

孕足月正常血压孕妇血清尿酸水平与新生儿出生体重的相关性

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摘要 目的 探讨孕足月正常血压孕妇血清尿酸水平与新生儿出生体重的相关性。方法 分层随机抽取2012年1月至2022年12月期间中国医科大学附属盛京医院产科病房1 200例足月分娩且血压正常的孕妇作为研究对象。根据分娩时新生儿体重将孕妇分为适于胎龄儿(AGA)组($n = 600$)、大于胎龄儿(LGA)组($n = 300$)、小于胎龄儿(SGA)组($n = 300$)。收集3组患者各项临床指标并比较,采用logistic回归分析新生儿出生体重的影响因素。结果 LGA组、SGA组孕妇血清尿酸分别为 $336(269\sim 388)\mu\text{mol/L}$ 和 $377(297\sim 431)\mu\text{mol/L}$,远高于AGA组 $[288(243\sim 350)\mu\text{mol/L}]$,差异均有统计学意义(均 $P < 0.001$)。将孕妇血清尿酸水平与LGA、SGA发生情况纳入多因素logistic回归分析,结果显示,LGA(孕妇血清尿酸水平每增加 $10\mu\text{mol/L}$,调整后 $OR=1.040,95\%CI:1.020\sim 1.060$)和SGA(孕妇血清尿酸水平每增加 $10\mu\text{mol/L}$,调整后 $OR=1.072,95\%CI:1.049\sim 1.095$)发生风险随尿酸水平增加而升高。LGA组新生儿出生体重百分位数与孕妇尿酸水平呈正相关($r = 0.108, P < 0.05$);SGA组新生儿出生体重百分位数与孕妇尿酸水平呈负相关($r = -0.224, P < 0.01$)。限制性立方样条回归分析显示,孕妇尿酸水平与新生儿出生体重呈现近似“U”形关系,新生儿出生体重在 $3\ 000\text{g}$ 时,母体尿酸水平最低。结论 孕足月血压正常孕妇的血清尿酸水平是影响新生儿出生体重的独立危险因素。孕足月血压正常孕妇的血清尿酸水平与新生儿出生体重密切相关,其中LGA组呈正相关,SGA组呈负相关。

关键词 孕妇;尿酸;新生儿出生体重;相关性

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Relationship between serum uric acid levels in normotensive pregnant women at full-term of pregnancy and birth weight of newborns

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Abstract Objective To investigate the relationship between serum uric acid levels of full-term pregnant women with normal blood pressure and the birth weight of their newborns. **Methods** A total of 1 200 pregnant women in the obstetrics ward of Shengjing Hospital of China Medical University were randomly selected by stratification for the study from January 2012 to December 2022. These women had full-term deliveries and a normal blood pressure. According to the weight of neonates at delivery, they were divided into groups as follows: appropriate for gestational age (AGA, $n = 600$), large for gestational age (LGA, $n = 300$), and small for gestational age (SGA, $n = 300$). Clinical data of the patients was collected for a retrospective study. Nonparametric tests were used to compare the differences in each group, and logistic regression was used to analyze the factors influencing neonatal birth weight. **Results** The maternal serum uric acid values in the LGA and SGA groups were $336(269\sim 388)\mu\text{mol/L}$ and $377(297\sim 431)\mu\text{mol/L}$, respectively-much higher than that of the AGA group $[288(243\sim 350)\mu\text{mol/L}, P < 0.001]$. Multivariate logistic regression analysis showed that the risk of occurrence for LGA (for every $10\mu\text{mol/L}$ increase in the blood uric acid level of pregnant women, the adjusted $OR=1.040,95\%CI:1.020\sim 1.060$) and SGA (for every $10\mu\text{mol/L}$ increase, the adjusted $OR=1.072,95\%CI:1.049\sim 1.095$) increased with the level of uric acid in the patients. The birth weight percentile of neonates in the LGA group was positively correlated with uric acid levels ($r = 0.108, P < 0.05$), while in the SGA group it was negatively correlated with uric acid levels ($r = -0.224, P < 0.01$). Restrictive cubic spline regression analysis showed that the relationship between maternal uric acid levels and newborn birth weight was similar to a “U” shape. When newborn birth weight was around $3\ 000\text{g}$, maternal uric acid level was the lowest. **Conclusion** Serum uric acid level of full-term pregnant women with normal blood pressure is an independent risk factor for neonatal birth weight. Serum uric acid level of full-term pregnant women with normal blood pressure

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is closely associated to neonatal birth weight, and shows a positive correlation in the LGA group and negative correlation in the SGA group.

Keywords pregnant woman; uric acid; neonatal birth weight; relationship

尿酸是嘌呤及其衍生物在肝脏由黄嘌呤氧化酶代谢的终产物^[1-2]。人体生理浓度的尿酸参与抗氧化反应和抗DNA损伤;但高浓度尿酸可引起内皮功能障碍和血管增生,是痛风、心血管及肾脏疾病的危险因素^[3]。正常孕妇妊娠期间血清尿酸水平呈现孕早期、孕中期逐渐下降,孕晚期逐渐升高的生理变化^[4]。

有研究^[5]表明,妊娠期高尿酸血症与不良的胎儿结局和妊娠期高血压疾病相关。尿酸可能通过刺激血管收缩和炎性细胞因子而诱导NO产生,并增加血管平滑肌细胞中血栓素生成,导致内皮细胞功能障碍,引发高血压。也有研究^[6]显示子痫前期(pre-eclampsia, PE)患者中,胎盘缺血引起的氧化应激和细胞因子诱导了尿酸代谢关键酶XO的活性,胎盘中XO和血清腺苷的表达水平升高。XO通过产生氧化剂(超氧阴离子等)将黄嘌呤转化为尿酸^[7]。血压正常孕妇血尿酸水平是否与胎儿宫内生长发育相关还存在一定争议^[3,8-9]。本研究比较了孕足月血压正常孕妇尿酸水平与新生儿出生体重的关系,旨在为临床重视孕妇血清尿酸水平的异常并及时干预提供依据。

1 材料与方法

1.1 研究对象及分组

收集2012年1月至2022年12月中国医科大学附属盛京医院产科病房住院分娩的130 703例患者的临床资料。其中分娩适于胎龄儿(appropriate for gestational age, AGA)孕妇119 509例,大于胎龄儿(large for gestational age, LGA)孕妇8 695例,小于胎龄儿(small for gestational age, SGA)孕妇2 499例。分层随机抽取1 200例血压正常且足月分娩的汉族孕妇纳入本研究。排除标准:(1)胎儿先天性异常、染色体异常以及新生儿死亡;(2)患有妊娠期高血压;(3)既往患有糖尿病、肾病、系统性红斑狼疮等可能影响尿酸代谢的疾病;(4)入院前2个月内曾服用糖皮质激素、利尿剂或其他可能影响尿酸代谢的药物。本研究属于回顾性研究,获得我院医学伦理委员会批准

并豁免受试者的知情同意书(2023PS864K)。将入组孕妇按照新生儿出生体重分为LGA组($n = 300$)、AGA组($n = 600$)和SGA组($n = 300$)。

1.2 诊断标准

孕妇入院后静息状态间隔4 h, 2次以上测量血压为记录血压,根据第9版《妇产科学》^[10]判断标准,收缩压 <140 mmHg和舒张压 <90 mmHg为血压正常。新生儿出生体重的分布曲线和各周龄新生儿出生体重的百分位数参考《中国不同出生胎龄新生儿出生体重、身长和头围的生长参照标准及曲线》^[11]。SGA,新生儿出生体重 $<$ 第10百分位;AGA,新生儿出生体重第10百分位~第90百分位;LGA,新生儿体重 $>$ 第90百分位。

孕妇入院后分娩前抽取清晨空腹血(2 mL)检测血尿酸水平,根据《中国高尿酸血症相关疾病诊疗多学科专家共识》^[12],血尿酸 >420 $\mu\text{mol/L}$ 诊断为高尿酸血症。根据《妊娠期高血糖诊治指南(2022)》^[13],将妊娠24~28周及以前尚未诊断为糖尿病,且口服葡萄糖耐量试验(oral glucose tolerance test, OGTT)结果提示:空腹血糖 ≥ 5.1 mmol/L;服糖后1 h血糖 ≥ 10.0 mmol/L, 2 h血糖 ≥ 8.5 mmol/L孕妇诊断为妊娠期糖尿病。

1.3 观察指标

收集纳入孕妇和新生儿的一般资料和实验室指标。孕妇临床资料包括年龄、身高、孕前体重指数(body mass index, BMI)、孕期体重增长、孕次、产次、孕周、此次分娩方式、收缩压、舒张压、尿酸和肌酐等。新生儿临床资料包括性别、出生身高、体重、头围、腹围及头围/胸围比值。

1.4 统计学分析

利用SPSS 25.0软件进行统计学分析。采用PASS软件确定满足本研究每组统计检验的最小样本量为184例。符合正态分布的计量资料采用 $\bar{x} \pm s$ 表示,多组比较采用方差分析,两组比较采用LSD法;非正态分布数据采用 $M(P_{25} \sim P_{75})$ 表示,两组比较采用Mann-Whitney U 检验,多组比较采用Kruskal-Wallis H 检验。计数资料采用率(%)表示,组间比较采用

χ^2 检验。采用多因素logistic回归分析影响新生儿出生体重的独立危险因素。采用Kendall's Tau-b相关分析探讨尿酸水平与新生儿出生体重的相关性, 并进行限制性立方样条回归分析。以尿酸浓度的整10百分位数对应数值为分界点, 将研究对象分为10组, 以尿酸344~<375 $\mu\text{mol/L}$ 组为参照组, 进行血清尿酸水平与LGA、SGA发病关系的logistic回归模型分析。 $P < 0.05$ 为差异有统计学意义。

2 结果

2.1 3组一般情况比较

结果显示, 3组年龄, 身高, 孕前BMI, 孕期体重增长, 分娩前收缩压、舒张压, 分娩方式比较均有统

计学差异(均 $P < 0.05$); 3组孕妇高尿酸血症发生率, 分娩孕周, 新生儿出生体重、身高、头围、胸围、头/胸围比值比较也均有统计学差异(均 $P < 0.05$)。而3组孕妇孕次、产次比较均无统计学差异(均 $P > 0.05$)。与AGA组比较, LGA组及SGA组收缩压、舒张压、剖宫产率及孕期体重增长均显著升高(均 $P < 0.05$); 与AGA组比较, SGA组分娩年龄、孕前BMI及分娩孕周均显著降低(均 $P < 0.05$), 见表1。

根据入院分娩前血清化验结果, 高尿酸血症207例(17.2%), 其中AGA组56例(9.3%), LGA组46(15.3%), SGA组105例(35.0%)。3组患者空腹尿酸及肌酐比较结果显示, 与AGA组比较, LGA组、SGA组血尿酸、肌酐水平均显著升高(均 $P < 0.05$); 与

表1 3组一般临床指标比较
Tab.1 The general clinical indicators of the three groups

Item	AGA group (n = 600)	LGA group (n = 300)	SGA group (n = 300)	P
Age (year)	31 (27-36)	32 (29-37)	29 (25-35) ¹⁾	0.011
Height (cm)	159 (156-164)	162 (159-168)	161 (157-165) ¹⁾	0.021
BMI before pregnancy (kg/m ²)	22.4 (19.3- 26.0)	23.0 (21.2-26.8)	21.1 (18.1-25.1) ¹⁾	<0.001
Weight gain during pregnancy (kg)	15.0 (12.0-22.3)	17.0 (14.0-24.0) ¹⁾	14.5 (11.5-21.0) ¹⁾	0.041
Systolic blood pressure (mmHg)	115 (108-120)	122 (115-130) ¹⁾	130 (120-138) ¹⁾	<0.001
Diastolic blood pressure (mmHg)	70 (67-80)	78 (71-82) ¹⁾	78 (70-87) ¹⁾	<0.001
Pregnancy	2 (1-3)	2 (1-3)	2 (1-2)	0.053
Parity	0 (0-0)	0 (0-1)	0 (0-1)	0.061
Mode of delivery [n (%)]				<0.001
Vaginal delivery	321 (53.5)	141 (47.0) ¹⁾	118 (41.4) ¹⁾	
Cesarean section	279 (46.5)	159 (53.0)	182 (58.7)	
Gestational age at delivery (week)	39 (38-39)	39 (38-39)	37 (37-38) ¹⁾	<0.001
Gestational diabetes mellitus [n (%)]				0.168
Yes	105 (17.5)	64 (21.0)	57 (19.0)	
No	495 (82.0)	236 (78.7)	243 (81.0)	
Hyperuricemia [n (%)]				<0.001
Yes	56 (9.3)	46 (15.3) ¹⁾	105 (35.0) ¹⁾	
No	544 (90.7)	254 (84.7)	195 (65.0)	
Uric acid ($\mu\text{mol/L}$)	288 (243-350)	336 (269-388) ¹⁾	377 (297-431) ^{1),2)}	<0.001
Creatinine (mmol/L)	43.3 (38.3-48.2)	45.2 (40.7-50.3) ¹⁾	47.3 (40.9-54.9) ^{1),2)}	<0.001
Newborn sex [n (%)]				0.123
Male	320 (53.3)	168 (56.0)	143 (47.7)	
Female	280 (46.7)	132 (44.0)	157 (52.3)	
Birth weight (g)	3 310 (3 100-3 560)	4 150 (4 060-4 310) ¹⁾	2 290 (2 031-2 430) ¹⁾	<0.001
Newborn length (cm)	50 (50-51)	53 (52-54) ¹⁾	46 (43-48) ¹⁾	<0.001
Newborn head circumference (cm)	34 (33-35)	36 (35-37) ¹⁾	32 (30-33) ¹⁾	<0.001
Newborn chest circumference (cm)	33 (32-34)	36 (35-38) ¹⁾	31 (30-33) ¹⁾	<0.001
Head circumference/chest circumference	1.03 (1.03-1.03)	1.00 (0.97-1.03) ¹⁾	1.03 (1.03-1.07) ¹⁾	<0.001

1) $P < 0.05$ compared with AGA group; 2) $P < 0.05$ compared with LGA group.

LGA组比较,SGA组血尿酸、肌酐水平均显著升高(均 $P < 0.05$),见表1。

2.2 单因素logistic回归分析影响新生儿出生体重的因素

将3组孕妇比较有统计学差异($P < 0.05$)指标作为自变量,新生儿出生体重作为因变量(AGA=0, LGA=1, SGA=2)进行单因素logistic回归分析,以AGA

组为参考类别,以尿酸增加 $10 \mu\text{mol/L}$ 作为一个单位,分析各指标与新生儿出生体重的相关性。结果显示,孕前BMI、孕期体重增长、收缩压、舒张压、尿酸、肌酐是增加LGA风险的因素;身高是降低LGA风险的因素。年龄、孕前BMI、收缩压、舒张压、尿酸、肌酐是增加SGA风险的因素;身高和孕期体重增长是降低SGA风险的因素,见表2。

表2 分娩SGA、LGA危险因素的单因素logistic分析
Tab.2 Univariate logistic analysis of risk factors for SGA and LGA

Variable	LGA group		SGA group	
	OR (95% CI)	P	OR (95% CI)	P
Age	1.025 (0.997-1.055)	0.085	1.047 (1.018-1.007)	0.001
Height	0.933 (0.904-0.962)	<0.001	0.881 (0.853-0.911)	<0.001
BMI before pregnancy	1.051 (1.014-1.090)	0.007	1.051 (1.015-1.090)	0.007
Weight gain during pregnancy	1.034 (1.010-1.058)	0.005	0.854 (0.829-0.880)	<0.001
Systolic blood pressure	1.051 (1.039-1.064)	<0.001	1.067 (1.054-1.080)	<0.001
Diastolic blood pressure	1.053 (1.035-1.071)	<0.001	1.060 (1.042-1.078)	<0.001
Uric acid	1.058 (1.040-1.077)	<0.001	1.098 (1.078-1.117)	<0.001
Creatinine	1.026 (1.011-1.042)	0.001	1.055 (1.039-1.071)	<0.001

2.3 多因素logistic回归分析新生儿出生体重的影响因素

将影响新生儿出生体重单因素分析有统计学意义($P < 0.05$)因素纳入多因素logistic回归模型。结果显示,孕期体重增长、收缩压升高增加孕妇分娩LGA的风险,身高则是分娩LGA的保护因素(均 $P < 0.05$)。收缩压、肌酐升高是孕妇分娩SGA的危险因素,身高、孕期体重增长是分娩SGA的保护因素(均 $P < 0.05$),见表3、4。

研究结果显示,血清尿酸水平与分娩SGA、LGA显著相关。以AGA组为对照组,孕妇血尿酸水平每增加 $10 \mu\text{mol/L}$,发生LGA的风险增加4% (95%CI:

1.020~1.060, $P < 0.05$);发生SGA的风险增加7.2% (95%CI: 1.049~1.095, $P < 0.05$),见表3、4。

2.4 孕妇尿酸水平与新生儿出生体重的相关性分析

采用Kendall's Tau-b相关性分析探讨孕妇尿酸水平与新生儿出生体重之间的相关性。结果显示,当3组整体进行分析时,孕妇尿酸水平[317 (259~388) $\mu\text{mol/L}$]与新生儿出生体重[3 310 (2 650~3 950) g]呈负相关($r = -0.084, P < 0.001$);3组分别进行分析时,AGA组孕妇尿酸水平与新生儿出生体重不相关($r = 0.017, P = 0.532$);LGA组孕妇尿酸水平与新生儿出生体重呈正相关($r = 0.108, P = 0.006$);SGA组孕妇尿酸水平与新生儿出生体重呈负相关($r =$

表3 分娩LGA危险因素的多因素logistic分析
Tab.3 Multivariate logistic analysis of risk factors for LGA

Variable	β	SE	Wald	P	OR (95%CI)
Height	-0.072	0.017	18.187	<0.001	0.931 (0.900-0.962)
Weight gain during pregnancy	0.028	0.013	4.928	0.026	1.029 (1.003-1.055)
BMI before pregnancy	0.024	0.020	1.437	0.231	1.024 (0.985-1.065)
Systolic blood pressure	0.047	0.009	25.184	<0.001	1.048 (1.029-1.068)
Diastolic blood pressure	-0.006	0.013	0.204	0.651	0.994 (0.968-1.020)
Uric acid	0.039	0.010	15.414	<0.001	1.040 (1.020-1.060)
Creatinine	0.008	0.009	0.756	0.385	1.008 (0.990-1.026)

-0.224, $P < 0.001$)。

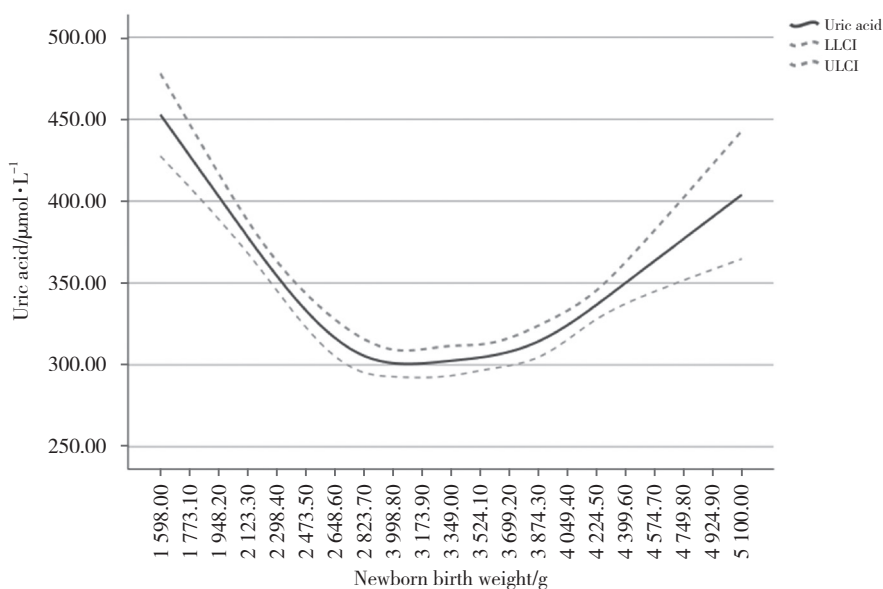
对孕妇血尿酸水平与新生儿出生体重间关系进行限制性立方样条回归分析显示,二者呈现近“U”形关系。新生儿出生体重在3 000 g时,孕妇血尿

酸水平处于最低值;新生儿出生体重>3 000 g时,孕妇尿酸水平随新生儿出生体重增加而上升;新生儿出生体重<3 000 g时,孕妇尿酸水平随新生儿出生体重增加而下降,见图1。

表4 分娩SGA危险因素的多因素logistic分析

Tab.4 Multivariate logistic analysis of risk factors for SGA

Variable	β	SE	Wald	P	OR (95%CI)
Age	0.019	0.017	1.182	0.277	1.019 (0.985-1.053)
Height	-0.141	0.020	48.542	<0.001	0.869 (0.835-0.904)
Weight gain during pregnancy	-0.166	0.017	90.629	<0.001	0.847 (0.819-0.877)
BMI before pregnancy	0.019	0.022	0.730	0.393	1.019 (0.976-1.063)
Systolic blood pressure	0.064	0.010	38.134	<0.001	1.066 (1.045-1.088)
Diastolic blood pressure	-0.027	0.015	3.125	0.077	0.974 (0.945-1.003)
Uric acid	0.069	0.011	39.179	<0.001	1.072 (1.049-1.095)
Creatinine	0.032	0.010	11.147	0.001	1.033 (1.013-1.053)



LLCI, lower limit of the confidence interval; ULCI, upper limit of the confidence interval.

图1 新生儿出生体重与孕妇血尿酸水平之间的关系

Fig.1 The relationship between neonatal birth weight and serum uric acid levels of pregnant women

2.5 孕妇尿酸水平与分娩LGA和SGA的关系

为了进一步探索孕妇血清尿酸水平与LGA和SGA发生风险的关系,以整10百分位数对应的尿酸浓度值为分界点,将所有研究对象分为10组,以尿酸344~<375 μmol/L组为参照组,进行血清尿酸水平与LGA、SGA发病风险的logistic回归模型分析。结果显示,尿酸水平375~<407 μmol/L孕妇分娩LGA的可能性最大,是分娩AGA可能性的2.101倍(OR=2.101, 95%CI: 1.144~3.858)。随尿酸水平递增,孕妇发生SGA风险总体呈逐渐上升趋势,当尿酸≥344 μmol/L

时,孕妇分娩SGA的可能性明显增大;当尿酸≥434 μmol/L时,孕妇分娩SGA的可能性是分娩AGA的3.677倍(OR=3.677, 95%CI: 1.98~6.83),见图2。

3 讨论

近几十年来,高尿酸血症与妊娠的关系一直受到关注。妊娠期血尿酸水平波动较大,孕妇孕早期由于肾血流量和肾小球滤过率增加,血清尿酸水平下降;而在妊娠中晚期,孕妇肾脏代谢尿酸能力下降,胎儿逐渐发育成熟,与母体物质交换能力减弱,

胎儿通过羊水排泄尿酸等原因,孕妇出现生理性血尿酸水平升高^[14-15]。目前,不同孕龄健康女性血尿酸正常值范围尚缺乏大样本数据,妊娠期高尿酸血症也没有统一的诊断标准。本研究结果显示,血压正常孕妇高尿酸血症发生率为17.2%;AGA组和LGA

组和SGA组孕妇高尿酸血症发生率分别为9.3%、15.3%和35.0%,SGA组显著高于AGA组、LGA组(均 $P < 0.05$);3组孕妇年龄、身高、孕前BMI、孕期体重增长、分娩方式及分娩孕周比较均有统计学差异(均 $P < 0.05$)。

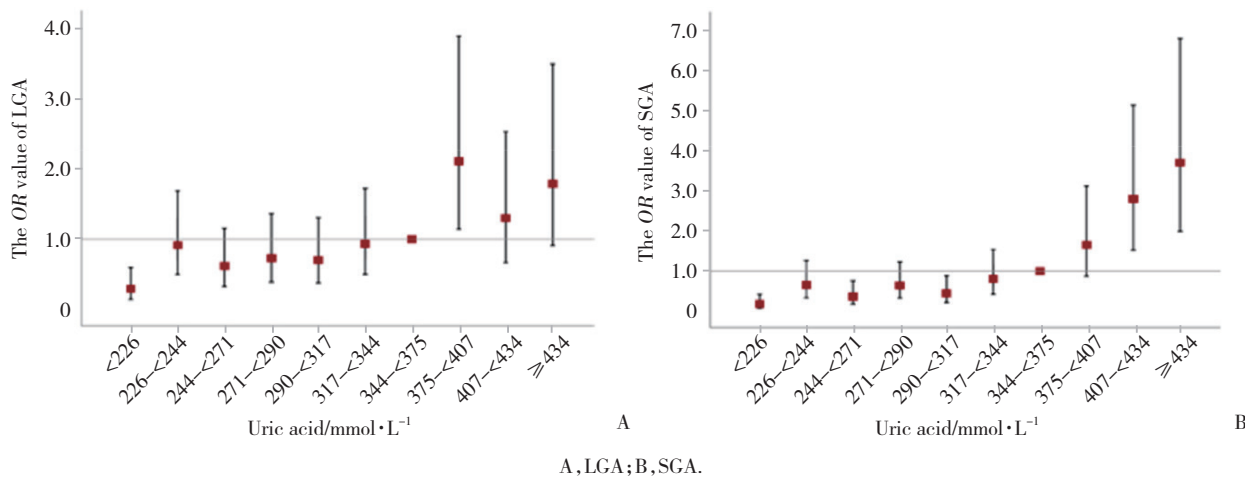


图2 孕妇尿酸水平与发生LGA、SGA风险的回归性分析

Fig.2 Regression analysis of uric acid levels and risk of LGA and SGA in pregnant women

尿酸是一种还原性物质,可参与氧化还原反应,有抗氧化、抗DNA损伤作用,对于维持机体内环境稳定具有重要价值。然而,高浓度尿酸会促进血管平滑肌增生,从而导致内皮结构和功能紊乱。研究^[16]表明,血清尿酸水平与痛风、心脑血管疾病及代谢综合征等疾病的发生密切相关。近年来一些研究^[15,17]显示妊娠期血尿酸升高与PE、妊娠期糖尿病、胎儿宫内发育迟缓等母婴不良结局相关。LE等^[18]研究显示,血尿酸>393 μmol/L PE患者发生早产、胎儿生长受限、低APGAR评分、新生儿死亡等不良结局增加。1项大型前瞻性研究^[19]发现尿酸水平越高的孕晚期患者,母体发生早产、妊娠期糖尿病和PE风险,新生儿发生低体重出生儿及SGA的风险均明显增加。除此之外,MISHU等^[20]研究发现与非妊娠期糖尿病孕妇相比,妊娠期糖尿病孕妇中孕期血清尿酸水平比较无统计学差异,而妊娠期糖尿病孕妇晚孕期尿酸水平高于非妊娠期糖尿病晚孕期患者。本研究中3组患者妊娠期糖尿病的发生率比较无统计学差异,因此可以排除妊娠期糖尿病造成尿酸水平差异的影响。

本研究结果显示,SGA组及LGA组孕妇尿酸、肌

酐水平均显著高于AGA组(均 $P < 0.05$)。值得注意的是,本研究所有孕妇孕期及产后血压均正常,但LGA组和SGA组入院收缩压和舒张压均高于AGA组(均 $P < 0.05$)。有研究^[21]认为要重视正常血压高值低风险孕妇的监测和管理,这些孕妇发生不良妊娠的风险增加,本研究结果支持这一观点。

既往研究表明孕妇尿酸水平不仅可以作为新生儿出生体重的独立影响因素,也可以作为孕妇分娩SGA及不良围产期结局的预测因素。RYU等^[17]在PE孕妇模型中预测低出生体重儿的血清尿酸阈值为6.35 mg/dL (377 μmol/L)。HAWKINS等^[22]发现妊娠期高血压疾病患者血清尿酸>5.9 mg/dL (350 μmol/L)与不良母婴围产期结局有关。本研究多因素logistic回归分析结果显示,孕妇尿酸水平是影响新生儿出生体重的独立危险因素,孕妇血清尿酸水平每增加10 μmol/L,发生LGA的风险增加4%,发生SGA的风险增加7.2% (均 $P < 0.05$),与以往研究结果一致。

关于孕妇血尿酸水平与新生儿出生体重的关系一直备受关注。1项纳入1 291例密歇根州孕妇的研究^[23]比较了孕16~27周时血清尿酸水平与新生儿

出生体重的关系。结果显示,AGA组孕中期孕妇血尿酸水平与新生儿出生体重无关,在SGA组二者呈J形关系,在LGA组二者呈线性关系。青岛大学的1项队列研究^[24]显示,孕晚期孕妇血尿酸水平与新生儿出生体重呈负相关,与SGA分娩的发生风险呈正相关。AKAHORI等^[25]研究比较了40例正常血压SGA孕妇和80例正常血压AGA孕妇孕晚期血清尿酸水平。结果显示SGA组尿酸水平显著高于AGA组,重度SGA组尿酸水平与新生儿体重呈显著负相关。本研究结果显示,足月正常血压孕妇血尿酸水平与新生儿出生体重相关。AGA组孕妇血尿酸水平与新生儿出生体重不相关;LGA组孕妇血尿酸水平与新生儿出生体重呈正相关;SGA组血尿酸水平与新生儿出生体重呈负相关。在限制性样条回归分析中,二者呈现类似“U”形关系,即新生儿出生体重3 000 g时孕妇血尿酸水平最低。新生儿出生体重<3 000 g时,孕妇血尿酸水平随新生儿出生体重增大逐渐降低;新生儿出生体重>3 000 g时,孕妇血尿酸水平随新生儿出生体重增大而逐渐升高。

孕妇血尿酸水平升高与LGA和SGA发生风险增高的机制尚不清楚。LAUGHON等^[8]研究观察了212例正常血压孕妇,发现孕妇中孕期尿酸水平升高与胰岛素抵抗及新生儿低出生体重相关,高尿酸水平与低出生体重的相关性被胰岛素抵抗减弱。目前尚未证实高尿酸血症是否直接导致胎儿生长受损。胎盘血管缺乏自主神经支配,局部及循环中的血管活性物质对调控胎盘血流灌注非常重要^[26]。机体内尿酸水平过度升高,可抑制NO的产生,损伤胎盘灌注,影响胎儿生长。患有高尿酸血症孕妇妊娠早期也可能由于滋养细胞侵袭不佳而出现胎盘异常,影响胎儿宫内发育^[27]。LGA组孕妇尿酸水平与新生儿体重正相关机制尚不清楚,推测可能由于高体重胎儿产生更多的尿酸进入母血循环所致。

综上所述,本研究比较AGA组、LGA组和SGA组孕妇孕晚期血清尿酸水平,发现LGA组和SGA组孕妇尿酸水平均高于AGA组;LGA组和SGA组尿酸水平与新生儿出生体重相关,表明这些孕期血压正常孕妇机体内亦存在亚临床异常,而尿酸水平的异常可能是早期表现。因此,对于尿酸水平升高孕妇,临床医生应该严格控制患者尿酸水平,必要时监测胎儿生长发育,预防不良围产期结局发生。本研究纳

入了较大样本的汉族人群研究,排除妊娠期高血压以及早产对胎儿生长发育的影响,考虑了孕妇尿酸水平与新生儿出生体重之间的非线性关系,对SGA和LGA组进行了单独评估,明确尿酸可以作为新生儿出生体重的独立影响因素。后续还需进一步明确尿酸在胎儿生长发育中的确切作用;深入分析孕妇血尿酸水平是否可以导致母体胎盘微环境的变化,进而影响胎儿生长发育。

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