

The Incidence and Prevalence of Type-1 Diabetes Mellitus

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Aim: To determine the incidence, prevalence of type-1 diabetes mellitus (DM) and the presence of islet-cell antibodies (ICAs) in people of African ancestry in the Bahamas.

Method: Hospital records of type-1 DM were reviewed. Seventeen consecutive patients had postmeal C-peptide and ICA determined.

Results: The incidence and prevalence of type-1 DM in the Bahamas were: incidence—10.1/100,000, age 0–14 years; and prevalence—31/100,000 age 0–24 years. Only two out of 17 (11.8%) patients had ICAs.

Conclusion: Type-1 DM is common in children of African ancestry in the Bahamas. ICAs were absent in the majority of the patients.

Key words: type-1 diabetes mellitus ■ islet-cell antibodies

INTRODUCTION

Type-1 diabetes mellitus (DM), an immune-mediated disease, is known to be commoner in Caucasians compared to people of African origin. Finland has the highest incidence worldwide (40/100,000) as compared to Tanzania (0.8/100,000).^{1,2} On relocation to the Bahamas in 2000, a higher frequency of type-1 DM was observed by the corresponding author in Bahamian children of African ancestry when compared to those in New York City. The Bahamas is an archipelago consisting of over 700 islands and cays, with only 13 inhabited. The population as of the 2000 census is 310,000. People of African ancestry comprise 85% of the population and have been in the Bahamas for over two centuries. This study aims to determine the incidence and prevalence of type-1 DM and the frequency of occurrence of islet-cell antibodies (ICAs) in a subsample of these patients of African ancestry in Bahamas.

METHODS

Princess Margaret Hospital is the only tertiary care center in the Commonwealth of the Bahamas. Patients with diabetic ketoacidosis are admitted to this hospital. The diagnostic criteria for diabetic ketoacidosis were as follows: plasma glucose >250 mg/dl, serum bicarbonate <15 meq/l, positive ketone in the urine. The prevalence was determined by using hospital medical records and a type-1 DM registry kept by the department of pediatrics from 1992. The patients admitted to the department of pediatrics with new-onset type-1 DM presenting with ketoacidosis for the year 2001–2002 determined the incidence. The population statistics were obtained from the 2000 census report of the Department of Statistics, Ministry of Economic Development.

Seventeen patients had their blood withdrawn postmeal for C-peptide level and pancreatic ICAs estimation. C-peptide levels were measured by chemiluminescent enzyme immuno assay. The pancreatic ICA was assayed by an indirect immunofluorescence technique utilizing monkey pancreas tissue

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slides developed by The Binding Site Ltd., Birmingham, United Kingdom.⁴ Test and control samples were incubated with pancreatic tissue slides. The unreacted antibodies were thereafter washed off as above. Slides were viewed with fluorescent microscope. The presence of antibodies in a 1:1 dilution of patient's serum constitute a positive test.

RESULTS

Nine patients presented in a 12-month period between 2001 and 2002 with new-onset DM with ketoacidosis (Table 1). There were six females and three males, age range 2–14 years, mean age 9.8 ± 3.7 . Two males had positive ICAs. All had a family history of DM, however, no siblings with DM. The population census showed a total of 89,329 people in age range 0–14 years. Thus, incidence of type-1 is 10.1/100,000.

Of the other eight patients, seven had DM for a duration of <3 years, and one had diabetes for >10 years. Six patients had a family history of diabetes. ICAs were negative in all eight patients.

Prevalence

The type-1 diabetes registry had a total of 44 patients (14 males and 30 females), age range 2–24 years. The population in the Bahamas of age group 0–24 years is 140,540. Thus, the prevalence of type-1 DM in the Bahamas is 31/100,000.

DISCUSSION

The incidence of type-1 DM in the Bahamas is almost three times that of Barbados—4.1/100,000³—and twice that of the U.S. Virgin Islands African Ancestry population of 5.6/100,000,⁴ 0–14 age group, and 13 times that of Tanzania: 0.8/100,000. The 17 patients studied show a 2:1 female:male ratio. The low BMI and low C-peptide levels confirmed that our patients were definitely type-1 DM and not type-2 DM in the young. Only two patients were positive for ICA. GAD65 and 1AA are other ICAs which were not measured because of their lower frequency in type-1 DM. However, it is clear that T-cells and not autoantibodies mediate the immune destruction of insulin-producing cells.

Bahamians tend to be xenophobic and, as a result, there is not as much genetic admixture as compared to the neighboring Caribbean countries. Possible

explanations for this could be due to genetic and environmental factors.^{5,6}

Environmental factors are significant. Early exposure to cow's milk is associated with a high incidence of type-1 DM. Breastfeeding for the first three months appears to be protective. Bovine serum albumin, a protein in cow's milk with structural similarities to the islet-cell antigen, may be an etiological trigger for destruction of β -cells by molecular mimicry in genetically susceptible infants.⁷ The rising cost of living in the Bahamas has necessitated that both parents enter the job market. As a result, infants are exposed to formula feeding (cow's milk) within the first three months of life. Measles, Rubella and Coxsackie B viruses have been associated with type-1 DM. More recently, rotavirus has been incriminated as a cause of gastroenteritis in pre-school children in the Bahamas. A sequence similarity exists between the VP7 protein of rotavirus serotype-3 and both GAD65 and the tyrosine phosphatase IA2 islet antigen.

Thus, the T-cells stimulated by rotavirus may trigger islet β -cell autoimmunity by molecular mimicry. The Australian baby diabetic study has recently shown that rotavirus seroconversion was associated with the appearance or rise of ICAs in 24 children who had a first-degree relative with type-1 DM compared with HLA and age matched controls.⁸

The hygiene hypothesis may be relevant to our high incidence of type-1 DM. This hypothesis proposes that the noted increase in prevalence of autoimmune and allergic diseases results from a decrease in the prevalence of childhood infections.^{9,10} A significant decline in infant mortality rate has been achieved in the Bahamas during the past decade from 24.9 per 1,000 live births in 1992 to 14.7 per 1,000 live births in 2000,¹¹ strongly suggesting a decrease in the prevalence of childhood infections.

Finally, our cohort of patients can be a significant pool to help elucidate the etiology of type-1 DM.

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Table 1. Study Group—17 Patients

Female	Male	Age	BMI	ICA	C Peptide
11	6	Mean 12.2 ± 5.2 years	Mean 20.5 ± 4.9	2 Pos. 11.8%	Mean 0.2 ± 0.3 nmol/L
Incidence—10.1/100,000 age 0–14 years; prevalence—31/100,000 age 0–24 years					

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