

A Prospective Study of Children Who were Admitted for Diabetes Mellitus at a Jamaican Hospital

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ABSTRACT

Background: Type 1 diabetes mellitus is the predominant form of youth onset diabetes, and a majority of hospital admissions of this group of patients is usually due to a poor control of diabetes.

Objective: This study was undertaken to determine the prevalence of type 1 diabetes mellitus in children who were admitted to the Bustamante Hospital for Children in Jamaica over a ten year period.

Methods and Materials: A medical records study was conducted over this ten year period.

Results: These showed that there were 77,679 admissions, of which 85 were for type 1 diabetes mellitus. Fifty (50) percent of the latter was between 8-12 years old. Female diabetic patients were twice as that of the males.

Conclusion: It appears that one in every thousand children who were admitted to this institution were admitted for type 1 diabetes mellitus, and that girls between the ages of 8-12 years were more at risk.

Key Words: Diabetes mellitus, Admissions, Children, Hospital

INTRODUCTION

The Caribbean island of Jamaica has an area of 11,460 square kilometers and a population of just over 2.7 million, which is predominantly of Afro-origin. From the most recent census, 27.32% of the population was found to be under 15 years of age [1]. Diabetes mellitus is one of the most common diseases which is prevalent in school-going children. Type 1 diabetes mellitus is the predominant form of youth onset diabetes, accounting for most of the cases of diabetes with an onset before 20 years of age [2, 3]. In the Caribbean, the estimated prevalence rate of type 1 diabetes in children under 15 years of age ranged from 6.4 per 10,000 in Puerto Rico to 0.3 per 10,000 in Haiti in 1997 [4]. In Jamaica, the prevalence of diabetes among persons who were aged 25-74 years has been estimated to be 12% to 16% [5, 6], and a point prevalence of 17.9% was found in the 15 years and above age group of the population [7].

The SEARCH study for Diabetes in Youth, one of the largest to examine this phenomenon, estimated that the prevalence of diabetes in the United States residents, who were less than 20 years old in 2001 was 1.82 per 1,000 persons, with 15% of the 10-19 years olds having type 2 diabetes mellitus [8]. In a study which was done by Tulloch-Reid et al, type 1 diabetes was found to be the most common form of diabetes in Jamaicans with youth onset diabetes, with 22% of the participants who were studied having type 2 diabetes [9].

The hospitalization in children and adolescents with diabetes is associated with a high individual burden and high social costs [10, 11]. The data on the hospitalization of diabetic paediatric patients is scarce. We undertook this study to examine the admission rate of type 1 diabetic patients who were under the age of 13 years old at the Bustamante Hospital for Children in Jamaica.

MATERIALS AND METHODS

The hospital notes in the medical records of all the children with diabetes mellitus who were admitted to the Bustamante Hospital

for Children (both the newly diagnosed patients and subsequent admissions) for the period from 1985-1995 were examined. The Bustamante Hospital for Children is a children's hospital in Kingston, Jamaica. It was established in 1963 and it serves approximately 35,887 outpatients and 70,331 casualties per year. It has 283 including 5 intensive care unit beds [12].

The information which was collected included the basic demographic data, the pattern of the admissions, the reasons for the admissions, the existing picture or previous history of an infectious disease, the immunization status and the family history of diabetes mellitus. The patients were placed in three broad categories according to their ages: 0-3 years, 4-7 years and 8-12 years.

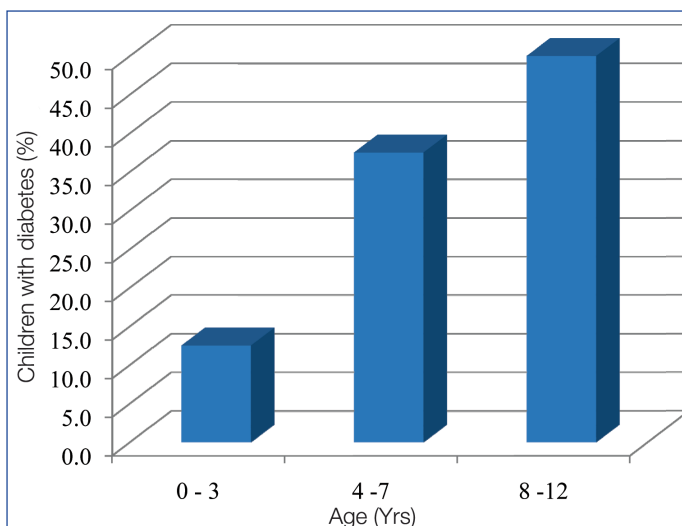
RESULTS

77, 679 admissions were recorded at the Bustamante Hospital for Children between 1985 and 1995. Approximately 0.11% of these were for type 1 diabetes mellitus. One-half (50.0%) of the latter was between ages 8-12 years old; while 37.5% and 12.5% were recorded for the 4-7 years and the 0-3 years age groups respectively [Table/Fig-1].

In the overall diabetic population, 62.5% were females as compared to their male counterparts (37.5%). Three-quarters (75.0%) of the patients had an existing or a previous history of an infectious disease and 68.8% were fully immunized, while 31.3% had no record of being immunized. Just under two-thirds (62.5%) of the total diabetic population had a history of diabetes mellitus within the immediate family.

DISCUSSION

The relatively low prevalence of type 1 diabetes mellitus which was observed in this preliminary study was consistent with the results of scientifically organized international studies [13]. These have shown that it was unknown or rare in certain groups and that the highest rates occurred in Caucasian populations.



[Table/Fig-1]: Graph of the percentage of type 1 diabetic children by age group

Type 1 diabetes accounts for almost all the diabetes cases in children who are less than 10 years of age [14]. The hospitalization of children and adolescents with type 1 diabetes mellitus results in high expenditures which amount to 63-80% of the total direct costs [15]. Icks et al., found that the diabetic children and adolescents in Germany had an approximately three times higher hospitalization risk and three times more hospital stay than the age-matched non-diabetic subjects in the general population [16]. Amongst 650 type 1 diabetic children in Sydney, a majority of the admissions were due to the poor control of diabetes [17]. High glycosylated haemoglobin levels and hypertension were identified by Moss et al., as the predictive factors for the hospitalization for 777 diabetic patients under the age of 30 years, who lived in Wisconsin, United States [18]. Reducing hospitalization is a main goal in the structured treatment of childhood diabetes, and it is a major outcome indicator in the diabetes quality management [19, 20].

The high incidence which was seen in the 8-12 years age group concurred with the results of a majority of population studies [13]. These had demonstrated age peaks in the clinical presentation of type 1 diabetes mellitus, one of a particular magnitude which occurred in the 10-13 years age group [21]. In a study which was done by Icks et al., of the 5,874 diabetic patients from 61 paediatric centers who were between 1 and 19 years of age, who were treated in 1997, 52% were males. In our study, 62.5% of the diabetic patients were females [16]. Lipton et al., examined the risk factors for 216 African-American and Latino children who were diagnosed with type 1 diabetes mellitus, who were under the age of 18 years, over a 6 year period and found that females were twice as likely to be hospitalized as males [22]. In California, a study which was done by Cohn et al., found increased hospitalization rates among young girls as compared to boys in a cohort of 2,889 type 1 diabetic children who were aged 0-18 years during 1991 [23]. These authors suggested that the underlying cause may be biological or behavioural [24].

The high incidence of the existing picture or a history of infectious diseases within our diabetic population is not unusual. Epidemiological studies provide circumstantial evidence for a possible causative role of viral infections in type 1 diabetes mellitus [24]. Among the viruses that have been implicated are rubella, mumps and human coxsackie virus B4. Experiments which were done by using animal models support the possible aetiological role of certain viruses in the genetically susceptible host [25,26]. Yang et

al., reported that infectious diseases are associated with a large and transient increase in the risk of type 1 diabetes in paediatric patients during 42 days after the infection [26].

Type 1 diabetes is preceded by autoimmunity against the insulin-producing islet β -cells [27,28]. The development of islet auto-antibodies and type 1 diabetes is influenced by both genetic and environmental factors, and the detection of islet autoantibodies in members of the affected families helps in identifying a minority of the individuals who have a markedly elevated risk of type 1 diabetes [29]. In a study which was done by Tulloch-Reid, which examined the prevalence of diabetes and other autoantibodies in patients with recently diagnosed youth onset diabetes in Jamaica, GAD65 was found to be the most common diabetes-associated autoantibody in patients with type 1A diabetes [30]. Children who had a first-degree relative with type 1 diabetes were at the highest risk for young-onset type 1 diabetes [28].

There was a reported genetic predisposition in approximately two-thirds of the type 1 diabetic patients in this study. Family studies have shown the existence of strong genetic components in type 1 diabetes mellitus as well as in type 2 diabetes mellitus [31]. The susceptibility in type 1 diabetes mellitus is conferred by the genes in the HLA-D region of the major histocompatibility complex on chromosome [32]. The genes in this complex control the immune responses. It is believed that an individual inherits a susceptibility to develop either type 1 or type 2 diabetes mellitus and that one or more non-generic and presumably environmental factors can eventually precipitate the overt clinical disease.

CONCLUSION

It appears that one in every thousand children who were admitted at this institution had type 1 diabetes mellitus, and that girls between the ages of 8 and 12 years were more at risk. The reduction in the hospital admissions of paediatric diabetic patients in Jamaica and the cost of diabetes care are of critical importance because of the increasing health care expenditures and the incidence rates of childhood diabetes. Further studies could examine the reasons for which the type 1 diabetic patients are hospitalized and the length of the hospital stay.

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REFERENCES

- [1] The statistical Institute of Jamaica: *Demographic Statistics*. Kingston, Jamaica, The Statistical Institute of Jamaica, 2008. Available at: <http://statinja.gov.jm/EndofYearPopulationbyAgeandSex2008.aspx>.
- [2] Fagot-Campagna A. Emergence of Type 2 diabetes mellitus in children: epidemiological evidence. *J Paediatr Endocrinol Metab*. 2000;13(suppl 6):1395-402.
- [3] Pinhas-Hamiel O, Zeitler P. The global spread of type 2 diabetes mellitus in children and adolescents. *J Pediatr*. 2005;146:693-700.
- [4] Fraser de Llado TE, González de Pijem L, Hawk B. Incidence of IDDM in children who live in Puerto Rico. The Puerto Rican IDDM Coalition. *Diabetes Care* 1998;21(5):744-6.
- [5] Cooper RS, Rotimi CN, Kaufman JS, Owoaje EE, Fraser H, Forrester T, et al. Prevalence of NIDDM among populations of the African diaspora. *Diabetes Care* 1997;20(3):343-8.
- [6] Wilks R, Rotimi C, Bennett F, McFarlane-Anderson N, Kaufman JS, Anderson SG, et al. Diabetes in the Caribbean: results of a population survey from Spanish Town, Jamaica. *Diabet Med*. 1999;16(10):875-83.

- [7] Ragoobirsingh D, Lewis-Fuller E, Morrison EY. The Jamaican Diabetes Survey. *Diabetes Care*. 1995;18(9):1277-9.
- [8] Liese AD, D'Agostino RB Jr, Hamman RF, Kilgo PD, Lawrence JM, Liu LL. The burden of diabetes mellitus among the US youth: prevalence estimates from the SEARCH for Diabetes in Youth Study. *Paediatrics*. 2006;118:1510-8.
- [9] Tulloch-Reid MK, Boyne MS, Smikle MF, Choo-Kang EG, Parkes RH, Wright-Pascoe RA, Barton EN, Wilks RJ, Williams DE. Clinical and laboratory features of youth onset type 2 diabetes in Jamaica. *West Indian Med J*. 2010;59(2):131-8.
- [10] Gray A, Fenn P, McGuire A. The cost of insulin-dependent diabetes mellitus (IDDM) in England and Wales. *Diabet Med*. 1993;12:1068-76.
- [11] Olsson J, Persson U, Tollin C, Nilsson S, Melander A. Comparison of the excess costs of care and production losses because of the morbidity in diabetic patients. *Diabetes Care*. 1994;17:1257-63.
- [12] Bustamante Hospital for Children. http://en.wikipedia.org/wiki/Bustamante_Hospital_for_Children.
- [13] The World Health Organization Technical Report Series (727) on Diabetes Mellitus. 1985;1-36.
- [14] Centers for Disease Control and Prevention. National Diabetes Fact Sheet: general information and national estimates on diabetes in the United States, 2011. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2011.
- [15] Simell T, Sintonen H, Hahl J, Simell OG. Costs of insulin-dependent diabetes mellitus. *Pharm Econom*. 1996;9:24-38.
- [16] Icks A, Rosenbauer J, Haastert B, Giani G. Hospitalization among diabetic children, adolescents and non-diabetic control subjects: a prospective population-based study. *Diabetologia*. 2001;44(Suppl 3):B87-92.
- [17] Sutton DL, Greenacre P, Howard NJ, Cowell CT, Silink M. Patterns of hospitalisation in a paediatric diabetes clinic in Sydney. *Diabetes Research and Clinical Practice*. 1989; 7(4):271-6.
- [18] Moss SE, Klein R, Klein BE. Risk factors for the hospitalization in people with diabetes. *Archives of Internal Medicine*. 1999;159(17):2053-7.
- [19] Chiarelli F, Verrotti A, Di Ricco L, De Martino M, Morgese G. Approaches to the quality of the control in diabetes care. *Horm Res*. 1998;50:41-7.
- [20] International Society of Pediatric and Adolescent Diabetes: Consensus Guidelines for the Management of Insulin-Dependent (Type I) Diabetes Mellitus (IDDM) in Childhood and Adolescents. London, Freund Publishing, 1995.
- [21] Spencer KM, Cudworth AG. The aetiology of insulin dependent diabetes mellitus. In: Mann, J. I. et al, ed., *Diabetes in epidemiological perspective*. Edinburgh, Churchill Livingstone, 1983;99-121.
- [22] Lipton RB, Zierold KM, Drum ML, Klein-Gitelman M, Kohrman AF. Re-hospitalization after the diagnosis of diabetes varies by gender and socioeconomic status in the urban African-American and Latino young people. *Pediatr. Diabetes* 2002;3(1):16-22.
- [23] Cohn BA, Cirillo PM, Wingard DL, Austin DF, Roffers SD. Gender differences in the hospitalizations for IDDM among adolescents in California, 1991. Implications for prevention. *Diabetes Care*. 1997;20(11):1677-82.
- [24] Cudworth AG, Gorsuch AN. Autoimmunity and viruses in Type 1 (insulin-independent) diabetes. In: Ellenberg, M. and Rifkin, H., ed. *Diabetes Mellitus: Theory and practice*, 3rd ed. New York, Medical Examination Publishing Co. Inc., 1983;505-17.
- [25] Alba A, Planas R, Verdaguer J, Vives-Pi M. Viral infections and autoimmune diabetes. *Immunología*. 2005;24;1:33-43.
- [26] Yang Z, Zhou F, Dorman J, Wang H, Zu X, Mazumdar S, LaPorte R E. Association between infectious diseases and type 1 diabetes: a case-crossover study. *Pediatric Diabetes*. 2006;7:146-52.
- [27] Eisenbarth GS. Type 1 diabetes mellitus: a chronic autoimmune disease. *N Engl J Med*. 1986;314:1360-8.
- [28] Atkinson MA, MacLaren NK. The pathogenesis of insulin-dependent diabetes mellitus. *N Engl J Med*. 1994;331:1428-36.
- [29] Atkinson MA, Eisenbarth GS. Type 1 diabetes: new perspectives on the disease pathogenesis and treatment. *Lancet* 2001;358:221-9.
- [30] Tulloch-Reid MK, Boyne MS, Choo-Kang EG, Parkes RH, Wright-Pascoe RA, Barton EN, Wilks RJ, Palmer-Levy ML, Smikle MF. Autoantibodies in Caribbean youth with diabetes mellitus. *Hum Antibodies*. 2008;17(3-4):57-62.
- [31] Pyke DA. Diabetes: the genetic connections. *Diabetologia*. 1979;17:333-43.
- [32] Kobberling J, Tattersall R. Ed. *The genetics of diabetes mellitus*. London Academic Press, 1982.

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