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RESEARCH

Diabetes mellitus in pregnancy, still changing

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Objective: The management of pregnant women with diabetes mellitus places a significant burden on healthcare systems. Significant global changes have been proposed with regard to the diagnosis and management of women with diabetes mellitus in pregnancy. The study aims were to document the contemporary numbers, treatments and outcomes of diabetes mellitus in pregnancy, with particular focus on gestational and type 2 diabetes mellitus.
Design, subjects and setting: A retrospective audit was performed of pregnant women (n = 278) with diabetes mellitus, managed over a 12-month period in a combined secondary and tertiary unit in South Africa.
Results: Of the 278 cases analysed, 60% had gestational and 33% type 2 diabetes mellitus. The perinatal mortality ratio for all diabetes mellitus in pregnancy was 52.6:1 000, with only one early neonatal death. Ninety-five per cent and 70% of women with gestational and type 2 diabetes mellitus, respectively, were overweight or obese. Chronic hypertension was present in 23% of women with gestational and in 42% of women with type 2 diabetes mellitus. The glycosylated haemoglobin decreased from 6.7% at diagnosis to 6.4% at delivery in the gestational diabetes mellitus group, and from 7.5% at booking to 6.6% at delivery in the type 2 diabetes mellitus subjects. Lifestyle modification and metformin sufficed in 88% of women with gestational diabetes mellitus. Insulin was only required in 12% of pregnancies with gestational and in 53% of pregnancies with type 2 diabetes mellitus.
Conclusion: Pregnancies complicated by gestational and type 2 diabetes mellitus are common and challenging. The addition of the oral agent, metformin, lowers the need for insulin therapy.

Keywords: diabetes mellitus, glucose threshold, maternal and foetal health, pregnancy

Introduction

Glucose metabolism changes during pregnancy. Compared to those in non-pregnant women, fasting levels of serum glucose are decreased, while postprandial levels are increased. Glucose tolerance decreases progressively after the first trimester. Physiological insulin resistance is brought about by placental hormones, such as human placental lactogen, glucagon and cortisol. Ultimately, insulin production is almost doubled to maintain euglycaemia. This explains gestational diabetes mellitus when the increased demand for insulin is not met owing to a genetically programmed reduced β-cell reserve, as well as the increased therapy requirements of established diabetes mellitus.

The incidence of type 2 and gestational diabetes mellitus is rising. Firstly, populations are becoming older and obese. Rising levels of obesity, corresponding with high-calorie diets and decreased physical activity, affect many countries, including South Africa.[1,2] Secondly, diagnostic thresholds have been lowered in gestational diabetes mellitus, following the sentinel Hyperglycemia and Adverse Pregnancy Outcome (HAPO)[3,4] and Australian Carbohydrate Intolerance Study in Pregnant Women (ACHOIS)[5] studies, which showed composite benefit by beginning an intervention at a lower glucose level.

The diagnosis and management of diabetes mellitus in pregnancy continues to change, but currently still lacks universal agreement. Specific screening and diagnostic tests with a threshold should reflect an equitable balance between current and future health risks and local resource capacity, but practice is inconsistent, even in countries with stipulated screening policies.[6] The cost, time and reliability factors of screening and diagnostic tests present challenges at all levels. Regarding medical interventions, two oral agents, i.e. metformin and glibenclamide or glyburide, have been integrated into certain treatment regimens during pregnancy.[7,8]

The aims of this study were to document the contemporary numbers, treatments and outcomes of pregnant patients with diabetes mellitus in a combined secondary or tertiary unit, with particular focus on gestational and type 2 diabetes mellitus, because of the changes in diagnosis and management.

Method

A retrospective audit of pregnant women with diabetes mellitus managed from 1 July 2010 to 31 June 2011 was performed. The audit was conducted in the Obstetric Special Care Unit at Tygerberg Academic Hospital, a secondary and tertiary hospital in South Africa. Patients were managed by a team of obstetricians, endocrinologists and dietitians. The files of all registered cases were assessed. Data were captured anonymously.

A diagnosis of pre-gestational diabetes mellitus (types 1 or 2) was made when the history was known. Gestational diabetes mellitus was regarded as any new-onset dysglycaemia in pregnancy in this study. It was diagnosed according to the provincial guideline on diabetes mellitus in pregnancy, which advocates a selective rather than universal approach to screening.[9] Patients with risk factors are tested between 24 and 28 weeks' gestation, or earlier, if necessary. The guideline provides two options for testing. The first is a 75 g oral glucose tolerance test (OGTT) with fasting and two-hour blood glucose sampling. A glucose load of 75 g is substituted by a non-standardised glycaemic load in the second practical option, whereby the patient's breakfast is brought to the clinic and consumed after the fasting glucose test. A two-hour postprandial blood glucose measurement is

then performed. Both options use cut-off values of 5.6 mmol/l and 7.8 mmol/l, for the fasting and two-hour values, respectively.[9] The second option was followed during this study. Glucose levels were measured using capillary samples for the Accu-Chek® Active glucometer, which corrects to venous sample values.

Upon clinic entry, patients with pre-gestational diabetes mellitus underwent special investigations and a review of their history and an examination. Serum creatinine, urinary protein quantification and culture were performed. The haemoglobin (Hb)A_{1c} level was determined (a target threshold of 6%) and repeated monthly thereafter. A formal ophthalmological evaluation was carried out to exclude pathology. Foetal evaluation included an 11–13 week scan, followed by a detailed scan at 18–22 weeks, umbilical artery Doppler at 24 weeks, and a growth scan between 34 and 36 weeks' gestation. Similar investigations were performed for patients with gestational diabetes mellitus.

Patients with gestational diabetes mellitus were managed according to the provincial guideline, beginning with lifestyle modification (diet and moderate exercise). When this failed to lower fasting, postprandial and HbA_{1c} levels to the target threshold, oral therapy with metformin was instituted at 500 mg twice daily with meals, and increased incrementally to 850 mg three times daily with meals. When glycaemic control was still insufficient, patients were admitted to evaluate fasting and all pre- and two-hour postprandial values, including a 02h00 value in order to commence insulin therapy. Target levels used were 3.5–5.5 mmol/l (fasting),< 7 mmol/l (two-hour postprandial) and < 6.1% for the HbA_{1c}. Foetal macrosomia and polyhydramnios were also regarded as evidence of suboptimal control.

Oral sulphonylureas were stopped in pre-gestational type 2 diabetes mellitus, but metformin was continued or started. Lifestyle modifications and medical therapy were re-evaluated every two weeks. When insulin was required, it was initiated using a nocturnal dose of intermediate-acting human neutral protamine hagedorn insulin to optimise fasting glucose values before consideration was given to a multiple injection regimen (basal bolus regimen). Thereafter, preprandial doses of short-acting insulin (human regular insulin) were added, as necessary. Patients receiving daily or bi-daily doses of fixed-combination insulin (human 30/70 biphasic insulin) before pregnancy continued with their regimen, provided that control was optimal. A basal bolus regimen was initiated when necessary and feasible.

Pregnant women with diabetes mellitus were seen in the obstetric special care clinic every two weeks, when a glucose profile was performed. Patients on insulin used Accu-Chek Active® glucometers to monitor their glucose profiles at home. These were recorded on a provided chart and reviewed regularly.

Delivery was offered as standard practice at 38 weeks' gestation. Intrauterine death was defined as asystole after 24 weeks' gestation or > 500 g at birth. Viability was defined as 27 weeks' gestation or an estimated foetal weight ≥ 800 g. Other important definitions were macrosomia, i.e. a birthweight > 4 000 g or characteristic ultrasound findings; neonatal hypoglycaemia, i.e. a glucose value of < 2.6 mmol/l or symptomatic hypoglycaemia; and early neonatal death, i.e. death within the first six days of life.

Data were analysed using Statistica® version 9 and largely expressed as medians, ranges or *n* (%). Differences were analysed using Student's *t*-test. The Mann-Whitney U test was used for data that was not normally distributed. Analysis of variance or the Kruskal-Wallis test was applied for comparisons between continuous variables and nominal variables, while the chi-square test (Fisher's method) was used to compare two nominal variables. A *p*-value of < 0.05 was regarded as significant. The study was approved by the Ethics Committee for Human Research of the Faculty of Medicine and Health Sciences, Stellenbosch University (N11/09/268).

Results

Three hundred and one patients were entered during the 12-month period. Twenty-three files were excluded because of incorrect diagnosis or classification, leaving 19 (6.8%) patients with pre-gestational type 1 diabetes mellitus, 92 (33.1%) patients with pre-gestational type 2 diabetes mellitus, and 167 (60.1%) patients with gestational diabetes mellitus for class data analysis. During the study period, there were 5 430 hospital births, with 266 deliveries by patients with diabetes mellitus after the exclusion of miscarriages. Therefore, the deliveries of patients with diabetes mellitus constituted 4.9% of the referral hospital deliveries. Neonatal data from five multiple pregnancies were incomplete. The perinatal mortality rate was 52.6/1 000. The baseline characteristics are shown in Table 1.

Gestational diabetes mellitus

A normal body mass index (BMI) at booking was recorded in 9 (5.4%) of the women with gestational diabetes mellitus. Twenty-four (14.4%) were overweight, 69 (41.3%) obese (a BMI of 30–39 kg/m^2), and 65 (38.9%) morbidly obese (a BMI of ≥ 40 kg/m^2). The median systolic blood pressure (SBP) and diastolic blood pressure (DBP) at booking was 130 mmHg (83–190 mmHg) and 78 mmHg (57–120 mmHg), respectively. Of the 38 (22.8%) women with chronic hypertension, 20 (52.5%) were not taking antihypertensive treatment. Other baseline values (median or range) were daily urinary protein excretion of 200 mg (100–2 500 mg) and serum creatinine of 51 µmol/l (20–90 µmol/l).

The median first HbA_{1c} value was 6.7% (4.8–12%). The 25th and 75th percentiles were 5.9% and 7.4%, respectively. The median pre-delivery HbA_{1c} lowered to 6.4% (4.4–11.7%). The 25th and 75th percentiles were 5.9% and 6.9%, respectively. The final treatment modalities are shown in Table 2.

Important maternal complications according to the mean HbA_{1c} category are shown in Table 3. An association was not demonstrated between metformin use and spontaneous preterm labour (*p* 0.1). Two intrauterine deaths occurred in this group. The first was diagnosed at 40 weeks' gestation and weighed 3 040 g. The mother had defaulted on attending appointments and had given a history of reduced foetal movement. In the second case, the patient presented with early pre-eclampsia and an intrauterine death at gestation of 32 weeks, 6 days. The baby weighed 1 770 g.

Most deliveries (*n* = 93, 55.7%) occurred at 38 weeks' gestation. There were 54 (32.3%) deliveries before, and 19 (11.4%) beyond, 38 weeks' gestation. Eighty-eight patients (53%) were delivered by Caesarean section. Of these, 34 were elective procedures, 51 non-elective procedures, while the indication was unclear in three cases. Foetal macrosomia was suspected in 10 of the elective Caesarean sections. Thirty-two of the non-elective procedures were performed after induction of labour. Only 19 were regarded as emergency procedures. The median (range) gestation

Table 1: Baseline characteristics of pregnant women in the diabetes mellitus classes

Characteristics	Pre-gestational		Gestational
	Type 1 *n* (%)	Type 2 *n* (%)	Gestational diabetes mellitus*n* (%)
Total *n* (%)	**19 (6.8)**	**92 (33.1)**	**167 (60.1)**
Ethnicity			
Coloured	12	55	107
Black	6	33	55
Other	1	4	5
Age (years)*	27 (17–39)	33 (21–45)	32 (18–46)
Body mass index (kg/m²)*	26.4 (19–34)	34 (18–54)	36.9 (20–68)
Parity			
0	6	8 (8.7)	25 (15.0)
1	7	30 (32.6)	45 (26.9)
2	6	22 (23.9)	43 (25.7)
≥ 3	0	32 (34.8)	54 (32.3)
Previous gestational diabetes mellitus	N/A	13 (14.1)	18 (10.8)
Pre-existing maternal complications			
Retinopathy	2	4	0
Renal lesion	1	6	7
Other	0	4	2
Previous pregnancy complications			
Macrosomia	1	17 (18.5)	26 (15.6)
Miscarriage	4	23 (25.0)	45 (26.9)
Intrauterine death	0	6 (6.5)	20 (12.0)
Shoulder dystocia	0	3 (3.3)	4 (2.4)
Chronic hypertension	1	39 (42.4)	38 (22.8)
Pre-conception counselling	1	1	2
Booking gestation, (weeks)*	12.5 (6–28)	13 (5–34)	n/a
Gestation at diagnosis of diabetes mellitus (weeks)*			28 (6–39)

Note: N/A = not applicable
*Median (range)

Table 2: Treatment modalities for gestational diabetes mellitus prior to delivery

Modalities	*n* (%)
Lifestyle modification (diet and exercise) only	29 (17.4)
Lifestyle modification plus metformin	117 (70.1)
Lifestyle modification plus insulin	3 (1.8)
Lifestyle modification plus metformin plus insulin	18 (10.8)

Table 3: Maternal complications in women with gestational diabetes mellitus in relation to the mean haemboglobin A_{1c} category for each patient

Complications, *n*	≤ 6.0%	6.1–7.0%	7.1–8.0%	≥ 8.0%
Total	**47**	**74**	**29**	**10**
Preterm birth	2	8	3	1
Hypertension*	9	10	11	1
Urinary tract infection	6	12	2	4
Diabetic ketoacidosis	0	0	0	1**

*Includes pre-eclampsia
**Gestational diabetes mellitus diagnosed at 12 weeks; probable undiagnosed pre-gestational diabetes mellitus

at delivery was 38 weeks (31–41 weeks) and the median birthweight 3 280 g (1 570–5 101 g). A birthweight of > 4 kg was recorded in 28 (17.4%) babies. There was one case of shoulder dystocia. A five-minute Apgar score < 7 was recorded for six babies, and two

Table 4: Treatment modalities for type 2 diabetes mellitus prior to delivery

Treatment modalities	Before pregnancy *n* (%)	During pregnancy *n* (%)
Metformin	81 (88.0)	86 (93.5)
Sulphonylurea*	31 (33.7)	1 (1.1)
Oral agents only	74 (80.4)	43 (46.7)
Insulin only	5 (5.4)	2 (2.2)
Oral agent, plus insulin	13 (14.1)	47 (51.1)
All cases with insulin	18 (19.6)	49 (53.3)

*Any sulphonylurea before pregnancy, glibenclamide during pregnancy

Table 5: Maternal complications in women with type 2 diabetes mellitus in relation to the mean haemboglobin A_{1c} category for each patient

Maternal complications*	≤ 6.0%	6.1–7.0%	7.1–8%	≥ 8.0%
Total, *n*	**25**	**25**	**20**	**9**
Preterm birth**	1	7	6	2
Hypertension***	2	4	3	1
Urinary tract infection	6	6	3	3

*Pre-delivery haemoglobin A_{1c} was not available in 13 cases
**: Does not include hypertension
***Includes pre-eclampsia

Table 6: Intrauterine deaths in women with type 2 diabetes mellitus

Gestation	Weight (g)	Details
36 weeks, 0 days	3 080	Large for gestational age
36 weeks, 3 days	2 560	Defaulted from clinic for 10 weeks. Cause undetermined
37 weeks, 0 days	2 640	Placental abruption with pre-eclampsia
38 weeks, 2 days	2 580	Defaulted from clinic for 5 months. Cause undetermined
38 weeks, 2 days	3 350	No foetal movements for 3 days

were admitted to the neonatal intensive care unit. Six (3.6%) babies were born with anomalies. There were no early neonatal deaths.

Pre-gestational type 2 diabetes mellitus

Most women were classified as obese according to BMI at their first pregnancy visit (booking). Nineteen (20.9%) were overweight, 31 (34.1%) obese and 14 (15.4%) morbidly obese. The median SBP and DBP at booking were 130 mmHg (90–160 mmHg) and 80 mmHg (50–100 mmHg), respectively. Of the 39 (42.4%) women with chronic hypertension, 6 (15.4%) were not on antihypertensive treatment. Other baseline values (median or range) were daily urinary protein excretion 140 mg (40–1 550 mg) and serum creatinine 56 µmol/l (28–153 µmol/l).

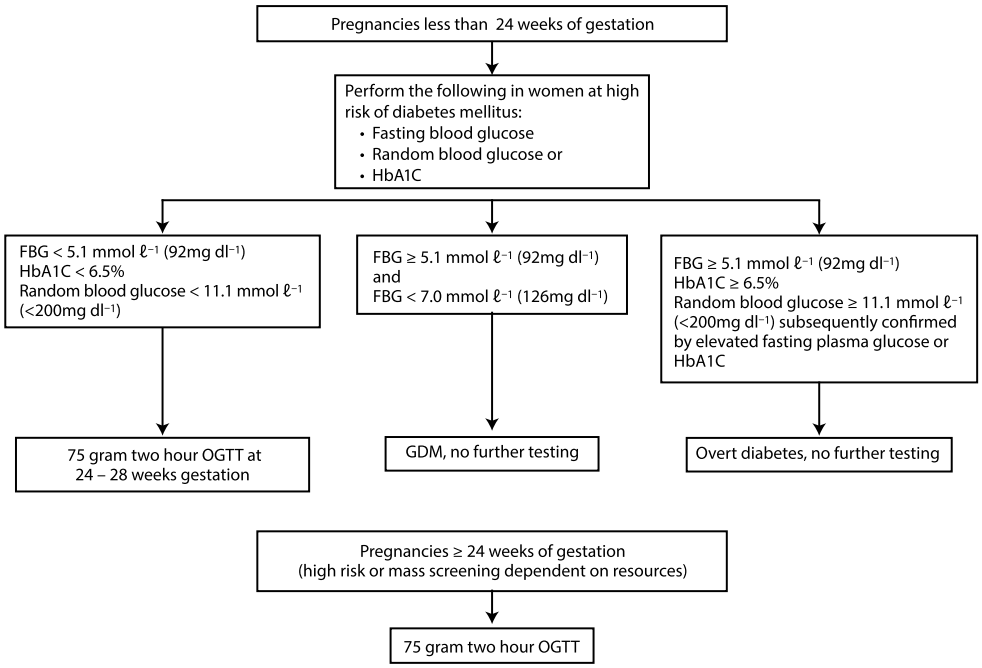
The median booking HbA_{1c} was 7.5% (5.0–13.5%). The 25th and 75th percentiles were 6.8% and 9.2%, respectively. Pre-existing microvascular (renal and retinal) disease was documented in 10 women. The retinal complications included three cases with proliferative, and one with non-proliferative, diabetic retinopathy. The median pre-delivery HbA_{1c} lowered to 6.6% (4.4–10.4%). The 25th and 75t^{h} percentiles were 5.9% and 7.5%, respectively.

Thirty-three (35.9%) patients with type 2 diabetes mellitus who had received oral hypoglycaemic agents only before pregnancy required the addition of insulin for optimal glucose control during pregnancy. Prandial insulin, in addition to the nocturnal dose of intermediate-acting insulin, was instituted in 10 cases. Thirty-one (33.7%) patients used a sulphonylurea before pregnancy. Eleven patients required only metformin after sulphonylurea discontinuation, while 20 patients needed insulin in addition to metformin. One patient presented at an advanced gestation (32 weeks) on combination therapy, with acceptable glucose control. She remained on metformin and glibenclamide. The final treatment modalities are shown in Table 4.

Important maternal complications according to the mean HbA_{1c} category for each patient are shown in Table 5.

Seven cases with foetal anomalies were recorded, including central nervous system anomaly, i.e. Dandy-Walker syndrome; cardiac, i.e. ventricular septal defect and atrialventricular septal defect; skeletal, i.e. rhizomelic limb shortening, hemivertebra, *spina bifida* and *tallipes equinovares;* and renal, i.e. multicystic kidneys. The details of the five intrauterine deaths are shown in Table 6.

Eighty-four pregnancies reached viability. Of these 35 (41.7%) were delivered before, and 47 (55.9%) at, 38 weeks' gestation. Induction of labour was performed in 41 (48.8%) viable pregnancies and 50 (59.5%) infants were delivered by Caesarean section, of which 26 were elective operations. Two of the latter procedures were performed for suspected foetal macrosomia. The median (range) gestation at delivery was 37 weeks (25–39 weeks), and the median birthweight was 3 070 g (650–5 070 g). A birthweight of > 4 kg was recorded in 8 (9.5%) infants, and there was one case of



Note: FBG: fasting blood glucose, HbA_{1c}: haemoglobin A_{1c}, OGTT: oral glucose tolerance test.[11]

Figure 1: International Association for Diabetes and Pregnancy Study Groups protocol for the evaluation of diabetes mellitus in pregnancy.

shoulder dystocia. A five-minute Apgar score < 7 was recorded in 10 babies. One baby was admitted to the neonatal intensive care unit. There were no early neonatal deaths.

Discussion

The diagnosis, classification and management of diabetes mellitus in pregnancy continue to change. The results from this study will be used to discuss certain pertinent aspects. The first study aim was to document the contemporary numbers in our secondary or tertiary unit. The 285 cases seen every two weeks until delivery translated into a considerable workload. While pregnant women with pre-gestational diabetes mellitus require care at specialist level or higher, most of the women (60%) in this clinic had gestational diabetes mellitus which generally does not require specialist care. However, gestational diabetes mellitus with co-morbidities, such as morbid obesity (39%), chronic hypertension (23%), previous adverse outcomes or a previous Caesarean section, requires a higher level of care.

With obesity on the rise[1,2] and diagnostic thresholds being lowered, rising patient numbers further burden resource-limited healthcare systems.[10,11] While overt diabetes mellitus in pregnancy is associated with significant adverse perinatal outcomes, the risks of hyperglycaemia less severe than overt diabetes mellitus are limited, and mostly relate to foetal overgrowth and maternal hypertensive risk.[11]

Recently, the International Association of Diabetes in Pregnancy Study Group (IADPSG) proposed more stringent diagnostic criteria, which unlike all previously proposed criteria, are based not only on the maternal risk of sustained dysglycaemia after pregnancy, but also on adverse pregnancy outcomes.[11] However, because the observational HAPO study reported a continuum of risk, rather than an obvious threshold, units and administrators must determine their own screening policies by balancing the cost-effectiveness and treatment benefits of gestational diabetes mellitus.[3,12] Importantly, significant risks of foetal overgrowth, foetal hyperinsulinaemia and the association with maternal hypertensive disorders were demonstrated to be independent of obesity; a metabolic abnormality almost invariably present in these patients, and which is able to contribute to these morbidities independently.[3,4]

The World Health Organization, which specifically concerns itself with health promotion in resource-limited countries, recently adopted the new IADPSG guidelines despite the expectation of increased patient numbers. Therefore, personnel in South African institutions that manage gestational diabetes mellitus should at least consider these new criteria as a gold standard and adapt practice pragmatically.

It is encouraging to note that the criteria used to formulate the Western Cape's diabetes in pregnancy provincial guideline[9] has further been supported by the most recent revision of the National Institute for Health and Care Excellence (NICE) guidelines.[13] This document advocates a one-step approach with diagnostic thresholds using fasting and two-hour values of 5.6 mmol/l and 7.8 mmol/l, respectively. With the plethora of confusing diagnostic values for gestational diabetes mellitus, it should be noted that the NICE and Western Cape guidelines conform to the well-known, pre-diabetes mellitus thresholds in non-pregnant individuals. A lower fasting cut-off of 5.1mmol/l is proposed in the current IASDPG gold standard values in pregnancy.[9]

Because overt diabetes mellitus implies periconceptional dysglycaemia, and holds greater risks for the mother and foetus, it is important to detect undiagnosed pre-gestational (usually type 2) diabetes mellitus, often falsely regarded simply as gestational diabetes mellitus, as early as possible.[11] The new proposed IADPSG guidelines emphasise that women at high risk of overt diabetes mellitus should be tested at the first opportunity, rather than waiting until between 24 and 28 weeks, as often recommended, because of this (Figure 1).[11]

The current literature provides guidance on how to distinguish between these two conditions which have significantly different

risks. Approaches include timing, using fasting values or OGTT values diagnostic of diabetes mellitus in non-pregnant women, or recognising pathology specific to pregestational diabetes mellitus.[11] If a pregnant woman, at any time in pregnancy, meets any of the diagnostic criteria for overt diabetes mellitus in non-pregnancy, she must be regarded as having pre-gestational and not "true" gestational diabetes mellitus.[11]

This is a fundamental change in our way of thinking, as traditionally, any degree of dysglycaemia diagnosed for the first time in pregnancy was referred to as gestational diabetes mellitus. It is not advocated that the HbA_{1c} measurement is used to screen for gestational diabetes mellitus. However, internationally, its use is accepted in diagnosing pre-gestational diabetes mellitus.[14] During our study, these distinguishing characteristics were not strictly applied in early pregnancy. With a high prevalence of obesity and limited exposure to formal health care, cases of undiagnosed pregestational diabetics in pregnant women will occur. These considerations and findings in our study led to the deduction that the traditional definition of gestational diabetes mellitus needs to be revised to ensure appropriate patient care.

Another study aim was to evaluate the contributions of therapies. Lifestyle modification and insulin are well established, but recently two oral agents, metformin and glibenclamide, have gained prominence.[7,8] In our study, lifestyle modifications alone were sufficient in 17% of gestational diabetes mellitus cases. This is low compared to the findings in the study by Crowther et al. (80%).[5] One explanation is that resources are limited and the diet contains a high proportion of carbohydrates in this study population. Financial challenges limit the ability to fully embrace the proposed lifestyle changes. In addition, the low percentage of those controlled by lifestyle modification provides further evidence of undiagnosed cases of pre-gestational diabetes mellitus within the "traditional" gestational diabetes mellitus group.[5]

Metformin is a safe and well tolerated agent which reduces the need for insulin, decreases macrosomia and reduces Caesarean sections.[15] As a result of using metformin in our study, 88% of women with gestational and 47% with type 2 diabetes mellitus did not require insulin. These results are similar to the metformin "success rate" of 79% reported by Silva et al., but better than those noted in the study by Rowan et al., in which 46% needed supplemental insulin.[7,16] However, population characteristics and targets vary within studies. The "success rate" of glibenclamide and glyburide in gestational diabetes mellitus varies from 71–96%.[8,16]

The final study aim was to investigate certain specific outcomes. The decrease in HbA_{1c} values during care for both groups was encouraging. Most deliveries occurred at 38 weeks' gestation, with co-morbidities accounting for deviations, which supported the necessity of frequent follow-ups. After 20 weeks, the risk of intrauterine death in a large cohort of pregnant women with pre-gestational diabetes mellitus was reported by Tennant et al. to be more than four times greater than that in women without diabetes mellitus, with no difference found for types 1 and 2 diabetes mellitus.[17] There were seven intrauterine deaths, but no early neonatal deaths, in our study. In three cases, patients defaulted on keeping appointments for their visits, and at least one intrauterine death could have been prevented by induction at 38 weeks. Obesity and diabetes mellitus are well known associations of pre-eclampsia which complicated two intrauterine death cases. When compared to routine care, the Cochrane meta-analysis on treatment for gestational diabetes mellitus demonstrated a significant reduction in pre-eclampsia and perinatal morbidity with intensive treatment, including the induction of labour.[18]

Strategies to further improve outcomes include facilitating planned pregnancies with pre-conception counselling and optimal glycaemic control for pre-gestational diabetes mellitus and the prompt recognition of undiagnosed type 2 diabetes mellitus in pregnant women. The latter point is closely linked to our screening and diagnosis policy which is undergoing revision. Furthermore, close compliance with care is essential. Finally, because neonates from pregnancies complicated by diabetes mellitus suffer from higher rates of obesity and metabolic dysfunction later in life, attempts to break the vicious circle of metabolic imprinting through education and interventions are important.[19]

Conclusion

Pregnancies complicated by gestational and type 2 diabetes mellitus are increasing. It is important to distinguish between undiagnosed pre-gestational diabetes mellitus and gestational mellitus in the South African context. Lifestyle modification and metformin lower the need for insulin therapy substantially. Good results can be anticipated, despite the fact that both diabetes mellitus and associated morbidities pose management challenges. Optimal management of patients with diabetes mellitus in pregnancy would not only improve immediate maternal and foetal well-being, but might significantly impact on metabolic foetal imprinting, and thus hopefully reduce the present burden of metabolic sequelae in adult life.

Supplementary material

Supplementary material for this article can be accessed here http://dx.doi.org.10.1080/16089677.2015.1069015.

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