Original Article

Screening for gestational diabetes in pregnancy in Northwestern Ontario

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Abstract

Introduction: We estimate the screening and prevalence of gestational diabetes mellitus (GDM) in a primarily first nations obstetrical population in Northwestern Ontario.

Methods: The study is an 8-year retrospective analysis of all gestational glucose challenge and tolerance tests performed at the Sioux Lookout Meno Ya Win Health Centre (SLMHC) laboratory from 1 January, 2010 to 31 December, 2017. Test, gestational timing and completion rate of screening were recorded, and GDM prevalence was calculated on the tested population. Screening completion rates were recorded for the subset of women who delivered at SLMHC from 2014 to 2017.

Results: The average annual GDM prevalence was 12%, double the Ontario rate. Over the 8-year period, 513 patients were diagnosed with GDM among the 4298 patients screened. Patients were screened with the 2-step (90%) or the 1-step (10%) protocol. Screening occurred <20 weeks in 3%; 54% occurred in <28 weeks and 40% >28 weeks. Seventy percent of the tests were from remote nursing stations. The screening completion rate for women delivering at SLMHC in 2017 was 80.8%.

Conclusion: The prevalence of GDM in Northwestern Ontario is twice the provincial rate. Most screening used the 2-step protocol; early screening was underused. Improvements in screening programming are underway and future research may match surveillance rates and results to GDM outcomes.

Keywords: Gestational diabetes mellitus, screening, pregnancy

Résumé

Introduction: Nous estimons le dépistage et la prévalence du diabète gestationnel au sein d'une population obstétrique composée principalement de femmes des Premières Nations du Nord-Ouest de l'Ontario.

Méthodologie: Il s'agissait d'une analyse rétrospective de 8 ans de toutes les épreuves d'hyperglycémie gestationnelle provoquée et de tous les tests de tolérance au glucose effectués au laboratoire *Sioux Lookout Meno Ya Win Health Centre* (SLMHC) entre le 1er janvier 2010 et le 31 décembre 2017. Le nombre de tests, le moment de la grossesse et le taux d'achèvement des tests de dépistage ont été consignés, et la prévalence du diabète gestationnel a été calculée dans la population testée. Le taux d'achèvement des tests de dépistage du sous-groupe de femmes ayant accouché au SLMHC entre 2014 et 2017 a aussi été consigné.

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Résultats: La prévalence annuelle moyenne de diabète gestationnel était de 12 %, soit le double de celle de l'Ontario. Durant les 8 ans qu'a duré l'étude, 513 patientes ont reçu un diagnostic de diabète gestationnel parmi les 4298 patientes soumises au dépistage. Le protocole à 2 étapes ou à 1 étape a servi au dépistage chez les patientes, à raison de respectivement 90 et 10 %. Le dépistage a eu lieu à < 20 semaines chez 3 %; à < 28 semaines chez 54 % et à > 28 semaines chez 40 % des patientes. Soixante-dix pour cent des tests ont été effectués dans des postes éloignés de soins infirmiers. Le taux d'achèvement du dépistage chez les femmes ayant accouché au SLMHC en 2017 était de 80,8 %.

Conclusion: La prévalence de diabète gestationnel dans le Nord-Ouest de l'Ontario est le double du taux provincial. La plupart des tests effectués ont eu recours au protocole à 2 étapes; le dépistage précoce était sous-utilisé. L'on tente actuellement d'améliorer les programmes de dépistage, et de plus amples recherches pourraient documenter le taux de surveillance et approfondir notre compréhension des issues liées au diabète gestationnel.

Mots-clés: Diabète gestationnel, dépistage, grossesse

INTRODUCTION

Diabetes in pregnancy includes pre-gestational diabetes mellitus (PGDM) and GDM. Screening for newly diagnosed diabetes in pregnancy (GDM) is clinically challenging. Rural obstetrical programmes serving indigenous populations face unique difficulties. Indigenous obstetrical populations experience higher rates of diabetes and associated complications.[1-8] Rural obstetrical programmes serving this population need to pay diligent attention to diabetes screening in pregnancy.

We reviewed GDM criteria from 2006 to 2018, as published by the Society of Obstetricians and Gynecologists of Canada; Diabetes Canada (formerly Canadian Diabetes Association) and the International Association of Diabetes and Pregnancy Study Groups (IADPSG)[9-12] [Table 1]. Screening for diabetes in pregnancy has evolved. There are currently two approaches to GDM screening. Diabetes Canada identifies the "preferred" 2-step approach as a non-fasting 1-h 50-g glucose challenge test (GCT), followed if needed by a fasting 2-h 75-g oral glucose tolerance test (OGTT).[7,11] With this common strategy, the 50-g GCT can be diagnostic if results are very elevated, ≥11.1 (was ≥10.3 until 2013). Indeterminant 50 g results (7.8–11.0 mmol/L) require a diagnostic 75 g OGTT.

In 2013, a 1-step "alternate" strategy was added, consisting of going directly to a fasting 75 g OGTT. This diagnostic standard was developed by the IADPSG Consensus Panel in 2010 and identifies additional patients who are at diabetes-related risk during pregnancy.[10] We note that a 2014 Cochrane review did not find evidence to support either universal screening or a specific diagnostic/screening protocol.[13]

The same 75-g OGTT is performed in each protocol, but they have slightly different reference ranges if performed as part of a 1-step or 2-step approach, further complicating diagnosis [Table 1]. It is common practice for laboratories to use the 2-step reference range for both (personal communication, LK).

The timing and population indicated for testing was discretionary before 2013, but subsequently includes universal screening at 24–28 weeks and first-trimester screening of high-risk patients, a category which includes indigenous patients. Early screening allows the identification of overt diabetes, which carries increased risk for congenital anomalies and stillbirths [Table 1].[8,10]

Table 1: Diagnostic and testing criteria for gestational diabetes mellitus

	2-step (50/75)			1-step (75)	Screening	
	50-g GCT	50 g→75 GCT/OGTT	75 g OGTT	75 g OGTT	Population, timing	Protocol
2006-2012	≥10.3	7.8-10.2	≥5.3/10.6/8.9	N/A	High risk, 24-28 weeks	2-step
2013-2018	≥11.1	7.8-11.0	≥5.3/10.6/9.0	≥5.1/10.0/8.5	Low risk: 24-28 weeks; High risk 1st trimester	1-step or 2-step

GCT: Gestational diabetes screen, OGTT: Oral glucose tolerance test, 75 g OGTT values: ≥fasting/1 h/2 h, N/A: Not applicable

This study estimates the prevalence of GDM and the screening completion rate, gestational timing and screening protocol use in Northwestern (NW) Ontario.

METHODS

Setting

Regional GDM screening data (1 January, 2010–31 December, 2017) were collected from the Sioux Lookout Meno Ya Win Health Centre (SLMHC). The SLMHC laboratory processes all regional in-patient and out-patient testing for 26 remote First Nations nursing stations and the town of Sioux Lookout. The catchment population is 29,015, with 85% of residents living in remote communities.[14] The regional birth rate is double the provincial rate (19.5 vs. 10.2/100,000); 70% of regional patients deliver at SLMHC.[4] The screening and GDM prevalence estimates are regional, including the prenatal testing of the 30% of northern women who delivered at other facilities (Thunder Bay, Winnipeg).

Gestational diabetes mellitus testing

Laboratory records were accessed for all GDM testing performed at SLMHC, including those from remote nursing stations. All 50-g GCTs and 75-g OGTTs were manually reviewed independently by two researchers (LK, JP). The timing of screening was calculated retrospectively for the 3-year period (2014–2017) based on the date of delivery of the infant, assuming this to be on an average 39 weeks.[11] A sample year (2017) was chosen to estimate the proportion of screening tests performed in a nursing station. The same year was used to document the screening rate for the subset of women who delivered at SLMHC. Follow-up testing was assessed for 2014–2018 from a limited laboratory data set accessed electronically for that purpose. The delivery date was used for estimating the gestational timing of testing. Ethics approval was granted by the SLMHC Research Review and Ethics Committee.

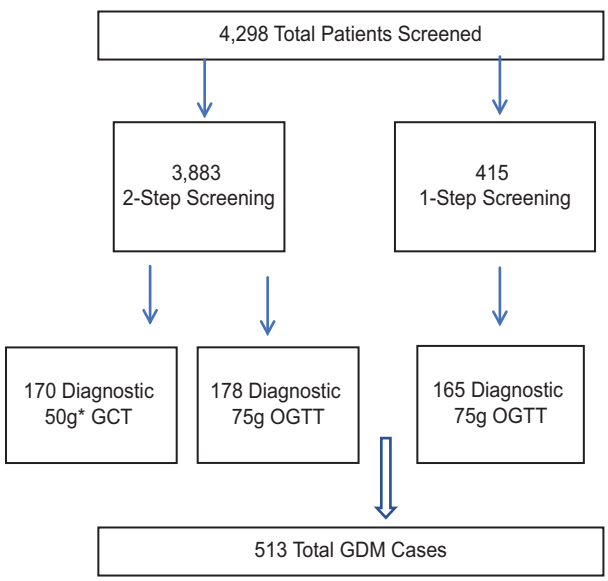


Figure 1: Gestational diabetes mellitus testing and outcomes Sioux Lookout Meno Ya Win Health Centre catchment area 2010–2017. *2010–2013 ≥10.3; 2013–2018 ≥11.1.

RESULTS

Prevalence

Over the 8-year period, 4298 patients were screened for GDM through the SLMHC laboratory: 3883 (90%) with a 2-step approach and 415 (10%) with a 1-step [Figure 1]. A majority of the tests performed in 2017 (70%, 325/467) were for patients receiving screening and prenatal care in remote nursing stations.

GDM was diagnosed in 513 patients. Sixty-eight percent of GDM cases were diagnosed with the 2-step approach; 32% with a 1-step [Figure 1].

The annual prevalence ranged from 8% to 17%, with a mean of 12% [Figure 2]. The screening rate for the 421 women who delivered at SLMHC in 2017 was 80.8% (344/421).

50-g glucose challenge test

Most 50-g GCTs were negative (91%). When the diagnostic threshold was increased from ≥10.3

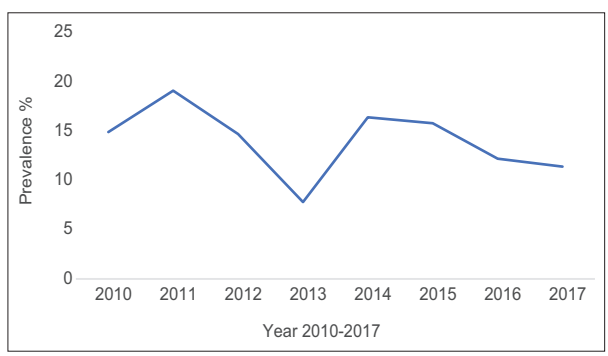


Figure 2: Annual gestational diabetes mellitus prevalence in Sioux Lookout Meno Ya Win Health Centre catchment area 2010–2017.

to ≥11.1 in 2013, the diagnostic contribution of the 50-g GCT decreased from 95 (2010–2013) to 75 cases (2014–2017). Of the 756 patients with an indeterminant 50 GCT in the 2-step protocol, 539 patients had the required g OGTT follow-up test (71%).

75-g glucose tolerance test

The SLMHC laboratory follows the common practice of using the reference range for the 2-step protocol for all 75-g OGTTs [Table 1]. The 1-step protocol has a lower diagnostic threshold, increasing the number of diagnoses. We, therefore, retrospectively estimated GDM prevalence using the appropriate 1- or 2-step diagnostic range for each 75-g OGTT. Using the 1-step reference range for a 75-g test done in that protocol, GDM diagnoses increased by 17% (243–284), versus using the 2-step diagnostic thresholds for all 75-g OGTTs. The 1-step 75-g OGTT had a high case yield, with 40% (165/415) being diagnostic.

Timing of screening

Until 2013, testing was recommended at 24–28 weeks; following that, high-risk patients were recommended to have earlier screening. In the 4 years following that recommendation, only 3% (58/1951) had screening <20 weeks; 20 of these 58 early tests were 1-step 75-g OGTTs. Testing occurred before 28 weeks in 54% of the tested population, and at >28 weeks in 40% [Table 2].

Post-partum screening

Follow-up testing up to 9 months post-partum to detect residual or transition to type 2 diabetes mellitus (T2DM) occurred in 18% of the 2014–2018 GDM cases (32/183), 56% of whom were screened with an A1C.

DISCUSSION

The GDM prevalence in this region of NW Ontario is a mean of 12%, double the 6% provincial rate.[15] This is not surprising given this is a primarily First Nations population, with known high rates of diabetes.[16-18] While this is higher than the general population, it is equivalent to the 11.7% found in James Bay Cree communities in northern Quebec, but higher than in Alberta and Manitoba First Nations studies (6%–7%).[3,5,6,19]

The prevalence of GDM screening for the 421 women who delivered at SLMHC in 2017 was 80.8%. This compares favourably with provincial and international rates of 68%–94%.[20-23]

Over the 8-year period, 90% of GDM screening used the 2-step approach. The 50-g GCT was negative in 91% of patients, supporting its effectiveness as an initial screen and obviating the need for further testing. A surprisingly large number of GDM cases (170) with very high glycaemic levels were diagnosed at the initial 50-g GCT, which is generally considered a screening, rather than diagnostic test.[20] The limited follow-up (71%) of indeterminant 50-g GCT with a 75-g OGTT is concerning. There are limited comparative data. A province-wide 2016 Alberta study found a 95% follow-up rate, while an earlier study conducted in Hamilton, Ontario, documented rates of 36%.[20,24]

The 1-step protocol was applied in 10% of screening. The 40% case yield associated with 1-step testing is not surprising, as it was used to diagnose clinically 'expected' GDM. It is also in keeping with the known literature where the 'stricter' standard of the IADSGP 1-step criteria produces higher GDM estimates.[25]

Since 2013 early screening of high-risk patients has been recommended.[11] Most of the regional pregnancies in this study would be identified as

Table 2: Gestational timing of diabetes screening in pregnancy 2014-2017

	2014, *n* (%)	2015, *n* (%)	2106, *n* (%)	2017, *n* (%)	Total 2014-2017, *n* (%)*
<20 weeks	13 (3)	18 (4)	17 (4)	10 (2)	58 (3)
20-23 weeks	43 (9)	22 (5)	18 (4)	29 (6)	112 (6)
24-28 weeks	241 (48)	226 (46)	219 (45)	199 (43)	885 (45)
>28 weeks	183 (36)	193 (39)	207 (42)	187 (40)	770 (40)
Data unavailable	25 (5)	32 (7)	31 (6)	38 (8)	126 (7)
Total	505	491	492	463	1951 (100)

*Missing data: *n* (%)=126 (7)

'high risk' (indigenous heritage). Early screening is generally defined as <20 weeks, the standard used in this study.[12] The uptake of early screening has been poor in this programme at 3%.

Even by low-risk testing protocol (24–28 weeks) standards, only 54% of screening occurred before 28 weeks. There are many practical considerations involved in the regional delivery of prenatal care, including the initiation of GDM surveillance. Most prenatal bloodwork (70%) is initiated at remote nursing stations, where protocols recommended the pre-2013 screening at 24–28 weeks. A review of protocols is underway and earlier screening (1 or 2-step), will be integrated into early prenatal care. These changes should improve rates of early screening as the majority of patients would be considered at high risk of developing GDM. A 50-g GCT, with its high negative predictive value, has a role, even in this high-risk population. The balance between 1-step or 2-step approaches will evolve. The 2-step approach can be effective in ruling out GDM; the 1-step in ruling it in and identifying GDM at lower levels of hyperglycaemia. Capacity and practicality will affect the development of screening practices in this complex social and geographic environment.

Follow-up screening is recommended for GDM patients at 6–36 weeks post-partum.[12] Our rate of 18% at 9 months is suboptimal. Compliance may improve with the increasing use of the less sensitive, but more practical A1C, rather than the recommended OGTT.[12]

The optimal GDM screening strategy for a population considered high risk, living in remote communities, remains unspecified but should include early screening, with repeat testing later in the pregnancy, as needed. Future prospective regional research might clarify the association of diabetes screening and treatment on maternal and neonatal outcomes in this population.

Gestational diabetes is commonly identified as an important contributor to overall population-based T2DM; it is believed to affect the subsequent development of diabetes in both mother and child.[26,27] Given the significant diabetes-associated burden of morbidity and mortality in First Nations populations, attention to its occurrence in pregnancy warrants vigilance.

Limitation

This study relied on laboratory results of SLMHC-tested patients. The prevalence of denominator is limited to this population, excluding untested patients. We used the date of delivery for establishing the time of screening, as the estimated date of birth data was not consistently available.

CONCLUSION

The is a high prevalence of gestational diabetes in the First Nations population of NW Ontario. Most screening in this study used the 'preferred' Canadian 2-step approach; early diabetes screening in pregnancy is underused. Future research might clarify optimal testing, treatment and outcomes in this population.

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Conflicts of interest: There are no conflicts of interest.

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