ORIGINAL ARTICLE

Effectiveness of selective risk based screening for Gestational Diabetes (GDM) in Malaysia: A retrospective cohort study based on the National Obstetric Registry (NOR) of Malaysia

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ABSTRACT

Introduction: Gestational diabetes (GDM) has significant maternal and foetal implications. Screening allows active interventions which significantly improves pregnancy outcomes. Despite World Health Organization (WHO), FIGO and National Institute of Clinical Excellence (NICE) recommendations for universal screening especially among high risk population; Malaysia currently adopts a selective risk based screening for GDM.

Objective: The objective is to audit the effectiveness of the current practice of selective risk based screening in detection of GDM in Malaysia.

Methodology: This is a retrospective cohort study based on the National Obstetric Registry (NOR) which comprises of 14 major tertiary hospitals in Malaysia. The study period was from 1st January 2011 till 31st December 2012 and a total of 22,044 patients with GDM were analysed. Logistic regression analysis was used to calculate the crude odd ratio.

Results: The incidence of GDM in Malaysia is 8.4%. Maternal age of ≥25, booking BMI ≥27kg/m2, booking weight ≥80kg and previous hypertension are non-significant risk of developing GDM in Malaysia. Parity 5 and more was only associated with an odds-ratio of 1.02 (95% Confidence Interval: 0.90-1.17) as compared to parity below 5. The association of women with previous stillbirth with GDM was not significant.

Conclusion: Current risk based screening for GDM based on maternal age, booking BMI, weight and hypertension is inappropriate. An ideal screening tool should precede disease complications, which is the novel objective of screening. Universal screening for GDM in Malaysia may be a more accurate measure, especially with regards to reducing maternal and foetal complications.

KEY WORDS:
Gestational diabetes, GDM, selective screening in Malaysia

INTRODUCTION

The prevalence of diabetes has reached alarming proportions. The International Diabetic Federation (IDF)'s most recent estimates indicate that 8.3% of adults, or 382 million people worldwide have diabetes, and the number of people with the disease is set to rise beyond 592 million in less than 25 years. Yet, with 175 millions of cases currently undiagnosed, a vast amount of people with diabetes develop complications even prior to having a diagnosis established.[1] South East Asia alone has 72 million people with diabetes.[1] World Health Organization (WHO) had projected that the deaths from complications of diabetes will be doubled in 2030 as compared to 2005.[2] The burden of the disease is extremely significant and diabetes remains one of the most essential preventable non-communicable diseases in developing countries.

Coherently, the prevalence of gestational diabetes has also increased; namely due to the direct impact of unhealthy diet, sedentary lifestyle and increase in the prevalence of obesity.[3] This is even more relevant among South East Asians, including Malaysians who are considered at a higher risk of developing metabolic diseases, especially GDM and diabetes.[1,2]

GDM is associated with significant maternal and foetal implications. The maternal risk of GDM includes an increased risk of caesarean delivery, post-partum haemorrhage and more significantly a 40% risk of developing diabetes in future. The foetal risk includes foetal macrosomia, birth trauma, shoulder dystocia, stillbirth, neonatal jaundice and neonatal hypoglycaemia.

The Hyperglycaemia and Adverse Pregnancy Outcomes (HAPO) study highlighted the important influence of maternal hyperglycaemia and neonatal birthweight,

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demonstrating a linear relationship between maternal fasting plasma glucose with neonatal birthweight above the 90th percentile.[4] Importantly, infant adiposity exhibited a similar strong linear relationship with maternal glucose levels.[4,5] This is extremely worrying and this might be related to the subsequent risk of metabolic diseases as now we better appreciate the developmental origins of health and diseases (DOHaD).[6]

Two large randomised controlled trials have investigated the effects of screening, diagnosis and treatment of gestational diabetes. The Australian Carbohydrate Intolerance Study in Pregnant Women (ACHOIS) established that active management of GDM in pregnancy, namely via lifestyle interventions, exercise and insulin treatment significantly reduces the incidence of foetal macrosomia, deaths and shoulder dystocia.[7] Similar results was echoed by the Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network of treatment of mild gestational diabetes.[8]

Thus, screening and detection of GDM allows active intervention in pregnancy which significantly improves pregnancy outcomes. On the long run, this indirectly aids in implementing positive lifestyle changes which is essential in preventing the future risk of developing diabetes, both in the mother and in the offspring based on the DOHaD principles. A significant percentage of Malaysians may also have undiagnosed diabetes which may be detected for the first time in pregnancy.

Historically screening for GDM has been controversial despite the significant maternal and foetal implications. However, in light of the recent evidence on benefits of intervention, there is a growing evidence towards universal screening, especially among high risk populations. The International Association of Diabetes and Pregnancy Study Groups (IADPSG)[9] recommends universal screening in pregnancy and this has now been adopted by WHO, International Federation of Gynaecology and Obstetrics (FIGO)[10] and International Diabetes Federation (IDF).[1] National Institute of Clinical Excellence (NICE) also recommends universal screening among high risk ethic population.[11]

Malaysia however still practices selective risk based screening in pregnancy.[12] IDF and WHO reports the disease burden of diabetes to be enormous, contributing to 5.1 million deaths, with the health care cost of USD 548 billion dollars, or 11% of total spend in health care cost worldwide in 2013.[1,2] Thus, universal screening in Malaysia may be the way forward, as per WHO, FIGO and IDF recommendations.[1,9,10]

Based on the Malaysians Clinical Practice Guidelines on Diabetes,[12] among the parameters which are currently used for GDM screening are age ≥25, BMI ≥27 kg/m^2, weight >80 kg, parity of ≥5, previous stillbirth and hypertension as part of the risk based screening for GDM in Malaysia. The objective of this study is to audit the effectiveness of these parameters in predicting the risk of developing GDM in Malaysia.

MATERIALS AND METHODS

This is a 24-month retrospective cohort study and the dataset was derived from the National Obstetrics Registry of Malaysia (NOR). The NOR is the largest Obstetrics and Gynaecology Registry in Malaysia which incorporates 14 major tertiary hospitals throughout Malaysia; with a total of 260,959 patients during the study period from 2011 till 2012. A total of 22,044 patients with GDM were analysed in this study. The dataset for the registry are captured at the time of delivery.

Essential factors

The objective is to audit the effectives of selective risk based screening for GDM; which is the current standard of practice in Malaysia. WHO and FIGO recommends universal screening for GDM while NICE also recommends universal screening of high risk ethic populations.

Outcomes

The primary outcome was the incidence of gestational diabetes.

The variables which were used for GDM screening were maternal age at booking, booking BMI, booking weight, parity, previous stillbirth and hypertension and these were analysed to review the association with the risk of developing GDM. Booking was defined as the measurement documented at the first contact at the health clinic and only those before 16 weeks of gestation were included in this study.

Statistical analysis

Since this is a non-randomised trial, the adjusted odds ratio was derived from a univariate analysis. All the outcomes were measured in a categorical manner. Univariate analysis was then performed using logistic regression. All data were analysed by IBM SPSS (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp).

RESULTS

Table I shows that maternal age ≥25, higher BMI (≥27 kg/m^2), increased maternal weight (≥80 kg) and hypertension are negatively associated with the risk of developing GDM in Malaysia.

Although parity ≥5 is a significant risk, the OR was only 1.02 (0.90-1.17) as compared to parity <5. The association of stillbirth with GDM was non-significant in this study.

DISCUSSION

In 1968, WHO commissioned the report on screening based on the extensive work of James Maxwell Glover Wilson.[13] That has now become the standard in public health care on the essential criteria's for disease screening. The criteria for screening includes a condition which is a significant health problem with acceptable treatment options and a recognised latent phase. The test should also be suitable, acceptable and cost effective. Screening for GDM definitely fulfils all the essential requirements of the WHO criteria, in fact more significantly than other conditions which are currently being screened in most parts of the world. Prevention remains the ultimate aim in management.

Table I: Relationship of selected risk factors and association with GDM

Variables	Gestational Diabetes				Crude OR 95% CI
	Yes		No		
	No	%	No	%	
Age					P value < 0.006
<25	1,750	8.6	141	8.3	0.98 (0.81-1.18)
25-34	11,903	58.5	938	55.0	1.00 (ref)
≥35	6,687	32.9	625	36.7	0.84 (0.76-0.94)
Booking BMI (kg/m2)					P value < 0.001
<27	8,588	42.4	631	37.2	1.08 (0.94-1.24)
27-29	4,085	20.2	324	19.1	1.00 (ref)
≥30	7,572	37.4	741	43.7	0.81 (0.71-0.93)
Booking weight (kg)					P value < 0.001
<80	16,074	79.1	1,249	73.3	1.00 (ref)
≥80	4,240	20.9	454	26.7	0.73 (0.65-0.81)
Parity					P value 0.717
<5	16,747	82.4	1,409	82.7	1.00 (ref)
≥5	3,580	17.6	294	17.3	1.02 (0.90-1.17)
Hypertension					P value <0.001
No	17,967	88.3	1,368	80.3	1.00 (ref)
Yes	2,373	11.7	336	19.7	0.54 (0.47-0.61)
Previous stillbirth					P value 0.063
No	20,109	98.9	1,676	98.4	1.45 (0.98-2.16)
Yes	231	1.1	28	1.6	1.00 (ref)

Gestational diabetes is significantly associated with the future risk of developing diabetes.[9,11] The physical, social and emotional implications are substantial and the burden of the disease is enormous. Zhang et al.[14] in 2010 estimated that Malaysia is among the top 10 countries in the world in terms of percentage of health care budget spend on diabetes, which is estimated to be around 16% of the total health care budget. This is in fact higher than the projected WHO estimate; which is 11% of health care cost for diabetes in most other countries. In 2010, up to USD 1,005,095 was estimated to have been spent on managing diabetes related health care in Malaysia.[14]

Pregnancy is now perceived as a "stress test of life" and a "window to the future".[15] Many conditions that may be detected in pregnancy predates the true events which may unfold in the later stages in life, such as the association of GDM with diabetes. Thus, screening in pregnancy is the way forward and it definitely has positive implications in terms of disease prevention in the future. It also remains an essential opportunistic time to implement positive lifestyle changes. This further strengthens the importance of screening for GDM in pregnancy.

The evolution and progress in the field of medicine, particularly medical diseases in obstetrics has allowed better understanding of the nature of the disease and prevention of complications. This is further substantiated with the practice of evidence based medicine. HAPO2 and ACHOIS6 are time defining studies which has significantly changed the management of GDM throughout the world. That is the fundamental basis for the current recommendations from WHO1 and FIGO10 towards universal screening for GDM. Similarly, NICE also recommends screening of high risk ethic groups for diabetes. Birth trauma, shoulder dystocia, post-partum haemorrhage and caesarean sections are adverse obstetric morbidities which can be significantly reduced or prevented by screening and treatment of GDM.[6]

Unfortunately, the wave of progress is yet to reach the shores of Malaysia in terms of GDM screening. We currently still adopt a more conservative approach of risk based screening. WHO and various trials in developed and developing countries have demonstrated from time to time that it is truly cost effective to screen for GDM based on the WHO recommendations.[14,16,17] It is obvious the burden of the disease in Malaysia is significant and universal screening is a cost-effective measure.

Traditionally, it has been perceived that maternal age, BMI and weight was associated with the risk of GDM. Despite NICE recommendations of screening mothers aged 35 and above, the criteria for screening in Malaysia was reduced to above 25 based on the Clinical Practice Guidelines recommendations from the Ministry of Health of Malaysia, 2009.[12] That has been used as a reference for screening since 2009; while age of 35 was used prior to that. Following the Asian references of BMI, a cut-off of 27kg/m^2 has been used as a benchmark apart from maternal weight of above 80 kg. Hypertension and previous stillbirth was also perceived as a significant risk for screening.

The novel aim of screening is to prevent disease progression and complications. Thus, screening following GDM complications of foetal macrosomia, polyhydramnios, pregnancy induced hypertension, stillbirth or bad obstetric

history may not be ideally relevant, especially at such modern times. Unfortunately, such criteria are still being used for screening in Malaysia and in certain parts of the world. Interestingly, a significant number of patients were only detected following such complications, whom may have benefitted from a universal screening and these obstetric morbidities may have been prevented.

Other risk factors for GDM screening in Malaysia includes bad obstetric history which is often poorly defined and yet again may be a complication of the disease. Glycosuria on the other hand may be physiological in pregnancy. Thus, this further strengthens the need for a more holistic and sensitive screening methodology in Malaysia, which is perhaps universal screening.

This study suggest that maternal age alone may have poor correlation with risk of developing GDM in Malaysia and the results are statistically significant (P value < 0.006). The current cut of reference of age above 25 is inappropriate as a screening criteria. Similarly, maternal weight and booking BMI is also negatively associated with the risk of developing GDM, once again with a significant p value. Hypertension, which is a screening criteria in Malaysia is also not a significant risk for developing GDM (p value <0.001). Although parity of ≥5 is a significant risk for GDM, the OR was only 1.02 (0.90-1.17) as compared to parity of below 5. The association of stillbirth with the risk of GDM is not significant.

Strength

The strength of this is the large sample size for analysis. This adds great value to the validity of the results. A previous study proved a significant sample size of at least 500 to be of adequate in power.

LIMITATIONS

A limitation of this study is that all the findings above are based on a single national registry. Perhaps future collaboration with other obstetric registries might overcome these shortcomings. The retrospective nature of this study may also be a limiting factor.

Another limitation is the lack of standardised practice within the hospitals captured in the registry as various different diagnostic criteria's were used for diagnosis of GDM. Some strictly adhered to the Malaysian CPG guidelines while certain centres used modified NICE recommendations. All the patients labelled as gestational diabetes were included and were then compared to each of the identified variables. This further strengthens the importance of this study and the limitations of current practice in Malaysia.

CONCLUSION

Selective screening based on maternal characteristics of age, booking BMI, weight and hypertension as a risk for GDM among Malaysians is inappropriate. Screening following disease complications contradicts the benefits of screening. Universal screening for GDM in Malaysia may be a more accurate measure as per WHO, FIGO and NICE recommendations.

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REFERENCES

1. International Diabetic Federation. Diabetes atlas, 6th Edition. [updated 2013; cited on December 2016]. Available from www.idf.org/diabetesatlas.
2. World Health Organization. WHO diabetes fact sheet; [updated November 2016; cited on January 2017]. Available from http://www.who.int/mediacentre/factsheets/fs312/en/.
3. World Health Organization. WHO obesity and overweight factsheet; [updated June 2016; cited on January 2017]. Available from http://www.who.int/mediacentre/factsheets/fs311/en/.
4. HAPO Study Cooperative Research Group, Metzger BE, Lowe LP, Dyer AR, Trimble ER, Chaovarindr U, et al. Hyperglycemia and adverse pregnancy outcomes. N Engl J Med 2008; 358(19): 1991-2002.
5. HAPO Study Cooperative Research Group. Hyperglycemia and Adverse Pregnancy Outcome (HAPO) Study: Associations with neonatal anthropometrics. Diabetes 2009; 58(2): 453-9.
6. Barker DJ. The developmental origins of adult disease. J Amer Coll Nutr 2004; 23(6 Suppl): 588S-595S.
7. Crowther CA1, Hiller JE, Moss JR, McPhee AJ, Jeffries WS, Robinson JS; Australian Carbohydrate Intolerance Study in Pregnant Women (ACHOIS) Trial Group. Effect of treatment of gestational diabetes mellitus on pregnancy outcomes. N Engl J Med 2005; 352(24): 2477-86.
8. Landon MB, Spong CY, Thom E, Carpenter MW, Ramin SM, Casey B, et al. A multicentre randomized trial of treatment for mild gestational diabetes. N Engl J Med 2009; 361(14): 1339-48.
9. International Association of Diabetes and Pregnancy Study Groups Consensus Panel, Metzger BE, Gabbe SG, Persson B, Buchanan TA, Catalano PA, et al. International association of diabetes and pregnancy study groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. Diabetes Care 2010; 33(3): 676-82.
10. Hod M, Kapur A, Sacks DA, Hadar E, Agarwal M, Di Renzo GC, et al. The International Federation of Gynaecology and Obstetrics Initiative on gestational diabetes: a pragmatic guide for diagnosis, management and care. Int J Gynaecol Obstet 2015; 131(Suppl 3): S173-211.
11. National Institute for Health and Clinical Excellence (NICE). Diabetes in pregnancy: management from preconception to the postnatal period. [updated August 2015; cited on January 2017]. Available from https://www.nice.org.uk/guidance/ng3.
12. Clinical Practice Guidelines, Management of Type 2 Diabetes Mellitus (5th Edition) December 2015. MOH/P/PAK/303.15(GU). [updated December 2015; cited on January 2017]. Available from http://www.moh.gov.my.
13. Wilson JMG, Jungner G. Principles and practice of screening for disease. Public Health Papers No. 34. Geneva: World Health Organization 1968.
14. Zhang P, Zhang X, Brown J, Vistisen D, Sicree R, Shaw J, et al. Global health care expenditure on diabetes for 2010 and 2030. Diabetes Res Clin Pract 2010; 87(3): 293-301.
15. Smith GN, Saade G. Society of Maternal Fetal Medicine White paper. Pregnancy as a window to future health: [cited on January 2017]. Available from https://www.smfm.org/publications/141-smfm-white-paper-pregnancy-as-a-window-to-future-health.
16. Marseille E, Lohse N, Jiwani A, Hod M, Seshiah V, Yajnik CS, et al. The cost-effectiveness of gestational diabetes screening including prevention of type 2 diabetes: application of a new model in India and Israel. J Matern Fetal Neonatal Med 2013; 26(8): 802-10.
17. Scott DA, Loveman E, McIntyre L, Waugh N. Screening for gestational diabetes: a systematic review and economic evaluation. Health Technol Assess 2002; 6(11): 1-161.