Women With Impaired Glucose Tolerance During Pregnancy Have Significantly Poor Pregnancy Outcomes

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OBJECTIVE — This article tests the hypothesis that women with impaired glucose tolerance (IGT) have the same pregnancy outcomes as those of their counterparts with normal glucose tolerance.

RESEARCH DESIGN AND METHODS — From December 1998 to December 1999, 84 of 90 antenatal care base units (ACBUs) under the Tianjin Antenatal Care Network in China participated in the first screening program for gestational diabetes mellitus (GDM). A total of 9,471 pregnant women under the care of participating ACBUs were screened. Of the women screened, 154 were positive for IGT. Of the 154 women, 102 opted for conventional obstetric care. The comparison group was 302 women of normal glucose tolerance (NGT). The initial screening consisted of a 50-g 1-h glucose test, and was carried out at 26–30 gestational weeks. Women with a serum glucose ≥7.8 mmol/l were followed up with a 75-g 2-h oral glucose tolerance test. The World Health Organization's diagnostic criteria for GDM were used.

RESULTS — Women with IGT were at increased risk for premature rupture of membranes (P-ROM) (odds ratio [OR] 10.07; 95% CI 2.90–34.93); preterm birth (6.42; 1.46–28.34); breech presentation (3.47; 1.11–10.84); and high birth weight (90th percentile or 4,000 g) (2.42; 1.07–5.46); adjusting for maternal age, pregravid BMI, hospital levels, and other confounding factors.

CONCLUSIONS — The presence of IGT in pregnancy is predictive of poor pregnancy outcomes.

Diabetes Care **25:1619–1624, 2002**

Before the current study, diabetes in pregnancy was not routinely screened in the city of Tianjin, China, even in high-risk women. Studies have failed to show relationships between perinatal morbidity and impaired glucose tolerance (IGT) during pregnancy (1–4) or gestational diabetes mellitus (GDM) (5). Randomized controlled clinical trials, available to date, have not shown any significant effect of the treatment of GDM on pregnancy outcomes (6,7). The importance of GDM has been questioned because of the lack of consistent evidence on its effects on pregnancy outcomes (8,9). In 1998, the World Health Organization (WHO) published diagnostic criteria for GDM (10) and recommended treatment for both IGT and diabetes in pregnancy. The effect of IGT on pregnancy outcomes remains unknown. The Tianjin Study of Diabetes in Pregnancy (TSDP) introduced a universal screening of diabetes during pregnancy in December 1998 using a unique population of pregnant women (11). Most of the women in the study have only one child due to a successful implementation of the "One Child Policy."

We report differences in pregnancy outcomes between pregnant women with IGT and those of normal glucose tolerance (NGT).

RESEARCH DESIGN AND METHODS

— TSDP is a prospective study of perinatal outcomes in six urban districts of the greater city of Tianjin and was carried out within the public health administrative system of the Tianjin antenatal care network. Tianjin is about 120 km south of Beijing, China, and has about 10 million habitants. From December 1998 to December 1999, the first universal screening program was implemented in 84 of the 90 Antenatal Care Base Units (ACBUs) within the catchment areas. The initial screening, diagnostic and glucose measurement methods, and exclusion criteria have been reported elsewhere (11). Briefly, the screening consisted of a 50-g 1-h glucose test and was carried out at 26–30 gestational weeks of nonfasting state. A slightly later approach to the initial screening (26–30 vs. 24–28 gestational weeks) was used (12). This approach has been shown to increase the yield of the screening (13). Additionally, retesting women at risk of GDM at a later gestational age was not feasible under the local antenatal care setting. Women <18 years of age, those who had multiple pregnancies or maternal-fetal ABO incompatibility (titer >1:30), and those with other maternal diseases, including prepregnancy diabetes and those under long-

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Received for publication 7 February 2002 and accepted in revised form 11 May 2002.

Abbreviations: ACBU, antenatal care base unit; DBP, diastolic blood pressure; EPH, edema proteinuria hypertension; GDM, gestational diabetes mellitus; GOD, glucose oxidase; IGT, impaired glucose tolerance; LGA, larger than gestational age; NGT, normal glucose tolerance; OGTT, oral glucose tolerance test; P-ROM, premature rupture of membranes; RCV, routine coefficient of variance; SBP, systolic blood pressure; TSDP, Tianjin Study of Diabetes in Pregnancy; WHO, World Health Organization.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

term medical treatment that may affect glucose metabolism were excluded from the initial screening. Women with a venous serum glucose level ≥7.8 mmol/l at the initial screening were referred to a centralized GDM Clinic at the Tianjin Institute for Women's Health for a further oral glucose tolerance test (OGTT). The OGTT consisted of a 75-g 2-h glucose test and was carried out after overnight fasting (10–16 h) and at least 3 days of unrestricted diet and normal physical activity. The WHO diagnostic criteria for diabetes were used to define GDM (10): a fasting venous serum glucose level of ≥7.0 or a 2-h serum glucose level of ≥11.1 mmol/l indicates diabetes and a 2-h venous serum glucose level of 7.8 mmol/l but <11.1 mmol/l (except diabetes) is defined as IGT. GDM includes both IGT and diabetes.

A total of 9,471 pregnant women had been screened, representing 85% of the eligible population. Of those screened, 154 women had IGT. Three women who delivered outside of Tianjin City and one who had other significant disease conditions were excluded from the study. Of the 150 who completed data collection, 48 women accepted a trial for diabetes care in pregnancy and received treatment; 102 women opted for conventional care and received no treatment. The effect of diabetes treatment, including dietary and physical activity advice and home glucose monitoring, on pregnancy outcomes is being addressed separately as a sequel to this article. This study is concerned with the pregnancy outcomes of the 102 IGT women who opted for conventional care.

The control group comprised women with NGT from the same catchment of obstetric population during the study period. A secondary center and a tertiary center, both of which are representative of obstetric care providers in Tianjin City, consented to perinatal data collection and medical records access by the research team. Women who took part in the initial screening with confirmed NGT were eligible for the control group. Women who lived in rural districts or chose home delivery were excluded. Perinatal data and other medical records of 302 women (282 from the secondary and 20 from the tertiary center) with confirmed eligibility and who had agreed to take part in the comparative study were collected in sequence during the study period.

All women (IGT and NGT) were cared for at the local ACBUs before the 32nd gestational week, and were then referred to a secondary or tertiary hospital of their choice until after childbirth. Clinicians at the participating ACBUs attended the GDM screening and data collection training workshops before the commencement of the study. The perinatal data were collected from hospital medical records.

All blood samples for the OGTT were processed at the Tianjin Institute for Women's Health. A glucose oxidase (GOD) method was used to determine serum glucose levels (14). Venous blood was collected in nonfluoride plain tubes (Dusheng Plastic Product Company, Cangzhou, China) and allowed clotting at room temperature. After clotting, serum was obtained by separation of the blood at 3,000 rpm/min. Serum was used for glucose determination. Glucose Liquid Reagent (Zhongsheng High-Tech Bioengineering Company, Beijing, China) and a semiautomatic biochemical analyzer were used to determine serum glucose. The wave-length was at 546 nm (Hg), and the reaction temperature was set at 37°C. The readings of light absorption of the standard ($A_{standard}$) and the sample (A_{sample}) were recorded from the semiautomatic biochemical analyzer. Glucose concentration in the sample was calculated according to the following formula: C (mmol/l) = $(A_{sample}/A_{standard}) \times C_{standard}$. All blood specimens obtained by the laboratory staff were separated and determined within 1 h after sampling. The mean routine coefficient of variance (RCV) was 3.14% (SD 0.82, range 2.04–4.37%). All participating ACBUs collected serum samples and used the GOD method. A standardized procedure was implemented in all participating ACBU laboratories.

Weight gain during pregnancy was obtained by subtracting body weight at delivery from the self-reported pregravid body weight. Stature was measured at the initial screening using a standardized procedure and recorded to the nearest 0.1 cm (11). BMI (kg/m^2) was used to measure overweight and obesity.

The Statistical Analysis System (SAS) was used to analyze the data (15). Wilcoxon's rank sums test was used to test differences between two means of skewed and non–normal sampling distributions. The χ^2 test was used to test differences between two proportions (rates) and the Fisher's exact test for contingency tables (2×2) with a small expected cell count (>20% of cells <5%). Tertiary hospitals, which were referral centers, accounted for ~25–30% of the total annual deliveries in the City of Tianjin (urban and rural) and were likely to care for women with obstetric complications. Normal pregnancies were usually delivered at a secondary hospital near the women's residence. Multiple logistic regression modelling was used to obtain estimates of odds ratio (OR) while controlling for conventional confounding factors as well as hospital levels to which women were admitted for delivery. Ethics approval was obtained from the Standing Committee for Research into Human at Monash University, and informed consent was obtained from all women who participated in the study.

RESULTS — Women with IGT were significantly older (mean ± SD: IGT 28.0 ± 3.68 years vs. NGT 26.5 ± 2.95 years, $P = 0.0004$) and had a higher pregravid BMI (IGT 22.6 ± 3.49 kg/m^2 vs. NGT 21.5 ± 2.57 kg/m^2, $P = 0.0146$) compared with women of NGT. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were similar in the two groups at the initial screening. Women with IGT, however, had a significantly higher SBP and DBP than those of NGT when admitted for delivery (SBP, IGT 117 ± 17.2 mmHg vs. NGT 112 ± 11.2 mmHg, $P = 0.0259$; DBP, 77 ± 10.6 mmHg vs. 74 ± 8.6 mmHg, $P = 0.0294$). Weight gain in pregnancy and gestational age at delivery were similar in the two groups (Table 1).

Women with IGT were more likely to develop edema proteinuria hypertension (EPH) syndrome than those of NGT (19.6 vs. 6.62%, $P = 0.0001$) (Table 2). The significance level greatly reduced after controlling for maternal age, pregravid BMI, hospital levels, and other confounding factors (OR 2.10; 95% CI 0.89–4.94, $P = 0.0889$) (Table 3). Women with IGT also had a significantly higher rate of premature rupture of membranes (P-ROM) than those with NGT (13.7 vs. 1.99%, $P < 0.0001$) (Table 2). After controlling for age, stature, pregravid BMI, pregnancy weight gain, hospital levels, and EPH syndrome, women with IGT were 10.07 times (95% CI 2.90–34.93) more likely to have P-ROM than their normal counterparts (Table 3). Breech presentation was significantly more common in

Table 1—*Population characteristics between women with IGT and NGT*

Characteristics	NGT (N = 302)	IGT (N = 102)	P*
Age (years)	26.5 ± 2.95	28.0 ± 3.68	0.0004
Stature (cm)	161.3 ± 4.58	160.5 ± 5.60	0.1018
Pregravid body weight (kg)	56.0 ± 7.14	58.2 ± 9.62	0.1260
Pregravid BMI (kg/m^2)	21.5 ± 2.57	22.6 ± 3.49	0.0146
Household monthly income per person (RMB: Yuan)	645 ± 479.5 (n = 299)	590 ± 272.3	0.7571
SBP at initial screening (mmHg)	106 ± 8.8	107 ± 11.6	0.7356
DBP at initial screening (mmHg)	70 ± 6.8	69 ± 8.1	0.6295
SBP at admission for delivery (mmHg)	112 ± 11.2 (n = 298)	117 ± 17.2 (n = 101)	0.0259
DBP at admission for delivery (mmHg)	74 ± 8.6 (n = 298)	77 ± 10.6 (n = 101)	0.0294
Body weight at admission for delivery (kg)	71.4 ± 8.95 (n = 290)	73.0 ± 10.95 (n = 83)	0.2215
Weight gain in pregnancy (kg)	15.4 ± 5.60 (n = 290)	15.4 ± 6.48 (n = 83)	0.6977
Gestational weeks at delivery	39.8 ± 1.54	39.4 ± 1.57	0.0936
Parity before delivery			0.5078†
0	97.35% (294/302)	96.08% (98/102)	
1	2.65% (8/302)	3.92% (4/102)	

Data are means ± SD values otherwise indicated. *Derived from Wilcoxon's rank sums test; †derived from Fisher's exact test.

women with IGT than those of NGT (10.8 vs. 3.31%, P = 0.0033). The risk of breech presentation persisted after controlling for age, stature, pregravid BMI, EPH syndrome, hospital levels, and pregnancy weight gain (OR 3.47; 95% CI 1.11–10.84). Preterm birth rate was also higher in women with IGT than in the NGT group (7.84 vs. 1.32%, P = 0.0026). Pregravid BMI was a significant predictor of preterm birth (OR 1.28; 95% CI 1.06–1.55). After controlling for pregravid BMI, EPH syndrome, hospital levels, and other factors, the OR of preterm birth for the IGT group was 6.42 (95% CI 1.46–28.34). Overall caesarean delivery rates were similar in the two groups, but the breech-specific caesarean delivery rate was significantly higher in the IGT group. High birth weight (≥90th percentile or 4,000 g; 95th percentile or 4,200 g) occurred more frequently in women with IGT than in the NGT group (Table 2). The differences persisted after adjusting for maternal age, pregravid BMI, infant's sex, EPH syndrome, weight gain, hospital levels, and gestational weeks at delivery (OR 2.42; 95% CI 1.07–5.46). Weight gain and gestational weeks at delivery were independent predictors of high birth weight (90th percentile) (Table 3).

The risk of perinatal death in the two groups was not significantly different (1.96% or 2 of 102 vs. 0.66% or 2 of 302, P = 0.2654). Log-linear model analyses revealed that there were interactions between IGT and P-ROM, IGT and EPH-syndrome, and P-ROM and preterm birth after accounting for hospital levels to which women were admitted for delivery.

CONCLUSIONS — Women with GDM have been repeatedly reported to be at a higher risk of pregnancy-induced hypertension and/or pre-eclampsia (16–19). For women with IGT, the risk for pregnancy-induced hypertension and/or pre-eclampsia is less consistent. In a ret-

Table 2—*Pregnancy outcomes in women with IGT and NGT*

Variables	NGT (N = 302) % (n)	IGT (N = 102) % (n)	P§
EPH syndrome*	6.62 (20)	19.6 (20)	0.0001
Mild or moderate	6.62 (20)	16.7 (17)	0.0024
Preeclampsia and eclampsia	0.00 (0)	2.94 (3)	0.0157‖
P-ROM	1.99 (6)	13.7 (14)	<0.0001
Breech presentation	3.31 (10)	10.8 (11)	0.0033
Vertex presentation	96.4 (291)	89.2 (91)	0.0060
Preterm birth (<37 gestational weeks)	1.32 (4)	7.84 (8)	0.0026‖
Caesarean delivery	65.9 (199)	73.5 (75)	0.1535
Cephalopelvic disproportion	33.4 (101)	23.5 (24)	0.0611
Breech	3.64 (11)	8.82 (9)	0.0370
Foetal distress	13.6 (41)	11.8 (12)	0.6394
Postdates	1.96 (2)	0.00 (0)	0.0633‖
Others	22.9 (69)	46.1 (47)	<0.0001
Birth trauma or dystocia	0.00 (0)	0.00 (0)	—
Fetal male gender	52.3 (158)	54.9 (56)	0.6512
Birth weight ≥90th percentile	13.3 (40)	21.6 (22)	0.0437
Birth weight ≥95th percentile	5.96 (18)	12.8 (13)	0.0260
Low birth weight (<2,500 g)	1.66 (5)	1.96 (2)	1.0000‖
Apgar score at 1 min ≤7	0.99 (3)	1.96 (2)	0.6039‖
Hypoglycemia†	0.33 (1)	0.98 (1)	0.4417‖
Pneumonia	0.00 (0)	1.96 (2)	0.0633‖
Perinatal death‡	0.66 (2)	1.96 (2)	0.2654‖

*Mild EPH syndrome is SBP/DBP >173/12 kPa (130/90 mmHg), or with an increase in blood pressure of 4/2 kPa (30/15 mmHg) compared with basal blood pressures, that may be accompanied with moderate proteinuria and edema. Moderate EPH syndrome: increase in blood pressure, SBP/DBP >21.3/14.6 kPa (160/110 mmHg), proteinuria with +, or accompanied with edema or mild symptoms. Severe EPH syndrome includes pre-eclampsia and eclampsia; †capillary blood glucose level <1.7 mmol/l; ‡fetal/neonatal death from 28 gestational weeks to 7 days after birth; §χ^2 test; ‖Fisher's exact test.

Table 3—*Independent predictors for pregnancy outcomes*

Variables	OR	95% CI	*P*
EPH syndrome*			
IGT status (IGT vs. control)	2.10	0.89–4.94	0.0889
P-ROM†			
IGT status (IGT vs. control)	10.07	2.90–34.93	0.0003
Breech presentation†			
Stature (cm)	1.12	1.03–1.23	0.0128
IGT status (IGT vs. control)	3.47	1.11–10.84	0.0323
Preterm birth†			
Prepregnancy BMI (kg/m^2)	1.28	1.06–1.55	0.0124
IGT status (IGT vs. control)	6.42	1.46–28.34	0.0140
Birth weight ≥90th percentile‡			
IGT status (IGT vs. control)	2.42	1.07–5.46	0.0329
Weight gain in pregnancy (kg)	1.16	1.09–1.24	<0.0001
Gestational weeks at delivery	1.24	1.00–1.54	0.0498

*Controlling for age (years), household monthly income per person (RMB: Yuan), educational attainment (1. junior high school or less; 2. senior high school; 3. college; 4. university), stature (cm), pregravid BMI (kg/m^2), weight gain in pregnancy (kg), parity, and hospital levels (secondary vs. tertiary); †controlling for EPH syndrome and above factors except for parity; ‡controlling for above all factors, plus gestational weeks at delivery, infant's sex (1. male; 2. female), and parity.

rospective comparison of 90 women with IGT, Oats and Beischer (20) found that the incidence of pre-eclampsia was significantly higher in women with IGT (26.5%), compared with that of hospital-based incidence (10.6%). Lucas et al. (21) found that, in a study of 159 women with class A1 GDM, differences in the development of peripartum hypertension were significantly higher in these women compared with the normal control subjects ($n = 151$). In a study of 944 Singaporean pregnant women with IGT, Tan and Yeo (3) found that the risks of hypertensive disease in pregnancy were significantly higher in the IGT group (RR: 2.43), but the increase was not statistically significant when older and obese women were excluded from the analyses. Our data show that women with IGT were at an increased risk of EPH syndrome (mild/moderate EPH syndrome or pre-eclampsia or eclampsia). However, the OR for EPH syndrome was marginally significant (2.10, 95% CI 0.89–4.94) after controlling for age, pregravid BMI, hospital levels, and other confounding factors.

In this study, women with IGT were more likely than women with NGT (adjusted OR = 10.07) to have P-ROM. This finding was also found in a study of 622 women in Mainland China (19). Goldman et al. (18) reported in a retrospective study of 150 women with GDM that preterm labor did not occur more frequently in GDM women. Bar-Hava et al. (22) reported a similar result in a retrospective study of 550 with GDM. Preterm birth has been reported to occur more often in pregnancies complicated by GDM (23,24). In the current study, women with IGT were 6.42 times (95% CI 1.46–28.34) more likely to have a preterm birth after adjusting for age, pregravid BMI, EPH-syndrome, hospital levels, and stature. P-ROM has been shown to be the cause of 30–40% of all preterm births (25). Our data also showed an association between P-ROM and preterm birth. P-ROM may predispose women with IGT to preterm birth. Chia et al. (26) in an retrospective study of 411 women with GDM observed that GDM women were more likely to have a malpresentation in labor compared with their nondiabetic counterparts. In line with this finding, our study found that breech presentation occurred more frequently in women with IGT (10.78% or 11 of 102 vs. 3.31% or 10 of 302, $P = 0.0033$).

Studies have shown high rates of caesarean delivery in women with GDM than in their nondiabetic counterparts (18,27–30). In a retrospective cohort study of 874 U.S. women with class A1 GDM, Casey et al. (31) reported a significantly higher caesarean delivery in these women compared with the general obstetric population (30 vs. 17%). Roberts et al. (32) reported a higher rate of caesarean delivery in the IGT group compared with the normal group. However, as Naylor et al. (33) argued, "The recognition of GDM might lead to a lower threshold for surgical delivery."

With respect to our study, locally unpublished data from the Tianjin Bureau of Public Health revealed a rate of 64.6% caesarean delivery in 1999. Caesarean delivery has been a common practice in parts of Tianjin city before the current study. Local attitudes were that caesarean delivery was "better" for the baby (i.e., a more advantageous and therefore preferred mode of delivery), especially following the implementation of the "One Child Policy." With such a high caesarean delivery rate in this obstetric population, it is perhaps not surprising that caesarean delivery rates did not differ significantly between the IGT and NGT groups. The only difference observed was in the breech presentation–specific caesarean delivery rate (9 of 102 vs. 11 of 302, $P = 0.0370$). It is thus most unlikely that the recognition of GDM has contributed to the already high rate of caesarean delivery in this obstetric population.

Macrosomia is a complication of GDM-related pregnancies and is associated with poor perinatal outcomes. Studies reported a high rate of macrosomia and/or larger than gestational age (LGA) in women with GDM (29,34–37). Furthermore, studies reported an increased incidence of macrosomia in women with mild glucose tolerance or even NGT. The Toronto Tri-Hospital Gestational Diabetes Project reported a rate of 28.7% in women with an untreated borderline GDM ($n = 115$) compared with a rate of 13.7% in the normoglycemia control subjects (38). In a small Chinese population, Ma et al. (39) also reported a higher rate of macrosomia in the IGT group compared with the control group ($P < 0.025$). The reported increase in macrosomia, however, has not always been attributed to the presence of IGT during pregnancy (32,40). Macrosomia means different things to different clinical/research applications. Our data show that IGT was a predictor of high birth weight (≥90th percentile or 4,000 g) after controlling for weight gain, gestational weeks at delivery and hospital levels (Table 3). Our data also predicted that glucose levels at the initial screening were also a predictor of birth weight (X.Y., H.Z., L. Dong, S. Yu, Z. Guo, B.H.-H., unpublished data).

Traditional northern Chinese dietary compositions are of low fat and high car-

bohydrates. Bicycles are primary means of transportation and widely used by all. The combination of the two is known to be conducive to metabolism and is likely to offer beneficial effect to both groups. It is thus conceivable that IGT during pregnancy may contribute to fetal growth and hence high birth weight.

Glucose intolerance in GDM has been associated with more pronounced insulin resistance and impaired insulin secretion (41–43). More recently, Solomon and Seely (44) suggested that both preeclampsia and gestation hypertension might be associated with greater degrees of insulin resistance than characteristics of normal pregnancy. In our study, women with IGT were somewhat more likely to develop EPH syndrome than their counterparts of NGT (Tables 2 and 3). The relationship, however, was weak and accounted for by the hospital level to which women were admitted for delivery.

Weiner (45) found that women with GDM had a significantly higher risk of low Apgar score (<7 at 1 min) and neonatal hypoglycemia than women with NGT. Findings from Rey et al. (46) suggested that mild carbohydrate intolerance was also associated with higher rates of neonatal hypoglycemia and hyperbilirubinemia. Other studies, however, showed an insignificant increase in morbidity in the offspring of mothers with GDM, especially those with IGT or mild glucose intolerance (4,32). The current study showed that asphyxia and hypoglycemia were similar in the two groups. Neonatal hypoglycemia, however, may be underestimated because not all neonates of IGT mothers were tested for glucose levels under the current local neonatal care setting. Undiagnosed neonatal hypoglycemia associated with IGT has been speculated for possible long-term morbidity (47).

Before the introduction of the current study, women with IGT during pregnancy were unaware of the presence of the condition and therefore often were being cared for in the same way as that of their normal counterparts. We demonstrated in this article that the presence of IGT in pregnancy is predictive of P-ROM and preterm birth, breech presentation and high birth weight. The high frequency of breech presentation in the IGT group is associated with the increased caesarean delivery rate in the same group.

This study is the first to introduce a screening program for diabetes in pregnancy in Tianjin. Technical, as well as logistic, difficulties were potential barriers to scientific data collection that is fundamental to future policy decision. Despite careful planning in hospital selection to obtain a representative NGT sample, we found that the sampling distribution for age, BMI, blood pressure (SBP and DBP), and gestational weeks at the initial screening for the 302 control subjects shifted to the right-hand side of the general obstetric population of Tianjin City. The bias appeared systematic and was in part removed through statistical adjustments. As a comparison group, a higher rather than lower reading on age, BMI, blood pressure, and gestational weeks at the initial screening is likely to contribute to an underestimation of poor pregnancy outcomes that are reported here. Missing medical records, in particular maternal body weight when admitted for delivery (IGT: 19 and NGT: 12), may also contribute to a reduced predictive power and further underestimate poor perinatal outcomes.

China is faced with a rising prevalence of type 2 diabetes (48). The introduction of a screening program for diabetes in pregnancy is a step toward improved obstetric care in women, as well as prevention of type 2 diabetes in women and childhood obesity. If treatment options are to be introduced to women with IGT, the effects of such options on pregnancy outcomes will need to be assessed, taking into account social, cultural, economic, and clinical benefits.

Acknowledgments— The authors would like to thank Yue Chen for her unrelenting effort in the management of the GDM Clinic and data collection, and Dr. Anthony Hunter for his advice at the initial stage of the study. The Glucotrend II meters were supplied by Roche Diagnostic (China) and insulin injection pens by Nova Nordisk (China).

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