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血乳酸和心肌酶变化在胎儿宫内窘迫新生儿中的临床意义*

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摘要 目的:探讨血乳酸和心肌酶变化在胎儿宫内窘迫新生儿中的临床意义。**方法:**选取2017年3月到2018年8月期间在我院出生的胎儿宫内窘迫新生儿120例,其中有55例出生后未出现窒息,将其纳入观察1组,另外65例新生儿出生后出现窒息则纳入观察2组,同时选取同期在我院出生的健康、足月新生儿60例作为对照组。比较三组新生儿的血乳酸、乳酸脱氢酶(LDH)、肌酸激酶(CK)、肌酸激酶同工酶MB(CKMB)、血氧分压(PaO_2)、二氧化碳分压(PaCO_2)的水平,并分析血乳酸与心肌酶、 PaO_2 、 PaCO_2 的相关性。**结果:**出生时、出生后5d,观察2组的血乳酸、LDH、CK、CKMB水平均高于观察1组和对照组,且观察1组的血乳酸、LDH、CK、CKMB水平均高于对照组,差异均有统计学意义($P<0.05$)。出生时,观察2组的 PaO_2 水平低于观察1组和对照组, PaCO_2 水平高于观察1组和对照组,差异均有统计学意义($P<0.05$),观察1组的 PaO_2 水平低于对照组, PaCO_2 水平高于对照组,差异均有统计学意义($P<0.05$)。Pearson相关性分析结果显示,胎儿宫内窘迫新生儿血乳酸水平与CK、CKMB、 PaCO_2 呈正相关,与 PaO_2 呈负相关($P<0.05$),与LDH无明显的相关性($P>0.05$);LDH、CK、CKMB与 PaCO_2 呈正相关,与 PaO_2 呈负相关($P<0.05$)。**结论:**胎儿宫内窘迫新生儿血乳酸和心肌酶水平明显升高,且出生后存在窒息的新生儿中更为明显,胎儿宫内窘迫新生儿血乳酸、心肌酶水平与缺氧程度密切相关。

关键词:胎儿宫内窘迫;血乳酸;心肌酶;新生儿窒息;临床意义

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Clinical Significance of Changes of Blood Lactate and Myocardial Enzyme in Neonates with Intrauterine Distress*

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ABSTRACT Objective: To investigate the clinical significance of blood lactate and myocardial enzyme changes in neonates with intrauterine distress. **Methods:** A total of 120 neonates with intrauterine distress, who were born in the Second Naval Hospital of Southern Theater Command from March 2017 to August 2018, were enrolled and were divided into two groups: observation group I ($n=55$, no asphyxia after birth) and observation group II ($n=65$, asphyxia after birth). At the same time, 60 healthy and full-term newborns born in this hospital were chosen as control group. Blood lactate, lactate dehydrogenase (LDH), creatine kinase (CK), creatine kinase isoenzyme MB (CKMB), blood oxygen partial pressure (PaO_2), and carbon dioxide partial pressure (PaCO_2) levels in three groups of neonates were compared. The correlation between blood lactate and myocardial enzymes, PaO_2 and PaCO_2 was analyzed. **Results:** At birth and 5 days after birth, the levels of blood lactate, LDH, CK and CKMB in observation group II were higher than those in observation group I and the control group, and the above indexes in observation group I were higher than those in control group. The differences were statistically significant ($P<0.05$). At birth, PaO_2 level of observation group II was lower than that of observation group I and control group, but PaCO_2 level was higher than that of observation group I and control group, and the differences were statistically significant ($P<0.05$). The PaO_2 level of observation group I was lower than that of control group, but PaCO_2 level was higher than that of control group, the differences were statistically significant ($P<0.05$). Pearson correlation analysis showed that the blood lactate level in neonates with intrauterine distress were positively correlated with CK, CKMB and PaCO_2 , and negatively correlated with PaO_2 ($P<0.05$), and significantly not correlated with LDH ($P>0.05$). LDH, CK and CKMB were positively correlated with PaCO_2 , and negatively correlated with PaO_2 ($P<0.05$). **Conclusion:** The levels of blood lactate and myocardial enzymes in neonates with intrauterine distress significantly increase, and this phenomenon is more pronounced in neonates with asphyxia after birth. The levels of blood lactate, myocardial enzymes in neonates with intrauterine distress are closely related to the degree of hypoxia.

Key words: Intrauterine distress; Blood lactate; Myocardial enzyme; Neonatal asphyxia; Clinical significance

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前言

胎儿宫内窘迫是指胎儿在宫内缺氧和酸中毒,导致胎儿的胎心率、代谢发生改变,大部分胎儿宫内窘迫可引起新生儿窒息,并且会影响新生儿神经系统的发育,导致缺血缺氧性脑病、脑瘫等严重神经系统损伤后遗症,对新生儿的生命健康构成巨大威胁^[1-3]。乳酸是无氧代谢的产物,是可反映代谢性酸中毒的生化指标,同时可在一定程度上反映组织缺氧的程度^[4,5]。由于人心肌细胞在正常情况下主要是以有氧代谢为主,在发生缺氧后会对心肌细胞造成一定损伤^[6],有研究指出^[7],宫内窘迫胎儿心室舒张功能存在明显的异常。心肌酶是存在于心肌的多种酶的总称,如乳酸脱氢酶(Lactate dehydrogenase, LDH)、肌酸激酶(Creatine kinase, CK)、肌酸激酶同工酶 MB (Creatine kinase isoenzyme MB, CKMB)等,以上心肌酶均可在一定程度上反映心肌受损程度^[8-10]。本研究分析了胎儿宫内窘迫新生儿的血乳酸和心肌酶的变化,现将研究结果整理如下,以期临床防治胎儿宫内窘迫新生儿心功能受损提供参考。

1 资料与方法

1.1 一般资料

选取 2017 年 3 月到 2018 年 8 月期间在我院出生的胎儿宫内窘迫新生儿 120 例,纳入标准:(1)所有新生儿均经 B 超确诊为胎儿宫内窘迫;(2)均为单胎;(3)胎龄 ≥ 37 周;(4)新生儿家属对本次研究知情,且同意参与本次研究,签署知情同意书。排除标准:(1)产妇产龄超过 35 岁;(2)存在先天性代谢性疾病;(3)存在先天性心脏病;(4)产妇近期服用过可能影响血乳酸水平的药物。120 例胎儿宫内窘迫新生儿中有 55 例出生后未出现窒息,将其纳入观察 1 组,另外 65 例新生儿出生后出现窒息则纳入观察 2 组,同时选取同期在我院出生的健康、足月新生儿 60 例作为对照组。观察 1 组男 30 例,女 25 例,胎龄 37-42 周,平均(39.54 $\pm$ 1.28)周,自然分娩 30 例,剖宫产 25 例,

产妇年龄 25-33 岁,平均(29.34 $\pm$ 2.38)岁。观察 2 组男 33 例,女 32 例,胎龄 37-41 周,平均(39.04 $\pm$ 1.15)周,自然分娩 38 例,剖宫产 27 例,产妇年龄 23-33 岁,平均(28.12 $\pm$ 2.17)岁。对照组男 31 例,女 29 例,胎龄 37-42 周,平均(39.78 $\pm$ 1.33)周,自然分娩 34 例,剖宫产 26 例,产妇年龄 24-34 岁,平均(29.01 $\pm$ 2.48)岁。三组新生儿的一般资料比较无统计学差异($P>0.05$)。本研究经我院伦理委员会批准。

1.2 检测指标

在新生儿出生时、出生后 5d 收集静脉血 2 mL,采用德国 Senslab 公司的 Lactata-scout 便携式乳酸盐分析仪测定血乳酸水平,采用奥普森公司的 AMS-300 全自动生化分析仪测定 LDH、CK、CKMB 水平,同时收集动脉血 2 mL,采用 i-STAT 血气分析仪分析动脉血氧分压 (Partial pressure of oxygen, PaO₂)、二氧化碳分压 (Partial pressure of carbon dioxide, PaCO₂) 的水平。

1.3 统计学方法

采用 SPSS25.0 进行数据分析,以率的形式表示计数资料,进行卡方检验,以均值 $\pm$ 标准差的形式表示计量资料,多组间比较采用单因素方差分析,两组间比较采用 LSD-t 检验,采用 Pearson 法进行相关性分析。若 $P<0.05$,则认为差异有统计学意义。

2 结果

2.1 三组新生儿的血乳酸和心肌酶变化情况比较

出生时、出生后 5d 三组新生儿的血乳酸和心肌酶水平比较均有统计学差异($P<0.05$);出生时、出生后 5d,观察 2 组的血乳酸、LDH、CK、CKMB 水平均高于观察 1 组和对照组,且观察 1 组的血乳酸、LDH、CK、CKMB 水平均高于对照组,差异均有统计学意义($P<0.05$);出生后 5d,各组新生儿的血乳酸、LDH、CK、CKMB 水平与出生时相比均有所降低,差异均有统计学意义($P<0.05$),见表 1。

表 1 三组新生儿的血乳酸和心肌酶变化情况比较

Table 1 Comparison of blood lactate and myocardial enzymes among three groups of newborns

Groups	n	Blood lactate (mmol/L)		LDH (U/L)		CK (U/L)		CKMB (U/L)	
		At birth	5 days after birth	At birth	5 days after birth	At birth	5 days after birth	At birth	5 days after birth
Control group	60	2.28 $\pm$ 0.52	73.22 $\pm$ 10.18a	2.02 $\pm$ 0.48a	425.14 $\pm$ 36.48	183.62 $\pm$ 24.58a	200.62 $\pm$ 23.47	42.53 $\pm$ 8.36	25.31 $\pm$ 6.59a
Observation group 1	55	2.74 $\pm$ 0.63b	2.19 $\pm$ 0.51 ^{ab}	631.45 $\pm$ 120.31 ^b	221.63 $\pm$ 31.49 ^{ab}	591.24 $\pm$ 62.57b	113.64 $\pm$ 27.31 ^{ab}	103.54 $\pm$ 12.65 ^b	32.57 $\pm$ 9.31 ^{ab}
Observation group 2	65	3.12 $\pm$ 0.64 ^{bc}	2.56 $\pm$ 0.50 ^{abc}	865.67 $\pm$ 163.48 ^{bc}	302.57 $\pm$ 43.61 ^{abc}	731.56 $\pm$ 102.34 ^{bc}	167.26 $\pm$ 45 ^{abc}	143.65 $\pm$ 21.58 ^{bc}	59.62 $\pm$ 10.27 ^{abc}
F		28.534	9.362	93.254	32.582	85.361	53.247	91.524	25.364
P		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: compared with the same group at birth, ^a $P<0.05$; compared with control group at the same time point, ^b $P<0.05$; compared with observation group 1 at the same time point, ^c $P<0.05$.

2.2 三组新生儿的 PaO₂、PaCO₂ 变化情况比较

出生时三组新生儿的 PaO₂、PaCO₂ 水平比较有统计学差异

($P<0.05$); 出生时观察 2 组的 PaO₂ 水平低于观察 1 组和对照组, PaCO₂ 水平高于观察 1 组和对照组($P<0.05$);出生时观察 1

组的 PaO_2 水平低于对照组, PaCO_2 水平高于对照组 ($P<0.05$); ($P>0.05$); 出生后 5d 各组新生儿的 PaO_2 水平与出生时相比有出生后 5d 三组新生儿的 PaO_2 、 PaCO_2 水平比较无统计学差异 所增加, PaCO_2 水平有所降低 ($P<0.05$), 见表 2。

表 2 三组新生儿的 PaO_2 、 PaCO_2 变化情况比较Table 2 Comparison of PaO_2 and PaCO_2 among three groups of newborns

Groups	n	$\text{PaO}_2(\text{mmHg})$		$\text{PaCO}_2(\text{mmHg})$	
		At birth	5 days after birth	At birth	5 days after birth
Control group	60	52.34± 12.32	79.57± 7.68 ^a	43.54± 6.32	40.21± 4.33a
Observation group 1	55	32.24± 8.93 ^b	77.32± 6.93 ^a	49.27± 8.39 ^b	41.62± 3.57 ^a
Observation group 2	65	25.36± 5.93 ^{bc}	76.68± 6.58 ^a	59.65± 13.58 ^{bc}	41.86± 3.61 ^a
F		31.589	1.202	25.367	0.985
P		0.000	0.121	0.000	0.723

Note: compared with the same group at birth, ^a $P<0.05$; compared with control group at the same time point, ^b $P<0.05$; compared with observation group 1 at the same time point, ^c $P<0.05$.

2.3 胎儿宫内窘迫新生儿血乳酸、心肌酶及 PaO_2 、 PaCO_2 的相关性分析

经 Pearson 相关性分析显示, 胎儿宫内窘迫新生儿血乳酸水平与 CK、CKMB、 PaCO_2 呈正相关 ($r=0.412, 0.398, 0.267$, $P=0.000, 0.000, 0.027$), 与 PaO_2 呈负相关 ($r=-0.289, P=0.022$), 与 LDH 无明显的相关性 ($r=0.154, P=0.268$); LDH、CK、CKMB 与 PaCO_2 呈正相关 ($r=0.296, 0.304, 0.311, P=0.012, 0.001, 0.000$), 与 PaO_2 呈负相关 ($r=-0.308, -0.314, -0.321, P=0.002, 0.000, 0.000$)。

3 讨论

母体血液含氧量不足、母胎间血氧运输或者交换障碍等原因均可引起胎儿宫内窘迫, 同时胎儿自身因素也可引起该疾病, 如胎儿存在严重的心血管疾病、呼吸系统疾病、合并有宫内感染等因素均可导致胎儿运输及利用氧的能力下降, 造成胎儿慢性缺氧^[11-13]。胎儿发生轻度缺氧时会使得儿茶酚胺分泌增多, 导致心率加快, 但若缺氧持续存在, 则会导致迷走神经兴奋性增加, 心率由快变慢, 同时无氧糖酵解增加, 发展为代谢性酸中毒, 出现乳酸堆积的情况, 胎儿的心肌、脑等重要器官会出现进行性损害^[14-16]。胎儿缺氧会导致胎儿心肌受损, Davis L 等人的研究显示^[17], 胎儿宫内窘迫新生儿存在明显的心肌损害, 并且有研究认为^[18,19], 胎儿缺氧与成年后心血管疾病的发生存在密切的关系, 因此早期探究胎儿的心肌受损情况, 并且及时给以干预、治疗十分重要。

本研究结果显示, 观察 2 组的血乳酸、LDH、CK、CKMB 水平均高于观察 1 组和对照组, 且观察 1 组的血乳酸、LDH、CK、CKMB 水平均高于对照组, 这说明胎儿宫内窘迫新生儿存在明显的心肌损害和乳酸堆积, 且这种情况在出生后出现窒息的新生儿中更为明显。LDH、CK、CKMB 均是诊断心肌损伤的常用指标, 心肌细胞对缺氧尤为敏感, 成年人在出现轻微的缺氧时便会出现呼吸急促、心率加快等变化, 并且心肌酶指标也会出现一定的改变, 而胎儿宫内窘迫可导致胎儿出现严重缺氧, 因此其心肌受损明显, LDH、CK、CKMB 等心肌酶的水平会明显增加^[20-22]。机体在发生缺氧时, 葡萄糖或糖原会发生无氧酵解, 产生能量、生成乳酸, 因此机体在缺氧时会出现乳酸堆积的情

况, 导致血乳酸水平上升^[23,24]。新生儿窒息是指出生后 1 min 内无自主呼吸或未能建立规律呼吸, 因此相比出生后未出现窒息的新生儿其存在明显的低氧血症、酸中毒等病理变化, 进而会导致心肌损害和乳酸堆积的情况更加严重^[25-27]。血气分析结果显示, 出生时, 观察 2 组的 PaO_2 水平低于观察 1 组和对照组, PaCO_2 水平高于观察 1 组和对照组, 观察 1 组的 PaO_2 水平低于对照组, PaCO_2 水平高于对照组, 这也说明了与健康新生儿相比, 胎儿宫内窘迫新生儿血液含氧量不足, 且该现象在出生后出现窒息的新生儿中更为明显, 该结果也间接的解释了观察 2 组血乳酸、LDH、CK、CKMB 水平均高于观察 1 组的原因。Pearson 相关性分析结果显示, 胎儿宫内窘迫新生儿血乳酸水平与 CK、CKMB、 PaCO_2 呈正相关, 与 PaO_2 呈负相关, LDH、CK、CKMB 与 PaCO_2 呈正相关, 与 PaO_2 呈负相关。乳酸是无氧糖酵解的产物, 其水平与缺氧程度密切相关, 而心肌细胞对缺氧尤为敏感, 缺氧导致的心肌损伤可直接影响 LDH、CK、CKMB 的水平^[28-30]。

综上所述, 胎儿宫内窘迫新生儿血乳酸和心肌酶水平明显升高, 且该现象在出生后存在窒息的新生儿中更为明显。胎儿宫内窘迫新生儿血乳酸、心肌酶水平与缺氧程度密切相关, 临床可通过联合检测血乳酸、心肌酶水平来评估其心肌受损情况和缺氧程度。

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