J Surg Med. 2018;2(2):96-98.
DOI: 10.28982/josam.409615

Research article
Araştırma makalesi

Journal of Surgery and Medicine
e-ISSN: 2602-2079

The role of lactate clearance on deciding discharge in exacerbation of chronic obstructive pulmonary disease: Retrospective cohort study

Kronik obstruktif akciğer hastalığı alevlenmesinde taburculuk kararı verilmesinde laktat klirensinin rolü: Retrospektif kohort çalışma

Nazlı Görmeli Kurt [1], Murat Orak [2], Mehmet Üstündağ [2]

[1] Department of Emergency Medicine, Batman State Hospital, Batman, Turkey
[2] Department of Emergency Medicine, Dicle University, Faculty of Medicine, Diyarbakır, Turkey

Abstract

Aim: Patients presenting with chronic obstructive pulmonary disease (COPD) exacerbation in crowded emergency departments are often discharged with symptomatic treatment. This situation increases the number of patients admitted to the hospital and the number of attacks. It is very important to be able to predict hospitalization with cheap and easy blood parameters to be looked at the time of application. In our study, we aimed to investigate the relationship between lactate Clearance and admission or discharge decision in patients presenting with acute exacerbation of COPD.

Methods: In this study, patients over 18 years old who were admitted to Batman Regional State Hospital Emergency Department with COPD attack between January 1, 2014 and January 1, 2018 were retrospectively studied. The patients were divided into 2 groups. Group 1 included the patients who discharged after treatment in emergency, group 2 included the patients who hospitalized. Both groups were compared in terms of lactate clearance values.

Results: We studied 117 patients who met the criteria for inclusion in the study. Of these, 65 were discharged and 52 were hospitalized. Six of the hospitalized patients were hospitalized in the intensive care unit. Forty-one patients were female and 76 were male. We did not find any difference between the first and last lactate values of patients who were admitted and discharged (p=0.345 and 0.829). However, the lactate clearances of the discharged patients were higher, while the lactate clearances of patients with hospitalization indications were lower (p<0.001).

Conclusion: We think that lactate clearance can be used as a marker in patients presenting emergency services with COPD exacerbation without deciding on discharge or admission.

Keywords: Chronic obstructive pulmonary disease, Lactate clearance, Prediction

Öz

Amaç: Kalabalık acil servislerde kronik obstruktif akciğer hastalığı (KOAH) alevlenmesi ile başvuran hastalar sıklıkla semptomatik tedavi ile taburcu edilmektedir. Bu durum hastaların hastaneye başvuru ve atak sayısını arttırmaktadır. Başvuru anında bakılacak ucuz ve kolay kan parametreleri ile yatış öngörüsü yapabilmek oldukça önemlidir. Bizde çalışmamızda, acil servise KOAH akut alevlenmesi ile başvuran hastalarda, yatış veya taburculuk kararı verilmesi ile laktat klirensi arasındaki ilişkiyi araştırmayı amaçladık.

Yöntemler: Bu çalışmada, 1 Ocak 2014 ile 1 Ocak 2018 tarihleri arasında Batman Bölge Devlet Hastanesi Acil Servisi'ne KOAH atak nedeniyle başvuran 18 yaş üstü hastalar retrospektif olarak incelendi. Hastalar 2 gruba ayrıldı. Grup 1, acil olarak tedaviden sonra taburcu olan hastaları, grup 2'yi hastaneye yatırılan hastaları kapsamaktadır. Her iki grup laktat klirens değerleri açısından karşılaştırıldı.

Bulgular: Çalışmaya 117 hasta dahil edildi. Bunlardan 65'i taburcu olurken; 52'si hastaneye yatırıldı. Hastanede yatan hastalardan 6'sı yoğun bakım ünitesine yatırıldı. Hastaların 41'i kadın, 76'sı erkek idi. Başvuran ve taburcu edilen hastaların ilk ve son laktat değerleri arasında bir fark bulamadık (p=0,345 ve 0,829). Bununla birlikte, taburcu olan hastaların laktat açıklıkları daha yüksek iken, hastaneye yatırılan hastaların laktat klirensi daha düşük bulundu (p<0,001).

Sonuç: KOAH atak nedeni ile acil servise başvuran hastalarda taburculuk veya yatış kararı vermede, laktat klirensinin, bir belirteç olarak kullanılabileceğini düşünmekteyiz.

Anahtar kelimeler: Kronik obstruktif akciğer hastalığı, Laktat klirensi, Ön görmek

Introduction

Chronic obstructive pulmonary disease (COPD); is a preventable and treatable disease state characterized by complete non-reversible airflow restriction [1]. COPD is an important and increasing cause of morbidity and mortality worldwide [2]. According to the World Health Organization, COPD is the fourth most common cause of death worldwide and is predicted to be the third most common cause in 2020 [3]. Ministry of Health Global Burden of Disease (Global Burden of Study) using the method in the study aims to estimate the causes of death in Turkey, cause of death among the most common COPD 's been reported to be the third cause of death [4,5].

Corresponding author / Sorumlu yazar:
Nazlı Görmeli Kurt
Address / Adres: Batman Bölge Devlet Hastanesi, 72000, Batman, Türkiye
E-mail: nazligormeli@yahoo.com

Ethics Committee Approval: The study was approved by local Ethical Committee.
Etik Kurul Onayı: Çalışma için onay lokal Etik Kurulundan alınmıştır.

Conflict of Interest: No conflict of interest was declared by the authors.
Çıkar Çatışması: Yazarlar çıkar çatışması bildirmemişlerdir.

Financial Disclosure: The authors declared that this study has received no financial support.
Finansal Destek: Yazarlar bu çalışma için finansal destek almadıklarını beyan etmişlerdir.

Received / Geliş Tarihi: 26.02.2018
Accepted / Kabul Tarihi: 30.03.2018
Published / Yayın Tarihi: 30.03.2018

How to cite / Atıf için: Kurt NG, Orak M, Üstündağ M. The role of lactate clearance on deciding discharge in exacerbation of chronic obstructive pulmonary disease: Retrospective cohort study. J Surg Med. 2018;2(2):96-98.

COPD exacerbations are defined as an acute deterioration of respiratory symptoms, resulting in the need for additional treatment of stabilized periodic treatments. Exacerbations; are important events that should be considered in the management of COPD treatment because the health status of patients, re-admission and hospitalization rates to the hospital, and therefore the progression of the disease, are adversely affected [6,7]. Indications for admission to hospital during COPD exacerbations Exacerbation of dyspnea at rest, increase in respiratory rate, low oxygen saturation, confusion and drowsiness, acute respiratory insufficiency, lack of response to medical treatment, presence of serious comorbidities (egg heart failure, newly developed arrhythmia etc.) such as medical care [8].

The lactate in the human body is produced by the reduction of pyruvate by the lactate dehydrogenase enzyme [9,10]. In the normal physiological state, the reaction does not support the formation of lactate, which only accounts for one-tenth of the total pyruvate metabolism [11]. However, in critical situations such as hypo perfusion and hypoxia, pyruvate accumulates rapidly and shifts to lactate production, the metabolic anaerobic pathway [12,13]. As a result, intracellular lactate begins to multiply and pass into the bloodstream [14]. The single lactate level measured in the application is thought to be a marker of organ dysfunction and mortality. However, a single measurement of lactate may exhibit static variability. In order to be more clinically useful, it is necessary to define the relationship between lactate clearance (LK) and clinical outcome, which is a measure of the change in lactate levels during treatment [14]. There are studies showing that there is a relationship between high lactate clearance and high survival in sepsis and septic shock patients admitted to emergency services [15,16].

Patients presenting with COPD exacerbation in crowded emergency departments are often discharged with symptomatic treatment. This situation increases the number of patients admitted to the hospital and the number of attacks. It is very important to be able to predict hospitalization with cheap and easy blood parameters to be looked at time of application. In our study, we aimed to investigate the relationship between lactate clearance and admission or discharge decision in patients presenting with acute exacerbation of COPD.

Materials and methods

This retrospective cohort study was conducted on patients over 18 years old who were admitted to Batman Regional State Hospital Emergency Department with COPD attack between January 1, 2014 and January 1, 2018. This study includes patients who were admitted emergency service with exacerbation of COPD and have at least 2 blood gases at 6 hour intervals and older 18 years. Ethical approval was taken from a local ethic committee. Patients' age, gender, O_2 saturation, respiratory rate, blood pressure, fever, pulse and blood gas values at the time of admission and arterial blood gas values measured after 6 hours were recorded. The patients were divided into 2 groups. Group 1 included the patients who discharged after treatment in emergency, group 2 included the patients who hospitalized. Patients who did not have at least 2 arterial blood gases at 6 hour intervals, those younger than 18 years, those with acute hepatic insufficiency, and those who could not obtain information from the hospital automation system were excluded from the study. We compared the lactate clearance values of two groups in our study and investigate the place of lactate clearance giving discharge decision.

Lactate Clearance is calculated as explained; LC = Lactate Measured in Emergency Service Addition - Lactate Measured at 6^{th} hour x 100 / Lactate Measured in Emergency Service Addition. A negative result indicates an increase in lactate value relative to the reference after 6 hours, while the positive result of the addition indicates lactate reduction or clearance.

Statistical analysis

Univariate statistical analyzes were performed using Chi-Square test for categorical variables, Wilcoxon T test for dependent variables. T-test was used for comparison of descriptive variables with normal distribution and Mann-Whitney U without normal distribution. Numerical variables were given as n (%), mean (SD) and median (Inter quartile range (IQR) 25-75). $P < 0.05$ was considered statistically significant.

Results

We studied 117 patients who met the criteria for inclusion in the study. Of these, 65 were discharged and 52 were hospitalized. Six of the hospitalized patients were hospitalized in the intensive care unit. 41 of the patients were female and 76 were male. Patients who were hospitalized and discharged were comparable in terms of demographic characteristics and vital findings and did not show any statistically significant difference between the groups (Table 1). In total, 78 (66%) of the patients who applied were smoking.

Table 1: Demographic features and vital findings

	All patients (n=117)	Group 1 (n=52)	Group 2 (n=65)	p
Age (years) mean±SD	66±10	67±10	66±10	0.324
Gender				
Female n (%)	41 (35)	18 (35)	22 (34)	0.421
Male n (%)	76 (65)	34 (65)	43 (66)	
	median (IQR)	median (IQR)	median (IQR)	
Body temperature (° C)	36.5 (36.3-36.9)	36.5 (36.3-36.9)	36.7 (36.4-37.0)	0.892
Heart rate (beats / min)	106 (101-116)	110 (102-118)	104 (98-112)	0.125
Systolic blood pressure (mmHg)	136 (126-152)	132 (122-148)	143(133-156)	0.257
Oxygen saturation (% SaO2)	91(84-94)	87(82-93)	90(84-95)	0.823
Respiration rate (/ min)	28(21-35)	31(23-38)	27(20-34)	0.645

SD: Standard deviation, IQR: Inter quartile range

When we examined according to the time of admission, the most frequent emergency services were seen in the winter (n=79, 67%) and autumn (n=42, 35%) seasons. The most common complaints of the patients were dyspnea (86%) followed by chest pain. In total, no lung graphs were taken in 5 of the cases that were not studied. Pneumonic infiltration was present in 11 of 112 cases with chest X-ray. In total, 83 (71%) of the patients had a history of hospitalization.

Patients who were hospitalized and discharged compared blood gas parameters at the time of admission to the hospital with blood gas parameters taken at least 3 hours later. We did not statistically distinguish between the blood gas parameters taken at the time of application. We found a significant elevation in the CO_2 values of the blood gas parameters taken after at least 3 hours ($p=0.035$) (Table 2).

Table 2: Blood gas parameters of patients at the time of application and after 6 hours

Blood gas parameters		All patients (n=117)	Group 1 (n=52) median (IQR)	Group 2 (n=65) median (IQR)	p
admission	pO2 (mmHg)	67.6 (63.6-71.8)	63.2 (60.4-66.1)	69.4 (65.4-73.0)	0.679
	pCO2 (mmHg)	41.5 (37.8-46.7)	42.5 (37.3-47.2)	39.6 (34.2-43.8)	0.195
	pH	7.37 (7.13-7.51)	7.37 (7.12-7.50)	7.37 (7.13-7.52)	0.521
6th hour	pO2 (mmHg)	76.4 (74.2-80.8)	73.5 (70.9-77.3)	81.4 (77.9-85.6)	0.129
	pCO2 (mmHg)	40.7 (36.1-45.2)	44.5 (40.3-48.2)	38.6 (34.3-43.2)	0.035
	pH	7.39 (7.19-7.53)	7.38 (7.18-7.51)	7.41 (7.20-7.58)	0.201

IQR: Inter quartile range

We compared the lactate levels in the first and second blood gases of patients who were admitted and discharged. We did not find any statistically significant difference between the first and last lactate values of patients who were admitted and discharged (p=0.345 and 0.829). However, we found a statistically significant difference between the two groups in terms of lactate clearances. The lactate clearances of the discharged patients were higher whereas the lactate clearances of the patients who were hospitalized were found to be lower (p<0.001) (Table 3).

Table 3: Lactate and lactate clearance values at the time of application and after 6 hours

	Group 1 (n=52) median (IQR)	Group 2 (n=65) median (IQR)	p
First blood gas - lactate value (mg/dL)	12 (9-15)	15 (12-17)	0.621
Second blood gas - lactate value (mg/dL)	13 (10-17)	11 (9-13)	0.21
Lactate clearances	–10.6%	%15.3	<0.001

IQR: Inter quartile range

Discussion

In our study, the rate of lactate values (lactate clearances) in the first and last arterial blood gases was investigated in the emergency department of patients who applied with COPD exacerbation. According to this, it was determined that the clearances of the patients discharged within the 6-hour follow-up period were higher.

The GOLD guidelines in 2017 aimed to set a standard in COPD patient management, but nevertheless made it difficult for physicians to provide a standard [6], since the protocols applied indicated that the protocol would vary by patient, hospital and country. For this reason, we think that it would be useful to have easy and cheap parameters in the decision of hospitalization of patients with COPD in hospitals with crowded emergency services such as our country.

In disease states with hypo perfusion and hypoxia, pyruvate accumulates rapidly and its metabolism shifts to lactate production, and lactate increases and then passes into the bloodstream [12]. There are studies showing that tissue hypoxia increases blood lactate level [17]. Accordingly, it can be predicted that COPD exacerbations requiring hospitalization will not be able to clear the lactate canal due to prolonged tissue hypoxia. Lactate level measurement is thought to be a strong indicator of organ dysfunction and mortality.

However, lactate is a static variant. Therefore, in order for lactate measurement to be clinically useful, it is necessary to identify the lactate clearance to be measured during treatment and its relation to the clinical outcome. In previous studies, lactate clearance was found to be associated with all-cause mortality in various critical patient groups, such as sepsis followed in emergency care or intensive care units [14].

In our study lactate and lactate levels measured at 6th hour and lactate clearance of patients were calculated. There was a statistically significant difference between the lactate clearances and the first measured and second measured lactate values between the patient groups who were admitted and discharged by looking at these values. In our study group, lactate clearance was calculated as 15.3% in the patient group and -10.6% in the inpatient group and statistical difference was found between them. In other words, the negative lactate clearance that we found in the hospitalized group indicates to us that lactate cannot be cleaned after treatment.

This study has some limitations. Our study is not multicenter and the size of the sample is limited. There is a need for prospective study on this issue. We cannot reach all information about the patients due to our crowded emergency service the patient files aren't recorded. And also the comorbid disease may be affected the lactate clearance value.

In conclusion, we found that lactate clearance may be useful in patients with COPD exacerbation at deciding on discharge or admission.

References

1. Celi BR, MacNee W. Standarts for the diagnosis and treatment of patients with COPD: a summary of the ATS/ERS position paper. Eur Respir J. 2004;23:932-46.
2. Chapman KR, Mannino DM, Soriano JB et al. Epidemiology and cost of chronic obstructive pulmonary disease. Eur Respir J. 2006;27:188-207.
3. Barnes PJ, Celli BR. Systemic manifestations and comorbidities of COPD. Eur Respir J. 2009;33(5):1165-85.
4. Tan WC, Lo C, Jong A ve ark. Marijuana and chronic obstructive lung disease: a population-based study. CMAJ. 2009;180:814-820.
5. Hospers JJ, Postma DS, Rijcken B, Weiss ST, Schouten JP. Histamine airway hyperresponsiveness and mortality from chronic obstructive pulmonary disease: a cohort study. Lancet. 2000;356:1313-7.
6. Wedzicha JA, Seemungal TA. COPD exacerbations: defining their cause and prevention. Lancet. 2007;370:786-96.
7. Seemungal TA, Donaldson GC, Paul EA, Bestall JC, Jeffries DJ, Wedzicha JA. Effect of exacerbation on quality of life in patients with chronic obstructive pulmonary disease. Am J Respir Crit Care Med. 1998;157:1418-22.
8. Global Strategy for the Diagnosis, Management and Prevention of COPD, Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2017 Report. Web site: www.goldcopd.org
9. Brooks GA. Lactate shuttles in nature. Biochem Soc Trans. 2002;30:258-264.
10. Philp A, Macdonald AL, Watt PW. Lactate-A signal coordinating cell and systemic function. J Exp Biol. 2005;208:4561-75.
11. Vernon C, Letourneau JL. Lactic acidosis: Recognition, kinetics, and associated prognosis. Crit Care Clin. 2010;26:255-83.
12. Levy B, Sadoune LO, Gelot AM, Bollaert PE, Nabet P, Larcan A. Evolution of lactate/pyruvate and arterial ketone body ratios in the early course of catecholamine-treated septic shock. Crit Care Med. 2000;28:114-9.
13. Revelly JP, Tappy L, Martinez A, et al. Lactate and glucose metabolism in severe sepsis and cardiogenic shock. Crit Care Med. 2005;33:2235–40.
14. Zhang Z, Xu X. Lactate clearance is a useful biomarker for the prediction of all-cause mortality in critically ill patients: a systematic review and meta-analysis. Crit Care Med. 2014;42:2118-25.
15. Bernardin G, Pradier C, Tiger F, Deloffre P, Mattei M. Blood pressure and arterial lactate level are early indicators of short-term survival in human septic shock. Intensive Care Med. 1996;22:17–25.
16. Nguyen HB, Rivers EP, Knoblich BP, et al. Early lactate clearance is associated with improved outcome in severe sepsis and septic shock. Critical Care Med. 2004;32:1637-42.
17. Cain SM. Oxygen delivery and uptake in dogs during anemic and hypoxic hypoxia. J Appl Physiol Respir Environ Exerc Physiol. 1977;42:228-34.