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Title: Predictive Value of HbA1c in Women with Newly Diagnosed Gestational Diabetes

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Introduction:

Gestational diabetes (GDM) occurs in 5-10% of New Zealand women, and its prevalence is rising. GDM is defined as diabetes first detected in pregnancy that resolves after birth, and is associated with adverse outcomes for the mother and baby. It is therefore paramount to have effective screening guidelines in place, in order to minimize the impact of GDM and improve maternal and fetal wellbeing.

HbA1c is a blood test commonly used to screen for diabetes. In 2015 it was introduced to the first pregnancy blood tests taken at booking, to identify pre-diabetes and diabetes in early pregnancy. At Christchurch Women's Hospital, HbA1c was historically measured mid-pregnancy after GDM diagnosis (24-28 weeks), as it was useful to screen for undiagnosed Type 2 diabetes and to identify those at greater risk of adverse outcomes. However since these women may now be identified earlier in pregnancy, it brings into question the cost-effectiveness of mid-pregnancy HbA1c testing.

Aim:

To determine whether HbA1c testing at the time of GDM diagnosis has clinical benefit over the booking HbA1c test in predicting adverse maternal and baby outcomes, and whether this test should continue to be performed.

Impact:

We may find that either HbA1c measured mid-pregnancy in women with GDM is still beneficial, or that it is of no predictive value, in which case we would recommend the test be withdrawn leading to future cost savings of over \$3000 per year.

Method:

In this retrospective study, we used electronic records of mothers who attended Christchurch Women's Hospital diabetes clinic and birthed between Feb 2016 and Jan 2017. Inclusion criteria were GDM diagnosis and completion of both pregnancy HbA1c tests. Women with known pre-existing Type 1 or 2 diabetes were excluded. Data was collected on maternal characteristics and the following outcome measures:

1. Maternal: Gestation at birth, abnormal ultrasound findings (abdominal circumference and estimated fetal weight <10th/ >90th centile, reduced/ increased amniotic fluid), high blood pressure, caesarian birth, bleeding or injury at birth, and post-partum hyperglycemia.
2. Baby: Birth weight, injury at birth, and intensive care admission (breathing problems, low blood glucose).

HbA1c results were categorised into population-based HbA1c centiles by week of pregnancy, with HbA1c >97.5th centile (the upper limit of the reference interval) being defined as our 'high risk' group. The relationship between the two sets of pregnancy HbA1c results and adverse outcome measures was then studied.

Results:

There were 243 mothers included in our analysis group. Of these women 53% (129) were European, 5% (11) Maori, 6% (14) Pacific Islanders and the remaining 36% (89) classified as 'Other'. We found that the incidence of adverse maternal and baby outcomes was similar across all ethnic groups.

In total, 13 mothers had a HbA1c >97.5th centile in early pregnancy. A HbA1c >97.5th centile was found in 2% (3) of the European mothers, 18% (2) of Maori, 21% (3) of Pacific Islanders and 6% (5) of 'Other' ethnicity. Similarly in late pregnancy, an HbA1c result >97.5th centile was found in 13 mothers, which was seen in 4% (5) of Europeans, 18% (2) of Maori, 21% (3) of Pacific Islanders and 3% (3) of 'Others'.

Mothers with an early pregnancy HbA1c >97.5th centile were more likely to develop adverse baby outcomes and post-partum hyperglycaemia. A composite outcome of intensive care admission and injury at birth occurred in 69% of babies born to mothers >97.5th centile versus 36% of babies born to mothers with a lower HbA1c centile ($p < 0.02$). We also saw a trend towards increased caesarian births, which occurred in 62% versus 36% respectively ($p = 0.08$). Of the 63% of mothers who were screened post-partum, hyperglycaemia persisted in 50% of those with a HbA1c >97.5th centile versus 4% of those with a lower HbA1c ($p < 0.02$). Only 3 (23%) mothers with an early HbA1c >97.5th centile also had a mid-pregnancy HbA1c >97.5th centile, non-of whom had postnatal screening.

In comparison, mothers with a mid-pregnancy HbA1c >97.5th centile were significantly associated with large babies on ultrasound scan. An abdominal circumference >90th centile was seen in 77% of mothers with HbA1c >97.5th centile, versus 36% of mothers with a lower HbA1c centile ($p = 0.0001$). Similarly, an estimated fetal weight >90th centile was found in 69% of mothers with an HbA1c >97.5th centile, versus 17% of mothers below ($p = 0.0001$). There was also a trend towards adverse baby outcomes (intensive care admission and injuries at birth), occurring in 62% versus 36% of the respective groups ($p = 0.08$). Only 44% of mothers with a mid-pregnancy HbA1c >97.5th centile had post-partum screening for persistent hyperglycaemia, and all results were normal.

Conclusion:

Our results showed that both HbA1c tests predicted adverse baby outcomes, and the early pregnancy HbA1c also predicted post-partum hyperglycaemia. The mid-pregnancy HbA1c predicted babies who were large on ultrasound scan - however as all mothers with GDM are required to have an ultrasound scan shortly after diagnosis, these babies would have been identified regardless of HbA1c. Therefore we conclude that there is no clinical advantage in testing HbA1c at mid-pregnancy.