Lactate dehydrogenase concentration in different pediatric age groups.

Concentración de lactato deshidrogenasa en grupos de edad pediátrica diferentes.

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ABSTRACT

Normalisation of blood LDH level is associated with improved survival in many studies conducted in adults, in children and neonate. The study aimed to estimate the LDH for different pediatrics age groups. An observational study was conducted at Pediatrics ward, Abu Ghraib General Hospital, from January 2018 to December 2019. Study sample included 250 children; their age ranged from 1 day to 16 years. Children of both gender with these age groups admitted to ward, and blood LDH were calculated. The maternal history, fever, umbilical infection, SOB, hypoxia, sepsis, and respiratory distress syndrome (RDS) were documented accordingly. LDH measured as followed: New born: 160 to 450 units per litre (units/L) and child: 60 to 170 units/L. We divided sample to two-groups, newborn babies (1 day to 1 year) and chid (>1 year to 16 years), and the study variables were documented. The LDH concentration and variables correlation calculated. The prognostic value of serial serum LDH monitoring for predicting morbidity and mortality in sick children is confirmed. There is a correlation, although very clear, between the plasma LDH levels with infection, asphyxia, and RDS.

Key words: LDH, RDS, SOB, Hypoxia

Introduction

Monitoring of tissue perfusion markers in ill children is necessary for early recognition of disease which will enable to start an appropriate and timely management. Lactate dehydrogenase (LDH) has been considered as a marker of tissue damage. Normalisation of blood LDH level is associated with improved survival in many studies conducted in adults[1], in children[2,3] and neonate[4-7]. LDH concentrations at the moment of the pediatrics ages may have a positive correlation with the disease prognosis[8,9]. Several measurements of LDH concentrations are valuable in assessing the prognosis and response to treatment[10, 11]. Moreover, lactate dehydrogenase (LDH) is an intracellular enzyme that responds to energy shortages in all organs. Therefore, plasma LDH is also an indicator of body tissue hypoxia[12].

The study aimed to estimate the LDH for different pediatrics age groups.

Methods

An observational study was conducted at Pediatrics ward, Abu Ghraib General Hospital, from January 2018 to December 2019. Study sample included 250 children; their age ranged from 1 day to 16 years. Children of both gender with these age groups admitted to ward, and blood LDH were calculated. Neonates with congenital abnormalities, children with metabolic diseases, children died with in 24 hours of admission, postsurgical cases, and loss of follow-up were excluded. The maternal history, fever, umbilical infection, SOB, hypoxia, sepsis, and neonatal respiratory distress syndrome (RDS) were documented accordingly.

Plasma LDH testing was done at the time of admission as baseline record. Two milliliters of serum with Li-heparin and plasma underwent hemolysis by the automated analyzed technique. LDH measured as followed: Newborn: 160 to 450 units per litre (units/L) and child: 60 to 170 units/L. Statistical analysis performed using SPSS v24 (IBM Inc., Chicago, IL, USA). Descriptive statistics of qualitative variables consist of numbers, and percentages were measured. For quantitative variables, the mean, median, range and SD for categorical data calculated. An association between variables assessed by chi-square test. A two-sided P-value of less than 0.05 was considered statistically significant.

Results

We divided sample to two-groups, newborn babies (1 day to 1 year) and chid (>1 year to 16 years), and the study variables listed in table 1. The LDH concentration and variables correlation showed in table 2.

Table 1. General variables of the study groups.

Variables		No.	%	P value
Age	Newborn	88	35.2	0.06
	Child	162	64.8	
Gender	Male	142	58.4	0.092
	Female	108	41.6	
Mode of delivery	Normal	178	71.2	0.05
	CS	72	28.8	
Fever	Yes	39	15.6	0.049
	No	211	84.4	
Umbilical infection	Yes	41	16.4	0.01
	No	209	83.6	
SOB	Yes	98	39.2	0.056
	No	152	60.8	
Hypoxia	Yes	33	13.2	0.025
	No	217	86.8	
Neonatal sepsis	Yes	28	11.2	0.02
	No	222	88.8	
RDS	Yes	8	3.2	0.001
	No	242	96.8	

Table 2. The LDH concentration and variables.

Variables		LDH (U/L) Mean (median)	P value
Age	Newborn	488.3 (442)	0.01
	Child	205.5 (195)	
Gender	Male	312.2 (305)	0.56
	Female	342.7 (336)	
Mode of delivery	Normal	255.6 (248)	0.5
	CS	332.7 (312)	
Fever	Yes	428.2 (410)	0.01
	No	201.3 (196)	
Umbilical infection	Yes	477.5 (458)	0.03
	No	200.6 (202)	
SOB	Yes	387.4 (380)	0.02
	No	198.9 (195)	
Hypoxia	Yes	389.3 (375)	0.08
	No	222.4 (200)	
Neonatal sepsis	Yes	413.8 (410)	0.005
	No	189.6 (182)	
RDS	Yes	488.5 (475)	0.04
	No	176.4 (172)	

Discussion

In severe cases, the children bodies loss the oxygen and glucose that is metabolized in the anaerobic pathway to produce energy, and pyruvate is oxidized to lactate by the lactate dehydrogenase enzyme. The higher the oxygen deficiency, the greater the anaerobic metabolism, lead to more lactate is produced, the LDH also increases[13].

Studies have shown that elevated LDH values is significantly associated with negative outcome in paediatric age groups[14-16].

As, a point calculation of serum LDH does not reflect the events that occur after 24 to 48 hours of hospitalization. Interpretation of single LDH has its own limitations as an increased level might indicate other mechanisms of hyperlactatemia like increased lactate production via catecholamine-driven pathways or decreased lactate clearance due to hepatic dysfunction. In the study group of 275 newborn infants at Hue University Hospital, the median of the plasma LDH levels was 719

U/l, the 25th percentile was 578.25 U/l, and the 75th percentile was 892.5 U/l[17]. In the Eva study, the 25th and 75th percentiles of intravenous cord plasma LDH were 252–636 U/L[18].

This study showed newborn babies have LDH level significantly higher than in child (P=0.01). This is explained by the fact that the cell membranes with cell hypoxia in infants are more persistent and that cell metabolism is more incomplete in preterm infants compared to full-term and post-term infants[19].

When comparing newborn with child among severe clinical signs to those without signs, child with signs of fever, umbilical infection, SOB, hypoxia, sepsis, and RDS had higher plasma LDH levels than those with normal status. According to a study by Karlsson et al, infants with respiratory symptoms, such as coughing, wheezing, or rapid breathing, showed no difference (p = 0.05) between the group requiring active neonatal care and that requiring no active neonatal care or between the group with no fever. The plasma LDH levels in the sero-negative neonatal intensive care groups were also higher than those without active neonatal care[20]. Reddy's study concluded that the plasma LDH levels most accurately distinguish asphyxiated newborn infants from asymptomatic asphyxiated neonates[21]. Sanjay's study had a mean cut-off LDH value of 580 U/l with a sensitivity of 59.18% and a specificity of 92%[22].

There is, moreover, a difference in the LDH levels between hypoxia degrees[23]. A study by Karlsson et al showed that postpartum hypoxia is a poor predictor of LDH levels. The LDH cut-off of 1049 U/l is the best predictor, with a sensitivity of 100% and a specificity of 97%[24].

Morini's study concluded that blood LDL levels were significantly increased with infections ($p < 0.005$)[25]. A study by Powers et al found that peripheral plasma LDH levels elevated in infants with bacterial meningitis[26]. A study by Zein el al. concluded that elevated plasma LDH levels in severe infections, as a marker of tissue damage[27].

Conclusions

The prognostic value of serial serum LDH monitoring for predicting morbidity and mortality in sick children is confirmed. There is a correlation, although very clear, between the plasma LDH levels with infection, asphyxia, and RDS.

Declaraciones

Los autores declaran no tener conflictos de interés de ninguna clase, que el trabajo ha sido aprobado por el comité de ética responsable en el lugar de trabajo y no declaran medios de financiación del trabajo realizado.

Declarations

The authors declare that they have no conflicts of interest, that the work has been approved by the ethics committee responsible in the workplace, and do not declare means of financing of the work carried out.

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RESUMEN

La normalización del nivel de LDH en sangre se asocia con una mejor supervivencia en muchos estudios realizados en adultos, en niños y recién nacidos. El estudio tuvo como objetivo estimar la LDH para diferentes grupos de edad de pediatría. Se realizó un estudio observacional en Pediatrics Ward, Hospital General de Abu Ghraib, de enero de 2018 a diciembre de 2019. La muestra de estudio incluyó a 250 niños, su edad osciló entre 1 día y 16 años. Se calcularon los niños de ambos género con estos grupos de edad admitidos en Ward, y se calcularon LDH en sangre. La historia materna, la fiebre, la infección umbilical, la sollozo, la hipoxia, la sepsis y el síndrome de dificultad respiratoria (RDS) se documentaron en consecuencia. LDH medido como siguió: Recién nacido: 160 a 450 unidades por litro (unidades/L) y niño: 60 a 170 unidades/l. Dividimos la muestra a dos grupos, bebés recién nacidos (1 día a 1 año) y CHID (> 1 año a 16 años), y se documentaron las variables de estudio. La correlación de concentración y variables de LDH calculada. Se confirma el valor pronóstico del monitoreo de LDH en suero en serie para predecir la morbilidad y la mortalidad en los niños enfermos. Hay una correlación, aunque muy clara, entre los niveles de LDH en plasma con infección, asfixia y RDS.
Palabras clave: LDH, RDS, SOB, Hipoxia