

ORIGINAL ARTICLE

PREVALENCE OF MICROALBUMINURIA IN CHILDREN WITH TYPE 1 DIABETES MELLITUS

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Abstract

Diabetic nephropathy, the leading cause of morbidity and mortality in adults with type 1 diabetes mellitus may have its roots since childhood. The occurrence of microalbuminuria in children with Type 1 Diabetes may provide an early opportunity to study the natural history and plan earlier interventions. This study was done in diabetic clinic and pediatric nephrology department of the Institute of Child Health and Hospital for Children, Egmore, Chennai to determine the prevalence of microalbuminuria in children with Type 1 Diabetes mellitus (DM). Prevalence of microalbuminuria in children with Type 1 DM in our study was 13.4%. Higher diabetic age and higher glycosylated hemoglobin (HBA1c) levels were found to be significantly associated with microalbuminuria.

Key words: Type 1 Diabetes Mellitus; microalbuminuria; children

Introduction

Diabetic nephropathy (DN) is a leading cause of increased morbidity and mortality in patients with type 1 diabetes mellitus (DM). Microalbuminuria (MA) is an early predictor for diabetic nephropathy and is rarely detected before puberty. MA is predictive of future DN in adults with diabetes mellitus. This link between MA levels and DN allows patients to receive timely interventions. The predictive value of MA for DN in children with diabetes however is not well established. Diabetic nephropathy is rarely seen in childhood but the dreadful complication originates in the early years of disease when the child is still under pediatric care. The impact of early intervention on the future outcome needs to be studied.

Methods and Material

All the type 1 DM children who are regularly followed up at the diabetic clinic of a tertiary care pediatric institute were recruited. Study period was between January 2008 and December 2010. Children with febrile illness, urinary tract infection, diabetic ketoacidosis (DKA), children with preexistent renal disease were excluded from the study. Children were subjected to 3 early morning spot urine examinations for microalbumin/creatinine ratio (ACR) done over a period of 12 months and if two of the three samples were positive they were considered to have persistent microalbuminuria. The urine microalbumin estimation was done using fully automated immunoturbidometry method and creatinine by Jaffee method. ACR

ratio < 30mcg/mg of creatinine was defined as normoalbuminuria, between 30 -300mcg/mg of creatinine was defined as microalbuminuria and >300mcg/mg was defined as macroalbuminuria. Children had the glycosylated (HBA1c) levels evaluated once every 4 months. HBA1C was done by bidirectionally interfaced fully automated turbidometry by Roche. The mean HBA1c over the period of 12 months was considered for the diabetic control. Chronological age, duration of diabetes, age at the onset of diabetes, body mass index (BMI), insulin dose and level of diabetic control by HBA1c were compared between the group without microalbuminuria (group1) and the group with microalbuminuria (group2). Data were analyzed by Epi Info version 3.5.3, statistical soft ware. Chi-square test and Fisher exact test were used to calculate the difference among the two groups and the statistical significance was set at $p < 0.05$.

Results

One hundred twenty seven children were recruited for the study. Male: female ratio was 5:8. Seventeen children (13.4%) showed persistent microalbuminuria with a mean age at microalbuminuria being 10.9 ± 2.3 years and range from 5 to 15.7 years. One child was under 5 years of age, 3 were between 5-9 years, 7 were between 10-12 years and 6 were more than 12 years of age. The diabetic duration at diagnosis of MA was 1 to 9 years with a mean of 4.2 ± 2.6 years. The diabetic duration was < 3 years in 5 children, between 4-6 years in 8 children and more than 7 years in 4 children at the time of diagnosis of microalbuminuria. None had hypertension. None had macroalbuminuria. The gender distribution, mean chronological age, mean diabetic age, BMI, HBA1c levels, serum cholesterol levels and insulin dose in both the groups are depicted in Table 1. Children in the microalbuminuria group were found to be at a higher diabetic age ($p=0.01$) and had a higher HBA1c levels (0.004).

Discussion

Prevalence of microalbuminuria in Type 1 diabetes varies from 3 - 30 % in various studies. (1-3) Occurrence of microalbuminuria depends on many factors, including chronological age, duration of DM, glycemic control, gender, insulin dose, level of metabolic control, cholesterol and triglyceride level. (2,4-8) Longer duration of diabetes and higher HBA1c levels have been found to be consistently associated with microalbuminuria in most of the studies and has been demonstrated in this present study too. (2,4-8)

Table - 1: Factors associated with microalbuminuria

Parameter	Normoalbuminuria	Microalbuminuria	P value
Age at diagnosis (years)	6.5 ± 3.1	6.2 ± 2.7	0.75
Body mass index	21.1 ± 4.3	20.1 ± 5.8	0.47
Chronologic age (years)	11.2 ± 2.9	12.5 ± 3.2	0.08
Diabetic age (years)	4.7 ± 2.3	6.3 ± 2.8	0.01
Insulin dose (IU/kg)	1.3 ± 0.4	1.3 ± 0.4	0.69
Glycosylated hemoglobin (HBA1c)	9.2 ± 1.6	10.9 ± 2.3	0.004

Other study parameters like insulin dose, BMI, age at onset of diabetes did not show any statistically significant difference among the two groups.

Microalbuminuria occurring in older children is found to be clinically significant while the same in younger children may reflect functional, reversible renal changes. (9) Evaluation of urine for microalbuminuria is recommended after 5 years of diabetes in prepubertal children and after 2 years of diabetes in post pubertal children. (10) Our study has demonstrated urine microalbuminuria in children with less than 2 years of diabetes duration and in prepubertal children too. Currently ISPAD 2009 recommends screening from age 11 years with 2 years diabetes duration and from 9 years with 5 years duration to capture most evolving microalbuminuria in children and adolescents. (11) Based on the above criteria for screening, 5 children would have not been diagnosed with microalbuminuria in this study group. The occurrence of persistent microalbuminuria in children within one year of diagnosis or at a younger age as in our study may warrant annual evaluation of Type 1 diabetic children for urine microalbuminuria much earlier than the current recommendations.

Microalbuminuria confers a 60 - 85% risk of the development of overt proteinuria within 6 - 14 years. Without intervention approximately 80% of Type 1 diabetic patients with persistent microalbuminuria develop overt nephropathy after 10 - 15 years. Eventually 50% of these develop end stage renal failure within 10 years and 75% by 20 years. (8) The levels of microalbuminuria vary within patients and may totally regress to normal over time with or without treatment. (6,12,13) Persistent microalbuminuria predicts progression to macroalbuminuria while transient does not. Hence the natural history of persistent microalbuminuria needs to be evaluated among children with Type 1 diabetes.

The intervention to be planned in such children is not clear. Current recommendations favor tight metabolic control, hypertension control and use of angiotensin converting enzyme (ACE) inhibitors for prevention of progression of urine microalbuminuria among diabetic children with risk factors. (14) Longitudinal studies following up children with microalbuminuria may show a clear picture of their clinical relevance in predicting their progression to diabetic nephropathy as adults.

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