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Impact of Early Screening for Gestational Diabetes on Perinatal Outcomes in High Risk Women

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Abstract

Objective—To examine the benefits of early gestational diabetes mellitus (GDM) screening in a high risk population.

Study Design—Retrospective cohort of all singletons diagnosed with GDM with indications for early screening: GDM or macrosomia in a prior pregnancy or obesity. Subjects were classified as early (<20 weeks) or routine (>24 weeks) screening. Patients diagnosed with GDM were managed according to standard institutional protocols. Outcomes examined were cesarean delivery (CD), preeclampsia, large for gestational age (LGA), small for gestational age (SGA), macrosomia, and preterm birth (PTB).

Results—Subjects screened early were more likely to have had GDM in a prior pregnancy, hypertension, higher body mass index (BMI), and higher fasting glucose. Early and routine screening groups had similar incidences of CD (adjusted odds ratio [AOR] 0.95, 95% confidence interval [CI] 0.55–1.64), preeclampsia (AOR 0.84, 95% CI 0.38–1.83), LGA (AOR 0.90, 95% CI 0.51–1.72), SGA (AOR 0.38, 95% CI 0.13–1.13), and macrosomia (AOR 1.00, 95% CI 0.53–1.87). Subjects in the early screening group had a higher incidence of PTB (AOR 1.79, 95% CI 1.08–2.99).

Conclusion—We did not detect a benefit to early screening for women who met criteria. The utility of early GDM screening requires evaluation in a prospective trial.

Keywords

gestational diabetes; gestational insulin resistance; early screening gestational diabetes

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Introduction

Gestational diabetes mellitus (GDM) is defined as glucose intolerance detected during pregnancy. Universal screening is commonly employed in the United States for GDM detection at 24–28 weeks gestation[1]. Overall, studies have shown that treatment of GDM with diet and blood glucose control mitigates the risks of adverse outcomes such as shoulder dystocia, preeclampsia, and large for gestational age infants associated with GDM[2,3].

The American College of Obstetricians and Gynecologists (ACOG) recommends that early GDM screening be considered for high risk groups (previous history of GDM, known impaired glucose metabolism, and obesity)[1]. Early screening may detect either pregestational diabetes or early onset GDM. The goal of early screening is to allow earlier treatment, thereby leading to earlier glycemic control and potentially improved perinatal outcomes. However, no prior studies have demonstrated benefits to early screening. Prior retrospective studies have been limited by small size and have focused on the sensitivity and specificity of early screening for detecting GDM rather than the benefits of early detection of GDM[4–13]. Therefore, we aimed to examine the impact of early screening and diagnosis of GDM on maternal and neonatal outcomes.

Materials and Methods

This was a retrospective cohort study of all singleton pregnancies delivered at the University of Alabama at Birmingham (UAB) with a diagnosis of GDM from 2007 to 2013. Institutional review board approval was obtained.

Subjects were identified from our obstetric automated record, a prospectively collected, searchable electronic medical records database of all women who delivered at UAB. Charts of every woman with a diagnosis of gestational diabetes or diabetes mellitus were reviewed. Standardized chart abstraction forms were used to abstract data from the medical charts by individuals trained in chart abstraction. Data collected included detailed information on maternal demographics, medical and obstetrical history, GDM screening and diagnosis results, prenatal blood sugar logs, medication use, labor and delivery events, and neonatal outcomes.

At our institution regardless of the timing, GDM screening was accomplished with a one-hour, 50-gram glucose challenge test. If the glucose challenge test was ≥135 mg/dL, women proceeded to a three-hour, 100-gram glucose tolerance test. Women with a glucose challenge test ≥200 mg/dL were treated as GDM without further diagnostic testing[14]. The Carpenter-Coustan criteria were used to diagnose GDM (at least two values abnormal, fasting glucose ≥95 mg/dL, 1-hour glucose ≥180 mg/dL, 2-hour glucose ≥155 mg/dL, and 3-hour glucose ≥140 mg/dL)[15]. Due to concerns of hyperglycemia, at our institution women with a fasting blood sugar ≥120 mg/dL were not administered a 100-g glucose load and were diagnosed with GDM.

All women were managed by institutional protocol under the supervision of Maternal-Fetal Medicine specialists. Each woman underwent individualized nutrition counseling and diabetic education upon her diagnosis of GDM. Per institution protocol, hypoglycemic

medications were initiated after a trial of diet when ≥50% of blood glucose were elevated from target values of <95 mg/dL fasting and <120 mg/dL at 2 hours postprandial. At our institution, glyburide is typically initiated first, with progression to insulin if blood sugars remain elevated despite reaching maximum glyburide dose. However, glyburide dosing and initiation of insulin without a trial of oral medication based on clinical data such as blood sugars was also at physician discretion.

We identified women with a diagnosis of GDM and included in our study cohort only those who had at least one criterion that would potentially warrant early screening. Indications for early screening for this study were: obesity (pre-pregnancy body mass index (BMI) ≥30 kg/m^2), GDM in a prior pregnancy, and delivery of a macrosomic infant (≥4000 g) in a prior pregnancy. We then examined outcomes of those who underwent early screening versus those who had routine screening. Patients were excluded from this study if the pregnancy was complicated by major medical problems other than chronic hypertension (eg. systemic lupus erythematosus, maternal cardiac disease, HIV), congenital malformations, or late prenatal care (≥26 weeks). The decision of whether or not a patient had early screening for GDM was at the discretion of the managing provider. Outcomes were examined by whether a woman underwent early screening (first GDM testing <20 weeks gestation) or routine screening (first GDM testing 24–28 weeks gestation) for GDM. The exposure was determined by the timing of the initial screening test rather than the timing of diagnosis. In other words, if the first screen was performed <20 weeks but the final diagnosis of GDM was made after 24 weeks, subjects were categorized as early screen. Analyses were then stratified by the indication for early screening: prior pregnancy affected by GDM (with or without obesity) and obesity only (no prior pregnancy affected by GDM). Prior macrosomic infant was not evaluated separately as few subjects had this screening criterion alone. Finally, a sensitivity analysis including only women diagnosed with GDM<20 weeks in the early screening group was performed.

Maternal outcomes examined were cesarean delivery (any), primary cesarean, preeclampsia, A2 diabetes (defined as requiring any hypoglycemic medication), and insulin use. Cesarean delivery and preeclampsia were chosen as outcomes because treatment of GDM has been demonstrated to reduce its risk[2,3]; use of medications to treat GDM was selected as a marker of severity of GDM. Neonatal outcomes included birth weight, macrosomia (defined as birth weight ≥4000 g), large for gestational age (>90th percentile[16]), small for gestational age (<10th percentile), birth injury (shoulder dystocia, skull/clavicular/humerus fracture, or brachial plexus injury), gestational age at delivery, and preterm delivery (<37 weeks), all of which have been associated with GDM and its treatment[2,3].

Exposure groups were compared using Student's t-test, Mann-Whitney U test, or chi-squared tests as appropriate. Multivariable logistic regression models for the primary outcome were then developed to estimate the impact of early screening for GDM. Covariates for initial inclusion in multivariable statistical models were selected using results of the bivariate and stratified analyses and based on historical known confounding factors. Covariates considered included obesity, prior cesarean, prior vaginal delivery, prior macrosomia, chronic hypertension, nulliparity, prior preterm delivery, and GDM testing results. Factors were removed in a backward step-wise fashion, based on significant changes

(10%) in the exposure adjusted odds ratio or significant differences between hierarchical models using the likelihood ratio test. The statistical analysis was performed using Stata, version 13 Special Edition (College Station, TX).

Results

Of 1,213 subjects identified with GDM in their medical records, 775 (63.9%) had 1 or more indications (BMI≥30 kg/m^2, prior GDM, or prior macrosomic infant) for early screening. Of these 775 women with indications for early screening, 569 (73.4%) were included in the analysis (28 excluded for congenital malformations, 53 for late prenatal care, 51 for major medical problems, 25 for screening outside of the gestational age windows, and 49 for missing confirmatory glucose tolerance testing). Of the 569 total women in this study, 112 (19.7%) were screened early (<20 weeks) and 457 (80.3%) underwent routine screening (24–28 weeks). Of the 112 women that were screened early, 85 (76%) were diagnosed with GDM at <20 weeks while 27 (24%) women passed their initial screen and were diagnosed at 24–28 weeks gestation at the time of repeat GDM screening. All 112 women who were screened early, regardless of the timing of their GDM diagnosis, were analyzed as part of the early screening group. Of note, of the 112 women screened early, 85 (76%) were diagnosed with GDM prior to 20 weeks gestation. The two exposure groups did not differ significantly with respect to age, nulliparity, race, marital status, tobacco use, prior macrosomia, and prior preterm delivery (Table 1). Women in the early screening group were more likely to have private insurance, a prior pregnancy complicated by GDM, chronic hypertension, and a higher pre-pregnancy BMI. Women in the early group also had higher fasting blood glucose levels at the time of the glucose tolerance test and were, as expected, diagnosed with GDM earlier in pregnancy.

Women in the early screening group (n=112) had a similar incidence of primary (AOR, 0.76; 95% CI, 0.39–1.47) and repeat (AOR, 0.95; 95% CI, 0.55–1.64) cesarean delivery compared to women undergoing routine screening (n=457) (Table 2). The incidence of preeclampsia was also not significantly different between groups (AOR, 0.84; 95% CI, 0.38–1.83). Women in the early screening group had higher odds of having A2 GDM compared to women in the routine group (AOR, 2.03; 95% CI, 1.06–3.88) even after controlling for significant confounding factors. Also, the early group was more likely to require insulin for glycemic control as compared to the routine group (AOR, 4.49; 95% CI, 1.92–10.49). Birth weights were not significantly different between groups, as were the incidence of macrosomia (AOR, 1.00; 95% CI, 0.53–1.87), LGA (AOR, 0.90; 95% CI, 0.51–1.72), and SGA (AOR, 0.38; 95% CI, 0.13–1.13) infants. Early screening was not associated with a decreased odds of birth injury (AOR, 1.59; 95% CI, 0.59–4.23). Compared to routine screening, early screening was associated with an increased odds of preterm delivery (AOR, 1.79; 95% CI, 1.08–2.99).

When the analyses were stratified by indication for early screening, results were similar to the overall group (Tables 3–4). Analysis of prior macrosomic infant as indication for early screening was not performed as few patients had this as their sole criterion for early screening. In women with GDM in a prior pregnancy (n=63) (with or without obesity), the incidence of cesarean (AOR, 0.69; 95% CI, 0.25–1.94), primary cesarean (AOR, 0.70; 95%

CI, 0.17–2.88), and preeclampsia (AOR, 2.27; 95% CI, 0.55–9.42) were not significantly different between both early and routine screening groups (Table 3). Women who were screened early were more likely to have A2 diabetes than those in the routine screening group (AOR, 4.96; 95% CI, 1.55–15.91). Insulin use in the early group was significantly increased (AOR, 5.48; 95% CI, 1.60–18.80). The incidence of macrosomia (AOR, 1.00; 95% CI, 0.33–3.05) and LGA (AOR, 1.37; 95% CI, 0.45–4.21) were not significantly different between the two groups, as were the incidence of SGA (p=0.09), and incidence of birth injury (p=0.31). Preterm delivery (AOR, 2.63; 95% CI, 1.01–6.89) was more frequent in women in the early screening group.

When only obesity was considered as an indication for early screening (no history of prior GDM), the incidence of cesarean delivery and preeclampsia was not significantly different between groups (Table 4). Although the incidence of A2 diabetes was similar between both groups (AOR, 0.91; 95% CI, 0.35–2.36), insulin use was higher in the early screening group (AOR, 5.40; 95% CI, 1.26–23.21). Birth weight, incidence of macrosomia (AOR, 1.16; 95% CI, 0.48–2.78), LGA (AOR, 0.91; 95% CI, 0.38–2.18), SGA (AOR, 0.25; 95% CI, 0.03–1.94), birth injury, and incidence of preterm delivery (AOR, 1.43; 95% CI, 0.63–3.27) were not significantly different among both groups.

We then compared only women with an early diagnosis of GDM (n=85) to those who underwent routine screening (Table 5). Results were similar to the primary analysis, with no significant differences in cesarean, preeclampsia, macrosomia, LGA, SGA, or birth injury. The odds of requiring medication, requiring insulin, or undergoing preterm delivery were increased in the early diagnosis group.

Discussion

Early screening of this cohort of high risk women for GDM was not associated with significant reduction in the risk of cesarean, preeclampsia, macrosomia or birth injury. Women who were screened prior to 20 weeks gestation were more likely to receive insulin for glycemic control and to deliver preterm than women who were screened at the routine time. Of note, women who had early screening displayed higher prevalence of markers of higher risk such as higher mean BMI, GDM in a prior pregnancy, and chronic hypertension.

These findings may reflect that women in the early screening group represent a select group with a more severe form of diabetes than women in the routine screening group and are more likely to require insulin. Early screening and diagnosis may result in more aggressive management of diabetes due to a presumption of pregestational diabetes when GDM is diagnosed prior to 20 weeks. It also affords a longer time frame for providers to try oral medication and move to insulin prior to delivery. Increased monitoring associated with presumed pregestational diabetes may have led to more interventions during pregnancy as well and this may contribute to the increased risk of preterm birth. Unfortunately, despite increased insulin use in this group, we did not detect a decrease in the risk of macrosomia, LGA, or birth injury in the early screening group, although the incidence of these adverse outcomes may have been higher in the absence of early screening.

A study by Bartha et al examined maternal and neonatal outcomes in women diagnosed with GDM in the first trimester compared to those diagnosed in the second trimester. In this retrospective cohort, all women were screened in the first trimester. They noted that women diagnosed with GDM in the first trimester were a high risk group, with higher blood sugars, higher use of insulin, and an increased incidence of perinatal death[11]. However, as all women were screened at their first visit, no inferences can be made about the benefits of first trimester screening. In a study by Meyer et al, where all patients were screened at the initial prenatal visit, few subjects were diagnosed with GDM prior to 12 weeks gestation. No difference in birth weight (the only neonatal outcome examined) was detected between those with normal and abnormal glucose tolerance testing at the first visit[13].

We identified several retrospective cohort studies examining methods of diagnosing GDM in the first trimester. Some studies have examined the glucose tolerance testing thresholds prior to 20 weeks[10,12] in those who go on to develop GDM at 24–28 weeks. These studies recommend lowering the glucose thresholds for screening at earlier gestational ages. None of these studies, however, have examined maternal and neonatal outcomes in women screened in the first trimester compared to unscreened women.

The major strength of our study is the inclusion of only women with an indication for early GDM screening. The goal of doing so was to eliminate bias caused by confounding by indication, as women who are screened early at our institution inherently represent a higher risk group due to their indication for early screening. We also stratified by the indication for early screening, as prior gestational diabetes is a stronger risk factor for GDM than obesity. Additionally, we had detailed patient-level information enabling us to examine important confounding factors, such as glucose values during GDM testing.

The main limitation of this study is that it is retrospective and observational, and as such, despite our efforts, unmeasured differences between groups and differences in provider behavior may account for the results. Additionally, although compared to other studies we have a large sample of women screened for GDM early (n=112), we did not have adequate power to detect a difference in rare outcomes such as birth injury. Additional information regarding baseline blood sugars in both groups, measured by random blood sugars or glycosylated hemoglobin, would also have assisted in determining baseline differences between groups.

Since the choice of whether or not to perform early screening was at provider discretion, it is plausible that these women may represent a higher risk cohort for adverse outcomes. Therefore, it is somewhat promising that several adverse pregnancy outcomes were not more prevalent in the early group, suggesting that early diagnosis and treatment may have reduced the prevalence to that of the lower risk group. Thus, even outcomes such as preterm birth that were higher in the early screening group could have been higher in the absence of early screening. We attempted to eliminate selection bias by only including women who had an indication for early screening and by stratifying the analysis by the indication for early screen. However, because this is a retrospective study, it is very plausible that baseline differences between those who underwent early screening and those that did not persist and

remain unadjusted confounders. It is not possible to fully adjust for this type of selection bias during analysis.

In this high risk cohort, early screening for GDM was not associated with a decreased risk of adverse perinatal outcomes. As an early diagnosis of GDM is necessarily associated with higher costs of care compared to a third trimester diagnosis, due to increased visits, longer period of glucose monitoring, and more medication use, benefits of early diagnosis should be demonstrated prior to a broad application of this strategy. A randomized control trial of early screening for gestational diabetes in high risk groups is needed to determine whether early diagnosis and treatment can result in improved maternal and neonatal outcomes.

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References

1. ACOG Committee on Practice Bulletins-Gynecology TACoO Gynecologists. Practice Bulletin No 137: Gestational diabetes mellitus. Obstetrics and gynecology. 2013; 122(2 Pt 1):406–416. [PubMed: 23969827]
2. Landon MB, Spong CY, Thom E, et al. A multicenter, randomized trial of treatment for mild gestational diabetes. N Engl J Med. 2009; 361(14):1339–1348. [PubMed: 19797280]
3. Crowther CA, Hiller JE, Moss JR, et al. Effect of treatment of gestational diabetes mellitus on pregnancy outcomes. N Engl J Med. 2005; 352(24):2477–2486. [PubMed: 15951574]
4. Grewal E, Kansara S, Kachhawa G, et al. Prediction of gestational diabetes mellitus at 24 to 28 weeks of gestation by using first-trimester insulin sensitivity indices in Asian Indian subjects. Metabolism: clinical and experimental. 2012; 61(5):715–720. [PubMed: 22146095]
5. Georgiou HM, Lappas M, Georgiou GM, et al. Screening for biomarkers predictive of gestational diabetes mellitus. Acta diabetologica. 2008; 45(3):157–165. [PubMed: 18496643]
6. Watanabe N, Morimoto S, Fujiwara T, et al. Prediction of gestational diabetes mellitus by soluble (pro)renin receptor during the first trimester. The Journal of clinical endocrinology and metabolism. 2013; 98(6):2528–2535. [PubMed: 23720787]
7. Smirnakis KV, Plati A, Wolf M, Thadhani R, Ecker JL. Predicting gestational diabetes: choosing the optimal early serum marker. American journal of obstetrics and gynecology. 2007; 196(4):410, e411–416. discussion 410 e416–417. [PubMed: 17403439]
8. Smirnakis KV, Martinez A, Blatman KH, et al. Early pregnancy insulin resistance and subsequent gestational diabetes mellitus. Diabetes care. 2005; 28(5):1207–1208. [PubMed: 15855591]
9. Rasanen J, Quinn MJ, Laurie A, et al. Maternal serum glycosylated fibronectin as a point-of-care biomarker for assessment of preeclampsia. American journal of obstetrics and gynecology. 2014
10. Plasencia W, Garcia R, Pereira S, Akolekar R, Nicolaides KH. Criteria for screening and diagnosis of gestational diabetes mellitus in the first trimester of pregnancy. Fetal diagnosis and therapy. 2011; 30(2):108–115. [PubMed: 21454960]
11. Bartha JL, Martinez-Del-Fresno P, Comino-Delgado R. Gestational diabetes mellitus diagnosed during early pregnancy. American journal of obstetrics and gynecology. 2000; 182(2):346–350. [PubMed: 10694335]
12. Nahum GG, Wilson SB, Stanislaw H. Early-pregnancy glucose screening for gestational diabetes mellitus. The Journal of reproductive medicine. 2002; 47(8):656–662. [PubMed: 12216433]
13. Meyer WJ, Carbone J, Gauthier DW, Gottmann DA. Early gestational glucose screening and gestational diabetes. The Journal of reproductive medicine. 1996; 41(9):675–679. [PubMed: 8887193]

14. Standards of medical care in diabetes--2014. Diabetes care. 2014; 37(Suppl 1):S14–80. [PubMed: 24357209]
15. Carpenter MW, Coustan DR. Criteria for screening tests for gestational diabetes. American journal of obstetrics and gynecology. 1982; 144(7):768–773. [PubMed: 7148898]
16. Alexander GR, Himes JH, Kaufman RB, Mor J, Kogan M. A United States national reference for fetal growth. Obstetrics and gynecology. 1996; 87(2):163–168. [PubMed: 8559516]

Table 1

Maternal Baseline Characteristics

	Early Screen (n=112)	No Early Screen (n=457)	p
Age (yrs)	30.7 ± 5.4	29.7 ± 5.7	0.12
Nulliparous	21 (19%)	105 (23%)	0.33
Race			0.13
Black	50 (45%)	237 (52%)	
White	21 (19%)	50 (11%)	
Hispanic	35 (31%)	132 (29%)	
Other	1 (1%)	10 (2%)	
Government Insurance	74 (66%)	359 (79%)	<0.01
Unmarried	64 (57%)	276 (60%)	0.24
Tobacco Use	25 (22%)	86 (19%)	0.56
Prepregnancy BMI * (kg/m^2)	38.3 ± 10.2	35.9 ± 7.1	<0.01
Obese	87 (78%)	402 (88%)	0.01
GDM † in Prior Pregnancy	63 (56%)	61 (13%)	<0.01
Prior Macrosomia	16 (14%)	75 (16%)	0.58
Prior Preterm Delivery	25 (22%)	84 (18%)	0.44
Chronic Hypertension	26 (23%)	59 (13%)	<0.01
Gestational Age at First Ultrasound (weeks)	11.7 (8.9–15.4)	12.5 (9.7–17.1)	0.02
Gestational Age at First Screen (weeks)	14.9 (11.9–16.7)	25.8 (24.9–27)	<0.01
Gestational Age at Diagnosis (weeks)	16.6 (12.4–19.5)	26.9 (25.7–28.1)	<0.01
1-Hour Glucose Challenge Test (mg/dL) ‡	192 ± 43	183 ± 36	0.04
3-Hour Glucose Tolerance Testing (mg/dL)‡			
Fasting	118 ± 42	104 ± 17	<0.01
1-Hour	201 ± 25	199 ± 29	0.65
2-Hour	178 ± 26	177 ± 27	0.66
3-Hour	129 ± 31	138 ± 32	0.13

Data presented as mean ± standard deviation, median (interquartile range), or n (%) as appropriate

* BMI – body mass index

† GDM – gestational diabetes mellitus

‡ Results of the the 1-hour and 3-hour glucose tests diagnostic of GDM.

Table 2

Maternal and Neonatal Outcomes by Gestational Age at Initial Screen, Any Indication for Early Screening

	Early Screen (n=112)	No Early Screen (n=457)	p	AOR (95% CI)
Maternal Outcomes				
Any Cesarean	51 (46%)	212 (46%)	0.87	0.95 (0.55–1.64) *
Primary Cesarean	17/78 (22%)	107/352 (30%)	0.13	0.76 (0.39–1.47) †
Preeclampsia	20 (18%)	91 (20%)	0.62	0.84 (0.38–1.83) ‡
A2 Diabetes (oral or insulin)	76 (68%)	223 (49%)	<0.01	2.03 (1.06–3.88) §
Insulin	40 (36%)	26 (6%)	<0.01	4.49 (1.92–10.49) //
Neonatal Outcomes				
Birth weight (g)	3374 ± 888	3413 ± 690	0.61	-
Macrosomia	20 (18%)	77 (17%)	0.79	1.00 (0.53–1.87) ¶
Large for Gestational Age	24 (21%)	88 (19%)	0.73	0.90 (0.51–1.72) ¶
Small for Gestational Age	4 (4%)	34 (7%)	0.16	0.38 (0.13–1.13) #
Birth Injury	8 (7%)	17 (4%)	0.09	1.59 (0.59–4.23) **
Gestational age at Delivery (wks)	37.3 ± 4.1	38.5 ± 1.9	<0.01	-
Preterm Delivery <37 wks	30 (27%)	71 (16%)	<0.01	1.79 (1.08–2.99) ††

Data presented as % or mean ± standard deviation, as appropriate

* Adjusted for prior cesarean, prior GDM, obesity

† Adjusted for prior GDM, prior vaginal delivery

‡ Adjusted for nulliparity, chronic hypertension, obesity, and fasting value on 3-hour GTT

§ Adjusted for values of GCT, fasting value on 3-hour GTT

// Adjusted for prior GDM, fasting value on 3-hour GTT

¶ Adjusted for 1-hour GCT, prior macrosomic infant

Adjusted for chronic hypertension, obesity, nulliparity

** Adjusted for prior gestational diabetes

†† Adjusted for chronic hypertension, prior preterm delivery

Table 3

Maternal and Neonatal Outcomes by Gestational Age at Screening with GDM in Prior Pregnancy

	Early Screen (n=63)	No Early Screen (n=61)	p	AOR (95% CI)
Maternal Outcomes				
Any Cesarean	28 (44%)	23 (38%)	0.44	0.69 (0.25–1.94) *
Primary Cesarean	5/40 (13%)	5/43 (12%)	0.90	0.70 (0.17–2.88) †
Preeclampsia	8 (13%)	3 (5%)	0.13	2.27 (0.55–9.42) ‡
A2 Diabetes	48 (76%)	27 (44%)	<0.01	4.96 (1.55–15.91) §
Insulin	29 (46%)	7 (11%)	<0.01	5.48 (1.60–18.80) //
Neonatal Outcomes				
Birth weight (g)	3481 ± 821	3472 ± 632	0.95	-
Macrosomia	13 (21%)	11 (18%)	0.71	1.00 (0.33–3.05) ¶
Large for Gestational Age	16 (25%)	11 (18%)	0.29	1.37 (0.45–4.21) ¶
Small for Gestational Age	1 (2%)	5 (8%)	0.09	-
Birth Injury	6 (10%)	3 (5%)	0.31	-
Gestational age at Delivery (wks)	37.1 ± 4.0	38.5 ± 1.6	0.02	-
Preterm Delivery <37 wks	18 (29%)	9 (15%)	0.06	2.63 (1.01–6.89) **

Data presented as % or mean ± standard deviation, as appropriate

* Adjusted for prior cesarean, obesity

† Adjusted for obesity, prior vaginal delivery

‡ Adjusted for chronic hypertension

§ Adjusted for values of one hour glucose challenge test and fasting value on 3-hour GTT

// Adjusted for values fasting value on 3-hour GTT

¶ Adjusted for prior macrosomic infant, one hour glucose challenge test

** Adjusted for prior preterm delivery

-Logistic regression not performed due to small sample size or continuous variable

Table 4

Maternal and Neonatal Outcomes by Gestational Age at Screening with Obesity

	Early Screen (n=37)	No Early Screen (n=375)	p	OR (95% CI)
Maternal Outcomes				
Any Cesarean	17 (46%)	180 (48%)	0.81	0.83 (0.38–1.78) *
Primary Cesarean	8/20 (40%)	99/294 (34%)	0.58	0.59 (0.24–1.46) †
Preeclampsia	9 (24%)	88 (23%)	0.91	0.78 (0.29–2.13) ‡
A2 Diabetes	22 (59%)	188 (50%)	0.28	0.91 (0.35–2.36) §
Insulin	9 (24%)	18 (5%)	<0.01	5.40 (1.26–23.21) ‡
Neonatal Outcomes				
Birth weight (g)	3254 ± 1072	3395 ± 709	0.27	-
Macrosomia	7 (19%)	64 (17%)	0.77	1.16 (0.48–2.78) //
Large for Gestational Age	7 (19%)	75 (20%)	0.88	0.91 (0.38–2.18) //
Small for Gestational Age	1 (3%)	29 (8%)	0.26	0.25 (0.03–1.94) ¶
Birth Injury	1 (3%)	12 (3%)	0.91	-
Gestational age at Delivery (wks)	37.2 ± 4.8	38.5 ± 2.0	<0.01	-
Preterm Delivery <37 wks	9 (24%)	61(16%)	0.21	1.43 (0.63–3.27) **

Data presented as % or mean ± standard deviation, as appropriate

* Adjusted for prior cesarean

† Adjusted for prior vaginal delivery

‡ Adjusted for chronic hypertension, fasting value on 3-hour GTT

§ Adjusted for glucose challenge test, fasting value on 3-hour GTT

// Adjusted for prior macrosomic infant, chronic hypertension

¶ Adjusted for chronic hypertension, nulliparity

** Adjusted for chronic hypertension, prior preterm delivery

-Logistic regression not performed due to small sample size or continuous variable

Table 5

Maternal and Neonatal Outcomes in those with an Early Diagnosis compared to No Early Screen

	Early Diagnosis (n=85)	No Early Screen (n=457)	p	AOR (95% CI)
Maternal Outcomes				
Any Cesarean	38 (45%)	212 (46%)	0.035	1.04 (0.56–1.92) *
Primary Cesarean	15/62 (24%)	107/352 (30%)	0.13	0.97 (0.47–2.01) †
Preeclampsia	17 (20%)	91 (20%)	0.62	0.86 (0.34–2.12) ‡
A2 Diabetes (oral or insulin)	62 (73%)	223 (49%)	<0.01	3.29 (1.52–7.09) §
Insulin	34 (40%)	26 (6%)	<0.01	5.24 (2.04–13.47) //
Neonatal Outcomes				
Birth weight (g)	3369 ± 988	3413 ± 690	0.62	-
Macrosomia	18 (21%)	77 (17%)	0.79	1.09 (0.55–2.13) ¶
Large for Gestational Age	20 (24%)	88 (19%)	0.73	0.95 (0.49–1.86) ¶
Small for Gestational Age	3 (4%)	34 (7%)	0.16	0.38 (0.11–1.30) #
Birth Injury	8 (9%)	17 (4%)	0.02	2.23 (0.80–6.16) **
Gestational age at Delivery (wks)	36.9 ± 4.5	38.5 ± 1.9	<0.01	-
Preterm Delivery <37 wks	23 (27%)	71 (16%)	0.01	1.78 (1.01–3.15) ††

Data presented as % or mean ± standard deviation, as appropriate

* Adjusted for prior cesarean, prior GDM, obesity

† Adjusted for prior GDM, prior vaginal delivery

‡ Adjusted for nulliparity, chronic hypertension, obesity, and fasting value on 3-hour GTT

§ Adjusted for values of GCT, fasting value on 3-hour GTT

// Adjusted for prior GDM, fasting value on 3-hour GTT

¶ Adjusted for 1-hour GCT, prior macrosomic infant

Adjusted for chronic hypertension, obesity, nulliparity

** Adjusted for prior gestational diabetes

†† Adjusted for chronic hypertension, prior preterm delivery