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Diabetes Mellitus Among Canadian Indian Women Delivering Heavy-for-Date Newborns

SUMMARY

Canadian Indian women who delivered heavy-for-date newborns were studied to see whether they were more likely to be diabetic than were similar women who delivered normal birth-weight newborns. These women delivered newborns at the Sioux Lookout Zone Hospital between January 1, 1969 and December 31, 1972. The delivery of a heavy-for-date newborn was used as an indicator for gestational diabetes. Obstetric difficulties in pairs of women, and congenital anomalies and physiologic jaundice in pairs of newborns were also compared. The study results are discussed within the context of formulating a policy to screen this population of Indians for gestational diabetes. (*Can Fam Physician* 1988; 34:1529–1600.)

RÉSUMÉ

Les Indiennes canadiennes souffrant de diabète ont fait l'objet d'une étude afin de déterminer si elles avaient donné naissance des bébés d'un poids supérieur à celui des enfants nés de femmes non diabétiques. Ces femmes ont accouché à l'Hôpital de la Réserve des Sioux entre le 1er janvier 1969 et le 31 décembre 1972. L'accouchement d'un bébé de poids élevé a servi d'indice pour dépister le diabète. L'étude a aussi comparé chez les deux groupes de femmes les difficultés au moment de l'accouchement, puis les anomalies congénitales et l'ictère physiologique chez les deux groupes de nouveau-nés. Les auteurs discutent des résultats de l'étude dans l'optique de formuler une politique permettant de dépister le diabète gestationnel chez cette population d'Indiennes.

Key words: Native health, gestational diabetes mellitis, heavy-for-date newborns

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GESTATIONAL diabetes (GDM) is a class of diabetes mellitus (DM) in which glucose intolerance develops or is discovered through oral glucose-tolerance testing during pregnancy.[1] Obesity and multiparity are risk factors for GDM.[2] In Canada, obesity (as defined by the body mass index) is common among native Indians, and women in this group are heavier than other Canadian women at all ages.[3] High birth rates have also been documented among Native women.[2] Newborns of women with GDM are at risk for being heavy-for-date (HFD).[4] Native Indians have heavier newborns of both genders than have the general population of Canadian women, and roughly 6% of Native babies are HFD (i.e., greater than 4500 gm in weight).[2] Women with GDM may develop DM several years after giving birth.[1] DM is more common among male and female Natives than among other Canadians;[5] however, a valid comparison between these two populations is fraught with statistical limitations. DM is more frequent among women than men in these Indians.[5]

Despite these facts, little information is available on diabetes and pregnancy in Native Canadians. In particular, no one knows how frequently GDM occurs in this population. GDM may be common among these Indians, and this fact may explain, in part, why their newborns are so heavy, and why more of these women than these men have DM. Therefore, the object of this study is to see whether Native Canadian women with DM are more likely to have deliv-

Table 1a
Obsteric Difficulties in Women

Antepartum	Peripartum	Postpartum
Hemorrhage	Fetopelvic disproportion	Hemorrhage
Hydramnios		Infection
Premature or postmature labour	Malpresentation	Retained placenta and/or placenta parts
Premature rupture of membranes	Shoulder dystocia	

ered HFD newborns than are similar non-diabetic women. The study results are discussed in terms of formulating a policy to screen Native Canadians for GDM.

Methods

The study population was Native Cree-Ojibway Indians in northwestern Ontario who delivered their newborns at the Sioux Lookout Zone Hospital between January 1, 1969 and December 31, 1972; these newborns were also studied. The former date coincides with the introduction of visiting physicians' services co-ordinated by the University of Toronto Sioux Lookout Project.[6] Data were collected from the case-room records, and patients' charts were stored at the Zone Hospital.

HFD women gave birth to newborns with weights equal to, or in excess of, 4500 gm. These women were matched as closely as possible according to age (range: zero to six years) and parity (range: zero to seven) with non-HFD women whose newborns weighed less than 4500 gm. Newborns were matched exactly for gender. All but one pair of women gave birth within one month of one another. (The interval was five months for this pair.) Each woman and newborn was followed from the time of delivery until January 1, 1984 (range: 12 to 15 years). The diagnosis of DM was in accordance with the criteria proposed by the National Diabetes Data Group.[4] Pairs of women were compared according to the occurrence of obstetric difficulties (Table 1a) and the subsequent development of DM. Pairs of newborns were compared in terms of the presence or absence of congenital anomalies (Table 1b) and physiologic jaundice.

Results

Twenty-eight pairs of women and newborns were included in the study. Two eligible women with HFD newborns were excluded because no follow-up information was available. The mean age and parity of the HFD and non-HFD women were 27 years and four respectively. Absolute differences in age and parity between pairs of women are shown in Tables 2 and 3. The mean weight of HFD and normal-

Table 1b
Congenital Anomalies in Newborns

Congenital dislocation of the hip
Corneal opacification
Hydrocele
Ventricular septal defect

Table 2
Absolute Differences in Age Between Pairs of Women

Absolute Differnces in Age (years)	Number of Pairs
0–1	5
1–2	8
2–3	7
3–4	3
4–5	3
5	2

Note: Mean age (years) $\pm$ standard deviation (SD):
HFD Women = 27 ± 5
Non-HFD Women = 27 ± 6

($p > 0.10$, two-tailed t-test for paired samples, SD unknown, degrees of freedom (df = 27)(7).

Table 3
Absolute Differences in Parity Between Pairs of Women

Absolute Differences in Parity	Number of Pairs
0	9
1	8
2	6
3	2
4	2
≥ 5	1

Note: Mean Parity + Standard Deviation:
HFD Women = 4 ± 2
HFD Women = 4 ± 2

($p > 0.10$, two-tailed t-test)

Table 4
Development of Diabetes Mellitus

Women's Number Study ($n = 10$)	Delivery of an HFD Newborn	Subsequent HFD Newborns[a]	Latency (years)	Initial Management[b]
1	Y	Y(1)	12	D
3	Y	Y(1)	10	H
4	N	Y(2)	14	H
12	N	N	9	H
15	Y	Y(1)	12	H
16	N	N	6	I
23	Y	N	9	H
32	N	N	5	I
47	Y	Y(1)[c]	11	H
51	Y	Y(2)	12	H

a. Y = yes, N = no.
b. D = diet, H = oral hypoglycemics, I = insulin.
c. Had one previous HFD newborn.

Table 5
Relationship between Delivering a HFD Newborn and the Development of Diabetes Mellitus

HFD Women \ Non-HFD Women	DM	No DM	Total
DM	2 = a	4 = b	6 = a + b
No DM	2 = c	20 = d	22 = c + d
Total	4 = a + c	24 = b + d	28 = n

Note: Estimated Odds Ratio = $\frac{b^7}{c} = \frac{4}{2} = 2$

Chi-squared (x^2) = $\frac{(|b-c|-1)^2}{b+c} = \frac{(|4-2|-1)^2}{4+2} = 0.167$

(McNemar's test for paired samples)

Therefore $p > 0.10$ (df = 1)

weight newborns was 4703 and 3430 g respectively.

Ten of the 56 women studied developed DM; six of these women delivered HFD newborns, and four had newborns of normal weight (Table 4). The average interval between giving birth and the diagnosis of DM was 10 years. Four diabetic women who delivered HFD newborns were paired with non-diabetic women who delivered newborns of normal weight; two diabetic women who delivered newborns of normal weight were paired with non-diabetic women who delivered HFD newborns (Table 5). The estimated odds for a woman having delivered an HFD new born subsequently developing diabetes in comparison to her matched subject are two to one; however, this finding is not statistically significant ($p > 0.10$).[7]

No statistically significant difference was demonstrated in obstetric difficulties ($p > 0.10$) between discordant pairs of women nor in congenital anomalies and physiologic jaundice ($p > 0.10$) between discordant pairs of newborns (Table 6).

Discussion

It is estimated that GDM occurs in 1%–2% of pregnancies;[1] however, the

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Table 6
Comparison Between Pairs of Women and Newborns

i. Obstetric Difficulties
Comparison of Difficulties between Pairs of Women

HFD Women	Non-HFD Women: ≥1 Difficulty	No Difficulties	Total
≥1 Difficulty	7	7	14
No Difficulties	3	11	14
Total	10	18	28

Note: Estimated Odds Ratio = 2.3
$x^2 = 0$, $p > 0.10$

ii. Congenital Anomalies (CA)
Comparison of Complications Between Pairs of Newborns

HFD Newborns	Normal Weight Newborns: CA	No CA	Total
CA	1	3	4
No CA	3	21	24
Total	4	24	28

Note: Estimated Odds Ratio = .1
$x^2 = 0$, $p > 0.10$

iii. Physiologic Jaundice (PJ)

HFD Newborns	Normal Weight Newborns: PJ	No PJ	Total
PJ	5	2	7
No PJ	4	17	21
Total	9	19	28

Note: Estimated Odds Ratio = 0.5
$x^2 = 0.17$, $p > 0.10$

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prevalence of GDM in Native Canadians is unknown. The prevalence of GDM in Natives may be as high or higher because obesity and multiparity, both risk factors for GDM, are common among this group.[2] In this study the birth of a HFD newborn, a known complication of GDM,[4] was used to predict which women would develop DM, a condition that can follow GDM.[1]

The study was unable to show a statistically significant association between DM in women and the delivery of heavy-for-date newborns. Two main biases may have affected this outcome. First, an insufficient number of women may have been selected (i.e., type II error[8]). However, women could not have been entered any earlier into the study because no case-room records were available prior to 1969. Women could have been entered only after 1972 (average: seven to eight women per year) at the expense of the follow-up interval which, if shortened, might have lessened the chance of DM being detected. Secondly, not all women were followed for the same length of time (range: 12 to 15 years) but most women with GDM who go on to have DM will do so within five to 10 years of giving birth.[1]

Would screening for GDM in Native Canadians do more gccd than harm? Two points should be noted. First, several efficacious screening tests are available[9-11], and in a community-based screening program in Cleveland, 11% of the study entrants screened positive for GDM;[10] 27% of the positive screenees had GDM on subsequent oral glucose-tolerance testing (overall detection rate: 3%).[1] Secondly, dietary management of GDM, with or without the use of insulin, can prevent the associated harmful effects on the newborn.[1,2] The goal of detecting GDM through screening in these Indians, therefore, is to intervene nutritionally and medically so that related medical complications[4] that may befall newborns and their mothers can be prevented.

The study fails to show that women bearing HFD newborns have more obstetric difficulties or that HFD newborns experience more congenital anomalies or physiologic jaundice than their paired controls. However, these results are subject to the same biases mentioned above.

The success of a GDM screening program in Indians depends on several conditions being met. First, the screening test must be acceptable and available to pregnant women on the reserve. Screening is likely to be acceptable to most women, but not all of the reserve health-care workers (e.g., the community health representatives) have the knowledge and skills necessary to administer a test such as this. Secondly, accessible oral glucose-tolerance testing must be provided for positive screenees. To make this provision would be difficult, especially on remote reserves, owing to the inadequate training of many health-care workers and, also, to limited resources (e.g., medical supplies). Thirdly, health-care workers must be familiar with appropriate treatment strategies when GDM is detected, and sufficient health-care facilities must be available, if necessary, for proper therapy. Although some Indians could be treated at the Sioux Lookout Zone Hospital (e.g., if insulin is required), the former condition is hard to satisfy on the reserve because of the limited nutritional training and high turnover of health-care workers. Last, for such a program to succeed, women with GDM must comply with the advice and interventions that are offered to them. To achieve this goal is often impossible because of cultural and educational differences between Indians and health-care workers, and because of a shortage of adequate and appropriate foods.

Comments

In conclusion, this study fails to show a signficiant positive association between the development of DM and the delivery of a HFD newborn to a Native Canadian mother. In addition, women with HFD newborns do not experience more obstetric difficulties nor do their HFD newborns have more congenital anomalies and physiologic jaundice than paired controls. This latter finding fails to provide evidence that, if GDM were detected in these women through screening (and follow-up oral glucose-tolerance testing), a significant burden of perinatal disease that occurs in newborns and their mothers would be reduced through appropriate nutritional and medical intervention. If such a GDM screening program for Indians were introduced, it would probably be unsuccessful owing to an unstable and inexperienced pool of health-care workers, limited resources such as food and medical supplies, and cultural and educational barriers between Native Canadians and health-care workers in our own Canadian health-care system. ■

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