



St PAUL's HOSPITAL MILLENNIUM MEDICAL COLLEGE

MAGNITUDE OF DIABETIC KETOACIDOSIS IN NEWLY DIAGNOSED DIABETES MELLITUS CHILDREN IN SPHMMC

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2. DR BEREKET FANTAHUN (PEDIATRIC ENDOCRINOLOGIST)
3. DR EWENAT GEBREHANNA

September, 2017

Addis Ababa, Ethiopia

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A STUDENT RESEARCH REPORT TO BE SUBMITTED TO THE DEPARTMENT OF PUBLIC HEALTH, SPHMMC, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF MEDICINE

September, 2017

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ACKNOWLEDGMENT

I would like to thank my advisor Mr Seman Kedir, Dr Bereket Fantahun and Dr Ewenat Gebrehanna for their assistance and valuable comment in developing this research report. Also my heartfelt gratitude goes to my Friend Elias Berhanu and Dr Mhiretab Ermias in the finalization of this research Report.

Abstract

Background: Diabetic ketoacidosis (DKA) is a serious life threatening complication of type 1 diabetes mellitus and constitutes a medical emergency with significant morbidity and mortality. The study is important to contribute to the effort toward reducing morbidity and mortality related to DKA. The findings will also help for policy makers for planning since there is paucity of published data on magnitude of DKA in newly diagnosed DM children in Ethiopia.

Objectives: To assess the magnitude and clinical characteristics of DKA in newly diagnosed Diabetic Mellitus children in Addis Ababa.

Method: In this retrospective study, the case records of all children with newly diagnosed DM children seen in the Department of pediatrics, in SPHMMC between January 2013 to December 2016 were retrieved using data abstraction sheet/guiding questionnaire from patient card. Data was double entered from the paper-based abstraction sheet and exported to SPSS version 20 for analysis. A descriptive analysis was performed.

Result: A Total of 62 newly diagnosed type I dm children of age less than 15 were studied from January 2013 to December 2016, from this 43(63.5%) Of the children present with DKA. Of the 43 newly diagnosed type I DM children with DKA, 26 (60.5%) were females and 17(39.5%) were males giving a female to male ratio of 1.5:1. The mean age was 9.44, range (2 to 14). From 43 newly diagnosed type I DM with DKA children, 4(9.3%) of them have first degree relatives with DM and 39(90.7%) of the children do not have first degree relatives with DM. 86% of the children has sign and symptoms of DM before presenting with DKA.

Conclusion: The overall magnitude of DKA in children with newly diagnosed type 1 diabetes is high. The increased number of newly diagnosed patients presenting with DKA in our experience indicates that focus should be given upon earlier diagnosis and intervention of diabetes to reduce the occurrence of DKA.

Acronyms

DM-----Diabetes Mellitus

DKA-----Diabetic Ketoacidosis

ICU ----- Intensive Care Unit

ISPAD----- International Society for Pediatric and Adolescent Diabetes

SPHMMC --St. Paul's Hospital Millennium Medical College

T1DM-----Type 1 diabetes mellitus

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Introduction

1.1 Background

Diabetic ketoacidosis (DKA) is a serious life threatening complication of type 1 diabetes mellitus and constitutes a medical emergency with significant morbidity and mortality (1), mostly due to cerebral edema during the course of resuscitation. The international society for Pediatric and Adolescent Diabetes define DKA based on biochemical criteria as a blood glucose level $>11\text{mmol/l}$ ($>250\text{ mg/dl}$), Venous PH <7.3 or bicarbonate $< 15\text{mmol/L}$, ketonemia and ketonuria and based on clinical sign of DKA: dehydration, tachycardia, tachypnea, deep sighing respiration, Nausea and vomiting, abdominal pain, Confusion, drowsiness, progressive reduction in level of consciousness and, eventually, loss of consciousness (2).

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. Risk factors for DKA in newly diagnosed cases include younger age ($<2\text{yr}$), delayed diagnosis, lower socio economic status, and countries with low prevalence of type 1 diabetes mellitus (2).

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, reactive airways disease (asthma), or bronchiolitis and therefore treated with glucocorticoids and/or sympathomimetic agents that only compound and exacerbate the metabolic derangements. Because the diagnosis of diabetes is not suspected as it evolves, the duration of symptoms may be longer, leading to more severe dehydration and acidosis and ultimately to obtundation and coma (2-4).

Every year worldwide, approximately 79,100 children under 15 years of age develop type 1 diabetes. Up to 80% of these young people already have DKA when they are diagnosed with

diabetes. There is a wide geographic variation in the frequency of DKA at onset of diabetes. Frequency of DKA in newly diagnosed DM children ranges from 15-70% in Europe and North America (2-4).

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, and 8).

Other serious complications of DKA may include renal failure, which although extremely rare, may necessitate dialysis. Incidences of increased thromboembolic events are known to occur in children with DKA following dehydration, central venous catheter placement in ICU or idiopathic elevation of von Wille-brand factor. Although rare in children compared with adults, acute pancreatitis may present in children with severe DKA and unresolving abdominal pain despite treatment (9).

DKA at onset of diabetes is more common in under five children and in children whose families don't have access to medical care due to social and/or economical reasons. geographical factors like climate may influence the number of people affected with DKA. countries nearer the equator have high prevalence of DKA due to hot climates which lead to more rapid dehydration and onset of hyperglycemia particularly in young children (10).

Among the developed countries the frequency of DKA is lower in countries where the background incidence of type 1 DM is higher (10). Having first degree relatives with diabetes is associated with an up to six fold lower risk of DKA at diagnosis (7). 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. The true incidence of DKA in Sub Saharan Africa is unknown but unlike the western country DKA is uniquely frequent among type 2 diabetes (11). Some

observational studies in Africa suggested high prevalence of DKA at diagnosis, which is 80% to 88% (12).

1.2 Statement of the problem

For large areas of the World, particularly in Africa and South East Asia, there are few data or none at all, on the frequency of DKA in children. Observational studies from African countries suggest that the frequency is high but the exact figures are scarce. However, the report of a few studies from Africa indicated that the frequency varied from 80% to 88%. The reason for DKA at onset of newly-diagnosed diabetes is multifactorial. The management of DKA, in itself, imposes a significant economic burden on the patient and his family, particularly in developing countries. DKA is the most frequent cause of diabetes related death in children with the mortality rate ranging between 6% and 24% in developing countries. The magnitude of DKA in children in Africa from few pocket studies is much higher than the developed countries. In Ethiopia like other African countries the magnitude and risk factors of DKA in newly diagnosed DM children is not well studied. Without the knowledge of the magnitude and associated risk factors of DKA in children the preventable associated risk factors will not be handled and this leads to increase magnitude of DKA in children (1-4, 22)

1.3 Significance of the study

The proposed study is important to contribute to the effort toward reducing morbidity and mortality related to DKA. These findings will also help for policy makers for planning since there is paucity of published data on magnitude and risk factors of DKA in newly diagnosed DM children in Ethiopia. Understanding factors associated with DKA has the potential of improving our knowledge of the disease, enhancing the development of patient, professional and population based interventions to reduce the proportion of children whose first presentation is DKA. This study will also give clue for further prospective studies.

2. Literature review

2.1 Magnitude of DKA

Diabetic ketoacidosis (DKA) is a potentially life threatening acute complication of type 1 diabetes mellitus (T1DM), characterized by a biochemical triad of hyperglycemia, ketonaemia (ketonuria) and acidemia (13). DKA is caused by a decrease in effective circulating insulin associated with elevations in counter regulatory hormones (13, 14). The likelihood of ketoacidosis is occurring at the onset of diabetes varies considerably (between 15% and 67%) from one country to another (15). Studies have shown that in parts of the world where the prevalence of T1DM is low, symptoms of diabetes may be less familiar to medical practitioners; as a consequence more DKA occurs as the initial presentation of diabetes (16). The same is true where access to medical care is limited.

The Current criteria for diagnosis of DKA published by the International Society for Pediatric and Adolescent Diabetes is blood glucose $>11\text{mmol/L}$, Venous $\text{pH} < 7.3$ or bicarbonate $< 15\text{mmol/L}$, and ketonaemia and ketonuria (2) but there are different cut off point for diagnosis from study to study (4).

Recent epidemiological studies indicate that the incidence of type 1 diabetes is increasing worldwide, with the greatest increase in children aged 5 years old. Perhaps most alarming is that the diagnosis of type 1 diabetes in children aged 5 years is frequently associated with concurrent diabetic ketoacidosis (DKA) (10). There is a significant variation in the frequency of DKA between (and in some cases within) different countries around the world (4).

A systematic review done from 65 studies and 5 different continent in age group between 0-20 years stated the highest frequency of DKA being in UAE (80%), Romania (67%), Taiwan (65%) and Saudi Arabia (59%) and the lowest frequency were seen in Sweden (14%), Canada (18.6%), Finland (22%) and Hungary (23%) (10). Another population based study conducted in under 15 children in Austria for around 20 years (1989-2009) reported that the frequency of DKA to be 37.2%. The same study DKA was defined as, mild DKA $\text{pH} < 7.3$ and/or > 7.1 and severe DKA as $\text{pH} < 7.1$ or clinical sign of severe acidosis such as hyperventilation or unconsciousness (17).

A hospital based cross sectional study in under 19 years of age in Iran, (1995-2005), showed that the frequency of DKA to be 24%. This study considered DKA as blood glucose level $>250\text{mg/dl}$, arterial $\text{PH}<7.3$, blood bicarbonate $<15\text{mmol/L}$ and ketonuria greater than 2+ in dipstick urine test with recent positive symptoms of polyuria, polydipsia, nocturia and weight loss (18).

In study done in Kuwait, examined the frequency and severity of diabetic ketoacidosis (DKA) in 679 children and adolescents (0–14 years) at diagnosis of Type 1 Diabetes Mellitus (T1DM) in Kuwait. Between 1st January 2011 and 31st December 2013, all newly diagnosed children with diabetes were registered prospectively in a population-based electronic register. DKA was diagnosed using standard criteria based on the levels of venous pH and serum bicarbonate. Incidence of DKA in children at presentation of T1DM remains high at 33.6 % (24).

A follow up study from 1982 to 2001 in Finland revealed that the frequency of DKA in newly diagnosed DM children less than 15 years to be 18.1% $\text{PH}<7.3$ and 22.4% bicarbonate $<15\text{mmol/L}$ and children with severe DKA were 3.2% ($\text{PH}<7.1$) (19). A cohort study done in Italy in <17 years old children revealed that the frequency of DKA at new onset of diabetes to be 34.7% ($\text{PH}<7.3$) and 7.2% at $\text{PH}<7.1$ (which is the severe DKA) (20). A cross sectional study conducted in America to assess the trends of DKA at different time found the frequency of DKA to be 30.2% in 2002-2003, 29.1% in 2004-2005 and 31.5% in 2008-2010 (21).

A retrospective study conducted in Benin teaching Hospital by Alphonsus N Onyiruka and EmekaLfebi from 1996 to 2011 in children and adolescent reported the frequency of DKA to be 77.1%. Of whom 40.5% were males and 50.9% were females. The mean age at presentation was 12.7 ± 2.6 years. In the same study 52.3% of the families of the patients were from middle social class, 69.4% had symptoms for 2.3 weeks before presentation. In the same study DKA was diagnosed as hyperglycemia blood glucose level $>11\text{mmol/L}$, acidosis (serum bicarbonate $<15\text{mmol/L}$) and ketonuria $> +1$) (12).

A retrospective study conducted at TikurAnbesa specialized referral Hospital, Addisababa, Ethiopia, from September 1997 to September 2007, the frequency of DKA in children less than

12 years of age, was found to be 80%. The mean age at presentation was 6 years and the lowest age was nine and half months. The study defined DKA as patient presenting with vomiting, dehydration, kussmaul breathing, lethargy or coma and biochemically random blood sugar (RBS) > 250 mg/dl, glucosuria and ketonuria (3).

A facility based cross sectional study was conducted in selected hospitals in Addis Ababa, from January 1 to March 30 2015. Addis Ababa is the capital and largest city of Ethiopia. Governmental hospitals that have pediatric department and have high pediatric patient flow, Tikur Anbesa, Zewditu Memorial and Yekatit 12 hospital were included in the study. The clinical records of all children less than 12 years who were admitted in the pediatric wards by developing DKA were reviewed and from this, the magnitude of DKA in newly diagnosed children found to be 35.8%.(22).

2.2 Associated risk factors for DKA

A systematic review on 40 studies in 31 countries on the associated factors of DKA on newly diagnosed children found out different risk factors. In this systematic review the effect of age was reported in 32 studies. These studies showed that children <2 years old had three times the risk of presenting in diabetic ketoacidosis compared to children aged ≥ 2 years significantly. Twenty one studies reported the effect of sex on the frequency of diabetic ketoacidosis, of which only one study showed the significant effect of sex on DKA. In this systematic review the effect of family history on DKA was reported by six studies. Although having a first degree relative with type1 diabetes decreased the frequency of diabetic ketoacidosis in three studies it did not predict a diagnosis of new onset diabetes before (23).

The others associated risk factors reported by this systematic review were parental consanguinity, parental education, family structure, ethnicity, health insurance status, residence, family income, parental employment, delayed diagnosis(>24hours), diagnostic error, number of medical consultation before diagnosis, preceding illness/febrile illness(23).

The systematic review done in 65 countries revealed that latitude and background incidence of type 1 DM was significantly associated with frequency of DKA. The frequency of DKA decreases with the higher background incidence of DM. There were no significant associations with study size, period of study design or method of case identification (10).

In study done in Kuwait, at the time of diagnosis, mild/moderate DKA was present in 24.8% of the children, while severe DKA was present in 8.8%. Incidence of ketoacidosis was significantly higher in young children less than 2 (60.7% vs 32.4% $p < 0.005$) compared to children 2–14 years old, and a higher proportion presented with severe DKA (21.4% vs 8.3% $p < 0.05$). No association was seen with gender. Significant differences were found in the incidence of DKA between Kuwaiti and non-Kuwaiti children (31.1% vs 39.8%; $p < 0.05$). Family history of diabetes had a protective effect on the occurrence of DKA (OR= 0.44; 95% CI= 0.27–0.71)(24).

In a study conducted in Austria girls were significantly at higher risk of developing DKA than boys and the frequency of DKA found to be negatively associated with age at onset of DKA and in children less than 2 years of age the frequency was 60%. In the same population based survey from 3331 children under 15 years one female patient with age of 14.3 years died due to cerebral edema (17) and another cross sectional study in Iran girls were presented more frequently (60%) with DKA than did boys but the difference was not statistically significant ($p = 0.58$). No death were recorded among the study populations(18).

A study in Finland stated as there is no significant difference between boys and girls in developing DKA. Under five children tended to develop DKA than older children but it is not statistically significant. When we see the frequency of DKA in under four years of age in this study it is significantly higher than older children and the frequency of severe DKA is significantly higher in under two children. The frequency of DKA is higher in under five children (23.7%), followed by age group between 10-14 (23.1%) and DKA is least observed among children between 5-9.99(11.3%) years of age ($p = 0.001$) (19).

The frequency of DKA was significantly higher in under 2 children than the other group in a study done in Italy. Of whom 9.4% of the patients had first degree relatives with diabetes. DKA occur in less frequency in children who have first degree relatives with type 1 than children who do not have first degree relatives with type 1 diabetes. First degree relatives and age at onset of DKA found to have a significant association with DKA (20).

In a study in America the overall frequency was higher in the 0 to 4 years of age group (39%) and lowest in 15 to 19 year age group (23%). The same study household income showed a significant association with DKA, the odds of children with low house hold income had a higher

risk of developing DKA than children with high house hold income. Gender and parental education did not show significant association in developing DKA (21).

A study in Benin indicated as socioeconomic status and first degree relatives with DM got a significant relation on developing DKA (12).

In a study conducted at Tikur Anbesa one fourth of the cases had family history of DM, 81.2% were from Addis Ababa and nearby town. Significant number of children (53.5%) had families who joined secondary and higher education. In this study average monthly income and level of education did not show significant association with DKA. In 44.6% of patients the precipitating factor for DKA was infection. Over all the study revealed around 7 deaths with 6% case fatality rate. Of these deaths one of the patients died because of cerebral edema (3).

A study conducted in Addis Ababa, Ethiopia in 2015, children's age, the knowledge of sign and symptoms of DKA, sign and symptoms of DKA prior to onset of DKA and infection prior to DKA are found to be the significant explanatory variable of DKA in primary onset of DM (22).

3. Objectives

3.1 General Objective

- To assess the magnitude and clinical characteristics of DKA in newly diagnosed DM children in SPHMMC

3.2 Specific Objectives

- To assess the magnitude of DKA in newly diagnosed DM children at SPHMMC
- To assess clinical characteristics of DKA in newly diagnosed DM children SPHMMC

4. METHODS

4.1 Study Area

This study was conducted in SPHMMC in pediatrics department; SPHMMC is located in Addis Ababa, is the capital and largest city of Ethiopia. It was built in 1969 by Emperor HaileSelassie in collaboration with the German evangelical church as source of medical care for underserved populations. It has currently 392 beds, with annual average of 200,000 patients and a catchment of more than 5 million. There are over 1300 clinical and non-clinical staff in over 13 departments. The pediatrics department gives different services for the community. Pediatric endocrinology unit is one of the service, given every Monday in the afternoon. The study will be conducted in this endocrinology unit.

4.2 Study design

Four year Retrospective study from December 2013 to January 2016 design was conducted using routine hospital data and interview.

4.3 Population

4.3.1 Source population

All less than 15 years of age children diagnosed with Type I DM in the last four years.

4.3.2 Study Subjects

All Children less than 15 years with newly diagnosed DM who presented with DKA in the last four years.

4.3.3 Sample size determination

All cases of newly diagnosed DM children which are seen by SPHMMC Pediatric department in the year from January 2013 to December 2016 were included. The ideal sample would have been 246 patients, with this

95% confidence interval

5% margin of error (d)

80% expected prevalence (study from black lion)

$$n = \frac{z^2 p(1-p)}{d^2} = \frac{1.92^2 \times 0.8(1-0.8)}{0.05^2} = 245.8$$

4.4 Data collection procedures

In this retrospective study, the case records of all children with newly diagnosed DM children seen in the Department of pediatrics, in SPHMMC between January 2013 to December 2016 were retrieved using data abstraction sheet/guiding questionnaire from patient card. Data was collected by myself and filled in to the abstraction sheet/guiding questionnaire, which was prepared by reviewing different literatures.

4.5 Data Analysis procedures

Descriptive analysis was performed using frequency distribution, mean, median, tables and graphs.

4.6 Study Variable

Dependent variable

- Diabetic ketoacidosis in newly diagnosed children

Independent Variables

- Age
- Sex
- Family income
- First degree relatives with DM
- Preceding infection/AFI
- Preceding sign and symptoms of DKA/DM
- Parental employment
- Parental educational status

4.7 Operational Definition

- **Diabetic Ketoacidosis in newly diagnosed children:**-children between 0-14 years who have blood glucose level $\geq 250\text{mg/dl}$, Ketonuria and ketonemia and diagnosed being Diabetes Mellitus patient for the first time.
- **First degree relatives with DM:**-child's mother, father or sibling with DM.
- **Preceding infection:**-any infection 1-2weeks before the onset of DKA reported by health professional.
- **Preceding sign and symptoms of DM/DKA:**-a child who had polyuria, polydipsia and weight loss 1-2week prior to DKA.

5. Ethical consideration

Ethical clearance was obtained from SPHMMC public health department and finally SPHMMC authorize the ethical clearance. Confidentiality was maintained by omitting their personal identification.

6. Dissemination of results

The results of this study will be disseminated or communicated to SPHMMC public health department, department of pediatrics, Regional health bureau, local institutions and other concerned bodies through reports and publication on an appropriate journal.

7. Result

Socio-demographic characteristics

A Total of 62 newly diagnosed type I dm children of age less than 15 were studied from January 2013 to December 2016, from this 43(63.5%) Of the children present with DKA. Of the 43 newly diagnosed type I DM children with DKA, 26 (60.5%) were females and 17(39.5%) were males giving a female to male ratio of 1.5:1. The age category below was taken from different literatures, and shows 7(16.3%) of the children from age 1-4, 14(32.6%) from age 5-9 and 22(51.2%) from age 10-15. The mean age was 9.44, range (2 to 14).

Table 1

Characteristics	Frequency (N=43)	Percentage
Child age groups		
1-4 years	7	16.3
4-9 years	14	32.6
10-15 years	22	51.2
Child sex		
Male	17	39.5
Female	26	60.5
Parent's religion		
Christian	36	83.7
Muslim	7	16.3
Ethnicity		

Oromo	17	39.5
Amhara	18	41.9
Guraghe	6	14.0
Others	2	4.7
Place of residence		
Addis Ababa	23	53.5
Out of AddisAbaba	20	46.5
Is place of residence urban or rural		
Urban	23	53.5
Rural	20	46.5

Clinical characteristics of DKA

From 43 newly diagnosed type I DM with DKA children, 4(9.3%) of them have first degree relatives with DM and 39(90.7%) of the children do not have first degree relatives with DM. 86% of the children has sign and symptoms of DM before presenting with DM. Of 43 children who developed DKA 4(9.3%) present with abdominal pain, 35 (81.4%) present with polysymptoms, 3(7%) of present with coma, 4(9.3%) of present with kussmal's breathing and 4(9.3%) present with other symptoms of DKA like vomiting and easy fatigability.

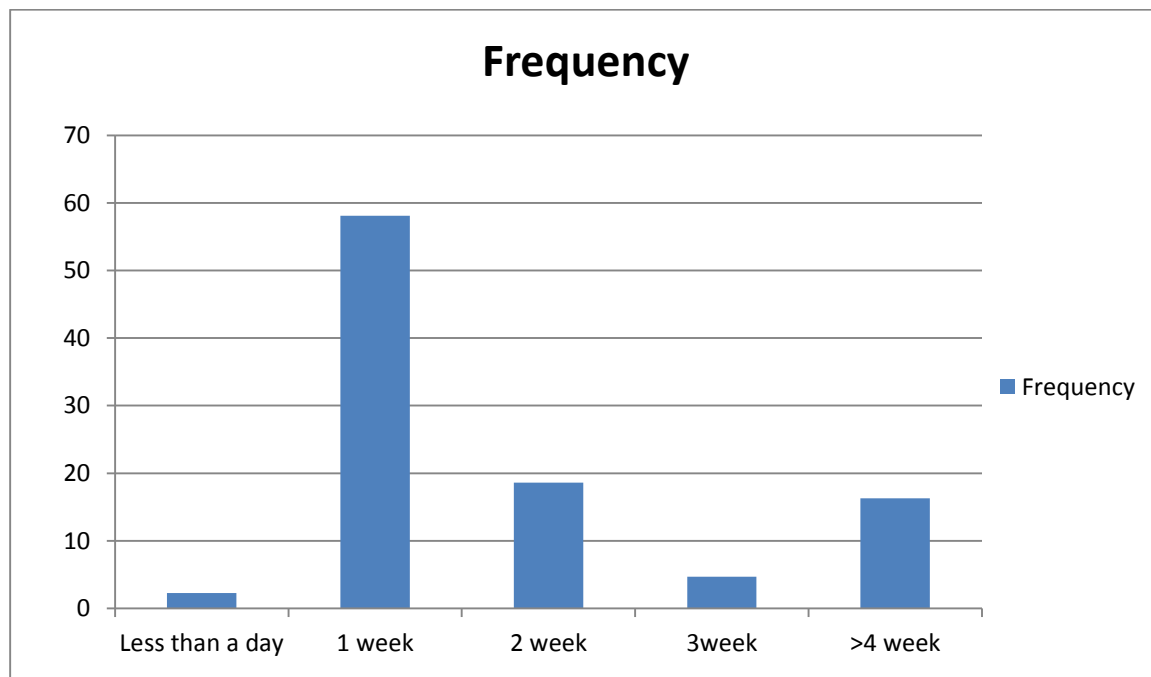
The mean duration of symptoms before presentation is 11.26 days and with median 7 days with SD of 9.6 days. Of the 43 newly diagnosed type I DM children with DKA, 14(33.3%) of them has precipitating factors and infection was the only precipitating factor for all of the cases. In 95.3 % RBS was between 250-500 mg/dl and the remaining 4.7%was above 500 mg/dl. All patients were out of DKA with no complication after treatment.

Table 2

Variables	Frequency (N=43)	Percentage
Family history of DM		
Yes	4	9.3
No	39	90.7
Have DM symptoms before presenting with DKA		
Yes	37	86.0

No	6	14.0
DM symptoms*		
Polysymptoms	34	94.4
Weight loss	10	27.8
Abdominal pain	8	22.2
Presenting DKA symptoms		
Polysymptoms	35	81.4
Coma	3	7.0
Kussmaul's breathing	4	9.3
Abdominal pain	4	9.3
Others	4	9.3
Duration of symptoms		
Less than a day	1	2.3
1 week duration	25	58.1
2 weeks duration	8	18.6
3 weeks duration	2	4.7
>4 weeks duration	7	16.3
Any precipitating factors		
Yes	14	33.3
No	28	66.7
Precipitating factors (N=14)		
Infection	14	32.6
RBS at diagnosis		
250-300 mg/dL	5	11.6
300-350 mg/dL	4	9.3
350-400 mg/dL	18	41.9
400-450 mg/dL	10	23.3
450-500 mg/dL	4	9.3
500-550 mg/dL	2	4.7
Patient outcome		
Out of DKA	43	100.00

Figure 1: Duration of Presentation



8. Discussion

Diabetic ketoacidosis is a potentially preventable presentation and complication of DM, representing a predominant cause of mortality and morbidity in these children. More than half (63.5%) of the children in this study manifested with DKA at first diagnosis of diabetes. A study conducted in black lion hospital found the magnitude of DKA to be 80%, another retrospective cross sectional study conducted in Benin teaching hospital found the frequency of DKA in newly diagnosed children to be 77.1 and, In a study which was done in Sudan they found that 81.2% of the newly diagnosed diabetic children presented to hospital with DKA (3, 11, 27). This is consistent with the higher magnitude in our study.

This is not surprising as a similar high prevalence rate has been reported in a previous study in Nigeria (25). The same is true of reports from Iran and the United Arab Emirates (18, 26).

However, some studies(28,29)have reported lower prevalence rates, all reflecting the well known wide geographic variation in frequency of DKA at onset of pediatric diabetes mellitus(14,16).The differing prevalence rates might be explained by differences in study population, the background prevalence of diabetes in the given population, presence or absence of family history of T1DM,family socioeconomic status, delayed diagnosis and treatments well as the definition of DKA used in the particular study. All these factors have been reported to influence the prevalence of DKA at onset of type I diabetes.

The frequency of DKA is higher among girls than among boys in our study(1.5:1) in agreement with, A previous, large study done over children with diabetes in Nile Delta and Northern Egypt, which reviewed data about newly diagnosed children over the period between 1 January 1994 and 31 December 2011 who were admitted to Mansoura University Children's Hospital or were beneficiaries from Health Insurance services, showed total numbers for female and male patients were 891 (55.7%) and 709 (44.3%), respectively and the female/male ratio was 1.3 in favour of girls (30).

There was a positive family history of DM in 9% of patients, which was higher than the reports in other studies (6, 8, and 31). Positive family history of DM is said to reduce the risk of DKA because the family will seek medical advice earlier (11).

The commonest clinical presentation was poly symptom (81.4%) followed by abdominal pain and kussmal breathing), which is consistent with a previous local study, (3). The results from this study compare favorably with other studies (32, 33), in that infection is the prominent precipitating factor.

9. Limitation of the study

- Since this study is retrospective, based on medical chart data, it has its own limitation associated to poor documentation.
- Associated risk factors are not assessed because of poor information from the medical record.

10. Conclusion

The overall magnitude of DKA in children with newly diagnosed type 1 diabetes is high. The increased number of newly diagnosed patients presenting with DKA in our experience indicates that focus should be given upon earlier diagnosis and intervention of diabetes to reduce the occurrence of DKA.

11. Recommendation

- Awareness campaign is needed to increase public awareness among health care providers, parents and school teachers .It is imperative that awareness campaigns targeted at the populace on the symptoms of the disease, and also to health workers for prompt diagnosis and appropriate treatment, should be intensified to prevent DKA at presentation of type 1 diabetes and its attendant complications.
- Prospective cross sectional study is recommended to know the exact burden of the disease
- Proper chart keeping and recording full medical information should improve.

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Annex 1

Magnitude and Associated Risk Factors for DKA among Newly Diagnosed DM Children in SPHMMC

MRN

1. Year of presentation
 - A 2013
 - B 2014
 - C 2015
 - D 2016
2. Child age _____
3. Child sex
 - A Male
 - B Female
4. Child religion
 - A Eth. Orthodox
 - B Muslim
 - C Protestant
 - D Catholics
 - E Others _____
5. Ethnicity
 - A Oromo
 - B Amhara
 - C Tigre
 - D Other _____
6. Place of residence
 - A Addis Ababa
 - B Other _____
7. Is place of residence urban or rural
 - A Urban
 - B Rural
8. Child's father's educational level
 - A Unable to read and write
 - B Can read and write only
 - C Grade 1-8
 - D Grade 9-12
 - E Above grade 12
9. Child's mother's educational level
 - A Unable to read and write
 - B Can read and write only
 - C Grade 1-8
 - D Grade 9-12
 - E Above grade 12
10. Average family income

- A Per month _____ birr
- B Per year _____ birr

ASSOCIATED RISK FACTORS

- 11. Family history of DM in first degree relatives
 - A Yes
 - B No
- 12. Did the child have any symptoms of DM before presenting with DKA?
 - A Yes
 - B No
- 13. If yes to 13, what were the symptoms
 - A Poly-symptoms
 - B Weight loss
 - C Abdominal pain
 - D Others _____
 - E Others _____
- 14. What are the presenting DKA symptoms?
 - A Poly-symptoms
 - B Coma
 - C Kussmaul breathing
 - D Others _____
 - E Others _____
- 15. Duration of the presenting symptoms
- 16. Did the child have any precipitating factor before presenting with DKA?
 - A Yes
 - B No
- 17. If yes to 17, which precipitating factor was found
 - A Trauma
 - B Surgery
 - C Infection
 - D Exams
 - E Others _____
- 18. RBS at diagnosis _____
- 19. Patient outcome
 - A Out of DKA
 - B Death
 - C Other _____

Annex 2

ASSURANCE OF INVESTIGATOR

The undersigned agrees to accept responsibility for the scientific ,ethical and technical conduct of the research project and for provision of required progress as per terms and conditions of the Research and Publication Directorate or/and Department of Public Health of St Paul’s Hospital Millennium Medical College.

Name of the student: **Mulugeta Gebremariam**

Date: _____ Signature _____

Approval of advisor(s)

Advisors Name	Signature	Date
1: _____	_____	_____
2: _____	_____	_____
3: _____	_____	_____