Article

Assessment of screening practices for gestational hyperglycaemia in public health facilities: a descriptive study in Bangalore, India

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Significance for public health

Rising burden of hyperglycaemia in pregnancy is a cause for concern and is associated with short and long term deleterious consequences for mother and offspring. Hence, there is an urgent need to explore the screening practices for gestational hyperglycaemia (GH). The current study considers patient and doctors' perspectives regarding GH screening. The results from our study indicate several issues during screening of gestational hyperglycaemia in public health facilities in Bangalore, India. These included low awareness levels among doctors, lack of standard operating procedures and lack of adequate care and attention provided to pregnant women. Re-orientation trainings of the doctors within public health facilities can improve their knowledge and thereby can efficiently screen for GH. Further, adequate planning and preparation of the patient prior to the tests can help ensure successful completion of the tests. The findings of the study are comparable with the practices of public health hospitals in India.

Abstract

Background. Screening and timely treatment of gestational hyperglycaemia (GH) is proved to be beneficial and improves maternal and foetal health outcomes. To understand screening practices, we explored the knowledge and perceptions of doctors working in public health facilities in Bangalore, India. We also studied participation factors by examining whether undergoing glucose estimation tests affects morning sickness in pregnant women.

Design and Methods. We aimed to understand the screening practices and knowledge of doctors. A semi-structured questionnaire was self-administered by the 50 participant doctors, selected from the sampling frame comprising of all the doctors working in public health facilities. We included 105 pregnant women for baseline assessment, in whom a well-structured questionnaire was used.

Results. We reported that gestational diabetes mellitus (GDM) screening was done in nearly all the health centres (96%). However, only 12% of the doctors could provide all components of GDM diagnosis and management correctly and 46% would diagnose by using a random blood glucose test. A majority (92%) of the doctors had poor knowledge (68%) about the cut-off values of glucose tests. More than 80% of pregnant women experienced some discomfort mostly due to rapid ingestion glucose in short span of time.

Conclusions. Our study established that screening for GH is done in most public health facilities. Nonetheless, knowledge of doctors on the glucose tests and their interpretation needs improvement. Re-orientation trainings of the doctors can improve their knowledge and thereby can efficiently screen for GH. Further, adequate planning prior to the tests can aid successful completion of them.

Introduction

Nearly 67 milion people live with type 2 diabetes mellitus in India, with another 30 million in the pre-diabetes group in the year 2013, and it is projected that this number will rise to 70 million by 2025.[1,2] In addition to other reasons, gestational hyperglycaemia (GH) contributes to the rising burden of diabetes.[3-6] The prevalence of GH in India varies from 3.8 to 21%.[7-10] Gestational hyperglycaemia can lead to an elevated risk of adverse pregnancy and foetal outcomes including maternal and perinatal mortality.[11] In early pregnancy, it can result in birth defects, often affecting major organs and an increased rate of miscarriage.[12] During the second and third trimester, GH can lead to over-nutrition and excess growth of the baby, thereby increasing the risk of adverse outcomes during labour and delivery.[13] Although GH usually resolves following birth, both mother and child are at higher risk of premature onset of type II diabetes.[12]

It is important to screen pregnant women to facilitate safe pregnancy and delivery. However, there is no consensus on whether universal or high-risk approach should be followed for screening GH. The Canadian Diabetes Association and U.S. Preventive Services Task Force recommend that all asymptomatic women are screened at 24-28 weeks gestation.[14] However, the American College of Obstetricians and Gynaecologists, the Society of Obstetricians and Gynaecologists of Canada, and the U.K. National Institute for Health and Clinical Excellence (NICE) recommend routine risk factor-based screening.[15,16] Further, NICE recommends that early screening and strict control of blood glucose is essential for better health outcomes.[12,17]

Diabetes in Pregnancy Study Group India (DIPSI) recommends a single step procedure of examining a venous blood sample two hours following 75 g oral glucose load.[18] Unlike the Oral Glucose Tolerance Test (OGTT), the DIPSI guidelines don't recommend collection of a fasting sample. However, it is unclear whether these guidelines are followed in primary care settings. Karnataka State provides free comprehensive health care and services to 64.1 million of people and hence provides the best opportunity to study the implementation of GH screening in primary care settings.[19] According to District Level Health Survey (DLHS IV), utilisation of government health services for com-

plete antenatal care (ANC) check-up in Bangalore was 59%, with 99.6% of the pregnant women completing at least one check-up in any public health facility in Bangalore.[21,22] In a study done by Shobhana *et al.* in south India, they found that patients in a low-income group spend as much as 25% of their income for diabetes-related care in private hospitals.[23] Despite providing free treatment to everyone, there are limited studies to document the screening and treatment practices in public health hospitals.

It is reported that pregnant women in India are at 11 times increased risk of having glucose intolerance during pregnancy compared to Caucasian women.[24,25] There is convincing evidence that Indian mothers are susceptible to gestational hyperglycaemia at younger age and at relatively lower BMI compared to the white Caucasians.[26] Furthermore, the available evidence indicates that the prevalence of GH is higher in urban areas as compared to rural areas.[4,8,18,27] With increasing proportion of urban population in India and corresponding increase in prevalence of gestational hyperglycaemia, it is imperative to understand the existing screening practices during pregnancy in urban areas.[8,18,25,28] However, earlier studies were done either in community settings or in hospital based settings. To our knowledge, we did not find any evidence about the existing screening practices in the Government run primary care settings in urban areas. Therefore, we explored the current screening practices in public health facilities, as the inferences would help in arriving at scalable recommendations for practice in India.

We carried out this study in the city of Bangalore, governed by Bruhath Bangalore Mahanagara Palike (BBMP) consisting of 198 wards with population of nearly 11 million. The public health facilities of BBMP include 6 tertiary care hospitals and 70 health centres. Additionally, link workers carry out outreach work in the field areas. The public health facilities in BBMP offer ANC services to nearly 50,000 women every year, mostly in maternity Homes and about half of these women deliver in these institutions. Hence, public health facilities provide an ideal opportunity to explore the existing screening practices in the city of Bangalore. The objectives of the study were to i) identify the practices employed by public health facilities for the screening and diagnosis for GH; ii) assess the knowledge level of doctors about GH screening by glucose estimation tests; and, iii) explore whether the procedures for glucose tolerance tests result in worsening morning sickness. The study was done from 10th April 2014 to 14th June 2014.

Design and Methods

Gestational hyperglycaemia screening practices in public health facilities

The sampling frame comprised of the 70 health centres in BBMP. We invited 70 doctors from the health centres in BBMP to participate in the study. Fifteen doctors could not participate in the study due to their non-availability and 5 doctors refused to participate, leaving a total of fifty doctors who participated in the study. All doctors were asked questions about how the screening for GH is done in the health centres. The questionnaire also sought responses on the general profile of ANC registration, number of ANC registrations done in the year 2013, trimester in which ANC registration was done, health staff responsible for the ANC check-up, number of GH diagnosed in the year and health staff doing the follow-up of pregnant women (Appendix).

Knowledge of doctors about gestational hyperglycaemia screening

A convenience sample of 50 doctors working in the BBMP hospitals was employed for assessing their knowledge on GH screening. The eligibility criterion was that doctor should be working in BBMP and should be doing ANC registration in their health centres. A semi-structured questionnaire was self-administered by the doctors who volunteered and consented to participate in the study. We maintained confidentiality by not recording the name of doctor or health centre. Questions to assess the knowledge of GH in doctors sought were the general understanding of doctors regarding Gestational Diabetes Mellitus (GDM), routine tests done for assessing GH in pregnant women in their health centres, how they manage GH during pregnancy and post-partum period including follow-up.

User associated perspectives

We conducted in-person interviews of pregnant women in a BBMP referral hospital with a high load of ANCs and deliveries. Based on the available information in public health facilities, the proportion of GH was around 3-4%.[8,18,21] With the hypothesised 4% of the GH in the population, and design effect of 1.5, the sample size required for 95% confidence limits was 89.[29] By assuming a refusal rate of 15% in the reference population, the sample size required was 102. Sample size calculations were done using the OpenEpi software, version 3.[30] Using purposive sampling, we included 105 pregnant women in the assessment. A structured interview was administered to collect data pertaining to their socio-economic status, pregnancy symptoms, and difficulties faced (if any) during the glucose estimation tests (Appendix).

Ethical considerations

The identity of the participants was kept anonymous and no names or other personal identifying information were collected from the participants. The study was reviewed and ethical approval was obtained from Institutional Ethics Committee, Indian Institute of Public Health-Hyderabad, (IIPH-H), Bangalore campus. Written informed consent was obtained from all the participants (Appendix). Administrative approval was taken from the office of the chief health officer of BBMP.

Data analysis

The collected information was compiled and entered in Microsoft excel work sheet and analysed using SPSS (statistical package of social science, IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, New York: IBM Corp). We analysed the knowledge and practices about GDM among doctors by giving a score of 3 as excellent, 2 as good, and 1 as fair. The knowledge was assessed by providing three correct choices as components of general understanding of doctors of gestational diabetes. For example, the question on general understanding of doctors on gestational diabetes included the following choices: i) is present during pregnancy; ii) disappears once baby is born; iii) may lead to permanent type 2 DM later in life; iv) is not very serious and v) I don't know. Each correct choice got a score of 1 point, thereby if the doctor provides all the three correct choices would score 3 (excellent). Similarly, two correct choices got a score of 2 (good) and at least one correct answer as fair. The scoring pattern was decided ahead of the plan for data analysis, third author did coding and the final scoring was cross-cheeked by the primary author. The prevalence of GDM was calculated by dividing number of GDM cases by the total number of women registered for ANC and expressed as percentages.

Results

Gestational hyperglycaemia screening practices in public health facilities

In the current study, 50 out of 70 doctors of BBMP participated, with participation rate of 71%. Antenatal care registration was done in all the centres, and about 40% of ANC check-ups were registered in the 1st

trimester. About 72% of the doctors did ANC themselves, while a separate register was maintained for GH in 22% of health centres (data not shown). Based on the reported information from the doctors, the prevalence of GDM in our study was less than 1% (data not shown). Also, 28% of the pregnant women with GDM came for follow-up. The number of ANC registration done per health centre in the year 2013 was 487. Among the health centres, 70% had laboratory facilities, which predominantly carried out pregnancy confirmation test, random blood glucose (RBG) and blood grouping (Table 1). The most common GH screening test employed by the health centres in BBMP was RBG (46%) (Table 2). Ninety-six per cent of centres conducted GH screening, suggesting universality. More than half of the doctors (52%) stated that screening would be done during 16-24 weeks, ignoring the recommended gestational age of 24-28 weeks (Table 3).

Knowledge of doctors about gestational hyperglycaemia screening

Twelve per cent of doctors could correctly provide the answers regarding general understanding of GDM, while 22% could get most of the elements (but not all components) of the disease. Additionally, 50% of them knew how to manage GDM, 20% had knowledge on post- pregnancy management of GDM, and 92% had knowledge about counselling

Table 1. Knowledge of doctors in public health facilities of Bangalore regarding screening of gestational hyperglycaemia, 2014.

Parameter	Number	%
Presence of laboratory facility		
Yes	35	70
No	15	30
Routine tests done in the Centre		
Pregnancy test	33	66
RBG	33	66
Blood grouping	32	64
Scanning	12	24
Others	55	110
Routine tests done outside the Centre		
Hb%	11	22
Blood grouping	8	16
HIV	6	12
HbsAg	14	28
Ultrasound	39	78
Others	32	64
Understanding of gestational diabetes		
Excellent	6	12
Good	11	22
Fair	31	62
Indeterminate	2	4
Knowledge of GDM management		
Excellent	25	50
Good	23	46
Indeterminate	2	4
Knowledge on post-pregnancy management of GDM		
Excellent	10	20
Good	40	80
Counselling of women with GDM for exercises and LSM		
Excellent	43	86
Fair	3	6
Poor	4	8

RBG, random blood glucose; HB%, blood haemoglobin percentage; HIV, human immunodeficiency virus; HbsAg, hepatitis B serum antigen; GDM, gestational diabetes mellitus; LSM, lifestyle modifications.

Table 2. Diagnosis of gestational diabetes mellitus in public health facilities by Doctors, Bangalore, 2014.

Parameter	Number	%
Test done for GDM diagnosis within health facility		
RBG	23	46
FPG	9	18
PPBG	6	12
OGTT	22	44
GDM diagnosis using FPG		
No	28	56
Yes	22	44
Cut-off of FPG for GDM diagnosis		
Good knowledge	16	32
Poor knowledge	34	68
GDM diagnosis using RBG		
No	30	60
Yes	20	40
Cut-off of RBG for GDM diagnosis		
Good knowledge	4	8
Poor knowledge	46	92
GDM diagnosis known*		
No	2	4
Yes	40	96
Amount of glucose to be given*		
100 gs	4	8
50 g	9	18
75 g	37	74
Recommend interval to test blood glucose*		
½ hr, 1 hr, 2 hrs	21	42
1 hr, 2 hrs, 3 hrs	29	58

GDM, gestational diabetes; RBG, random blood glucose; FPG, fasting plasma glucose; PPBG, post prandial blood glucose; OGTT, oral glucose tolerance test. *Diagnosis of GDM by Doctors using OGTT.

Table 3. Screening of gestational hyperglycaemia in public health facilities, Bangalore, 2014.

Parameter	Number	%
Proportion of centres doing GDM screening		
Yes	48	96
No	2	4
Screening beneficiaries		
All pregnant women	41	82
Only high risk	6	12
Only if doubtful	3	6
Risk factors for screening		
Obesity	41	82
Type 2DM in first degree relative	38	76
History of glucose intolerance	36	72
Previous infant with LGS	13	26
Age >35 years	17	34
Gestational age for screening		
16-24 wks	26	52
24-28 wks	8	16
28-32 wks	16	32

GDM, gestational diabetes; type 2DM, type 2 diabetes mellitus; LGS, large for gestational age.

of women with GDM for exercises and lifestyle modifications (Table 1).

Despite being the gold standard for diagnosis of GDM, the majority of doctors had poor knowledge on OGTT and even for the cut-off value of RBG and fasting plasma glucose (FPG). On the diagnosis of GDM, only 32% of the doctors had good knowledge of cut-off values of FPG for diagnosis of GDM (≥126 mg/dL) and 92% were not aware of the cut-off value of RBG (≥200 mg/dL). On diagnosis of GDM using OGTT, 96% of doctors said they used OGTT, but 42% had poor knowledge about the recommended interval of 1hr, 2hrs and 3hrs to collect blood samples for glucose testing (Table 2).

About 68% of participants said that they conducted deliveries in their health centres and do postpartum DM screening for 54% of the cases (Table 4). Mostly, FPG was used to detect DM and it was generally done during 6 weeks postpartum. The majority of the doctors reported that they provided counselling to the women for risk of GDM in next pregnancy and also the risk of type-2 DM (Table 4).

User associated perspectives

Among the pregnant women interviewed (n=105), more than half of them were in their 2nd trimester. A vast majority (90%) of them self-reported as healthy and claimed they are free from any co-existing illness. Most of them (82%) resided in areas surrounding the hospital. Less than half of the women had studied till high school and 6% were graduates. Ninety percent of the women were housewives. Fifty-six percent had a total family income of 5000-10,000 Indian national rupees per month, while 15% had more than 15000 per month in income.

The unwanted side effects of GH testing included nausea, vomiting, fainting and giddiness were more common during OGTT compared to those who were subjected to RBG or FPG. Most of the RBG or FPG tests were uneventful with only a few experiencing fatigue, nausea, vomiting, or giddiness in pregnancy. With respect to the OGTT, the results indicated that more than 80% of women experienced some form of uneasiness (mostly fatigue), nausea, vomiting, or giddiness during the procedure (data not shown).

Discussion

Our study reported the prevalence of GH in public health facilities as less than 1%. This may be an underestimate when compared to available evidence in India of 3.8 to 21%.[6,31] In another study, the overall prevalence of GDM was 12% in Bangalore.[8] The variation may have occurred due to discrepancies in protocols for screening and diagnosis. Such underestimation can be due to several reasons. Firstly, there is limited knowledge of GH screening among doctors and they are unaware of performing and interpreting the test results. It is important to stress the need of screening and create system-wide opportunities for referring pregnant women to be tested at health facilities. Secondly, the lack of standard protocols and lack of necessary consumables and equipment may pose major challenges. Thirdly, many health facilities are understaffed and the available staff have many other tasks and diseases to address and therefore difficult to prioritize GH screening. All the centres do not have a working laboratory. Among the centres, which had a lab facility, the tests done were mainly RBG and not confirmatory methods of GDM. It is important that screening and early detection of hyperglycaemia is done so that it can aid in lifestyle modifications in pregnant women and thereby reduce future risk of DM. The other reasons for variation in prevalence of GH throughout the Indian subcontinent can be due to varied access to care and changes in risk factors in different geographic regions.[32]

The knowledge about GDM among health professionals of BBMP was relatively poor with only 12% of the doctors knowing all the components of GDM correctly. In India, it is reported that lack of awareness among general practitioners results in the poor quality of care.[2] Responding to similar results including the work of Seshiah and colleagues, the state of Tamil Nadu adopted the universal screening of all pregnant women for GDM from 2008. A milestone was achieved in 2011 with the Indian Ministry of Health introducing free screening for GH among the five services offered to pregnant women below the poverty line in the National Rural Health Mission (NRHM). Our study is in conformity with the evidence underscoring an urgent need to strengthen and equip infrastructure in public health facilities in order to conduct and ensure uneventful universal screening. This should include rearrangement of space and personnel within the public health facilities. Many do not meet the basic requirement of having a cot or a bed, which is needed for drawing blood samples in the supine position. Besides, for OGTTs in particular, women should be closely monitored to ensure that the test is conducted properly. The RBG and FPG are the most routinely employed tests to help detect blood glucose levels in public health facilities. Most public health facilities prefer RBG or FPG as a routine screening test for every pregnant woman and the BBMP hospitals were no exception. However, even when RBG was used in the health centres for screening GH, 92% of doctors had poor knowledge about the cut-off values for the diagnosis of GDM. Nearly half of the doctors could not define the cut-off value of FPG, OGTT, or the recommended interval for blood testing in the OGTT for the diagnosis of GDM.

The results of this current study also provide also two important quality issues to minimize adverse events while performing screening for GH. Firstly, the blood samples drawn from a pregnant woman while in the sitting position invariably cause hypotension, which may subsequently trigger giddiness, fainting, nausea, and vomiting. Secondly, the intake of 75g of glucose can rapidly result in nausea and other discomfort. Nausea and emesis in early pregnancy is a common phenomenon

Table 4. Practices of health staff during post-partum counselling in public health facilities, Bangalore, 2014.

Parameter	Number	%
Proportion of deliveries conducted in health centre		
No	16	32
Yes	34	68
Post-partum DM screening		
No	23	46
Yes	27	54
Test used for post-partum screening		
RBG	7	14
FPG	18	36
PPBG	9	18
OGTT	10	20
Time at which post-partum screening is done		
6 weeks post-partum	23	85.2
Yearly post-partum	4	14.8
Counselling on risk of GDM in next pregnancy		
No	5	10
Yes	45	90
Counselling on risk of Type2 DM		
No	3	6
Yes	47	94
Risk of Type 2 DM in child		
No	11	22
Yes	39	78
Counselling		
Diet	40	80
Exercise	41	82
Follow up blood sugar level	48	96

DM, diabetes mellitus; Type 2 DM, type 2 diabetes mellitus; GDM, gestational diabetes; RBG, random blood glucose; FPG, fasting plasma glucose; PPBG, post prandial blood glucose; OGTT, oral glucose tolerance test.

affecting between 50% and 70% of pregnant women, but little is known about the aetiology and possible function of this common and often incapacitating condition. Seventy-four per cent of women reported nausea lasting a mean of 34.6 days.[33] *Morning sickness* occurred in only 1.8% of women, whereas 80% reported nausea lasting all day. Only 50% of women were relieved of nausea by 14 weeks' gestation; 90% had relief by week 22.[34] Most pregnant women experience nausea or vomiting some time during their pregnancy, with some estimates as high as 90%.[35] In any one week of early pregnancy we found that between 30 and 40% of women experienced nausea either all the time or at least once a day.[36] Estimates for the most severe form of nausea and vomiting are as high as 1.5%.[37] Though most pregnant women do not have side effects from the OGTT per se, some feel nauseated, sweaty or light-headed during the test, especially during the drawing of blood samples or before or after they drink the glucose solution. This poses a challenge to conduct the test. However, for various studies involving these tests, there is no sufficient evidence on whether or not the OGTT are triggering these side effects in pregnant women. The current study suggests that to ensure smooth completion of the tests, it is important to provide pregnant women with a comfortable place to lie down. Additionally, doctors may need to allay fears of needle-pricks during the procedure and ensure that the glucose solution is taken in as much time as 5 minutes.

In the state of Tamil Nadu, occasions such as maternity picnics and bangle ceremonies conducted at primary health centres are utilized for group counselling and other educational activities on GH for pregnant mothers.[9] The screening for glucose intolerance during pregnancy is not done routinely and probably the undiagnosed glucose intolerance has resulted in the increased prevalence of DM in India. This is disturbing, since GH has a far-reaching consequence in predisposing offspring to glucose intolerance. This observation was substantiated and documented in Pima Indians.[38] Hence as a policy to identify GH and its consequences on the infant, a 75g OGTT has been recommended to all women in the population during the third trimester of pregnancy.[38]

Taking care of women with GH is the first step in the primary prevention of later diabetes. Additionally, one study suggests that the cumulative risk of offspring developing type 2 DM was 30% at the age 24 yrs.[39] Our study had some limitations. The response rates of the doctors could have been better. One of the predominant reasons for this might be reluctance to allow researchers to evaluate their knowledge of medical care. Further, our study was not powered to detect and report on the determinants of GH screening at public health facilities. Instead, we provide information that may be used to generate hypotheses and lead to additional studies. Additionally, a comprehensive assessment of GH screening within all of the public health facilities was beyond the scope of this study. Another limitation of the study includes low number of pregnant participants and inability to include all the doctors in interview. Due to the reasons stated here, generalizability of the results of the study may be somewhat limited.

Conclusions

Our study found that screening practices in the public health centres were not standardized, with many doctors having poor knowledge and awareness about screening for GH. As GH is a *silent* disease, universal screening of pregnant women should be carried out.[9,32] Continued medical education and training for health care providers can be a useful strategy for addressing the lack of knowledge and awareness among doctors in our study. It is important to integrate GH screening into the existing antenatal care services package by including glucose testing,[32] and providing the support and necessary equipment to carry out the tests. Though international agreement on the clinical criteria and method of detection of GH has been elusive, the public health facilities should engage with professional bodies to standardize and implement universal screening for GH. As a first step toward this, deliberations should ensue toward using a 75 g OGTT between 24-28 weeks of gestation for all women.[9,28]

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