Investigating the relationship between the increase in color doppler ultrasound indices of the ophthalmic artery and the serum lactate level and the severity of the disease in patients with sepsis.

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Abstract

Background: The objective of this study was to investigate the relationship between the increase in color Doppler ultrasound indices of the ophthalmic artery and the serum lactate level and the severity of the disease in patients with sepsis.

Methods: This was a cross-sectional study conducted on 24 patients diagnosed with sepsis, who were admitted to the intensive care unit of Shariati Hospital. The patients were more than 18 years old, hospitalized in the first 42 hours, and selected by the portable color Doppler ultrasound available in the ICU department. The ESI probe was placed on the patient's eye with the eyelid closed, and the ophthalmic artery was located. The indices including RI, PSV, PI were measured along with their serum lactate levels. The correlation of these indices with the severity of sepsis was checked.

Results: In this study, 24 patients who were less than 81 years old were diagnosed with sepsis and had a sofa score above 3. It was observed that there is a significant relationship between the dose of increased lactate levels and PSV1, and this parameter can be considered a predictive factor. It was also observed that there is a significant relationship between the dose of increased lactate levels and PSV2, and this parameter can be considered as a predictive factor. Additionally, there is a significant relationship between the dose of increased levels of lactate and PI, and this parameter can be considered as a predictive factor.

Conclusions: The study found a significant relationship between increased levels of lactate and decreased blood supply in the optic artery. It is suggested that due to the lack of numbers in this study, more samples should be investigated in future studies. In a scientific article, the use of "we" and "our" should be avoided. If necessary, the third person should be used.

Introduction

The Optic Nerve Sheath Diameter (ONSD) studies of the patient were measured within the first 42 hours of hospitalization. It was observed that as the severity of the patient's sepsis increased, this diameter also increased. In most patients, the numerical value of this diameter exceeded 5.5 mm.

This study was conducted due to the widespread prevalence of sepsis in patients admitted to the intensive care unit and the need to find an accessible and easy way to predict the severity of sepsis in these patients. The aim was to determine the correlation between arteriophthalmic Color Doppler ultrasound indices (including PSV, RI, PI) within the first 42 hours of sepsis diagnosis. Simultaneously, the serum lactate level was measured to check the increase of these levels with the severity of sepsis.

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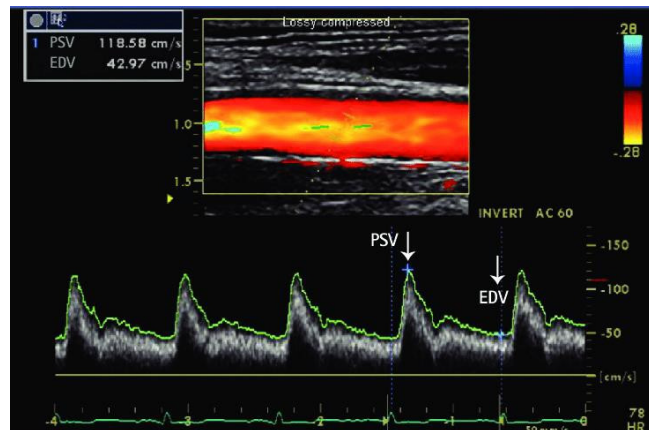
Figure 1: Peak systolic velocity (PSV) is an index measured in spectral Doppler ultrasound. On a Doppler waveform, the peak systolic velocity corresponds to each tall "peak" in the spectrum window.
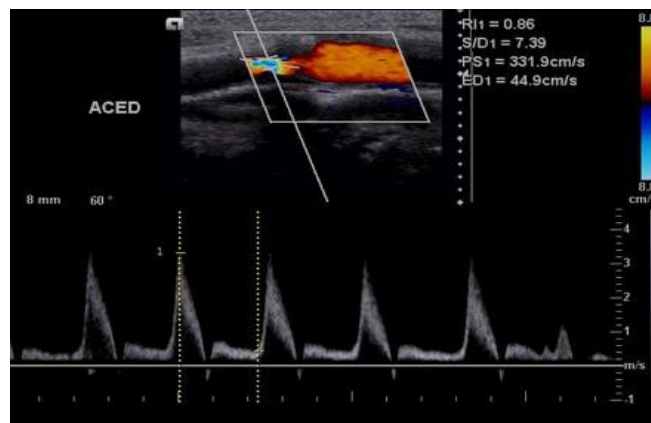
Figure 2: The pulsatility index (PI) (also known as the Gosling index) is a calculated flow parameter in ultrasound, derived from the maximum, minimum, and mean Doppler frequency shifts during a defined cardiac cycle.

Cerebrovascular evaluation has limitations; therefore, the examination of ophthalmic vessels can serve as a good representative of cerebral vessels. This method is accessible, inexpensive, safe, and non-invasive. Ophthalmic vessels can be a good representative of cerebral vessels due to their embryological, anatomical, and functional similarities.

This method is well-known in investigating non-obstetrical pathologies such as glaucoma, heart failure, atherosclerosis, multiple sclerosis, and vascular changes in tibolone users. This method is easily tolerated by the patient and requires very little time to perform.

Discussion

At present, sepsis is the leading cause of death in patients admitted to the intensive care unit. Severe sepsis can lead to shock and affect various organs, including the brain, heart, and kidneys. Given the significance of this issue, efforts are being made to identify readily available and straightforward prognostic factors to assess the severity of the disease.

However, finding an easy, inexpensive, safe, and accessible method to predict the severity of lactic acidosis and an increase in blood lactate in sepsis patients due to secondary anaerobic glycolysis from insufficient oxygenation is not enough. Although tissue hypoxia is not the only cause of increased blood lactate in these patients, and various factors can lead to this increase. The increase in blood serum lactate level, especially within the first 42 hours of hospitalization of sepsis patients, can be an important prognostic factor in evaluating the severity of sepsis in these patients.

Method

This study is a cross-sectional analysis involving 24 patients, all above 81 years old, diagnosed with sepsis, and with a SOFA score above 3. These

Table 1: Investigating the relationship between increased lactate levels (1-1.2) and PSV1

Model		Sum of Squares	df	Mean Square	F	Sig.
1	**Regression**	0.003	1	0.003	0.115	0.000[b]
	Residual	2.917	98	0.030		
	Total	2.920	99			

a.   Dependent Variable: psv1
b.   Predictors: (Constant), lactate

Table 2: Investigating the relationship between increased lactate levels (1.2-1.3) and PSV1

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	175.499	1	175.499	0.716	0.004[b]
1	**Residual**	24024.481	98	245.148		
	Total	24199.980	99			

a.   Dependent Variable: psv1
b.   Predictors: (Constant), lactate

Table 3: Investigating the relationship between increased lactate levels (1.3-1.4) and PSV1

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	5.759	1	5.759	0.086	0.000[b]
1	**Residual**	6555.663	98	66.895		
	Total	6561.422	99			

a.   Dependent Variable: psv1
b.   Predictors: (Constant), lactate

Table 4: Investigating the relationship between increased levels of lactate and PI:

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	0.005	1	0.005	0.002	0.001[b]
1	**Residual**	209.785	98	2.141		
	Total	209.790	99			

a.   Dependent Variable: PI
b.   Predictors: (Constant), LACTATE

patients were admitted to the General Hospital of Shariati Hospital. The serum lactate levels of these patients were checked within the first 42 hours of their hospitalization.

Following a comprehensive explanation to the patient or the patient's legal guardian, the ophthalmic artery was located and the wave was analyzed. This was achieved by placing the ultrasound probe on the patient's closed eyelid using the portable color Doppler ultrasound available in the General ICU. The parameters evaluated include (PSV, PI)[1], which are explained in detail in the subsequent sections.

Then the numbers obtained from these parameters

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1. PSV: Peak systolic velocity (PSV) is an index measured in spectral Doppler ultrasound.
PI: The pulsatility index (PI) (also known as the Gosling index) is a calculated flow parameter in ultrasound, derived from the maximum, minimum, and mean Doppler frequency shifts during a defined cardiac cycle.

and the lactate number of the patient's serum and their relationship with each other. The severity of sepsis will be analyzed and investigated.

Result

In this study, 24 patients admitted to the intensive care unit of Shariati Hospital with a diagnosis of sepsis and a SOFA score of 3 are being examined. If the patient is conscious, consent is obtained. If the patient is not conscious, the procedure is explained to the patient's legal guardian. The probe is placed on the patient's eye to locate the ophthalmic artery and analyze the best wave that can be observed from the ophthalmic artery. The patient's serum lactate level is also measured at the same time as the patient's blood sample is sent for analysis.

As observed in this study, there is a significant relationship between the increase in lactate levels

and PSV1. This parameter can be considered a predictive factor. As seen in this study, there is a significant relationship between the dose of increased lactate levels and PSV1, and this parameter can be considered a predictive factor.

In conclusion, it is observed that there is a significant relationship between increased levels of lactate up to 2 and the psv1 index. A similar significant relationship with a p-value less than 0.05 is also found between the psv2 index and increased lactate levels, which can be considered a prognostic factor.

From the findings of this study, it is evident that there is a significant relationship between the dose of increased lactate levels and PI. Therefore, this parameter can be regarded as a predictive factor

Conclusion

The study discovered a significant correlation between elevated lactate levels and reduced blood flow in the optic artery. However, due to the limited sample size in this study, it is recommended that further research should be conducted with a larger number of samples.

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