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孕妇 UtA 与胎儿 UmA 和 MCA 测量在胎儿宫内窘迫诊断中的价值 *

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摘要 目的：探讨胎儿大脑中动脉（Middle cerebral artery，MCA）与脐动脉（umbilical artery，UmA）和孕妇子宫动脉（uterine artery，UtA）测量诊断胎儿宫内窘迫的临床价值。**方法：**将我院自 2017 年 1 月至 2019 年 1 月间收治的孕晚期发生胎儿宫内窘迫的孕妇 80 例作为研究组，选择同期入院各项指标正常的健康孕妇 78 例作为对照组，对比观察两组胎儿 MCA 与 UmA 和孕妇 UtA 预测胎儿窘迫的价值及胎儿 MCA 与 UmA 与新生儿 Apgar 评分的相关性。**结果：**研究组孕妇 UtA 血流参数脐血流搏动指数（pulsatility index，PI）、脐血流阻力指数（resistance index，RI）和收缩 / 舒张比（systole/diastole ratios，S/D）指标水平均明显高于对照组，研究组胎儿 MCA 血流参数 PI、S/D 均明显低于对照组，研究组患儿 UmA 的血流参数 PI 和 S/D 高于对照组（$P<0.05$），RI 比较差异无统计学意义（$P>0.05$）；研究组新生儿 Apgar 评分≤ 7 分的比例为 40.00%，明显高于对照组 15.38%。研究组 UmA-PI、UmA-RI 和 UmA-S/D 随着 Apgar 评分的降低呈现升高的趋势，MCA-PI、MCA-S/D 和 MCA-S/D 随着 Apgar 评分的降低呈现逐渐减低的趋势。UtA 血流参数联合 MCA 血流参数诊断胎儿宫内窘迫的敏感度为 97.50%，特异性为 96.25%，均明显高于各项参数单独诊断在的敏感度和特异性（$P<0.05$）。**结论：**临床可利用孕晚期孕妇 UtA、胎儿 UmA 和 MCA 的血流动力学参数改变来预测胎儿宫内窘迫发生的几率，根据胎儿 UmA 和 MCA 的血流指标随着 Apgar 评分的变化趋势，可指导临床早期干预，降低胎儿出生缺陷和死亡率，临床价值较高，可推广使用。

关键词：孕妇；胎儿；宫内窘迫；子宫动脉；大脑中动脉；脐动脉；诊断；价值

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The Value of Uterine Artery and Fetal Umbilical Artery and Middle Cerebral Artery Measurement in the Diagnosis of Fetal Distress*

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ABSTRACT Objective: To investigate the clinical value of uterine artery and fetal umbilical artery and middle cerebral artery in the diagnosis of fetal distress. **Methods:** A total of 80 pregnant women with intrauterine distress in the third trimester of pregnancy from January 2017 to January 2019 were enrolled as the study group. 78 healthy pregnant women with normal indexes were selected as the control group. The value of fetal MCA and UmA and maternal UtA predicting fetal distress and the correlation between fetal MCA and UmA and neonatal Apgar score. **Results:** The RI, PI and S/D levels of UtA blood flow parameters in the study group were significantly higher than those in the control group ($P<0.05$). The PI and blood flow parameters of the fetal MCA in the study group were significantly lower than those in the control group ($P<0.05$). The blood flow of the UmA in the study group The parameters of PI and S/D were higher than those of the control group ($P<0.05$), and the difference of RI was not statistically significant ($P>0.05$). The proportion of neonatal Apgar score ≤ 7 in the study group was 40.00 %, which was significantly higher than that in the control group (15.38 %). The study group UmA-PI, UmA-RI and UmA-S/D showed an increasing trend with the decrease of Apgar score. MCA-PI, MCA-S/D and MCA-S/D gradually decreased with the decrease of Apgar score. Reduce the trend. The sensitivity of UtA blood flow parameters combined with MCA blood flow parameters in the diagnosis of fetal distress was 97.50%. The specificity was 96.25%, which was significantly higher than the sensitivity and specificity of each parameter ($P<0.05$). **Conclusion:** Clinically, the hemodynamic parameters of UtA and fetal MCA and UmA can be used to predict the incidence of intrauterine distress. According to the trend of the blood flow index of the fetal UmA and

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MCA along with the Apgar score, it can guide early clinical intervention, reduce fetal birth defects and mortality, and has high clinical value, can be promoted.

Key words: Pregnant women; Fetus; Intrauterine distress; Uterine artery; Middle cerebral artery; Umbilical artery; Diagnosis; Value
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前言

胎儿宫内窘迫(fetalditre)是指孕妇、胎儿或胎盘的各种高危因素引起的胎儿在子宫内出现缺氧和酸中毒的现象[1,2],临床检查出现胎心率和一系列代谢异常,危及其生命和健康的综合表现,发生宫内窘迫的胎儿出生后大部分呈新生儿缺血缺氧性脑病(Hypoxic ischemic encephalopathy,HIE),这都是围产期造成胎儿死亡和引起神经系统后遗症的重要原因,也是目前造成围产儿死亡的首位原因[3-5]。有资料显示,胎儿大脑中动脉(Middle cerebral artery,MCA)和脐动脉(Umbilical artery,UmA)等血流动力学指标的变化与胎儿 HIE 发生有密切的相关性,但是对于 MCA 和 UmA 的血流动力学指标与新生儿 Apgar 评分的相关性研究不多[6,7]。因此,本研究研究发生胎儿宫内窘迫的孕妇,分析胎儿 MCA 和 UmA 与孕妇 UtA 对预测胎儿窘迫的临床价值,比较 MCA 和 UmA 的血流动力学指标与新生儿 Apgar 评分的相关性,已明确其变化趋势,现将研究结果报告如下。

1 资料与方法

1.1 一般资料

将我院自 2017 年 1 月至 2019 年 1 月间收治的孕晚期发生胎儿宫内窘迫的孕妇 80 例作为研究组,选择同期入院各项指标正常的健康孕妇 78 例作为对照组,研究组年龄 22~35 岁,平均年龄 28.81± 3.29 岁,孕周 36~41 周,平均 38.26± 1.64 周;对照组年龄 23~34 岁,平均年龄 28.73± 3.36 岁,孕周 36~41 周,平均 38.19± 1.58 周;两组孕妇一般资料比较差异无统计学意义(P>0.05),具有可比性。

1.2 纳入和排除标准

纳入标准:研究组孕妇证实存在胎儿宫内窘迫指征,出现后有明确的缺氧表现,MRI 减产存在异常信号;对照组产前、产后均无任何缺氧指征,头部 MRI 检查无异常信号。

排除标准:将在妊娠过程中吸烟、饮酒、存在妊娠并发症的孕妇,存在胎盘异常、畸形胎儿、多胎的孕妇,存在遗传性疾病,胎儿臀位或横位的排除。

1.3 仪器和方法

仪器:美国 GE Voluson E10 、GE Voluson E8 多功能彩色多普勒超声诊断仪,GE Voluson S6,探头频率 1~5 MHz,在未使用刺激性食物、饮品的情况下安静休息 15 min,孕妇平静呼吸,保持放松的状态下再进行超声检查。

常规超声检查:确定胎儿胎位,对相关正常参数进行测定自动分析头围、腹围、双顶径等指标是否符合孕周正常值。

彩色多普勒超声检查:

(1)胎儿大脑中动脉血流检测:使用二维超声确定胎头位置,显示胎头标准双顶径平面,探头稍向下平移显示大脑脚,使用彩色多普勒功能,显示出等五边形、尖端向前的大脑动脉,将取样容积(2 mm)置于大脑中动脉中断,取样线和血管夹角<30°[8],获得三个以上的连续稳定标准波形即可停帧获取图像,使用仪器自带软件测量胎儿大脑中动脉阻力指数(RI)、搏动指数(PI),收缩期峰值血流速度和舒张末期血流速度比值(S/D)[9,10]。

(2)胎儿脐动脉血流检测:先用二维超声观察脐带走形,找到脐带入胎盘处,使用彩色多普勒显示脐带血流信号,将近胎盘血流充盈处作为取样点,容积设定为 2.0 mm,取样线与血管夹角<30°,获得三个连续稳定标准波形可停帧获取图像,测定 RI、PI、S/D。

(3)孕妇子宫动脉测量尽量靠近胎盘处取样,夹角接近 0,<30°,直至取上 5 个以上清晰完整[11]、形态相同的脉冲多普勒血流频谱,机器自动获得 S/D、PI、RI 等指标。

1.4 判断标准

胎儿宫内窘迫:胎儿胎心≥ 160 次 /min 或≤ 110 次 /min 连续持续 10 min 以上无明显变化,胎儿心律不齐;胎心监护出现频繁的晚期减速或重度变异减速;胎动频繁、减少或消失;羊水指数≤ 8.0 cm 或羊水池最大深度≤ 3 cm[12,13]。

观察两组新生儿 Apgar[14]。评分范围 0~10 分,起重工 0~3 分表示存在重度窒息;4~7 分表示轻度窒息;8~10 分表示正常。

1.5 统计学方法

使用统计学软件 SPSS21.0 对获得这次研究中获得的数据进行系统的分析和处理,计数资料用百分比(%)表示,组间用 x^2 检验,计量资料用均数± 标准差($\bar{x}$± s)表示,组间用 t 检验,P<0.05 为表示差异具有统计学意义。敏感性 = 真阳性 /(真阳性 + 假阴性),特异性 = 真阴性 /(假阳性 + 真阴性),孕妇 UtA 血流参数联合胎儿 MCA 和 UmA 血流的判断标准:这几种筛检方法检测,凡有一项检测为阳性者即判为阳性,所有检测均为阴性才判为阴性。

2 结果

2.1 两组孕妇 UtA 血流参数比较

研究组孕妇 UtA 血流参数 RI、PI 和 S/D 指标水平均明显高于对照组,组间比较差异具有统计学意义(P<0.05),详见表1。

2.2 两组胎儿 MCA 血流参数比较

研究组胎儿 MCA 血流参数 PI、S/D 均明显低于对照组,组间比较差异具有统计学意义(P<0.05),两组胎儿 MCA 参数 RI 指标水平比较差异无统计学意义(P>0.05),详见表 2。

2.3 两组 UmA 动脉血流参数比较

研究组胎儿 UmA 的血流参数 PI 和 S/D 高于对照组(P<0.05),RI 比较差异无统计学意义(P>0.05),详见表 3。

2.4 两组新生儿 Apgar 评分比较

研究组新生儿 Apgar 评分≤ 7 分的比例为 40.00%,明显高于对照组 15.38%,组间差异具有统计学意义(P<0.05),详见表 4。

表 1 两组孕妇 UtA 血流参数比较

Table 1 Comparison of UtA blood flow parameters between two groups of pregnant women

Groups	Cases	RI	PI	S/D
Study Group	80	0.61± 0.11*	1.78± 0.23*	3.07± 0.45*
Control group	78	0.50± 0.05	1.52± 0.09	2.34± 0.41

Note: Compare with the control group, *P<0.05.

表 2 两组胎儿 MCA 血流参数比较

Table 2 Comparison of fetal MCA blood flow parameters between the two groups

Groups	Cases	RI	PI	S/D
Study Group	80	0.68± 0.09	1.50± 0.43*	3.21± 0.61*
Control group	78	0.71± 0.11	1.82± 0.32	4.06± 1.43

Note: Compare with the control group, *P<0.05.

表 3 两组胎儿 UmA 血流参数比较

Table 3 Comparison of fetal UmA blood flow parameters between two groups

Groups	Cases	RI	PI	S/D
Study Group	80	0.69± 0.09	1.50± 0.43*	3.51± 1.12*
Control group	78	0.56± 0.11	1.30± 0.32	2.49± 0.45

Note: Compare with the control group, *P<0.05.

表 4 两组新生儿 Apgar 评分比较

Table 4 Comparison of pregnancy-related Apgar scores between the two groups

Groups	Cases	8~10	4~7	≤ 3
Study Group	80	48(60.00)	20(25.00)*	12(15.00)*
Control group	78	66(84.62)	11(14.10)	1(1.28)

Note: Compare with the control group, *P<0.05.

2.5 研究组胎儿的 MCA、UmA 血流参数与新生儿 Apgar 评分的相关性

研究组 UmA-PI、UmA-RI 和 UmA-S/D 随着 Apgar 评分的降低呈现升高的趋势，MCA-PI、MCA-S/D 和 MCA-S/D 随着 Apgar 评分的降低呈现逐渐减低的趋势，具体变化见表 5。

表 5 研究组胎儿的 MCA、UmA 血流参数与新生儿 Apgar 评分的相关性

Table 5 Correlation between MCA, UmA blood flow parameters and neonatal Apgar scores in the study group

Index	Project	8~10 (n-48)	4~7 (n=20)	≤ 3 (n=12)
UmA	PI	1.35± 0.25	1.47± 0.43	1.58± 0.47
	RI	0.56± 0.07	0.64± 0.09	0.73± 0.11
	S/D	3.14± 0.52	3.38± 1.04	3.67± 1.12
MCA	PI	1.62± 0.32	1.51± 0.41	1.45± 0.35
	RI	0.72± 0.21	0.65± 0.13	0.51± 0.14
	S/D	3.72± 1.14	3.35± 0.64	3.02± 0.41

2.6 各参数分别和联合诊断胎儿宫内窘迫的敏感度和特异性

孕妇 UtA 血流参数联合胎儿 MCA 和 UmA 血流参数诊断胎儿宫内窘迫的敏感度为 97.50%，特异性为 96.25%，均明显高于各项参数单独诊断在的敏感度和特异性(P<0.05)。

3 讨论

孕妇妊娠晚期出现胎儿宫内窘迫对妊娠结局造成不良影响[15]，造成胎儿宫内窘迫的主要原因有母体血液含氧量少、母胎间血氧运输或交换发生障碍、胎儿自身发育因素等诸多原因[16,17]，胎儿轻度缺氧时体内儿茶酚胺分泌量增多，造成心率加快，重度缺氧时迷走神经兴奋性增加，心率由快变慢[18,19]，孕晚期胎儿宫内窘迫发生后胎儿宫内生长受限，影响发育，甚至致死，也是导致各种新生儿神经系统病变和智力发育障碍的原因[20,21]。

常规胎儿胎心监护、胎动计数等方法都有各自的局限性，超声检查具有无损伤、可反复检查、价格低廉等特点，目前已经成为胎儿畸形检测和异常产前诊断和干预的主要手段之一[22,23]。

在常规二维超声观察胎儿大小和解剖形态的基础上，使用彩色多普勒超声检测胎儿脐动脉、大脑中动脉和孕妇子宫动脉的血流方向、速度和阻力指标等参数，能够对胎儿宫内发育和缺氧状态进行预测，常用的参数为 RI、PI、S/D，当血管的阻力越高，D 就越小，上述三项指标均异常升高，PI 利用了时间平均流速，可反映整个周期的阻力情况，而 RI 和 S/D 仅利用了收缩期、舒张末期流速，不能反映整个周期的血流情况，前者逐渐被广泛认可[24,25]。

UtA 是胎儿在宫内生长发育中从母体吸收血供的主要来源，因此其血流状态是否正常直接关系胎儿生长发育状态和围产期预后[26,27]。本次研究结果显示，出现胎儿宫内窘迫的孕妇，在妊娠晚期 UtA 血流动力学指标发生了明显的改变，RI、PI、S/D 异常增高，同时研究组 UmA-PI、UmA-RI 和 UmA-S/D 随着 Apgar 评分的降低呈现升高的趋势，由此可以证实，UtA 的参数越高，胎儿发生宫内窘迫的风险越大。MCA 是颈内动脉的延续，是胎儿时期含氧高的血流的流动路径，在发生宫内窘迫时，胎儿的大脑等重要脏器的血管处于扩张状态，体循环处于收缩状态以降低血供，MCA 管径扩张，PI 明显减弱为重要脏器提供血供[28,29]。本次研究中 MCA 的各项指标明显降低，MCA-PI、MCA-S/D 和 MCA-S/D 随着 Apgar 评分的降低呈现逐渐减低的趋势。提示对宫内缺氧具有一定的提示意义。UmA 是反应胎儿 - 胎盘循环的血流变化情况，在胎儿自身的调节中，阻力变化显著，发生窘迫时 UmA 血流动力学指标显著增加。本研究研究组胎儿脐动脉 PI 和 S/D 高于对照组，说明胎儿 UmA 的检测对胎儿宫内窘迫均有一定的预测价值。三者各项血流动力学参数联合诊断胎儿宫内窘迫的敏感度为 97.50%，特异性为 96.25%，均高于各项参数单独诊断，说明单一血管由于其自身的特点，对缺氧存在不同的反应，因此单一动脉血流参数难以较为全面准确的反映胎儿的真实缺氧情况，多项参数联合分析能够取长补短，较为全面的反应胎儿的情况[30,31]。发生胎儿宫内窘迫的研究组新生儿出生后 Apgar 评分≤ 7 分的比例高于对照组，提示可以在妊娠期重视围生期保健，提高孕妇自我保健意识，积极预防胎儿宫内窘迫发生的几率，可改善新生儿缺血、缺氧状态。

综上所述，临床可利用孕晚期孕妇 UtA、胎儿 MCA 和 UmA 的血流动力学参数改变来预测胎儿宫内窘迫发生的几率，根据胎儿 UmA 和 MCA 的血流指标随着 Apgar 评分的变化趋势，可指导临床早期干预，降低胎儿出生缺陷和死亡率，临床价值较高，可推广使用。

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