. doi:10.1097/TA.0b013e3281d87488.
11. Salottolo KM, Mains CW, Offner PJ, Bourg FW, Bar-Or D. A retrospective analysis of geriatric trauma patients: venous lactate is a better predictor of mortality than traditional vital signs. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*. 2013;21:7. doi:10.1186/1757-7241-21-7.
12. Westphalen, J., 2015. A Comparison of Prehospital Lactate and Systolic Blood Pressure for Predicting the Need for Resuscitative Care in Trauma Transported by Ground: Guyette FS, Meier EN, Newgard C, et al. *J Trauma Acute Care Surg* 2015; 78: 600–6. *Journal of Emergency Medicine*, 48(6), pp.786-787.
13. Vandromme, M.J., Griffin, R.L., Weinberg, J.A., Rue III, L.W. and Kerby, J.D., 2010. Lactate is a better predictor than systolic blood pressure for determining blood requirement and mortality: could prehospital measures improve trauma triage?. *Journal of the American College of Surgeons*, 210(5), pp.861-867.