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Research Article

Relationship between Serum Lactate with the Severity of Injury in Patients with Spinal Cord Trauma

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ABSTRACT

Background: Spinal cord trauma (SCT) is one of the types of traumas that causes many complications. In order to identify these complications, it is necessary to check the results of laboratory tests and radiology tests.
Methods: This study was conducted with the aim of determining the relationship between serum lactate of patients and the severity of injury caused in trauma patients. The study included 190 hospitalized patients with SCT. The researchers' enrolled patients with SCT injuries who met the inclusion criteria by visiting the hospital daily.
Results: Results showed that out of 190 examined patients, 32 (16.8%) patients died and 158 (83.2%) were discharged from the hospital. Also, 160 (84.2%) of the patients were male, and 30 (15.8%) of them were female. Regarding the injury mechanism, it was shown that 98 (51.6%) of the patients were due to road traffic accidents, 33 (17.4%) of the patients were due to falls, and only 8 (4.2%) were due to sports accidents. Also, the result showed the amount of lactate in the survivors group was 1.2 (0.8-2.6), and in the non-survivors group it was 3.9 (2.8-6.6).
Conclusion: Considering that there were laboratory changes in patients with TSCI, it is recommended to use the results of this study as a clinical guide for doctors.

Introduction

Trauma is a life-threatening factor for patients and will result in irreparable complications, including limb amputation, reduced physical strength, and death. There are different types of traumas including vascular trauma, dental trauma, eye trauma, orthopedic trauma, brain trauma, and SCT [1-6]. SCT is one of the types of traumas that causes many complications. In order to identify these complications, it is necessary to check the results of laboratory tests and radiology tests. In the field of laboratory tests, various tests such as serum lactate, white blood cell (WBC), sodium, potassium, hemoglobin, and glucose can be mentioned [7-8].

Lactate has been used as a marker of severe sepsis and septic shock. Also, lactate deficiency may not occur in all patients with septic shock or in those who eventually die as a result of it. The severity of hyperlactatemia, a well-known indicator of circulatory failure, correlates with mortality in various clinical conditions [9]. How serum lactic acid increases during and after surgery is not completely clear, but it seems that an increase in type A of serum lactic acid can be seen as a result of tissue hypoxia. Lactic acidosis type A is caused by a disturbance in the distribution of oxygen. Conditions

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such as low blood pressure and cyanosis lead to this type of acidosis. Also, in some cases, an increase in type B of serum lactic acid has also been seen, which is one of the main factors in tissue damage, the expansion and hemodilution of blood in tissue vascularization [10]. In type B, lactic acidosis can be caused by factors such as sepsis, liver failure, diabetes, malignancy, as well as the use of drugs such as acetaminophen, biguanides, and sorbitol [11].

The normal level of blood lactate in patients without stress is 0.5 to 1 mmol/L. Patients with lactate less than 2 mmol are considered normal. Hyperlactatemia refers to a persistent mild to moderate increase in blood lactate concentration of 2 to 5 mmol/L without metabolic acidosis. Also, lactic acidosis is a stable increase in blood lactate concentration of more than 5 mmol in relation to metabolic acidosis [12-13]. Lactate levels predict the severity of the disease in several critical diseases, including sepsis, burns, cardiac arrest, myocardial infarction, and trauma [14-15]. Also, higher serum lactate is associated with greater injury severity, and serum lactate level as an important metabolic marker of the whole body is affected by various factors, including kidney and liver function [16-17].

Among other tests performed in these patients, we can mention the WBC test. So an increase in the levels of white blood cells has been observed along with damage in different tissues such as the heart, intestine, skeletal muscle, and brain. Also, in trauma patients, the number of white blood cells is higher in patients with more severe injuries. In fact, the injury caused by trauma causes an inflammatory response by increasing the production of cytokines and thus increasing the number of blood leukocytes [18-19]. On the other hand, anemia is one of the common diseases in the intensive care unit, where low arterial oxygen content can be effective in causing intestinal damage. Untreated anemia can lead to irreversible complications for the patient [20]. In fact, hemoglobin level is one of the main determinants of oxygen transfer, and anemia is one of the important secondary causes in trauma-related injuries [21].

Aim

This study was conducted with the aim of determining the relationship between serum lactate of patients and the severity of injury caused in trauma patients.

Methods

In this study, 190 patients who were hospitalized due to SCT were included in the study. Inclusion criteria included patients with a GCS level of less than 13, abnormal radiology results related to the spinal cord, a doctor's diagnosis of SCT, and age between 18 and 65 years. Exclusion criteria included the presence of known hemophilia, a history of known diabetes in the patient, vitamin K deficiency, or known hemophilia, and patients for whom the tests desired by the researchers were not requested in the patient file.

By visiting the hospital daily, the researchers enrolled the patients who were injured with SCT and met the inclusion criteria. If the study entry criteria are met, a researcher-made checklist containing questions such as gender, age of the patient, causes of trauma, admission GCS score, season of injury, time of injury, and status of WBC tests (×109/L), IQR, Platelet (×109/L), IQR, Hemoglobin (g/L), IQR, Potassium (mmol/L), IQR, Sodium (mmol/L), IQR, PT (s), IQR, Lactate and Glucose. done. Ethical standards in the research included trustworthiness and keeping patients' secrets, not performing additional and unusual tests for patients, and obtaining permission from relevant authorities. SPSS 16 software was used for data analysis.

Results

Result showed, out of 190 examined patients, 32 (16.8%) patients died and 158 (83.2%) were discharged from the hospital. Also, 160 (84.2%) of the patients were male and 30 (15.8%) of them were female. Regarding the injury mechanism, it was shown that 98 (51.6%) of the patients were due to road traffic accidents, 33 (17.4%) of the patients were due to falls, and only 8 (4.2%) were due to sports accidents. was (Table 1).

Table 1- Examining the status of the demographic characteristics of the researched patients

Variable		N	%
Gender	Male	160	84.2%
	Female	30	15.8%
Mechanism of injury	Road traffic accident	98	51.6%
	Fall	33	17.4%
	Quarrel and conflict	32	16.8%
	Sport	8	4.2%
	Other cases	19	10%
Time of injury	Day	128	67.3
	Night	62	32.7
Season of damage	Spring	41	21.6%
	Summer	33	17.4%

	Fall	50	26.3%
	winter	66	34.7%
How to transfer	115	133	70%
	Methods outside of 115	57	30%
Age	M(Sd)	34.6	7.8

Table 2- Comparison of test results of trauma patients

Variable	Survivors	Non-survivors
Lactate	1.2(0.8-2.6)	3.9(2.8-6.6)
WBC (×109/L), IQR	17.26(12.5-22.8)	18.54(11.4-24.4)
Platelet (×109/L), IQR	257.0(189.7-33.6)	264.0(200-345.9)
Hemoglobin (g/L), IQR	101.03(83.14-11.35)	100.09(78.6-11.5)
Potassium (mmol/L), IQR	3.6(3.1-4.4)	3.3(3-3.9)
Sodium(mmol/L), IQR	137.6(135.1-139.3)	135.4(134.2-139.7)
PT (s), IQR	13.1(12.1-14.3)	17.7(16.2-23.9)

The result showed that the amount of lactate in the survivors group was 1.2 (0.8-2.6), and in the non-survivors group it was 3.9 (2.8-6.6) (Table 2).

Discussion

Chronic diseases will cause many complications for patients [22-26, 38-44]. Traumas related to the SCT have a significant prevalence [27-29]. So that in the study of Kumar et al. in 19 analyzed articles, the prevalence of TSI was 10.5 times per 100,000 and also 45.8% of patients needed surgery [30]. TSI includes severe injuries to the spinal cord, bony structures, nerve roots, and spinal components; these injuries may be caused by penetrating trauma or non-penetrating trauma [31]. TSI can be one of the causes of disability in people, especially young people, where falls, fights, and accidents are the main causes [32-33].

0–1 month after the injury was equal to 4.2 (0.1); in patients 1–12 months after the injury, it was equal to 4.3 (0.2); and in patients more than 12 months after the injury, it was equal to 4.3 (0.2). Also, in relation to the sodium test in 0-1 month after the injury, it was equal to 136.3 (1.1); in 1-12 months after the injury, it was equal to 137.6 (1.2); and in more than 12 months, it was equal to 139.7 (0.6) from apples [34]. In the study by Wang et al., in patients with head trauma, serum creatinine and lactate levels were higher, and GCS status was lower. Also, the white blood cell level is 15.73 (11.48-20.10), the hemoglobin level is 87 (75-106), the lactate dehydrogenase level is 373 (294-514), the serum Lactate level is 2.3 (1.5-3.6) and the serum creatinine level (umol/L) is equal to 69 (53-89) [35]. Also, in the study of Leal-Noval et al. in patients with TBI, there was a relationship between the amount of RBCT and the clinical condition of the patient [36].

In Wang et al.'s study, patients with Traumatic Brain Injury were examined, and the patients were divided into two groups: survivors with a sample size of 124 and non-survivors with a sample size of 149 patients. In survivors patients, glucose test results were equal to 8.53 (6.61-11.59), white blood cell results were equal to 15.09 (11.13-20.08), neutrophil outcomes (109 /L) were 11.81 (8.96-15.43), lymphocyte results (109 /L) were 0.88 (0.54–1.23), platelet results were equal to 114 (76–172), hemoglobin results were equal to 92 (79–110), albumin results were equal to 3.25 (2.86–3.70), lactate results were equal to 1.8 (1.2–2.8), and LDH results were equal to 360 (289-479). In non-survivors, glucose results were 12.66 (16.15-9.16), white blood cell results were 15.47 (11.54-20.14), neutrophil results were 11.98 (15.12-7.81), lymphocyte results were 0.74 (1.04-0.50), hemoglobin was equal to 81 (69-97), lactate results were equal to 3.1 (2.1-4.6), and serum creatinine results were equal to 84 (59-124) [16]. Also, in the study of Wettervik et al., 115 patients with severe TBI were included in the study; on the first day after the injury, the level of arterial lactate reached its maximum level [37].

Conclusion

Considering that there were laboratory changes in patients with TSCI, it is recommended to use the results of this study as a clinical guide for doctors.

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