

Does Parity have an Effect on Fetal Behavior? A Comparison between Primi- and Multiparas

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ABSTRACT

Aim: To evaluate the effect of parity on fetal behavior between primi- and multiparas.

Materials and methods: Fetal behavior was assessed by Kurjak's antenatal neurodevelopmental test (KANET) using four-dimensional (4D) ultrasound between 32 and 36 weeks of gestation. Forty-four primiparous and 61 multiparous women were studied. The total value of the KANET score and values of each parameter (8 parameters) were compared.

Results: The total KANET score was normal in both groups except for in only one case in the multiparous group (total KANET score of 9), and there was no significant difference in the total KANET score. When individual KANET parameters were compared, we found a significant difference in only one fetal movement, isolated eye blinking, between fetuses of primiparas (median, 2; range, 0–2) and multiparas (median, 1; range, 0–2) ($p < 0.040$). No significant differences were noted in the other seven parameters.

Conclusion: Our results suggest that the level of relaxation of pregnant women may affect fetal behavior, particularly the rate of eye blinking. A relaxed state of primiparas may promote the maturation of the fetal brain, especially the central dopamine system function.

Keywords: Dopamine system function, Four-dimensional ultrasound, Fetal behavior, KANET score, Maternal relaxation, Multipara, Parity, Primipara.

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INTRODUCTION

Maternal stress was reported to suppress fetal motor activity during pregnancy.¹ The level of relaxation of primiparas was greater than that of multiparas in the third trimester of pregnancy.² Moreover, maternal satisfaction early postpartum was significantly correlated with comfort in late pregnancy.² Therefore, the emotional or stress state in pregnancy might be different between primi- and multiparas, and this may have an effect on fetal behavior.

Kurjak's antenatal neurodevelopmental test (KANET) has been developed to evaluate fetal neurodevelopmental functions using four-dimensional (4D) ultrasound, based on the concept that fetal behavioral patterns directly reflect developmental and maturational processes of the fetal brain and central nervous system.³⁻⁵ The aim of the present study was to evaluate KANET scores using 4D ultrasound between primi- and multiparas in order to assess the effect of parity on fetal behavior.

MATERIALS AND METHODS

Fetal behavior was assessed by KANET using 4D ultrasound between 32 and 36 weeks of gestation. One hundred and five middle- and high-class pregnant Japanese women (44 primiparas and 61 multiparas) were studied using a Voluson E8 (GE Healthcare, Tokyo, Japan) with a curved array transabdominal transducer (4–8.5 MHz) between June 2013 and May 2015. The women were recruited randomly. Clinical characteristics of the subjects in each group are shown in Table 1. This study was approved by the Kagawa University Graduate School of Medicine ethics committee, and standardized written informed consent was obtained from all women.

Only non-smokers with singleton, uncomplicated pregnancies were included in the study. Each pregnant woman was examined only once for KANET evaluation. Based on the first day of the last menstrual period, gestational ages were estimated. First-trimester or early second-trimester ultrasound examinations were conducted to confirm these ages. The growth of all

fetuses was normal, and there were no abnormalities on conducting 4D ultrasound examination. Within 24 hours after delivery, an extensive pediatric assessment was performed of each neonate. No neonate was found to have congenital anomalies or genetic disorders.

Values of the total KANET score and each parameter (8 parameters) were compared between primi- and multiparas. As previously reported,³ eight types of fetal movement (isolated head anteflexion, cranial sutures and head circumference, isolated eye blinking, facial alteration or mouth opening, isolated leg movement, isolated hand movement or hand to face movements, finger movements, and gestalt perception of general movements) were examined. The duration of each ultrasound examination was between 15 and 20 minutes, and fetuses were examined while they were awake. A score range of 0 to 5 was characterized as abnormal, 6 to 9 was considered borderline, and 10 to 16 was normal. A quiet temperature-controlled room was used for all examinations. There was no mechanical or acoustic stimulation during image acquisition.

All statistical analysis was conducted with IBM SPSS statistical software, version 22 for Windows (IBM SPSS Inc., Chicago, IL, USA). Differences in the maternal age, birth age, and birth weight between primi- and multiparous groups were assessed by the unpaired t-test. Differences in parity and Apgar score values between the groups were investigated with the Mann-Whitney U test. Sex ratios were compared using a Chi-square test. Differences in variables of eight parameters and total KANET score between primi- and multiparas were also assessed with the Mann-Whitney U test. $p < 0.05$ was considered significant.

RESULTS

The clinical characteristics of subjects in each group are shown in Table 1. There were no significant differences in the birth weight or Apgar scores at 1 and 5 minutes between the two groups. There were significant differences in the maternal age, parity, birth age, and sex ratio between the groups ($p < 0.05$).

All total KANET scores were normal in both groups except for in only one case in the multiparous group (total KANET score of 9 in this case), and there was no significant difference in the total KANET score between fetuses of primiparas (median, 14; range, 10–16) and multiparas (median, 14; range, 9–16) (Table 2). When individual KANET parameters were compared (Table 2), we found a significant difference in only one fetal movement, isolated eye blinking, between primi- (median, 2; range, 0–2) and multiparous fetuses (median, 1; range, 0–2) ($p < 0.040$). There were no significant differences in the other seven parameters between primi- and multiparas (Table 2).

DISCUSSION

In the previous 4D ultrasound studies,^{6–9} the frequency of fetal eye blinking increased with the gestational age after 20 weeks of gestation. An increasing frequency of eye blinking with advancing gestation might suggest the development and maturation of the fetal brain and central nervous system.⁹ In neonates, spontaneous eye blinking is used as a noninvasive parameter of the dopamine system function.¹⁰ Moreover, brain functions regulate the spontaneous eye blinking rate,^{11,12} and an increase in the spontaneous eye blinking rate is likely to be related to central dopamine system maturation.^{13–16} In the present study, the eye blinking score of KANET in primiparas was significantly higher than that in multiparas. In the KANET score, a high eye blinking score indicates an increase in the eye blinking rate.^{5,17} Therefore, the maturation of the fetal brain, especially the central dopamine system function, may be promoted in primi- compared to multiparas in the third trimester of pregnancy.

Nakamura et al² studied the maternal emotional state using the prenatal comfort scale (PCS) between primi- and multiparas in the third trimester of pregnancy. The PCS measures positive affect in pregnant women, and a higher total score indicates greater experiences of maternal comfort during pregnancy.¹⁸ The total score in primiparas was significantly higher than that in multiparas in the third trimester of pregnancy, and

Table 1: Clinical characteristics of subjects

Subject	n	Maternal age (y.o.)	Para	Birth age (weeks)	Birth weight (gm)	Sex (male/female)	Apgar score	
		Mean (SD)	Median (range)	Mean (SD)	Mean (SD)		1 min Median (range)	5 min Median (range)
Primipara	44	30.3 (4.8)	0 (0)	40.1 (1.0)	3162.7 (370.1)	25/19	8 (7–9)	9 (9–9)
Multipara	61	33.4 (4.9)	1 (1–3)	39.7 (1.1)	3146.5 (313.7)	22/39	8 (3–9)	9 (7–10)
Significance		$p < 0.003$	$p < 0.0001$	$p < 0.026$	NS	$p < 0.047$	NS	NS

Y.O.: Years old; SD: standard deviation; NS: not significant

Table 2: Comparison of KANET scores between primi- and multiparas

Subject	n	Mean (SD)	Examination weeks	Isolated head antelexion		Cranial sutures and head circumference		Isolated eye blinking		Facial alteration or mouth opening		Isolated leg movement		Isolated hand movement or hand to face movements		Finger movements		Gestalt perception of general movements		Total score	
				Median (range)	Median (range)	Median (range)	Median (range)	Median (range)	Median (range)	Median (range)	Median (range)	Median (range)	Median (range)	Median (range)	Median (range)	Median (range)	Median (range)	Median (range)	Median (range)	Median (range)	Median (range)
Primipara	44	34.1 (1.6)		2 (2-2)	2 (2-2)	2 (0-2)	2 (0-2)	2 (0-2)	2 (0-2)	2 (0-2)	2 (0-2)	2 (0-2)	2 (0-2)	2 (2-2)	2 (2-2)	14 (10-16)					
Multipara	61	34.2 (1.5)		2 (0-2)	2 (2-2)	1 (0-2)	2 (0-2)	2 (0-2)	2 (0-2)	2 (0-2)	2 (0-2)	2 (0-2)	2 (2-2)	2 (2-2)	14 (9-16)						
Significance	NS	NS	NS	NS	NS	p < 0.04	NS	NS	NS	NS	NS	NS	NS	NS	NS						

KANET: Kurjak antenatal neurodevelopmental test; NS: not significant

comfort with motherhood was significantly correlated with maternal confidence regarding knowledge and childcare skills and maternal satisfaction in primiparas.² Therefore, the comfortable sensation of primiparas may promote the increase in the fetal eye blinking rate in the third trimester of pregnancy. In conclusion, the emotional state of pregnant women may affect the fetal behavior, in particular the rate of eye blinking. However, the data and interpretation should be considered with some degree of caution because of the small number of subjects studied. Further studies involving a larger sample size are needed to confirm the effect of parity on fetal behavior during pregnancy.

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