

Epidemiology of infants of diabetic mothers in indigent Micronesian population-Guam experience

Abstract: Diabetes complicating pregnancy has not yet been properly evaluated in Guam and the prevalence and morbidity of infants of diabetic mothers (IDM) in Micronesian population on Guam is described. The prevalence of IDM among the Micronesian population is 5.0% vs non-Micronesian's 3.7%. 82.5% were gestational diabetic mothers (GDM) diet controlled, 10.2% were GDM insulin controlled and 6.9% had Insulin Dependent Diabetes Mellitus. LGAs were 11% of IDMs in contrast to 6.4% of total births. Ten infants (NICU) spent total of 29 days on ventilator. Cesarean delivery, LGA, oxygen and ventilatory requirements were higher in Micronesian IDMs than in the non-Micronesian IDMs. The incidence is also higher in the Micronesian population (5.0%) compared to non Micronesian population (3.7%) on Guam. Micronesian IDMs were at higher risk for cesarean delivery, recurrent hypoglycemia, oxygen and ventilatory requirements than their non-Micronesian counterparts were. There is also a higher incidence of LGA among the Micronesian population and Chuukese had the highest incidence probably because they seek late or no prenatal care. We report 5.0% prevalence of diabetes during pregnancy in Micronesian population on Guam which imposes a significant economic burden on the local government's hospital resources. Micronesian IDMs were at higher risk for cesarean delivery, LGA, recurrent hypoglycemia, oxygen and ventilatory requirements than their non-Micronesian counterparts were. Chuukese had the highest LGA incidence in the study group. About 2/3rd of the IDM stayed 1110 extra days in hospital. IDMs accounted for the majority of expensive off-island transports.

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Background

Guam is a US territory island. It is approximately 3 times the size of Washington DC. It has a population of 160,794 consisting mainly of native Chamorros and natives of Yap, Palau, Marshall Islands, Chuuk and Philippines. Life style is mostly sedentary. The economy is vastly dependent on tourism industry. It is estimated that 9.5% of population has diabetes mellitus¹. Diabetes complicating pregnancy has not yet been properly evaluated in this population. About 90% of the births occur at one civilian hospital. Many of the indigent pregnant women do not seek proper prenatal care due to lack of insurance and as well as due to lack of health care education.

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Objective

To describe the prevalence and morbidity of infants of diabetic mothers (IDM) in Micronesian population on Guam.

Methods

A retrospective study of prevalence of IDM was conducted at Guam Memorial Hospital Authority for the years 2000, 2001 & first half of 2002. Institutional review board had approved the study. All the subjects were identified from the obstetric records. Corresponding infants' charts were evaluated. Those pregnant women who sought prenatal care were screened for diabetes at 28 weeks gestation following 50 grams of oral glucose at public health out patient clinics. Diabetes was confirmed with first hour serum glucose of ≥ 140 mg/dl. Hemoglobin A1c was not studied as it was an expensive test and not available on Guam.

Infants of diabetic mothers charts were evaluated for number of variables, such as age, sex, race, birth weight, mode of delivery, Apgar scores, complete blood count, serum glucose levels, jaundice, congenital anomalies, respiratory distress, length of stay, ventilator/oxygen requirement, off-island transfers etc. Hypoglycemia was defined as serum glucose or bedside glucose measurement of < 40 mg/dl. Low birth weight and large for gestational age (LGA) were defined as < 2.5 kgs and > 4 kgs respectively.

Statistics: SPSS 10.0 was used for calculating mean, frequency standard deviation of the variables in study population.

Results

There were 332 known infants of diabetic mothers in 2 1/

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Table 1. Distribution of IDM by ethnicity.

Ethnicity	% of Total births- (n=7375)	% of live births by ethnicity that are IDM	%of IDM (n=332)
Filipino	22.7 (1675/7375)	5.3 (89/1675)	26.8 (89/332)
Micronesians			
Chamorro	42.0 (3102/7375)	5.4 (167/3102)	50.3 (167/332)
Other Pacific islanders	6.0 (440/7375)	5.0 (22/440)	6.6 (22/332)
Chukese	12.4 (918/7375)	3.7 (34/918)	10.2 (34/332)

2 years out of total births of 7375 with an incidence rate of 4.5% of the births. The prevalence of IDM among the Micronesian population is 5.0% vs non-Micronesian's 3.7%. 82.5% were gestational diabetic mothers (GDM) diet controlled, 10.2% were GDM insulin controlled and 6.9% had Insulin Dependent Diabetes Mellitus. Chamorros accounted for 50.2% of the IDM followed by Filipinos 26.8% (Table 1). Though majority (61%) of the deliveries were vaginal (Table 2), the cesarean deliveries were higher in pregnancies complicated with diabetes 39% vs 22.6% in total live births on Guam and 23.6% for all races in mainland USA.

LGAs were 11% of IDMs in contrast to 6.4% of total births. Chuukese accounted for about 30% of the LGAs in IDM and Chamorros for about 38%. It is interesting to note that 32% of the Chuukese IDMs were LGA, where as only 8.4% of Chamorros IDMs were LGA. Hypoglycemia occurred in 40% of the population and recurrent (2 episodes) in 14% (Table 3). Sixty six percent have stayed two or more days (1,110 total days) as compared to hospital policy of 24 hours of stay for normal newborns. Seventy-eight IDM required oxygen for an average duration of 2.9 days (246 total days of oxygen). Ten infants (NICU) spent total of 29 days on ventilator. 3.6% of IDMs had some form of congenital heart defect 1/3 of who were complex heart defects like double outlet right ventricle, coarctation with tricuspid atresia. IDMs accounted for the majority (3/5) of the off-island transfers for heart surgery from NICU. There was only one death due to complex congenital heart disease. Cesarean delivery, LGA, oxygen and ventilatory requirements were higher in Micronesian IDMs than in the non-Micronesian IDMs (Table 4).

The bed charges for intermediate nursery per day are \$546.82 and average physician charges per day in the intermediate nursery are \$179.02 per day (based on year 2000 fee structure). Any newborn infant requiring oxygen and or antibiotics was considered at least to be in intermediate nursery status. Though many of these infants could

have stayed in the neonatal intensive care unit (without ventilator requirement) with higher charges, it is difficult to determine that retrospectively. Therefore, we want to assume the minimal charges these infants were entitled to excluding the consumable items charges such as blood culture bottles, gloves, syringes, x-rays etc. These babies have stayed an extra of 1,110 days at least in the intermediate nursery. The cost of physician charges and daily bed charges will amount to \$815,837.28 including average oxygen utilization charges, over and above the normal newborn expenses for first 24-hour stay.

Discussion

Abnormal carbohydrate metabolism was studied earlier in Guamanian women in early 1960s². But, infant morbidity has not been reported so far in diabetes complicating pregnancy and very high incidence of (28.9%) abnormal glucose tolerance test among the pregnant women has been reported. This is the first report describing the morbidity in Micronesian infants of diabetic mothers on Guam. We have also attempted to analyze the economic burden of this common preventable condition. Though, we could not study the number of pregnant mothers who did not receive the antenatal screening/glucose tolerance test, it is our personal experience that it is a significant number. Hence, the reported incidence of 4.5% may be under estimation, yet it is higher than the 2.9% incidence of diabetes during pregnancy in United States³. The incidence is also higher in the Micronesian population (5.0%) compared to non Micronesian population (3.7%) on Guam. The incidence of non insulin dependent diabetes in the adult population is 9.5%, but it is estimated that the true incidence may be as high as 25-27% based on unpublished observations in Saipan a neighboring Micronesian island. Hence, we decided to study the extent of the diabetes complicating pregnancy in our population and its possible impact on our feeble economic resources.

Chamorros are the main native population on Guam but has free influx of natives from other islands such Federated States of Micronesia (FSM). As Guam has better health care system and economic resources compared to FSM, many seek to deliver their babies on Guam. However, most of the local as well as natives of FSM do not have health insurance, they seek medical assistance

Table 2. Patient characteristics

Variable	Mean	Range
Birth Weight	3243g	1223-5308 g
Gestation age weeks	38.2	31-43
Male	51.2%	
Female	48.2%	
Vaginal delivery	61%	

only during advanced labor. Hence, many of the antenatal problems go unrecognized and untreated.

There are few limitations in our study. About 3% of the infants were not screened for hypoglycemia. This was probably because of lack of proper communication between obstetricians and pediatricians. Only about 37% and 18% of the IDMs had hematocrit and bilirubin values available respectively. Micronesian IDMs were at higher risk for cesarean delivery, recurrent hypoglycemia, oxygen and ventilatory requirements than their non-Micronesian counterparts were. There is also a higher incidence of LGA among the Micronesian population and Chuukese had the highest incidence probably because they seek late or no prenatal care.

The economic burden IDM impose on the local government's hospital resources is significant. The least expenses the hospital/government has incurred during the study period (over and above the usual expenses) are about \$ 815,837.28 on IDM alone. This did not include NICU expenses, consumables and nursing charges. Hospital incurred an additional \$326,334/pa (for just 332 infants) above the normal newborn expenses, which is about 22.7% additional cost. Since better antenatal management can reduce many of the morbidities in IDM, we speculate that better health education may not only reduce the morbidities of this important disease, but may also reduce the economic burden on the local government.

Conclusions

We report the first epidemiological data on IDMs in Micronesian population. We report 5.0% prevalence of diabetes during pregnancy in Micronesian population on Guam. Micronesian IDMs were at higher risk for cesarean delivery, LGA, recurrent hypoglycemia, oxygen and ventilatory requirements than their non-Micronesian counterparts were. Chuukese had the highest LGA incidence in the study

Table 3. Morbidities in IDMs

Variable	Mean	Range
LBW	12%	1223-2479 g
LGA	11.1%	4008-5308 g
APGAR 5 minute	9	7-10
O2 for 2 days	11.4%	2-19 days
Ventilator	3%	1-12 days
Polycythemia	4.2%	66.4-77.5% Hct
Hospitalization >2 days	36.7%	3-59 days
Heart disease	3.6%	12
Bilirubin > 5 mg/dl	16%	53
Recurrent Hypoglycemia	14%	2-14 episodes

group. About 2/3 of the IDM stayed 1110 extra days in hospital. Twenty three percent of IDM needed 246 days of oxygen. IDMs accounted for majority of expensive off-island transports. Hence, focusing on early recognition and management of diabetes during pregnancy will help not only to reduce the morbidity in the Micronesian infants but may also reduce the economic burden on the local government. A prospectively designed study may throw more light on this important health issue in the region.

References

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3. Annual Summary of Vital Statistics—2001, *Pediatrics* Vol. 110 No. 6 December 2002, 1037- 1052. ■

Table 4. Morbidity in Chamorro IDM vs Others

Variable	Chamorros n=167 (%)	% in others	Micronesian n=223 (%)	Non-Micronesian n=109
Cesarean delivery	68 (40.7)	37.5	93 (41.7%)	36(33%)
Preterm	33 (19.7)	18.8	44 (19.7%)	20(18.3%)
LGA	14 (8.3)	13.9	29 (13%)	8 (7.3%)
Hospital stay = 2 days	113 (67.7)	5.4	152 (68.0%)	67(61.4%)
Oxygen requirement	40 (23.9)	23	59 (26.5%)	19 (17.4%)
Congenital Heart	6 (3)	4.2	6 (2.7%)	4(3.7%)
Ventilator requirement	5 (3)	3	8 (3.6%)	2 (1.8%)
Polycythemia	9 (5.4)	3	9 (4.0%)	5(4.5%)
Bilirubin>5 mg/dl	31 (18.5)	13.3	40 (17.9%)	13(11.9%)
Hypoglycemia	68 (40.7)	39.3	94 (42.14%)	39(35.8%)
Recurrent = 2	28 (16.8)	10.9	40 (17.9%)	9(8.2%)