DIABETES AND ITS MACROVASCULAR AND MICROVASCULAR MANIFESTATIONS AMONG MICRONESIAN POPULATIONS

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ABSTRACT

This is a retrospective study. Over a period of 2 years between January 2000 and December 2001, a total of 416 adult diabetic subjects were admitted to various wards of Majuro hospital .The case records of the patients of both genders aged greater than 15 years and irrespective of underlying diseases were reviewed. A definitive diagnosis was made based on clinical features and blood glucose estimations according to American Diabetes Association.

There were 3,731 eligible subjects of which 416 were confirmed cases of diabetes mellitus (202 men and 214 women). The overall percentage of diabetes was 11.14%. Diabetes in females was slightly higher than in males. Diabetes significantly increased with age and was highest in 50-64 years. Of all diabetes 97.35% were type 2. Gestational diabetes diagnosed first time during pregnancy was 1.20%.

About 33.17% of patients presented with uncontrolled diabetes and in 0.96% ketoacidosis and non-ketotic hyperosmolar state was found. The most common and frequent chronic complications were diabetic foot and gangrene (27.88%), cardiovascular (10.33%) and renal (7.45%) patients. Major and minor amputations were done in 29 and 51 patients respectively. Interestingly malignant otitis externa was found in (1.68%) of patients. The majority of patients (88.46%) improved after admission. The overall mortality rate was 8.89%.

This study showed a trend of increasing diabetes with age in both sexes, reaching the highest rate in the fifth and sixth decades of life. Obesity, a high caloric western diet, aging populations and reduced physical activity may be the major precipitating factors.

INTRODUCTION

Diabetes mellitus is a chronic, often debilitating disease with severe complications, which is one of the most common endocrine disorders in all populations and all age groups. Previously rare, there is a rising prevalence of the disease in the developing countries with industrialization, socio-economic development, urbanization and changing life style.[1]

Worldwide diabetes epidemiological studies have shown quite marked differences in diabetes prevalence rates between ethnic groups. This pattern holds true in the pacific region and provides unique opportunities for comparative studies. Diabetes is rare in Melanesians, Polynesians, Micronesians, and Australian Aboriginals who retain their life-style. High prevalence rates of Type- 2 diabetes have been demonstrated in Polynesians, Micronesians, and Australian aboriginals who have adopted a western life-style.[2]

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Diabetes and its complications is in fact a major health problem in the Marshall Islands, but there is no indexed literature available to date to show its prevalence and complications.[3] The absence of a proper surveillance mechanism jeopardizes the planning of its control.

The present study therefore, was conducted to provide preliminary data on the magnitude of the problem of diabetes in the Marshall Islands. It was done at Majuro hospital, the largest health care facility in Republic of Marshall Islands.

We describe our experience with 416 consecutive cases of diabetes mellitus seen between January 2000 and December 2001. The purpose of the current study is to focus on the clinical presentation, complications and response to therapy in all cases of diabetes presenting to the Inpatient department of Majuro hospital and to document any changing trends compared with previous studies in the Marshall Islands.

MATERIALS AND METHODS

Over a period of 2 years between January 2000 and December 2001, 416 diabetic patients were admitted to the Majuro hospital. The case records of these patients, of both sexes who were more than 15 years of age were reviewed irrespective of underlying diseases.

A definitive diagnosis of diabetes was made based on clinical features and investigations as follows:
The definition of diabetes mellitus was adopted from the World Health Organization definition with some modifications. A subject with a medical history of diabetes was considered as diabetic. Subject without a history of diabetes and one fasting plasma glucose (FPG) level of 126mg/dl or greater or post-prandial glucose (PP) level of 200mg/dl or greater were considered as diabetic.[4,5]

Subjects were classified according to WHO criteria (1998) into diabetic groups.

Group	Diagnostic criteria
Non-diabetic	Fasting glucose up to 109mg/dl
(Fulfill both criteria)	PP glucose up to 139mg/dl
Diabetes mellitus	Fasting glucose 126mg/dl or more
(Fulfill any criteria)	PP glucose 200mg/dl or more.

The age, sex and plasma glucose concentration were recorded in standard performa. Plasma glucose concentration was determined by the hexokinase – glucose – phosphate dehydrogenase method presented as a general clinical laboratory method by Kunst et al.[6] The machine used was Dimension AR, Chemistry System from Dade Behring Dimension AR, Newark, DE19714, USA.

RESULTS

A total of 3731 adult subjects were admitted to various wards of Majuro hospital in the time frame and of these 416 patients were confirmed cases of diabetes mellitus. The overall percentage of diabetes was 11.14%. There were 202 (48.55%) males and 214 (51.44%) females. The male: female ratio was 1:1.05. The percentage of diabetes increased significantly with age and was highest in 50-64 years group.

Of all diabetics 97.35% were Type 2 and 1.44% Type 1. The percentage of Gestational diabetes (GDM) diagnosed first time during pregnancy was 1.20%.

Clinical Presentation

The most common features at presentation were generalized body weakness, nausea, vomiting, abdominal and flank pain (83%), diabetic foot with gangrene and severe earache .One hundred and thirty eight patients (33.17%) presented with uncontrolled diabetes, of which four patients (0.96%) presented with keto-acidosis and non-ketotic hyperosmolar state (Table I). One patient in the ketosis group was of Type 2. The random blood sugar levels in these patients ranged from 214 mg/dl to 789 mg/dl with mean of 375 mg/dl. The majority of patients who presented with uncontrolled diabetes were non-compliant with anti- diabetic drugs and diet.

The most common and frequent chronic complications were diabetic foot and gangrene in 116 (27.88%) patients followed by cardiovascular in 43(10.33%), and renal in 31(7.45%) patients. Malignant otitis externa was found in 7(1.68%) patients. Most of these patients presented with severe earache and were initially treated as cases of simple acute otitis media and externa without any clinical improvements, before they were referred to an ENT specialist.

Table I : Diabetic with Acute complications

Complications	No. of Patients	Percentage
Uncontrolled diabetes	138	33.17%
Keto-acidosis	4	0.96%
Non-ketotic hyperosmolar State	4	0.96%

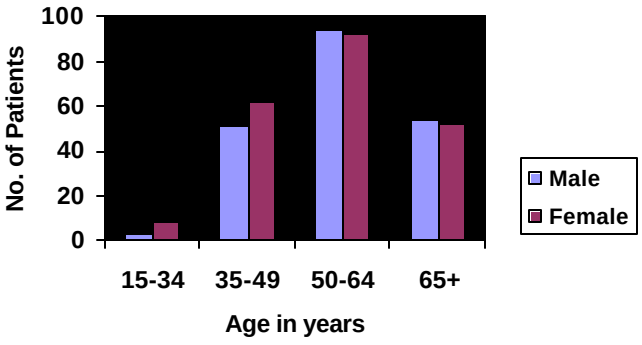

Fig.1 : Prevalence of diabetes by Age and Sex

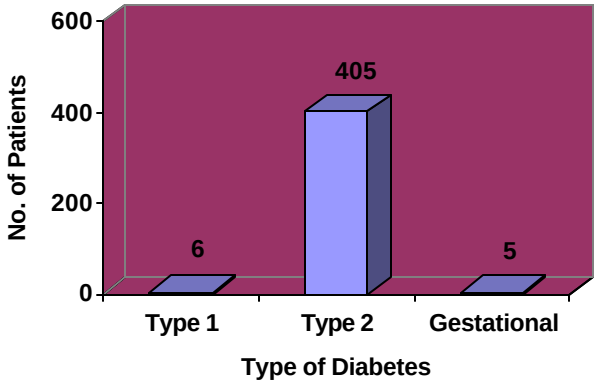

Fig. 2 : Types of Diabetes

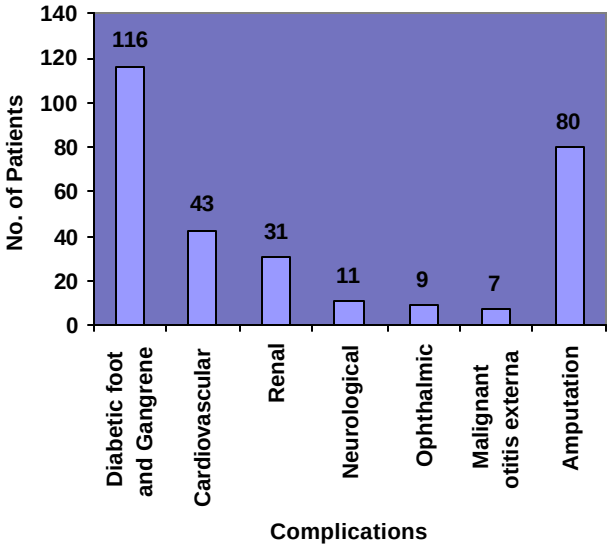

Fig. 3 : Inpatient with chronic complications

All diabetics were treated with Insulin and oral hypoglycemic agents and other appropriate medications and surgical intervention depending upon their complications as per standard protocol and guidelines. The twenty-nine patients with diabetic foot, gangrene and septicemia underwent major amputation (above and below knee) and fifty-one minor amputation (toes and fingers) respectively.

Majority of patients were improved (88.46%) with treatment. The average length of hospital stay was 15.7 days and it was longest with the complications of diabetic foot and gangrene with 31.63 days. The overall mortality rate was 8.89%. The causes of death in most patients were chronic renal failure, septicemia, and CVA. Two patients died due to CNS complications of malignant otitis externa and one due to acute complication of keto-acidosis.

DISCUSSION

Our study showed relatively high rate of diabetes mellitus, which is reflected in the health impact of this disease among the urban population of the Marshall Islands. We selected a hospital based inpatient study, because (a) diabetes is higher in urban areas in developing countries,[7,8,9,10] (b) diabetes and diabetes-related complications comprise a significant proportion of the patients in and around Majuro utilizing Majuro hospital health care resources.

The overall percentage of 11.14% in this study is relatively very high as compared to it was seen in similar hospital based study in urban adult population of Nepal (6.3%).[8] Obesity, a high caloric Western diet, aging populations and reduced physical activity may be the major precipitating factors.[2] This probably supports the proposal or hypothesis that the incidence of diabetes depends upon the level of industrialization and urbanization.[11]

As diabetes is rare in traditional Polynesians and Micronesians, but high in westernized populations of these ethnic groups, it appears these people may have a “diabetic genotype” that is unmasked by the change in life-style. A bimodal distribution of glucose tolerance has been demonstrated in both westernized Polynesians and Micronesians.[2]

In our series 97.35% of all diabetics were of Type 2 and 1.44% the percentage of Gestational (GDM) diabetes was 1.20% of all pregnancies.

In our study the most common complications was diabetic foot with gangrene (27.88%), and a significant number of these patients underwent amputations. The major (below and above knee) and minor amputations (toes and fingers) were done in 29 (6.97 %) and 51 (12.25 %) patients respectively. This high percentage of diabetic foot and gangrene in our series could be partially due to uncontrolled diabetes as most of were non-compliant to diet and anti- diabetic drugs. Some of these cases are also referred from remote outer island where they do not have accessibility to good surgical care facility.

The average length of hospital stay was 15.27 days. About 33.17% of all hospitalizations for diabetics were attributed to uncontrolled diabetes and most of them were non-compliant to diabetic diets and medications. In our study 0.96% of all diabetics presented with keto-acidosis.

The cardiovascular, renal, neurological and eye complications were seen in 10.33%, 7.45%, 2.63% and 2.16% of cases respectively. The lower rates of these complications in our series could be due to not including those patients who were attending and being treated as out patients.

Only sparse information exists on the percentage of microvascular and macrovascular complications of diabetes in pacific populations. However, there is clear evidence that they are occurring and they are similar in nature to the complications seen in Caucasian diabetic patients. Coronary artery disease was not a major problem in Pacific Islanders until recent years.[2] However, with increasing westernization, and given more time for the pathologic process of atheroma to develop, it has become a major cause of morbidity and mortality in Pacific Islanders (Micronesian).

One very important finding in our study was detection of seven (1.68%) cases of diabetes with malignant otitis externa. It has been reported that more than 90% of cases of malignant otitis externa are associated with diabetes. This is one of the rare but potentially fatal complications of uncontrolled diabetes.[12]

This study on urban and inpatient subjects may reflect the rural urban difference in the percentage rates of diabetes that has been consistently shown in developing countries. In addition, different diagnostic methods and criteria used in those previous studies may contribute to various estimates of diabetes prevalence. Most previous population – based survey measured the post-load plasma glucose value for the detection of the disease. In this study, we used fasting blood glucose and/or post- prandial blood glucose levels, using the recently proposed WHO (1998) and American Diabetes Association criteria (1997). Fasting blood glucose is more reproducible and is more convenient to draw than 2 hours after glucose load.

This study showed a rising trend of diabetes with age in both sexes, reaching the highest rate in the fifth and sixth decades of life. We also found a higher rate of diabetes in females than males, as reported also in another study in Asia.[8] However, selection bias and over estimation may have been introduced in this hospital-based study and the conclusions may not apply to the population at large. Moreover, in our series we were not able to find out the percentage of newly diagnosed and known diabetes as well as impaired glucose tolerance and impaired fasting glucose.

To clarify the above issues, field-based (community) countrywide epidemiological and prospective studies are necessary. This will provide realistic data on the magnitude of the problem of diabetes for health care planners and hopefully provide the etiologic basis of this disease in the Marshall Islands.

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