Prevalence of Diabetic Ketoacidosis in newly Diagnosed Diabetes Mellitus Pediatric Patients in Tikur Anbessa Specialized Hospital,

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Abstract

A retrospective descriptive study was conducted at Tikur Anbessa Specialized Referral Hospital (TAH) to determine the prevalence of newly diagnosed type I Diabetes Mellitus (DM) patients who initially presented with diabetic ketoacidosis (DKA). During the study period from September 1997 to September 2007 there were a total of 143 type I DM patients seen at pediatrics emergency out-patient department (E-OPD) of TAH. Of those, 118 patients were newly diagnosed type I DM patients and 25 were known DM patients who came for follow-up. Of the 118 patients 101 (80 %) were admitted to the wards with diagnosis of DKA. There were 7 deaths during the study period that makes the case fatality rate 6 % the deceased were newly diagnosed DM patients in DKA. Both sexes were equally affected. Significant number of children 31 (30.6%) were less than four years of age. Fifty seven children (56.4%) presented late. The parents' monthly income, level of education and the residential area were not found to have association with early seeking of medical advice. The study concluded that 80% of patients seen at the OPD with newly diagnosed DM presented with DKA and most of them (56 .4 %) came late. Hence, extensive health education has to be given both in urban and rural areas so that they will seek medical advice earlier to prevent occurrence of DKA and its associated morbidity and mortality.

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Introduction

Many patients with diabetes die from diabetic ketoacidosis (DKA) every year. Reduced insulin levels, decreased glucose use and elevated counter regulatory hormones cause DKA. It primarily affects patients with type I DM, but it may also occur in patients with type II DM (1). DKA occurs in 25-40 % of children with newly diagnosed type I DM and in those who have known type I DM at a rate of 8 per 100 person / year (2, 3, 4). DKA at the onset of type I DM is more common in younger children less than four years of age, children without a first degree relative with type I DM and those from families of low socioeconomic status. Some drugs have been reported to precipitate DKA in individuals not previously diagnosed with type I DM (7). The mortality rate for DKA ranges from 2 to 5 % in developed countries and 6 to 24% in developing countries. Without treatment it is 100 % fatal. It remains a major source of mortality and morbidity due primarily to the development of cerebral edema, which is the gravest complication of DKA. In places like ours, where medical services are less developed, the risk of dying from DKA is greater and children may die before they receive treatment. Overall cerebral edema accounts for 60 to 90% of all DKA related deaths in children. (5, 6, 7).

The younger the child the more difficult it is to obtain the classical history of polyuria, polydipsia and weight loss. Infants and toddlers in DKA may be misdiagnosed as having pneumonia, asthma or bronchiolitis and put on treatment with steroids or sympatomimetics, which can exacerbate the metabolic derangement. Because the diagnosis of diabetes is not suspected as it evolves the duration of symptoms may be longer, leading to more severe dehydration, acidosis ultimately to obtundation and coma. **A** high index of suspicion is very important for the diagnosis of DM and prevention of complications especially in very young children (9).

The purpose of this study is to determine the prevalence of newly diagnosed type I diabetes mellitus patients who initially presented with DKA and the precipitating factor and the outcome.

Patients and Materials

A retrospective descriptive study of prevalence of DKA is in children admitted for the first time at Tikur Anbessa Hospital over ten years of period was made .The clinical records of all children up to the age of 12 years who were seen at the pediatrics emergency Out Patient Department (OPD) for the first time and those referred from other health facilities for inpatient management as newly diagnosed diabetic mellitus with DKA were reviewed.

The diagnosis of DKA was made when the following diagnostic criteria were fulfilled. Patient presenting with vomiting, dehydration, kussmaul breathing, lethargy or coma and biochemically random blood sugar (RBS) > 250 mg/dl, glucosuria and ketonuria.

The average monthly income of parents was found to be 740 Birr. Those below the 740 Birr were considered as low-income category and those above 740 birr categorized as income of above the average for this study.

Parents who are illiterate and who are able to read or write only were considered as not attending a formal education. In this study Primary school attendance defined as attending one to eighth grade and those above eighth grade considered as having relatively high level of education.

Data was collected both from registry book and charts. Complete information consisting of identification of the patient, nutritional status, social data, medical history, physical examination, laboratory data and treatment outcome were collected onto a form prepared for the purpose of the study. Data entered, cleaned and analyzed using SPSS 12.0. Ethical clearance and approval for the research was obtained from department of pediatrics and child health.

Results

During the study period from September 1997 to September 2007 a total of 143 types I DM patients were seen at the pediatric OPD. Of these, 118 patients were newly diagnosed type I DM patients and 105 (80%) were admitted to

TAH as a case of newly diagnosed type I DM patients in DKA.

Table 1 shows 30.7% (n=30) of patients were less than 4 years of age and 37.6% (n=38) in the range of 4-9 years. The average age was 6 year, the lowest age was 9-½ month and the maximum age was 12 yr. The male to female ratio was nearly1:1. A quarter of the cases (n=25) had family history of DM and 81.2 % were from Addis Ababa and the nearby towns. More than half of parents have monthly income below the average and 42.6% (n=43) of parents attend higher level of education.

For a significant number of children early feeding pattern, monthly income and level of education of parents were not known. In 44.6 % of patients infection was the precipitating factor and in majority of the cases 53.5 % no precipitating factors were identified (Table 2). Table 3- shows the commonest presenting symptoms and signs**;** poly symptoms were the leading presenting symptom, which accounts for 98 %.

In 65.3 % RBS was between 250-500 mg/dl the remaining was above 500 mg/dl. Taking the duration of presenting symptoms the average duration was 16.5 days and the minimum was 1 day and the maximum was 120 days, majority came within one-week time. The duration of presentation was sub grouped as early and late using quartiles and those who lie in the first quartile were taken as early presenters, in this study it was seven days.

Table -4 shows the effect of different factors in their duration of presenting symptoms.

Around fifty six percent of patients came late. Depending on their residential location among those who came late 53.67 % were from urban area and 68.4% were from rural area with p-value of 0.181 which is not statistically significant (Fisher's Exact Test).

Taking also the parents' level of education, from those who did not attend formal education 70 % presented late and 40 % of those who attended primary school also came late.

Significant number of children (53.5%) was from families' who joined secondary school and higher education came late which shows that there was no association between the level of education of the parents' and the duration of presentation (p-value of 0.205).

Concerning the monthly income of the parents and the duration of presentation of symptoms significant number of children (35 %) from the families who get above the average income came late so there was no significant association between monthly income of the parents with their time of presentation(p- value of 0.08)).

No significant association was found between the duration of presenting symptoms with the parent's monthly income, level of education and their residential area. There were 7 deaths all of whom were newly diagnosed type 1 DM patients in DKA which makes the case fatality rate 6%, three deaths were analyzed in the study four deaths weren't included in the analysis because it was not possible to get the cards and excluded from the study. From the deaths, one patient repeatedly went to hypoglycemia and another died of sepsis and one patient died because of cerebral edema, the cause of death for the rest was unknown. The average hospital stay was 21 days and maximum was 91 days and minimum one day, majority of patients stayed for 3 weeks.

Discussion

DKA is acute complications of diabetes mellitus primarily type I but it can also occur in type II DM. It occurs in 25-40 % of children with newly diagnosed type I DM patients. DKA at diagnosis is more common in younger children and in children whose families don't have ready access to medical care for social or economic reasons (6). In this study 80 % (n=105) of patients from the newly diagnosed type I DM patients were found in DKA which is a high figure although there are some reports in newly diagnosed DM patients in which the prevalence of DKA can reach as high as 70 %(6). In a study which was done in Sudan they found that 81.2 % of the newly diagnosed diabetic children presented to hospital with DKA (16).In previous study at Tikur Anbessa hospital which showed that DKA occurred in 58 % of previously undiagnosed patients (11). The high figure in this study may be due to the fact that the hospital is the only referral hospital and there may be a tendency to refer these patients to this hospital for better patient management and other patients who aren't in DKA may be managed in other hospitals so the figure may be exaggerated. The study found that the male to female ratio was 1:1, in agreement with other study (10). There was a positive family history of DM in 24.8 % of patients, which was higher than the reports in other studies (6, 13, 14). A

positive family history of DM is said to reduce the risk of DKA because the family will seek medical advice earlier (9). More than 37% of DKA occurred in the age group of 4-9 year and 32% occurred in the age group of 9-12 years, which is also seen in other studies (6,10, 11,12) and these age groups are the peaks of presentation for diabetes mellitus, the first peak may coincides to the time of exposure to infectious agents with the beginning of school and the second peak may correspond to the pubertal growth spurt. Thirty-one percent of patients were less than 4 years of age, which is also significant number. The commonest clinical presentation was poly symptom (98%) followed by dehydration (51.5 %) and weight loss (48.5 %), which is consistent with a previous local study, (11).

The results from this study compare favorably with other studies (11,12), in that infection is the prominent precipitating factor (44.6 %) with upper respiratory tract infection and urinary tract infection being two of the most common causes. A number of studies showed that DKA at diagnosis is more common in children whose families do not have ready access to medical care for social or economic reasons (6,9,13) but this fact was not demonstrated in our study the reason might be for the significant number of parents their level of education and their monthly income wasn't known (28 %) and (27 %) respectively and even those parents who get higher income and having higher level of education they mayn't be aware of the problem and seek medical advice earlier.

The average duration of hospital stay was 21 days, which was comparable with the study done in TAH (11).

In this study the case fatality rate was 6 %, which was similar with the previous study (11) and with the other studies from elsewhere, which showed that the mortality rate for DKA ranges from 2-5 % in developed countries, and 6-24 % in developing countries (2). In one study, which was done in South Africa the mortality, rate was 2.5 % (13).

The study concluded that majority of patients with newly diagnosed type 1 DM patients presented with DKA and delay in presentation was a major cause of DKA and infection was also found to be the major precipitating factor. Significant number of children was less than four years of age so we have to have high index of suspicion in this age group. There was no significant association between the duration of presentation and the parents' monthly income, level of education and their residential area

In conclusion early diagnosis and initiation of treatment, targeted health education and access to health facilities may decreased the complication and mortality associated with DM. Prospective cross sectional study is recommend to know the exact burden of the disease.

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Table 1 Clinical characteristic of cases of Diabetic Ketoacidosis at Tikur Anbessa Hospital September 1997-September 2007

Factors	Numbers	Percentage
1. Age range		
< 1 yr	2	2
1-4 yrs	29	28.7
4-9 yrs	38	37.6
9-12 yrs	32	31.7
2. Sex		
Male	52	51.5
Female	49	48.5
3. Family history		
Yes	25	24.8
No	69	68.3
unknown	7	6.9
4. Early feeding pattern		
Breast feeding	38	37.6
Cow's milk	2	2
Formula feeding	5	5
Unknown	56	55.4
5. Monthly income of parents		
Below average	54	53.4
Above average	20	19.8
Unknown	27	26.8
6. Level of education of the parents		
Not attend formal school	10	9.9
Primary school	20	19.8
Secondary school and above	43	42.6
Unknown	28	27.7
7. Residential area		
Urban	82	81.2
Rural	19	18.8

Figure 1- Age distribution of the patients admitted with diabetic keto-acidosis

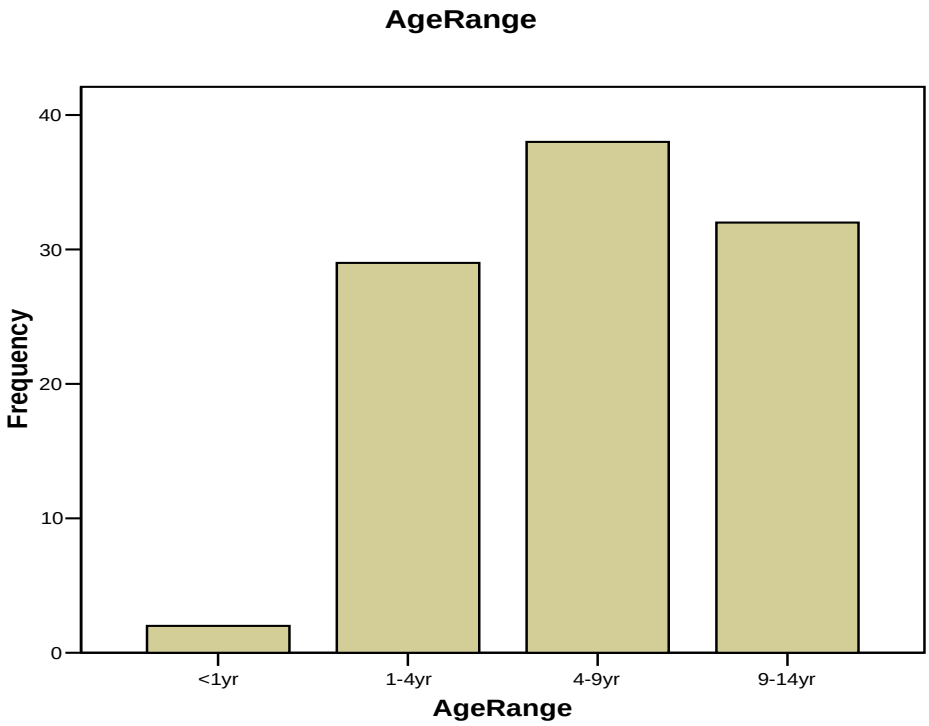

Table 2- Precipitating factors in newly diagnosed DKA patients

Factors	Number	Percentage
Infection	45	44.6
Trauma (physical/psychological)	2	2
No precipitating factor identified	54	53.5

Table 3- Presenting symptoms and signs of Diabetic Ketoacidosis

Signs / symptoms	Numbers	Percentage
Poly symptoms	99	98
Dehydration	52	51.5
Weight loss	49	48.5
Vomiting	38	37.6
Kussmal breathing	33	32.7
Abdominal pain	27	26.7
Body weakness	23	22.8
Fever	21	20.8
Coma	10	9.9
Headache	3	3

Table4 - Distribution of socio- economic factors and duration of presenting symptoms

Factors	Numbers	Late comers	p- valve
1. Residential area			
Urban	82	44 (53.65%)	0.181
Rural	19	13 (68.4%)	
2. Level of education			
Not attending formal school	10	7(70 %)	0.205
Primary school	20	8 (40 %)	
Secondary school and above	43	23 (53.5%)	
Unknown	28	19 (67%)	
3. Monthly income			
Below average	54	32 (59.2%)	0.08
Above average	20	7(35%)	
Un known	27	18(66%)	

References

1. Trachtenbarg D. Diabetic ketoacidosis. Am Fam Physician. 2005; 71(9): 1705-14.
2. Lebovitz HE. Diabetic ketoacidosis. Lancet. 1995; 345(8952): 767-72.
3. Kaufman FR. Diabetes mellitus. Pediatrics in review; 2003; 24: 291-299.
4. Rosenbloom AL. Diabetic ketoacidosis; Treatment guidelines. Clin Pediatr: 1996 ;35 (5): 261-6
5. Glaser N, Barnett P; Risk factors for cerebral edema in children with Diabetic ketoacidosis. N Engl J Med. 2001; 344(4): 264-9.
6. Wolfsdorf,J , Glaser N, ,Sperling MA. Diabetic ketoacidosis in infants, children, and Adolescents. Diabetes Care, 2006; 29(5): 1150-9
7. Dunger DB, Sperling,CL. European society for Pediatric Endocrinology/Lawson Wilkins pediatrics Endocrine Society : Consensus statement on diabetic ketoacidosis on children and adolescents. Pediatrics 2004 ; 113 (2):e 113-40
8. Curtis JR, Muirhead TS. Recent Trends in Hospitalization for Diabetic Ketoacidosis in Ontario Children, Diabetes Care.2002; 25(9): 1591-6.
9. Smith CP. Diabetic Ketoacidosis, Current Pediatrics, 2006; 16,111-116.
10. Bui TP, Werther GA, Cameron FJ. Trends in diabetic Ketoacidosis in childhood and adolescence: a 15-yr experience, Pediatr Diabetes .2002; 3(2) 82-8
11. Teshome D. Diabetic Ketoacidosis In An Addis Abeba Children's Hospital. Ethiop Med J 1992; 30:7-11
12. Koton S. The Israel IDDM registry study group; Incidence of type 1 DM in the 0-17 yr old Israel population, 1997-2003. Pediatr Diabetes.2007; 8(2): 60-6
13. Mudly S, Rambiritch V and Mayet L. An identification of the risk factors implicated in diabetic ketoacidosis in type 1 and type 2 DM in South Africa. SA Fam pract 2007; 49(10): 15
14. Elamin A, Altahir H, Ismael B, Tuvemo T. Clinical pattern of childhood type 1 DM in the Sudan. Diabetologia. 1992; 35(7); 645-8.