Diagnosis, Management and Maternal, Neonatal Outcomes of Hyperglycaemia in Pregnancy Among Pregnant Women in a Rural District of Sri Lanka: A Cross Sectional Descriptive Study

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Abstract

Background

Prevalence of hyperglycaemia in pregnancy is on the rise. Both gestational diabetes mellitus and pre-existing diabetes mellitus are linked to several maternal and foetal/neonatal complications. We describe the diagnosis, management and maternal, neonatal outcomes of hyperglycaemia in pregnancy and compare these variables between mothers with gestational diabetes mellitus and mothers with pre-existing diabetes mellitus in a rural district of Sri Lanka recovering from the effects of decades of civil war.

Methods

A retrospective cross sectional descriptive study was conducted among mothers with gestational or pre-existing diabetes with a singleton pregnancy, who delivered in the obstetric ward of district general hospital of Vavuniya from 01/10/2018 to 31/10/2019. Consecutive sampling was used.

Results

Mean age of the participants (n = 324) was 30.07 ± 4.63 (± SD) years. Post prandial blood glucose was checked in 88.8% during the booking visit. Pre-existing diabetes mellitus was detected in 13.5% of mothers. Medical nutrition therapy alone was used in the management of 54.01% of mothers. Addition of metformin alone was needed in 36.7% and 9.2% required combination therapy with metformin and insulin. There were no maternal deaths, intra uterine deaths or still births. Operative delivery was required in 46.3% of mothers. Birth weight > 3.5kg was observed in 13.3% of newborns. Low birth weight (birth weight < 2.5 kg) was noted in 5.2%. There were no cases of shoulder dystocia. Sixteen (4.93%) babies had minor complications. Post-partum complications were noted only in 7 (2.16%) mothers. Post-partum blood sugar levels were performed in 86.7% mothers. Neonatal complications and low birth weight were significantly higher among mothers with pre-existing diabetes.

Conclusions

We observed low rates of maternal and neonatal complications among mothers with hyperglycaemia in pregnancy. Re-establishment of public health system in these rural areas in the post-war period probably contributed to this. Mothers with pre-existing diabetes had significantly higher rates of low birth weight and neonatal complications compared to mothers with gestational diabetes mellitus. A significant number of mothers missed post-partum blood sugar testing which is an area that could be improved.

1. Introduction

The epidemiology of hyperglycaemia in pregnancy is not well known in many countries of the world (1). The situation is same if not worse in Sri Lanka. Prevalence of some form of hyperglycaemia in pregnancy in the world is estimated to be around 16.7% (2). The incidence of hyperglycaemia in pregnancy has increased in South Asia (3). Hyperglycaemia in pregnancy, both gestational diabetes mellitus (GDM) and pre-existing diabetes mellitus (DM), are linked to several maternal and fetal/neonatal complications (4). Prevalence of GDM in Sri Lanka was 10.86% in a population-based study (5). A previous research conducted in Sri Lanka among a group of pregnant women with diabetes mellitus revealed that 82% of them had GDM and 18% of them had pre existing DM (6).

Data on the diagnostic and management strategies used in the treatment of pregnant mothers with diabetes is sparse in Sri Lanka. IADPSG (the international association of the diabetes and pregnancy study groups) criteria had a good predictive value for macrosomia in a Sri Lankan study (7). A study conducted in Anuradhapura district found that random urine sugar tests were done as the screening test for hyperglycaemia in pregnancy in 93% and blood sugar levels were done in less than 41% (8). However random urine sugar test and fasting blood sugar test were found to be unreliable in another Sri Lankan study and they suggested that 2-hour blood sugar level after 75 g of oral glucose had better sensitivity and specificity for diagnosis of diabetes mellitus in early pregnancy (9). However, recent data are not available on the diagnostic and management strategies of hyperglycaemia in pregnancy.

Sri Lanka has a strong public health system which delivers maternal and neonatal care from grassroot level. Public health midwives and medical officers are the key health care workers involved in maternal care. They conduct ante natal clinics at village level and identify high risk pregnancies and refer them to tertiary care centers. However, 30 years of civil war in Sri Lanka destroyed key infrastructure and disrupted this system in districts like Vavuniya district (10). But, with the end of war in 2009, public health system has been re-established in these areas. Diagnosis, management practices and maternal, neonatal outcomes of mothers with hyperglycaemia in pregnancy have not been described before in a rural district of Sri Lanka recovering from the effects of decades of civil war. In this paper we try to achieve that.

2. Materials And Methods

We conducted a retrospective descriptive cross-sectional study to describe the diagnosis, management and maternal, neonatal outcomes of hyperglycaemia in pregnancy among mothers who delivered at district general hospital (DGH) Vavuniya from 01/12/2018 to 31/12/2019. All women with pre-existing DM and GDM with a singleton pregnancy who delivered at DGH Vavuniya were included. Patients with medical complications other than diabetes were excluded from the study. Consecutive sampling was used. Figure 1 shows sequential events of the study.

Data collection was done using a questionnaire which consisted of two parts and each part was designed by the team of investigators and was validated by a group of experts that included a consultant community physician and a consultant physician. “Part A” of the questionnaire was filled with the data

obtained from bed head tickets. “Part B” of the questionnaire was filled by interviewing participants individually and also by extracting the data from the B card of pregnancy record.

Women already enrolled to the study were visited with the help of the public health midwife (PHM) and MOH in relevant area to fill out the questionerre part B to assess the outcome of the pregnancy. That visit was scheduled after 6 weeks postpartum. Data was analyzed using version 28 of SPSS software. Categorical variables were compared using chi square test and means were compared using independent samples t test.

Ethics committee approval was obtained from university of Jaffna ethical review committee prior to data collection.

3. Results

3.1 Basic demographic details

Number of participants was 324. Mean age of the participants was 30.07 ± 4.63 (± SD) years. Ethnicity distribution was Sri Lankan tamil 52.2% (n = 169), sinhalese 28.1% (n = 91), muslim 10.5% (n = 34) and burgher 9.3% (n = 30).

3.2 Screening methods

Blood sugar levels were checked in 97.2% of (n = 315) patients during the booking visit. Out of the 9 mothers whose blood sugar was not checked in the booking visit 6 were checked at 28 weeks of POA. Other three were checked at 19, 20 and 21 weeks of POA. Post prandial blood sugar (PPBS) was performed in 88.8% (n = 288). 11.11% (n = 36) underwent 75g oral glucose tolerance test (OGTT) at the booking visit. This was interpreted according to pre pregnancy cut offs. Out of the 315 mothers who underwent blood sugar testing during the booking visit, 86.1% (n = 271) had a normal result. Pre-existing diabetes was diagnosed in 13.9% (n = 44) mothers. Rest of the mothers were diagnosed to have gestational diabetes from the one step 75 g oral glucose tolerance test done at 24 to 28 weeks which was interpreted according to IADPSG criteria.

3.3 Initial management

Medical nutrition therapy alone was used in the management of 54.01% (n = 175) of patients. Addition of metformin alone was needed in 36.7% (n = 119) and 9.2% (n = 30) of patients required addition of both metformin and insulin.

3.4 Pregnancy outcomes

Pre-term deliveries (before 37 weeks of POA) were observed in 12.0% (n = 39) of mothers. Out of all deliveries 51.5% (n = 167) were vaginal deliveries. Assisted vaginal delivery was required in 2.1% (n = 7). Operative delivery was required in 46.3% (n = 150). Emergency caesarian sections accounted for 36.6% (n = 55) of operative deliveries. Indications for operative delivery were past caesarian section in 59.33% (n =

89), pathological cardiotocography (CTG) in 16.67% (n = 25), obstructed labour in 3.33% (n = 5), meconium in 6% (n = 9), macrosomia in 3.33% (n = 5) and other reasons in 11.33% (n = 17). All 324 pregnant patients with hyperglycaemia in pregnancy delivered live babies and there were no intra uterine deaths or still births. There were no maternal deaths.

Three mothers had post-partum infection and three mothers had genital trauma. There was only one case of postpartum haemorrhage (0.3%).

3.5 Neonatal outcomes

Birth weight less than 2.5 kg was observed in 5.2% (n = 17) newborns and birth weight more than 3.5 kg was observed in 13.3% (n = 43) newborns. (Table 1)

Table 1
Number and percentage of newborns according to birth weight category.

Birth weight	Number of participants (percentage)
< 2.5 kg	17 (5.2%)
2.5 kg – 3.5 kg	264 (81.5%)
> 3.5 kg	43 (13.3%)

There were no cases of shoulder dystocia. Jaundice was observed in 2.16% of (n = 7) babies. Three babies had hypoglycaemia and 3 babies had prematurity. Birth asphyxia was observed in 3 babies.

3.6 Postpartum follow up

Postpartum blood sugar levels were done in 86.7% (n = 281) of patients.

3.7 Comparison of basic demographic details, management strategies and maternal, neonatal outcomes between mothers with GDM and mothers with pre- existing DM

We compared various parameters between mothers with gestational diabetes mellitus and those with pre-existing diabetes mellitus (Table 2). Out of the 324 mothers 9 didn’t undergo blood sugar testing during the booking visit. They were excluded from this analysis as it was not possible to accurately diagnose their type of diabetes.

Table 2
Comparison of various parameters between gestational diabetes mellitus and pre-existing diabetes mellitus. (GDM – gestational diabetes mellitus, SD – standard deviation, MNT – medical nutrition therapy). P < 0.05 was considered statistically significant. Significant values are denoted in bold.

	GDM	Pre-existing DM	P value
Number of mothers (percentage)	271 (86.03%)	44 (13.96%)	
Mean age (± SD), years	29.96 (± 4.6)	30.48 (± 4.4)	0.492
Initial management			0.574
MNT only (%)	144 (53.1%)	26 (59.1%)	
MNT + Metformin (%)	102 (37.6%)	13 (29.5%)	
MNT + Metformin + insulin (%)	25 (9.2%)	5 (11.4%)	
Number of mothers with post-partum complications (%)	6 (2.2%)	0	0.319
Type of delivery			0.225
Vaginal delivery (%)	135 (49.8%)	28 (63.6%)	
Assisted vaginal delivery (%)	6 (2.2%)	1 (2.3%)	
Operative delivery (%)	130 (48.0%)	15 (34.1%)	
Mean birth weight of baby (± SD), kg	3.014 (± 0.44)	3.011 (± 0.60)	0.978
Number of babies with low birth weight (< 2.5 kg) (%)	10 (3.7%)	5 (11.4%)	**0.027**
Number of babies with macrosomia (Birth weight > 3.5 kg) (%)	28 (10.3%)	8 (18.2%)	0.129
Number of babies with one or more neonatal complication (low birth weight/ jaundice/ birth asphyxia/ hypoglycaemia) (%)	20 (7.4%)	8 (18.2%)	**0.02**

Percentage of newborns with low birth weight was significantly higher among mothers with pre-existing diabetes. Overall neonatal complications were significantly higher in babies of mothers with pre-existing diabetes.

There was no statistically significant difference in maternal and neonatal outcomes with regard to the management modality used (MNT alone vs MNT + metformin vs MNT + metformin + insulin).

4. Discussion

There is a lot of uncertainty regarding screening for diabetes in pregnancy. While most authorities agree on OGTT at 24 to 28 weeks, diabetes screening during early pregnancy is a controversial issue with different organizations recommending different strategies. According to NICE guidelines (11), a 75 g 2-hour oral glucose tolerance test (OGTT) as soon as possible after booking visit (whether in the first or second trimester) is recommended in high risk groups. South Asian federation of endocrine societies (SAFES) recommends universal screening with 75-g OGTT during the booking visit (12). However, majority of patients in our study (88.8%) underwent post prandial blood sugar (PPBS) during the booking visit. A previous study conducted in Anuradhapura district in 2012 (8), used urinary sugar level which is not very reliable or accurate as the screening test. Compared to that we observed a marked improvement in diagnostic practice in our cohort. However, 2.8% of patients missed any form of blood sugar testing during the booking visit. Six mothers were diagnosed only during the third trimester.

American diabetes association (ADA) 2022 guideline recommends life style change and medical nutrition therapy as the first line therapy in gestational diabetes mellitus (13). More than 50% of our patients were managed with medical nutrition therapy alone. However, it advises caution on using metformin during pregnancy due to recent evidence suggesting Metformin may be associated with small for gestational age babies who have accelerated post-natal growth leading to higher body mass index (BMI) in childhood (14, 15). At the time of conducing this study this evidence was not available and therefore 36.7% of our patients were managed with metformin. In our study we didn't observe an increase in low birth rate in mothers managed with metformin and MNT compared to those who were managed with MNT alone.

A previous study conducted among pregnant mothers in Colombo district from 2011 to 2015 evaluated pregnancy outcomes among patients with diabetes in pregnancy, gestational diabetes mellitus and hyperglycaemia in early pregnancy (16). 572 patients were included in the final analysis and 2 intra uterine deaths were reported. 23.6% (n = 135) had birth weight more than 3.5 kg. 27.7% (n = 90) had birth weight less than 2.5 kg. Maternal complications were reported in 21.1% and neonatal complications were reported in 25.8%. Our study was conducted in district general hospital Vavuniya, which is a rural district still recovering from the impact of decades of civil war. Despite that our cohort of pregnant patients had very low rates of maternal and neonatal complications. This is due to the excellent public health program in Sri Lanka which delivers maternal care with the collaboration of different health care workers at different levels from primary care to tertiary care.

Studies conducted in Pakistan (17) and Bangladesh (18) have reported macrosomia rates of 13% and 24% respectively. Studies conducted in different parts of India have reported macrosomia rates of 32% (19), 4% (20), 28% (21), 27.6% (22) and 16.2% (23). Still birth rate was 4.8% in the study by Wahi et al (24). Low birth weight was reported in 21.8% (20), 8.2% (22) and 14.2% (23) in studies conducted in India. Rate of macrosomia (13.3%) and low birth weight (5.2%) was lower in our cohort compared to most of the above studies.

Caesarian section rate was only 25.9% in the study conducted in Pakistan by Akhter et al. Saxena et al reported a caesarian section rate of 42% among patients with gestational diabetes mellitus.

Although our cohort had a higher rate of caesarian sections, 63.3% of caesarian sections were elective and most of the caesarian sections were due to past caesarian section which is presumably unrelated to the diagnosis or management of diabetes in this pregnancy.

A history of gestational diabetes mellitus increases the risk of type 2 diabetes mellitus in future (24). Furthermore, some of these mothers have undiagnosed pre-existing diabetes. A sri lankan study showed that 18.6% of mothers with GDM had diabetes at 1-year post-partum follow up and 47.5% had abnormal glucose tolerance (25). Studies conducted in Turkey (26), France (27) and USA (28) have reported post-partum screening rates of 47.4%, 65% and 27% respectively. In our cohort post-partum screening rate was 86.7%. While this is better than the above studies, we have missed screening in 13.3%. If these mothers are not followed up in the post-partum period they can go to the next pregnancy with poor glycaemic control and diabetes related complications which will significantly increase the risk of maternal and foetal/neonatal complications. In Sri Lankan culture mothers return to their parents' home after delivery. This may be the reason why they were lost to follow up. Educating the mothers during ante natal period may be an important step to increase post-partum screening rates. Furthermore, a mechanism needs to be established where public health midwife of the area mother is visiting can trace her and refer her for screening.

To our knowledge this is the largest study conducted in a rural district of Sri Lanka which describes diagnosis, management and maternal and neonatal outcomes of diabetes in pregnancy. This is the first Sri Lankan study that describes post-partum screening rates.

However, a control group was not available to allow us to assess associations and determinants of hyperglycaemia in pregnancy. Furthermore, this data represents only those who delivered at the tertiary care hospital and may not be representative of the whole community.

5. Conclusions

We observed low rates of maternal and neonatal complications among mothers with hyperglycaemia in pregnancy. Re-establishment of public health system in these rural areas in the post-war period probably contributed to this. Mothers with pre-existing DM had significantly higher rates of low birth weight and neonatal complications compared to mothers with GDM. A significant number of mothers missed post-partum blood sugar testing which is an area that could be improved.

List Of Abbreviations

ADA
American diabetes association
BMI
body mass index
DGH

district general hospital
DM
diabetes mellitus
FBS
fasting blood sugar
GDM
gestational diabetes mellitus
IADPSG
international association of the diabetes and pregnancy study groups
MNT
medical nutrition therapy
MOH
medical officer of health
NICE
national institute for health and care excellence
OGTT
oral glucose tolerance test
POA
period of amenorrhoea
PPBS
post prandial blood sugar
SAFES
south Asian federation of endocrine societies
SD
standard deviation

Declarations

Ethics approval and consent to participate: - Informed, written consent was obtained from all mothers to participate in this study.

Consent to publish: - Informed, written consent was obtained from all participants for publication of their data.

Availability of data and materials: - Available on request

Competing interests: - The authors declare that they have no competing interests

Funding: - No funding

Authors' contributions: - MA was the principal investigator who designed the research, oversaw data collection, managed diabetes of most mothers and supervised manuscript writing. ND analyzed data and

wrote the manuscript. LW and KJ supervised data collection and managed mothers during the pregnancy. SM collected data, contributed to research design, data analysis and manuscript writing. CATU and KS collected data. PS helped with research design and designing the questionnaire.

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Figures

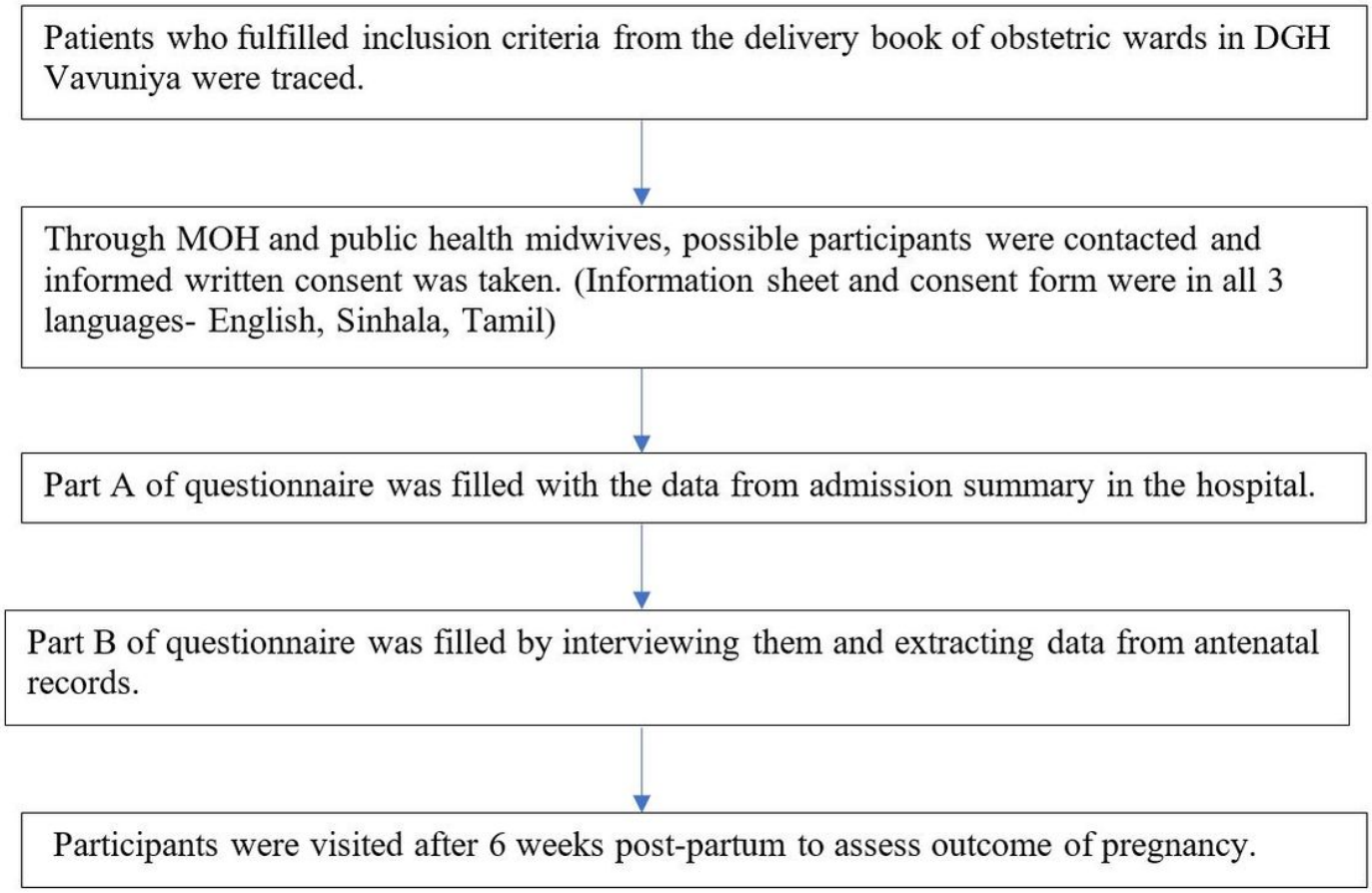

Figure 1

Flowchart for the sequential events of the study (MOH: Medical officer of health, DGH: District general hospital)