Lactate dehydrogenase level as an early predictor of transient tachypnea of the newborn duration and complications

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Research Article

Keywords: Transient tachypnea of newborn, lactate dehydrogenase level, the duration of hospitalization, complications

Posted Date: December 2nd, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-119294/v1>

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Abstract

Background: Transient tachypnea of the newborn (TTNB) is a common cause of respiratory distress in the postnatal period. It is rarely associated with serious complications that need intensive care. Prediction of the complications during the first hours of hospitalization is very difficult, so the purpose of the current study is to investigate the relationship between lactate dehydrogenase (LDH) level in blood and the course of Transient tachypnea of the newborn (the duration of hospitalization, and the incidence of complications).

Material and methods: In a cross-sectional study design included 120 neonates with Transient tachypnea of the newborn who had referred to the Neonatal Intensive Care Unit (NICU) at Tishreen University Hospital over 1 year period from January 2018 to January 2019. The neonates were classified according to Lactate dehydrogenase measurement as normal or high lactate dehydrogenase level in blood.

Results: The results showed that there was a significant relationship between the level of lactate dehydrogenase and the duration of hospitalization, the incidence of complications, and the frequency of complications.

Conclusions: lactate dehydrogenase might be useful for clinicians to predict the duration of hospitalization and the incidence of complications in neonates with TTNB.

Introduction

Transient tachypnea of the newborn (TTNB) is a parenchymal lung disorder characterized by pulmonary edema due to delayed absorption of pulmonary alveolar fluid (1). TTNB is a common cause of respiratory distress in newborns with an incidence of 5,7/1000 (2). Its clinical manifestations appear a few hours after birth as tachypnea (RR > 60 /min), grunting, nasal flaring, intercostal retraction, and cyanosis. Diagnosis is based on the previous clinical features after excluding the other causes of tachypnea depending on the laboratory and radiological tests (3). The etiology of TTNB is not completely clear, but it is believed that the delay in lung fluid absorption is the common cause. Lung fluid clearance usually begins in the last period of pregnancy (2-3 days before delivery), as a response to stress hormones elevation such as catecholamine, mature pulmonary epithelium starts sodium and fluid reabsorption instead of secretion of chloride and fluid into alveolar spaces (4-5), a large portion of the fluid is transported across aquaporin 5 (AQP5) water channels (6).

Although TTNB is a self- limited condition in most cases, but it can complicate with more serious problems in which the newborn needs oxygen support or mechanical ventilation. We cannot predict the course of TTNB since the earlier hours of hospitalization, so the current study investigates the association between LDH level in blood and the course of TTNB (the duration of hospitalization, and the incidence of complications).

Methods

A cross-sectional retrospective study included 120 neonates with TTNB who had referred to the Neonatal Intensive Care Unit (NICU) at Tishreen University Hospital in Latakia, Syria over 1 year period from January 2018 to January 2019. Patients who had pneumonia, early neonatal sepsis, meconium aspiration syndrome, asphyxia (Apgar 5 min < 6), cardiac/pulmonary abnormalities, or newborns of a diabetic mother were excluded .

clinical data include gestational age, gender, birth pattern, Apgar score, and birth weight was obtained. A Physical examination was performed. Chest-X-Ray and Laboratory data were obtained at the admission of all neonates including complete blood cells (CBC), C- reactive protein (CRP), and lactate dehydrogenase (LDH).

LDH was analyzed and classified according to the value LDH (290-775)U/l (7) into patients with normal or high LDH levels. The clinical course, duration of hospitalization, and the incidence of complications of patients were followed up.

All data were analyzed using the Statistical Package for Social Sciences (SPSS Version 20). Data were presented in simple measures of frequency, percentage, mean. The significance of the difference between different means (quantitative data) was tested using Student's t-test for the difference between two independent means, while different percentages (qualitative data) were tested using Pearson's Chi-square test.

Results

The study included 120 neonates with TTNB, 80(66.7%) were male and 40(33.3%) were female with a mean birth weight of 2855 g. Cesarean section pattern was predominant in 117(97.5%), gestational age more than 37 weeks was in 47cases(39.2%). The duration of hospitalization was less than 3 days in 72(60%). 12(10%) of neonates developed pneumothorax as a complication. **Table I** showed the demographic variable of the neonates.

The frequency of high LDH level was 46.6%. Comparison between high and low LDH level groups, There was a significant relationship between the high LDH levels and the duration of hospitalization and the complications according to Pearson's Chi-square test (**Table II**).

By calculating the value of the regression coefficient (R Square), it was 0.634 for the duration of hospitalization, which means that 63.4% of the changes in the duration of hospitalization are associated with an increase in the level of LDH (**Figure 1**). R Square was 0.239 for the complications that refers to 23.9% of changes in the incidence of complications are associated with the high level of LDH (**Figure 2**).

Table I : demographic variable of the neonates

Variables	Total neonates
Gender	
Male, n (%)	80(66.7)
Female, n (%)	40(33.3)
Mode of delivery	
Cesarean delivery, n (%)	117(97.5)
vaginal birth, n (%)	3(2.5)
Gestational age	
37 GW, n (%)	41(34.2)
38 GW, n (%)	47(39.2)
39 GW, n(%)	32(26.7)
duration of hospitalization	
less than 3 days, n (%)	72(60)
more than 3 days, n (%)	48(40)
complication(pneumothorax)	
No, n(%)	108(90)
Yes, n (%)	12(10)

GW: gestational week

Table II: Comparison between high and normal LDH groups according to the duration of hospitalization and complication

variables	High LDH levels	Normal LDH levels
	n=56	n=64
duration of hospitalization		
less than 3 days, n (%)	8(6.7)	64(53.3)
more than 3 days, n (%)	48(40)	0(0)
complication(pneumothorax)		
No, n(%)	44(36.7)	64(53.3)
Yes, n (%)	12(10)	0(0)

Discussion

Developed countries still suffer from difficulties in neonatal caring, the limited number of available places in NICU is one of them. Therefore, the predicting of the need for admission in NICU is essential in clinical practice in our country to avoid delay in providing the adequate support. The current study supports the importance of using laboratory tests in neonates with TTNB to predict the course of TTNB and thus predict the neonate's need for NICU

Delayed fluid absorption in TTNB leads to the filling of lung spaces with fluid which moves into the interstitium where it fills interlobar fissures and perivascular tissues, and that leads to a decrease in lung compliance, and development of tachypnea for decompensation, air trapping occurs due to the partial collapse of the bronchioles, eventually, hypoxemia occurs due to continued perfusion of these poorly ventilated alveoli (6). It is well known that enzymes leak out of cells after damage induced by ischemic hypoxemia. Lactate and LDH are considered as good predictors of asphyxia (8). LDH is an enzyme that mediates the conversion of lactate to pyruvate as well as the reverse reaction. It is found in several organs and tissues such as liver, heart, lungs, lymphatic tissues, and blood cells. When cells are damaged, LDH is released out of cells into bloodstream which elevates its level in plasma. There are several types of LDH known as isoenzymes, which are distinguished from each other by slight differences in structure and by the organs where they exist (9).

LDH level increases in the case of hypoxia and its highest level is within 72 hours after birth. It returns to normal within the first 10 days of life (10).

In the current study, we showed a positive correlation between the duration of hospitalization, the incidence of complications and the LDH level. The duration of hospitalization as well as the frequency of complication increase as the value of LDH increases

To Our knowledge, this is the first study investigating the relationship between the duration of hospitalization, the incidence of complications and the level of LDH in TTNB neonates.

In Turkey, Ozkiraz et al showed that there is a significant relationship between prolonged oxygen supplement and high LDH levels **(11)**. It was the only research in literature that studies the idea of high LDH in course of TTNB.

The lack of availability of pulmonary LDH analysis was one of the limitations of the current study. Repeated measurement of LDH was not made over time in Individual subjects to investigate the correlation with the clinical course of TTNB that may be also a limitation.

Conclusion

The current study demonstrates that the level of LDH may be predictive of subsequent hospitalization duration and the incidence of complications in neonates having TTNB. This may be used as a predictive measure through which prevention can be achieved by referring the TTNB patient to the NICU before the clinical situation is worsened.

Declarations

- **Data Availability:**

We can't share patient data due to our hospital's privacy policy, which is concerned with maintaining patient confidentiality and refuses to publish or share data. Also, the informed consent signed by the parents to participate in the study prevents the sharing of information with the non - Study researchers.

- **Acknowledgments**

We wish to thank the medical officer, doctors in the pediatric department, and laboratory assistants in Tishreen University Hospital laboratory who worked with us in reviewing the patients and doing the laboratory analysis.

- **Statement of Ethics:**

All parents whose children were studied gave informed consent for the sharing of this research. Ethical clearance for this study was obtained from the Ethical Committee of the University of Tishreen Hospital

- **Funding Sources :**

- **Conflict of Interest Statement:**

None Declared

- **Author Contributions:**

The Authors developed and carried out sample collection. Literature review, the data analysis and read through the final data were done by authors.

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Figures

Figure 1

The association between duration of hospitalization and LDH levels

Figure 1

The association between duration of hospitalization and LDH levels

Figure 2

The association between incidence of complications and LDH levels

Figure 2

The association between incidence of complications and LDH levels