ORIGINAL ARTICLE

Lactate and base deficit combination score for predicting blood transfusion need in blunt multi-trauma patients

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ABSTRACT

BACKGROUND: Lactate and base deficit (BD) values are parameters evaluated as indicators of tissue perfusion and have been used as markers of severity of injury and mortality. Objectives: The aim of the study was to determine the relationship between combined score (CS) and blood transfusion need within 24 h and comparison of the variables between transfusion and non-transfusion group, correlation lactate with BD and with physiological, laboratory parameters, and determining the major risk factors of patients for the need for blood transfusion.

METHODS: The study included a total of 359 patients (245 males, median age: 40, min–max: 18–95) with blunt multi-trauma. Demographics data, laboratory parameters (hemoglobin [Hb], hematocrit [Htc], lactate, BD, pH), physiologic parameters (systolic blood pressure [SBP], diastolic blood pressure [DBP], heart rate [HR], respiratory rate [RR]), shock index (SI), and revised trauma score (RTS) were recorded. Logistic regression method was used to create the CS formula using lactate and BD values. According to this formula, the probability value of 0.092447509 was calculated for the need for blood transfusion within 24 h. If CS was higher than the probability value, the need for blood transfusion within 24 h was considered. Furthermore, univariate analysis was used to determine major risk for blood transfusion need in 24 h, and the receiver operating characteristic curves were performed to compare CS, lactate, BD, SI and RTS.

RESULTS: The comparison between transfusion and non-transfusion group there was significance between SBP, DBP, HR, RR, SpO_2, Glasgow coma scale, Hb, Htc, lactate, BD, pH, SI and RTS (for each $p<0.05$). Lactate value has a positive correlation with SI, HR and has a negative correlation with BD, RTS, SBP, and DBP. BD values has a positive correlation with RTS, SBP, DBP, Hb, and Htc and has a negative correlation with SI, HR, and RR. The main risks for blood transfusion need were SI, lactate, BD, SBP, and SpO_2%. CS was >0.09 in 100 (27.85%) patients and 41 with high CS had blood transfusion within 24 h ($p<0.001$; OR21.803, sensitivity 83.7%, specificity 81%,positive predictive value 41%, and negative predictive value 96.9%). A ROC curve showed that CS (AUC: 86.) was more significant than SI and RTS for the need for blood transfusion.

CONCLUSION: CS is effective for predicting blood necessity in 24 h for blunt multi-trauma patients.

Keywords: Base deficit; blood transfusion need; combined; formula; lactate; trauma.

INTRODUCTION

Multi-trauma is a term used for severely injured patients, usually with multiple injuries or less often with two or more severe injuries in at least two areas of the body. The mortality rate in these patients is generally associated with the mechanism and severity of injury.[1] The most important cause of death in the 1st h after trauma is bleeding, and about 40% of trauma-related deaths are secondary to bleeding and complications.[2] Ongoing hemorrhage leads to the "lethal triad" of hypothermia, acidosis, and coagulopathy.[3] Early replacement therapy with blood products in trauma aims to correct coagulopathies, which is known to be associated with good survival.[4]

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Lactate and base deficit (BD) values are parameters evaluated as indicators of tissue perfusion and for many years they have been used as biochemical markers of severity of injury and mortality in sepsis, shock, and trauma. In critical patients, lactate parameter is not only a diagnostic, but also a prognostic marker. Its effect on therapeutic decisions and potential to improve patients' outcomes were also stated.[5] Similar to lactate, decreased BD was also associated with unfavorable outcomes in critical patients.[6–8] Studies have demonstrated that clearance of both lactate and BD are associated with volume of resuscitation required; the need for transfusion of blood products and mortality in trauma patients[9,10] and initial blood lactate and BD are both considered as useful biomarkers in trauma patients.[11,12] Although BD and lactate are widely used in predicting outcome in trauma patients, studies investigating the use of their combination are more recent.

The primary purpose of this observational cohort study is to investigate the ability of combined initial lactate and BD measurement score (combined score: CS) on the improvement to predict the need for blood transfusion in blunt multi-trauma patients within 24 h. Second, we aimed to compare patients who had blood product treatment within 24 h with patients who did not have this kind of treatment in terms of variables, as well as to determine the correlation of lactate and BD with physiological and laboratory parameters, and the major risk factors of patients for the necessity of blood transfusion.

MATERIALS AND METHODS

A review of all blunt multi-trauma patients admitted to our trauma unit approved as level 3 trauma center in Eskisehir Osmangazi University, from 01 January 2018 to 31 December 2018 was performed. Although data were prospectively acquired for a research purpose, the study should be considered as a retrospective. The study was approved by Eskisehir Osmangazi University, College of Medicine Research Ethics Review Board. All blunt multi-trauma cases triaged in a monitored area for evaluation and residency trained emergency medicine physicians and senior residents evaluated and started patients' management.

Eighteen years old or older blunt multi-trauma patients whose initial blood lactate and BD levels were measured, were included in the analysis Those with burns, known hepatic disorders, renal failure, malignancy, shock due to spinal trauma, pre-hospital cardiac arrest, drug use that may affect the heart rate (HR), penetrating trauma, drug poisoning, as well as patients who refuse treatment, patients without blood gas measurement at first admission to the ED and pregnants were excluded from the study.

Data Source and Collection

The following data were recorded by an emergency physician for each patient admitted to the study center: Patients' demographic data (age, sex), injury mechanism, clinical characteristics such as vital signs (systolic blood pressure [SBP], diastolic blood pressure [DBP], HR, respiratory rate [RR], peripheral oxygen saturation [SpO_2]), Glasgow coma scale (GCS), laboratory values (hemoglobin [Hb], hematocrit [Htc], lactate, BD, ph), shock index (SI), revised trauma score (RTS), and the necessity for blood transfusion in 24 h were obtained from the hospital records. Lactate, BD and SI were categorized based on the cutoff levels in the literature (respectively: 2 mol/l, −6 mmol/l, 0.9). SI was calculated by dividing HR by SBP at the time of admission. RTS was derived according to the formula; RTS = (0.9368 × GCS Code) + (0.7326 × SBP Code) + (0.2908 × RR Code). The patients were divided into two groups as transfusion (TG) and not transfusion group (Non-TG) according to documented blood product treatment within 24 h.

We used lactate and BD levels of venous blood samples obtained within the first 10 min of admission to the ED and before invasive procedures (intubation, mechanical ventilation, etc.) or treatments (blood transfusion) and analyzed within 15 min to prevent additional metabolism based on the references.[13–17] All samples were taken during vascular access to prevent lactate increase due to possible tourniquet application. Blood samples were measured by the ABL800 FLEX blood gas analyzer (Radiometer Medical, Brønshøj, Denmark) with the model year of 2011. A venous blood sample was obtained and put into ethylenediaminetetraacetic acid-containing tubes (up to the indicated line, about two milliliters) for complete blood count and analyses were conducted via SYSMEX XN-1000 complete blood count device with the model year of 2007.

$$Blood\,Need\,Probabilty\,Value = \frac{e^{-4.7206+0.62940*LL-0.32359*BD}}{1+e^{-4.7206+0.62940*LL-0.32359*BD}}$$

Statistical Analysis

Continuous data confirming normal distribution was indicated as mean±standard deviation. Ordinal variables were presented as median values and interquartile ranges. Shapiro-Wilk test was used to determine the normal distribution. Categorical variables were compared with the Chi-square test and summarized as frequencies and percentages. Mann-Whitney-U test was used to compare abnormally distributed continuous quantitative data. Kruskal–Wallis test was used to evaluate the independent effects of multiple categorical variables. Probability value ($p<0.05$) was recognized as statistically significant. Sensitivity, specificity, positive predictive value and negative predictive value were established in the groups for outcome measures. Significant factors affecting blood transfusion necessity were defined by univariate analysis. A backward logistic regression model was used to define factors significantly affecting these parameters. To compare the performance of lactate, BD, and lactate and BD with SI and RTS in predicting blood transfusion, receiver-operating characteristic (ROC) curves were constructed and the area under the curve (AUC) was calculated through MedCalc. (version 19.1.3) software program. We formed a score value of CS among the markers used in determining blood need in 24 h. Logistic regression analysis was used in linear combining. The equation was obtained to estimate the need for blood transfusion in 24 h after combining. A score value from the equation was used to determine the blood transfusion need. The equation result (blood need probability value) higher than 0.092447509, was considered as "blood transfusion is necessary for the patient," while less than this value, was accepted as "blood transfusion is not required." Below is the formula that was prepared and used in computer package programs to obtain the guide number.

RESULTS

The study included a total of 359 patients who were admitted to the ED due to blunt multi-trauma. The causes of the traumas were motor vehicle collision (47.4%), fall from height (25.3%), and motorbike accident (12.5%). The number of male patients was 245 (68.2%). The median age was 40 (Q1–Q3: 20–54, min–max: 18–95) years. In 207 (57.7%) patient's levels of lactate was ≥2 mmol/L and in 44 patients (12.3%) level of BD was ≤−6 mmol/L. The number of patients with both measurements abnormal was 39 (10.9%). SI was ≥0.9 in 68 (18.5%) and CS was >0.09 in 100 (27.85%) patients. The number of patients who needed blood transfusion within 24 h was 49 (17.5%).

In the comparison of two groups (TG and non-TG), data included age, sex, initial vital signs, laboratory values, SI, and RTS, and there was a significant difference in terms of SBP, DBP, HR, RR, SpO_2, GCS, Hb, Htc, lactate, BD, pH, SI, and RTS (p<0.05 for each) (Table 1).

Lactate value has a positive correlation with SI, HR and has a negative correlation with BD, RTS, SBP, and DBP. BD values have a positive correlation with RTS, SBP, DBP, Hb, and Htc; and have a negative correlation with SI, HR, and RR (p and r values are shown in Table 2).

As a result of univariate analysis, major risk factors were determined by binary logistic regression analysis for blood transfusion need in 24 h. In the regression model; age, sex, RTS, SI, lactate, BD, SBP, DBP, RR, SpO_2, Hb, Htc, and pH variables were used in the first step. Significant risk factors were SI, lactate, BD, SBP, and SpO_2%. Odds ratio (OR) values in determining the blood need within 24 h of the risk factors in the model were found as ORSI=1454.85; ORlactate=1.441; ORBD=0.775; ORSBP=1.036; $ORSpO_2$=0.945 (Table 3).

In the analysis performed by assuming a threshold value of 2 mmol/l for lactate, −6 mmol for BD, 0.9 for SI and 0.092447509 for CS; lactate >2 mmol was found in 43 of 207 (p<0.001; OR: 6.38, 95% CI: 2.7–15.04, sensitivity: 87.8%, specificity: 47.1%), BD <−6 mmol/l was found in 26 of 44 (p<0.001; OR: 18.33, 95% CI: 8.84–38.06, sensitivity: 53.1%, specificity:

Table 1. Comparison of demographic data, vital signs and laboratory values between non-transfusion and transfusion groups

Variables	Transfusion Group n=49, n (%)	Non-Transfusion Group n=310, n (%)	p
Sex (male)	35 (71.4)	210 (67.7)	0.606*
	Median (Q1-Q3)	**Median (Q1-Q3)**	
Age (year)	43 (29–58.5)	39 (27–54)	0.396**
Systolic blood pressure (mmHg)	90 (80–110)	120 (110–135)	<0.001**
Diastolic blood pressure (mmHg)	60 (50–70)	80 (70–80)	<0.001**
Heart rate (p/min)	115 (105–124.5)	85 (80–94)	<0.001**
Respiratory rate (p/min)	24 (20–26)	20 (18–20)	<0.001**
SpO2 (%)	91 (87.5–96.5)	97 (95–98)	<0.001**
Glasgow Coma Scale	15 (10–15)	15 (15)	<0.001**
Hemoglobin (mg/dl)	12.7 (11.45–14.15)	14.55 (13.2–15.8)	<0.001**
Hematocrit (%)	36.2 (33.95–42.05)	42.3 (38.55–45.52)	<0.001**
Lactate (mmol/l)	3.8 (2.65–5.7)	2.1 (1.5–2.7)	<0.001**
Base deficit (mmol/l)	-6.6 (-3.6–-9.15)	-0.9 (-2–0.5)	<0.001**
pH	7.32 (7.28–7.37)	7.39 (7.36–7.42)	<0.001**
Shock index	1.25 (0.97–1.5)	0.69 (0.61–0.78)	<0.001**
Revised Trauma Score	7.10 (6.23–7.84)	7.84 (7.84)	<0.001**

*Chi-Squared. **Mann-Whitney U test was used.

Table 2. Correlation of lactate and BD with demographic data, vital signs and laboratory values

	Lactate	BD	RTS	SI	Age	SBP	DBP	HR	RR	Hb	Htc
Lactate											
Correlation Coefficient	1.000	-.269	-.398	.306	.090	-.199	-.138	.330	.104	-.057	-.045
p*	–	<0.001	<0.001	<0.001	.090	<0.001	.009	<0.001	.051	.285	.395
BD											
Correlation Coefficient	-.269	1.000	.381	-.272	.053	.295	.272	-.234	-.181	.169	.155
p*	<0.001	–	<0.001	<0.001	.319	<0.001	<0.001	<0.001	.001	.001	.003

*Spearman Correlation test was used. BD: Base deficit; RTS: Revised Trauma Score; SI: Shock Index; SBP: Systolic blood pressure; DBP: diastolic blood pressure; HR: Heart Rate; RR: Respiratory rate; Hb: Hemoglobin; Htc: Hematocrit.

Table 3. Univariate analysis outcomes to determine major risk factors of blood transfusion necessity by Binary Logistic Regression Analysis

		β	Std. Error	Test Statistics	p*	OR	95% CI for OR	
							Lower	Upper
First step	Age	.001	.017	0.001	.976	1.001	.968	1.034
	Sex (male)	.858	.629	1.865	.172	2.359	.688	8.088
	RTS	.212	.341	.389	.533	1.237	.634	2.411
	Shock index	4.833	4.392	1.211	.271	125.52	.023	687370
	Lactate level (mmol/l)	.355	.199	3.199	.074	1.427	.967	2.106
	Base deficit (mEq/L)	-.241	.096	6.320	.012	.786	.651	.948
	SBP (mmHg)	.035	.034	1.061	.303	1.035	.969	1.106
	DBP (mmHg)	-.050	.041	1.433	.231	.952	.877	1.032
	Pulse Rate (p/min)	.013	.044	.082	.775	1.013	.928	1.105
	Respiratory Rate (p/min)	.098	.090	1.179	.278	1.103	.924	1.317
	spO2 (%)	-.043	.025	2.869	.090	.958	.911	1.007
	Hb (mg/dl)	-.188	.201	.874	.350	.829	.559	1.228
	Htc (%)	-.026	.066	.159	.690	.974	.856	1.108
	pH	1.426	4.030	.125	.723	4.163	.002	11217
	Constant	-16.722	30.775	.297	.586	.000		
Last step	Shock index	7.283	1.550	22.070	.000	1454.852	69.708	30363.665
	Lactate level (mmol/l)	.365	.176	4.329	.037	1.441	1.021	2.033
	Base deficit (mEq/L)	-.255	.073	12.071	.001	.775	.672	.895
	SBP (mmHg)	.035	.017	4.415	.036	1.036	1.002	1.071
	spO2 (%)	-.056	.024	5.545	.019	0.945	.902	.991
	Constant	-9.015	3.905	5.330	.021	.000		

OR: Odds ratio; CI: Confidence interval; RTS: Revised trauma score; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; Hb: Hemoglobin; Htc: Hematocrit.

94.2%), SI >0.9 was found in 30 of 68 (p<0.001; OR: 11.302, 95% CI: 5.82–21.91; sensitivity: 61.2%, specificity: 85.5%). CS >0.09 was found in 41 of 100 (p<0.001; OR: 21.803, 95% CI: 9.85–48.11; sensitivity: 83.7%, specificity: 81.0%) patients who received blood transfusion in 24 h (Table 4).

A ROC curve was constructed for the necessity of blood transfusion. Figure 1 shows lactate, BD, SI, and RTS values and AUCs (AUC values for lactate, BD and RTS were 0.816, 003; 0.847, 0.03, respectively) in predicting blood transfusion need in 24 h. Figure 2 shows CS, SI, and RTS measurement values and AUCs. CS was found as a more significant predictor than lactate and BD alone measurements than SI and RTS measurements. (respectively AUC and p values were: 0.867, 0.03; 0.866, 003; 0.814, 0.03, respectively).

Table 4. Comparison of Lactate and Base Deficit levels for blood transfusion need in 24 hours

	Lactate >2 mmol/l n=207	Lactate ≤2 mmol/l n=152	p	OR (95% CI)	Sensitivity (%)	Specificity (%)	PPV (%)	LR +	NPV (%)	LR -
‡Need Transfusion in 24h, n=49 (%)	43 (87.87)	6 (13.3)	<0.001	6.38 (2.7–15.04)	87.8	47.1	20.8	1.65	96.1	0.26
	BD < -6 mmol/l n=44	**BD ≥ -6 mmol/l n=315**	**p**	**OR (95% CI)**	**Sensitivity (%)**	**Specificity (%)**	**PPV (%)**	**LR +**	**NPV (%)**	**LR -**
‡Need Transfusion in 24h, n=49 (%)	26 (53.1)	23 (46.9)	<0.001	18.33 (8.84–38.06)	53.1	94.2	59.1	9.1	92.7	0.49
	SI ≥0.9 n=68	**SI <0.9 n=291**	**p**	**OR (%95 CI)**	**Sensitivity (%)**	**Specificity (%)**	**PPV (%)**	**LR +**	**NPV (%)**	**LR -**
‡Need Transfusion in 24h, n=49 (%)	30 (61.2)	19 (38.2)	<0.001	11.302 (5.82–21.91)	61.2	85.5	40.8	4.35	93.6	0.43
	CS >0.09 n=100	**CS ≤0.09 n=259**	**p**	**OR (%95 CI)**	**Sensitivity (%)**	**Specificity (%)**	**PPV (%)**	**LR +**	**NPV (%)**	**LR -**
‡Need Transfusion in 24h, n=49 (%)	41 (83.6)	8 (16.4)	<0.001	21.803 (9.85–48.11)	83.7	81	41	4.39	96.9	0.202

*Logistic procedure multiple linear combination test was used, ‡Chi-squre test was used. (BD: Base deficits; SI: Shock index; CS: Combining score). OR: Odds Ratio; PPV: Positive predictive value; LR: Likelihood ratio; NPV: Negative predictive value.

DISCUSSION

Our study revealed that CS, measured at the time of admission to the ED might be beneficial to predict blood transfusion necessity in 24 h in blunt multi-trauma patients brought to a level 3 trauma center and may be more valuable than lactate and BD alone and SI and RTS in determining blood need within 24 h.

At the ED, fast and systematic management of multi-trauma patients is vital to decide on a state of shock, blood trans-

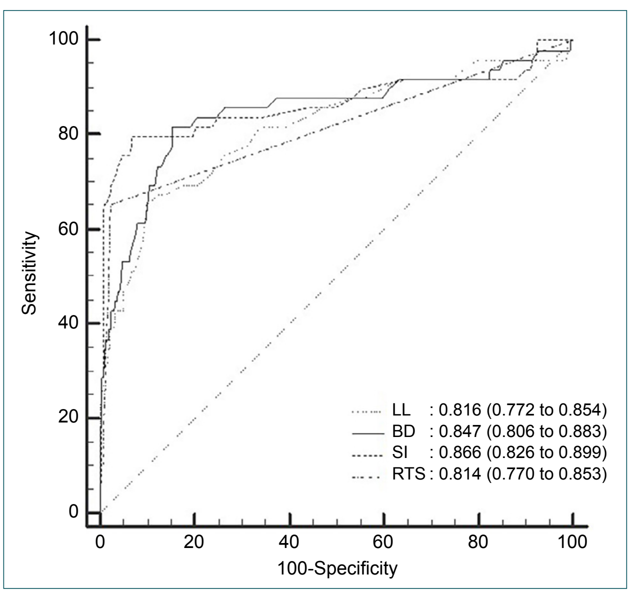

Figure 1. Comparison of ROC curve for predicting blood transfusion need in 24 h with LL, BD, SI, and RTS. LL: Lactate level; BD: Base deficit; SI: Shock index; RTS: Revised trauma score.

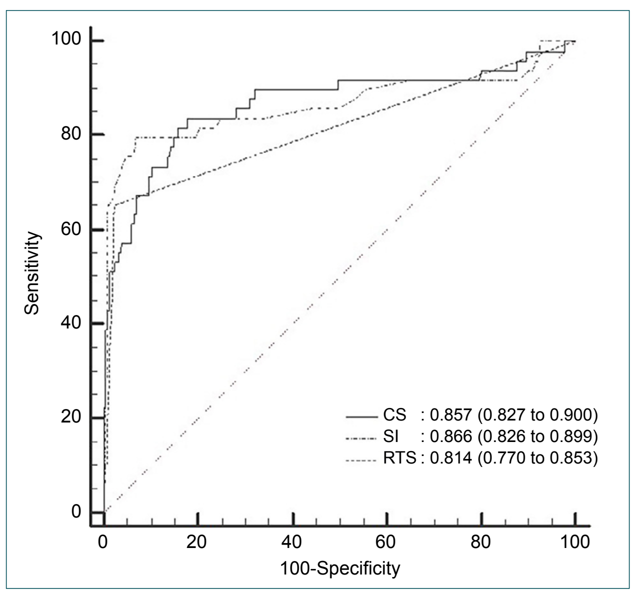

Figure 2. Comparison of ROC curve for predicting blood transfusion need in 24 h with CS, SI, and RTS. CS: Combined score; SI: Shock index; RTS: Revised trauma score.

fusion necessity and definitive treatment. The standard and conventional approach in identifying shock is to evaluate changes in SBP, urine output, and HR.[18–20] However, recent trauma guidelines state that these values are solely not sufficient enough to identify a shock; solely patients should be evaluated thoroughly with symptoms, physical examination and laboratory tests.[21] At present, in multi-trauma patients, the prediction and management of transfusion necessities are still complicated. Therefore, many studies have been conducted on SI, trauma scoring, lactate and BD measurements in terms of determining shock, blood need and predicting mortality. Although the relationship of SI, trauma scoring and lactate clearance has been revealed in determining the outcome, the relationship between the initial lactate and BD' with the necessity for blood transfusion is controversial.

SI can be easily obtained by dividing HR by SBP to demonstrate hypovolemic shock. A value between 0.5 and 0.7 indicates a normal SI measurement. Especially the values over 0.9 are used as threshold values to determine the severity of the patient.[22] Compared to other variables, SI was more predictive[23] for determining mortality. Present studies in trauma patients show that in the case of SI >0.9, blood transfusion is needed.[24] In another pre-hospital study, it was reported that 47.9% sensitivity, and 90.5% specificity were determined to predict more than 5 units of transfusion for 4 h if SI >1, after 1 liter of Sodium Chloride 0.9% intravenous infusion.[25] Our study showed that the reference value for SI was 0.9, to be a preventive tool for determining blood need similar to literature.

RTS is a physiological scoring system, and its accuracy rate is high in predicting mortality. Values encoded between zero and 4 (GCS, RR and HR) are multiplied by coefficients to create a compound score ranging from 0 (worst) to 7.408 (best). In a study in which mortality was predicted by Galvagno et al.,[26] the pre-hospital AUROC value of RTS was 0.66 (95% CI: 0.66,0.67), in another study, which included ED first admission and pre-hospital records, AUROC was 0.866 (95% CI 0.851, 0.881).[27] In our study to predict blood transfusion, RTS was found to have a better AUROC value than other studies. New methods such as inferior vena cava volume[28] and perfusion index[29] were investigated to determine the need for blood transfusion and hypovolemia. However, in predicting the need for transfusion, studies related to RTS are limited, in a study evaluating the relationship between massive transfusion and RTS, a lower AUROC (0.638) was found.[30] In our study, RTS was calculated according to the emergency admission values, and it was seen that it reached a higher value in predicting blood transfusion with AUROC 0.814 (95% CI 0.770, 0.853). However, AUROC was lower than SI, lactate and BD values (Fig. 1).

Lactate is the end product of anaerobic metabolism induced by tissue hypoperfusion and hypoxia. On the other hand, BD level is a calculated value based on arterial pressure of carbon dioxide, pH and serum bicarbonate. BD is a potential indicator of volume deficit in trauma patients. It shows the additional base amount which is required to be added to one liter of blood for pH normalization. Both parameters have been used for over 50 years.[31] A current trend for the evaluation of shock state in trauma patients in emergency medicine and intensive care is the use of lactate and/or BD in the initial assessment. Initial and/or serial measurements of lactate and BD have been used to predict morbidity and mortality in critical patients as well as of any cause of shock;[32–35] however, there are controversial publications on mortality.[36] Initial abnormal values might indicate a perfusion disorder and this might lead to an aggressive treatment plan. High lactate levels are expected to be treated in the early stage as a result of a proper liquid and blood transfusion, an attentive intensive care follow-up, and early and proper surgical interventions. Thus, lactate clearance or protracted lactate elevation is more valuable in predicting mortality. Serial measurements of lactate and BD revealed their effectiveness for mortality in the management of patients in shock.[9,10,37] Vandromme et al.[32] showed that blood lactate value is a better indicator than SBP in identifying patients who need transfusion. Low BD was also associated with blood transfusion necessity.[10,38] Similarly, our study also demonstrated that there was a strong relation between initial lactate and BD values and blood transfusion necessity in the first 24-h period.

In our study, lactate and BD measurements were well correlated with physiological, laboratory, SI and RTS. Furthermore, univariate analysis showed that SI, lactate and BD measurements are effective in predicting the need for blood transfusion.

The interesting point of our study is the threshold value determined by CS may be more valuable than the single measurements of SI, RTS, lactate and BD in determining the need for blood transfusion.

Besides supporting previous literature, this report is unique because it is the only evaluation of the CS with lactate and BD in blunt multi-trauma patients. To the best of our knowledge, previously reported literature consists primarily of lactate and BD measurements separately in determining both mortality and blood need, or their clearance.

Limitations

The SI calculation was not repeated. All patients were referred with the emergency medical system, vascular access was open and initial fluid therapy was started. Pre-hospital SI or vital value measurements and the exact amount of fluids they received could not be evaluated in our study.

Conclusion

Our findings demonstrate that elevated lactate and low BD values measured at the time of admission are simple and adequate markers to predict risk factors for blood transfusion necessity. However, the CS is more effective than lactate, BD, SI, and RTS measurements, with higher sensitivity and specificity. This becomes an advantage in the early prediction of patient outcomes. Both tests, especially the combination with the formula of lactate and BD parameters, should be evaluated more with further studies.

Ethics Committee Approval: This study was approved by the Eskisehir Osmangazi University Faculty of Medicine Non-Invasive Clinical Research Ethics Committee (Date: 23.07.2019, Decision No: 44).

Peer-review: Internally peer-reviewed.

Authorship Contributions: Concept: E.O.; Design: E.O.; Supervision: E.O.; Resource: E.O., N.O.Y., F.B.K.; Materials: E.O., N.O.Y., F.B.K.; Data: E.O., N.O.Y., F.B.K., M.E.C., M.B.; Analysis: E.O., N.O.Y., F.B.K., M.E.C., M.B.; Literature search: E.O., N.O.Y., F.B.K., M.E.C., M.B.; Writing: E.O., N.O.Y., F.B.K., M.E.C., M.B.; Critical revision: E.O., M.B.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Künt çoklu travma hastalarında kan transfüzyonunu ihtiyacını tahmin etmek için laktat ve baz defisiti kombinasyon skoru

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AMAÇ: Laktat ve baz defisiti (BD) değerleri, doku perfüzyonunun göstergeleri olarak değerlendirilen parametrelerdir ve yaralanma ve ölüm şiddetinin belirteçleri olarak kullanılmıştır. Çalışmanın amacı kombine edilmiş skor ile kan transfüzyonu ihtiyacı arasındaki ilişkiyi 24 saat içinde belirlemek ve transfüzyon ile transfüzyon yapılamayan grup arasındaki değişkenlerin karşılaştırılması, laktatın, BD, fizyolojik ve laboratuvar parametreleri ile korelasyonu ve kan transfüzyonu ihtiyacı için başlıca risk faktörlerinin belirlenmesidir.
GEREÇ VE YÖNTEM: Çalışmaya künt çoklu travmalı toplam 359 hasta (245 erkek, medyan yaş: 40, min-maks: 18–95) dahil edildi. Demografik veriler, laboratuvar parametreleri (hemoglobin, hematokrit, laktat, BD, pH), fizyolojik parametreler (sistolik kan basıncı: SBP; Diyastolik kan basıncı: DBP; kalp hızı: HR; solunum hızı: RR), Glascow Koma Ölçeği (GCS), şok indeksi (SI) ve Revize travma skoru (RTS) kaydedildi. Laktat ve BD değerleri kullanarak elde edilen kombine skoru (CS) formülü oluşturmak için logistik regresyon yöntemi kullanıldı. Bu formüle göre 24 saat içinde kan transfüzyon ihtiyacı için olasılık değeri 0.092447509 hesaplandı. Elde edilen CS, olasılık değerinden daha yüksek ise, 24 saat içinde kan transfüzyonu ihtiyacı olacağı düşünüldü. Ayrıca, 24 saat içinde kan transfüzyonu gereksinimi için majör riskleri belirlemede tek değişkenli analiz kullanıldı ve kombine edilmiş skor, laktat, BD, SI ve RTS'yi kendi aralarında karşılaştırmak için alıcı ROC analizi yapıldı.
BULGULAR: Transfüzyon ve transfüzyon yapılmayan gruplar arasındaki karşılaştırmasında SBP, DBP, HR, RR, SpO2, GCS, hemoglobin, hematokrit, laktat, BD, pH, SI ve RTS arasında farklılık anlamlı idi (her biri için $p<0.05$). Laktat değeri, SI, HR ile pozitif, BD, RTS, SBP, DBP ile negatif korelasyon gösterdiği tespit edildi. BD değeri, RTS, SBP, DBP, Hb ve Htc ile pozitif korelasyona, SI, HR ve RR ile negatif korelasyon tespit edildi. Kan transfüzyon ihtiyacı için major riskler SI, laktat, BD, SBP ve SpO_2 idi. CS, 100 hastada (%27.85) 0.092447509 değerinden yüksek idi ve yüksek CS'li 41 hastada 24 saat içinde kan transfüzyonu gerçekleştirildiği tespit edildi ($p<0.001$; OR: 21.803, duyarlılık %83.7, özgüllük %81, pozitif prediktif değer %41, negatif prediktif değer %96.9). ROC eğrisi, kan transfüzyonu ihtiyacı için CS'nin (AUC: 86). SI ve RTS'den daha anlamlı olduğunu gösterdi.
TARTIŞMA: CS, künt çoklu travmalı hastalar için 24 saat içinde kan ihtiyacının öngörülmesinde etkilidir.
Anahtar sözcükler: Baz defisiti; formül; kan transfüzyon ihtiyacı; kombine; laktat; travma.

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