ADDIS ABABA UNIVERSITY SCHOOL OF MEDICINE, DEPARTMENT OF EMERGENCY MEDICINE AND CRITICAL CARE.

PRECIPITATING FACTORS AND CLINICAL-LABORATORY FEATURES OF DIABETIC KETOACIDOSIS (DKA) AT TIKUR ANBESA SPECIALIZED HOSPITAL EMERGENCY DEPARTMENT, ADDIS ABABA, ETHIOPIA.

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A RESEARCH REPORT TO BE SUBMITED TO SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA UNIVERSITY, SCHOOL OF MEDICINE, DEPARTMENT OF EMERGENCY MEDICINE AND CRITICAL CARE, IN PARTIAL FULFILMENT OF MASTER DEGREE.

JUNE,2014

Addis Ababa,Ethiopia

Abstract

Background:-Diabetic ketoacidosis is potentially fatal metabolic disorder commonly present in emergency department.It is a life threating complication of diabetes.If it misdiagnosed or mistreated it is 100% fatal.

Purpose:-

To study precipitating factors and clinical-laboratory features of diabetic ketoacidosis (DKA) atatTikurAnbesa Specialized Hospital Emergency department, Addis Ababa Ethiopia.

DESIGN:-

A prospective study by reviewing medical charts.

SUBJECTS:

A sampled 103 Adult patients aged 12 years and above with known or previously unknown diabetes presentingin the emergency department from January 2011 to January 2013 with a diagnosis of diabetic ketoacidosis.

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RESULTS:

Mean (SD) age was 30.9 (12.11) years for males and 28.4 (14.4) for females. Majorityof patients 77(74.8%) were type I and 23(22.3%) were newly diagnosed. Infection was the leading precipitating factors 36(45%)and 24(30%) was due to treatment non adherence. Infection sites includegenito-urinary system, respiratory system and acute febrile illness. Only 11.1% had altered level of consciousness, when 8% were in coma and 35.9% had dehydration. More than half (52.7%) patients hadleukocytosis and 31.4% were hypokalemic.

CONCLUSION and RECOMMENDATION

Diabetic ketoacidosis commonly seen in TikurAnbesa hospital emergency department. It was a major cause of morbidity and mortality. The main precipitant factors of DKA were infections and missed insulin injections. These factors are preventable in order to improve outcomes of diabetic patients to not to complicate to DKAby improving patient education and access to care.

Key words: Diabetic ketoacidosis, precipitating factors, clinical and laboratory feature, TikurAnbesa

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Acronyms

CDC- center for disease control

DKA – diabetic ketoacidosis

DM – diabetes mellitus

Mmol/L- mill moll per litter

MEq/L – mill equivalent per litter

Mg/dL – mill gram per deciliter

P – P value

PUD – peptic ulcer disease

SD – standard deviation

SPSS- Statistical Package for the Social Sciences

WBC – white blood cell count

WHO – world health organization

CHAPTER ONE- INTRODUCTION

1.1Back ground

Diabetes mellitus is the commonest metabolic diseases all over the world. The worldwide prevalence of DM has risen dramatically over the past two decades, from an estimated 30 million cases in 1985 to 177 million in 2000. Based on current trends, Above 360 million individuals will have diabetes by the year 2030. In the United States, the Centers for Disease Control and Prevention (CDC) estimated that 20.8 million persons, or 7% of the population, had diabetes in 2005 and around 30% of individuals with diabetes were undiagnosed. In Africa 7 million individual had diabetes in 2000 and this number increase to 18.2 million on 2030. Worldwide estimates project that in 2030 the greatest number of individuals with diabetes will be 45–64 years of age.[1]

WHO estimates the number of cases of diabetics in Ethiopia to be about 800,000 in 2000 and projected that it would increase to about 1.8 million by the year 2030.[12] About 3% of admission to medical wards in Ethiopian hospital are due to diabetes mellitus.[2]

Diabetes mellitus leads to acute and chronic complications. The acute complications include diabetic ketoacidosis (DKA), hyperosmolar hyperglycemic state (HHS), and hypoglycemia during treatment. The chronic complications are neuropathy, nephropathy, retinopathy, ischemic heart disease, myocardial infarction, stroke, peripheral arterial disease, impotence and so on.[23]

Diabetic ketoacidosis is potentially fatal metabolic disorder present mostly in accident and emergency departments.[4] It is a life threating complication of diabetes. DKA is the body's response to cellular starvation due to insulin deficiency and counter regulatory or catabolic hormone excess. Insulin is the only anabolic hormone produced by the endocrine pancreas and is responsible for the metabolism and storage of carbohydrate, fat and protein. Counter regulatory hormones (include glucagon, catecholamine, cortisol and growth hormone) released in response to low insulin and responsible for degradation of fat and protein to produce glucose. The lack of insulin and excess of counter regulatory hormone result hyperglycemia (due to underutilization

of glucoseand excess production respectively), osmotic diuresis, prerenal azotemia, ketone formation and metabolic acidosis.[24,25]

Peoples suffering from diabetic ketoacidosis (DKA) usually have severe dehydration and significant alterations of the body's blood chemistry. Diabetic ketoacidosis (DKA) occurs commonly in people who have type 1 diabetes. However, people who have type 2 diabetes may also develop diabetic ketoacidosis.[5]

The most mentioned events that trigger the state of diabetic ketoacidosis in DM patients are:
An illness(40%), Some common illnesses that cause DKA are pneumonia and urinary tract infections. Inadequate insulin therapy (25%) and newly diagnosed or previously unknown diabetes(15%).Various other causes like Stress, Heavy use of concentrated carbohydrate, Physical or emotional trauma, Alcohol or drug abuse and Surgery contribute to DKA.However, there are no identifiable causes for 5 to 10% cases.[5]

Diabetic ketoacidosis is treated by administering fluids, electrolytes and insulin.Swelling in the brain (cerebral edema),Low blood sugar (hypoglycemia), Blood acidity, dehydration and potassium level disturbanceare major complication of DKA, However, these complications are prevented by early diagnosis and with lifesaving treatment.[3]

In the United States of America DKA accounts for 24 percent of all diabetic admission and has an incidence among diabetic 15 episodes per 1000 patients. Europe also has comparable incidence. Between 20 and 30 percent of DKA cases occur in patients with new onset of diabetes.[7]

In Ethiopia,based on May 1979 study, the mortality because of DKAwas 9.1%. Socioeconomic factors particularly the cost and unavailability of insulin supplies were major obstacles of ketoacidosis in Ethiopia patients.[11]

Mortality in DKA results mainly from sepsis or pulmonary and cardiovascular complications in the elderly where fatal cerebral edema in children and young adults (less than 28 years).[6]Over

all, both DKA and DKA related death rate were 34% in 1996. The highest death rates were among persons aged 75 years and older, followed by persons aged less than 45 years. Among race-sex groups, DKA death rates were highest among black males, followed by black females and then by whites. In 1996, DKA death rate for black males was almost twice that for white males.[7]

The mortality rate for DKA ranges from 2 to 5 percent in developed countries and 6 to 24 percent in developing countries. If it misdiagnosed or mistreated it is 100% fatal and in places like Ethiopia where medical services are less developed, the risk of dying from DKA is greater.[8,9,10]

In developing countries like Ethiopia, due to widespread poverty of individuals the healthcare systems are scarce and the few available centers are unable to adequately maintain a reliable system of insulin supply and exhaustively investigate their hospitalized patients. Consequently, there is little guarantee of successful outcomes. Poor people may also have sub-optimal nutrition, caused or worsened by diabetes, specially, at first presentation to hospital. Intensive insulin therapy in such individuals mimics re-feeding syndrome, an acute anabolic state whose outcome may be unfavorable during the period of treatment of diabetic ketoacidosis.[20]

DKA in the Ethiopian care setup has not been well documented.[2] Many patients with diabetes keep dying from DKA every year.[13]With the current trend of transition from communicable to non-communicable disease, it is projected that the latter will equal or even exceed the former in developing nations, thus culminating in double burden.[14,15]

1.2 Significance of the study

The United States of America study shows that better understanding of clinical feature, precipitating factor and uniform approach to diagnosis reduced mortality to less than 5% of reported episodes. Early clinical diagnosis with management like fluid therapy and insulin administration shows significant better outcome.[1]Following modified DKA patient approach and management based on scientific study on clinical symptoms and precipitating factors,death rates per 100,000 diabetic population for DKA and DKA related death declined between 1980 and 1996 (34%).[7]

Even though many DKA patients was seen in emergency unit of Ethiopian hospitals and health facilities, Little is known or very little study is done about precipitating factors and clinical-laboratory features of DKA among Ethiopian patients and information is scant to promote better health service to prevent mortality due to DKA.

Knowledge about precipitating factors and clinical-laboratory features of DKA will give insight about uniform approach of diagnosis. The information gained from this study will be step towards for supporting and promotingearly management,planningand prevention of DKA. The finding of this study may be used as a base line data for those who are interested in carrying out further study.

LITRATURE REVIEW

Diabetic ketoacidosis (DKA) is the most common hyperglycemic emergency in patients with diabetes mellitus. DKA most often occurs in patients with type 1 diabetes, but patients with type 2 diabetes are susceptible to DKA under stressful conditions, such as trauma, surgery, or infections.Worldwide, infection is the most common precipitating cause for DKA, occurring in 30–50% of cases. Urinary tract infection and pneumonia account for the majority of infection site. Other precipitating causes like surgery, trauma, myocardial ischemia, pancreatitis, psychological stress, and non-compliance with insulin therapy contribute to DKA. (26)

In the study carried out at Grand Memorial Hospital Atlanta, Georgia,To identify the causes of diabetic ketoacidosis (DKA), There were 56 episodes of DKA, and 75% of the episodes were in patients with known diabetes. In the known diabetic patients, the most common cause of DKA was missed insulin therapy, which occurred in 67% of episodes.(27)

A study conducted in King Abdul-Aziz University Hospital, Jeddah, Kingdom of Saudi Arabia, Sixty-eight patients were admitted with DKA over a 2 years period (April 1999 through to April 2001). Diagnosis of diabetic ketoacidosis was based on: clinical features, serum sugar >12 mmol/L with ketonuria, bicarbonate and base deficit.The mean age was 22.5 years with a male to female ratio of 1.4:1.According the study Poor compliance to continue the treatment (54.4%) and infection (28%) were the most common precipitating factors being responsiblefor DKA cases.(16)

A retrospective cohort study conducted in Soroka University Medical Center, Beer Sheva, Israelonpatients hospitalized with DKA during the period of 1 January 2003 to 1 January 2010. Three groups were compared: patients with mild DKA, with moderate DKA, and with severe DKA. The study population comprised 220 patients with DKA. In the mild (78 patients) and moderate (116 patients). There were a higher proportion of patients with type 1 DM (79.3%) compared with type II (20.7). Themost frequent precipitating factors were related to insulin

therapy andinfections. Patients with severe DKA had electrolyte abnormalities (hypokalemia, hypomagnesaemia, hypophosphatemia).[17]

Eighty patients with type 1 diabetes who had an emergency hospitalization for DKA between January 2005 and March 2010 at a tertiary care teaching hospital in Southern Brazil were studied. Data were collected by reviewing medical records and telephone calls. The mean age of patients was 26±13 years. Treatment non-adherence was defined as the precipitating factor and there was diet abuse, insulin therapy noncompliance without identifiable infection. The majority (91.5%) of the patients had unsatisfactory metabolic control before the hospitalization. The most common DKA precipitating factor was treatment non-adherence (39%) of cases, when all patients were evaluated only 49% patients was with previous type 1 diabetes.[18]

The epidemiology, incidence rates, precipitating factors and mortality rates was studied in an 11.2% sample of the Danish population (574,696 inhabitants) during a 24-month period, Denmark. Some 175 admissions in ketoacidosis (heavy ketonuria and plasma bicarbonate below 21mmol/l) were recorded. Based on prevalence rates from a socio-economically and ethnically comparable Danish county, the annual incidence rate of DKA was calculated to be 0.045 per diabetic. The major risk group was female teenagers. The total annual frequency of recurrence was 8.7%, 48% of the male episodes were ketoacidosis (DKA) associated with onset of diabetes, against 30% of the female episodes (P = 0.02). All Danish diabetics were at the time of the survey (1978–79) treated with conventional insulin treatment. Annual incidence rate in these established diabetics was 0.028.Mortality of DKA was low, 3.4%, and dependent upon age and precipitating factor but not upon the degree of acidosis. The overall annual mortality rate was 1.5 per 100 diabetics.[19]

In Literature review of relevant published literature from both Africa and the rest of the world, the main causes or precipitants of DKA in patients in sub-Saharan Africa were newly diagnosed diabetes, missed insulin doses and infections.Patientsmiss treated with insulin for various reasons, for example, inaccessibility occasioned by unavailability and unaffordability of insulin,

missed clinics, perceived ill-health and alternative therapies like herbs, prayers and rituals. Infections also occur quite often, but are not overt, like urinary tract, tuberculosis and pneumonia.[20]

A Prospective cross-sectional study conducted Inpatient medical and surgical wards of Kenyatta National Hospital, Nairobi. The study include patients aged 12 years and above with known or previously unknown diabetes hospitalized with a diagnosis of diabetic ketoacidosis. Over a nine month period, 48 patients had DKA out of 648 diabetic patients hospitalized within the period. Mean (SD) age was 37 (18.12) years for males, 29.9 (14.3) for females, range of 12 to 77 years. Half of the patients were newly diagnosed. More than 90% had altered level of consciousness, with almost quarter in coma, 36% had systolic hypotension, almost 75% had moderate to severe dehydration. Blunted level of consciousness was significantly associated with severe dehydration and metabolic acidosis. Over 65% patients had leukocytosis but most (55%) of them did not have overt infection. Among the precipitating factors, 34% had missed insulin, 23.4% had overt infection and only 6.4% had both infection and missed insulin injections. Infection sites included respiratory, genito-urinary and septicemia..[21]

A 10 years (1998-2008) retrospective study conducted in llorin teaching hospital, Nigeria (n=225). The study shows that 172 patients admitted because of DKA precipitated by septicemia and 36 DKA patients precipitated by meningitis.[22]

In the study carried out in urban hospital of Nigeria A total of 94 subjects who presented
With Diabetes ketoacidosis (DKA) the mean age (SD) of the subjects was 53.9 (14.4) years and their ages ranged from 22 to 86 years. DKA occurred in all subjects with type 1 DM and 73 (81%) of subjects with type 2 DM. Hypokalemia was documented in 41 (37%) of the subjects and hyperkalemiain subjects 2 (2.1%). 11(10%) subjects had hypotension.[29]

Prospective study to investigate the clinical characteristics of black South African diabetic patients admitted to hospital with hyperglycemic emergencies were conducted, the study cases were selected from the medical admissions to an urban, Johannesburg academic hospital over a period of 12 months. Only patients with severe diabetic ketoacidosis (DKA) were included. Over

the study period, 58 patients with severe DKA (M: 32, F: 26) were identified. Thirty-two of the patients with DKA (55.2 %) were classified as having non-insulin dependent (Type 2) diabetes mellitus (NIDDM). Compared to the 26 subjects with insulin-dependent (Type 1) diabetes mellitus (IDDM). Infection was the leading precipitating factor for both DKA followed by first presentation and non-compliance.[28]

In 1979 study, conducted in Ethiopia the clinical feature of 44 episodes of diabetic ketoacidosis in 34 Ethiopians, the mortality rate was only 9.1%, even though serum potassium, bicarbonate and pH could not be measured. Although 3 patients from 44 were new diabetics, and the cause was not found in 7, most cases resulted from omission of insulin (43%) or recurrent illness (28%). Socioeconomic factors, particularly the cost and unreliability of insulin supplies, are major obstacles to the control of diabetes and the prevention of ketoacidosis in Ethiopian patients.[11]

A clinical survey conducted in Yekatit 12 hospital, between 1936 and 1979,(n=44 patients) only 3 patients were previously undiagnosed diabetes. A misguided attempt at treatment with oral hypoglycemic agents aggravated 4 episodes, and intermittent illness was responsible for 15 patients, but no precipitating cause was identified for 7 patients. In 19 patients of 44 episodes (43%) the most important precipitating factor was omission of insulin. The reason for omission of insulin was inability to obtain it either because of the patient couldn't afford it and failed to acquire paper for free health care or because the health center or hospital have no insulin.[11]

CHAPTER THREE- OBJECTIVE

2. OBJECTIVE

2.1 General objective

To determine the magnitude ofdiabetic ketoacidosis (DKA) precipitating factors and clinical-laboratory featuresat TikurAnbesa specialized hospital Emergency department, Addis Ababa Ethiopia.

2.2 specific objectives

- To identify precipitating factors of diabetic ketoacidosis at TikurAnbesa specialized hospital Emergency department, Addis Ababa Ethiopia.
- To determine the clinical features of diabetic ketoacidosis at TikurAnbesaspecialized hospital Emergency department, Addis Ababa Ethiopia.
- To determine the laboratory feature of diabetic ketoacidosis at TikurAnbesa specialized hospital Emergency department, Addis Ababa Ethiopia.

3- METHODS

3.1 Study area and period

The study was conducted at TikurAnbesa specialized hospital Emergency department, Addis Ababa, Ethiopia. The hospital is a tertiary teaching hospital and is the final destination of patient referrals from hospitals all over the country. The hospital gives health service for more than 200,000 patients per year. The hospital's Emergency department gives services for more than 15,000 patients per year, around 400 DM patients visit the department per year and of those 360 were due to DKA. The emergency room has more than 40 beds for emergency admission.

The study was conducted from December 2013 toMay 2014

3.2 Study design

A retrospectivestudy, based on card review of all adult DKA patients came to the emergency room during the study period wasemployed. The entire patient chart (the current visit, previous visits, triage page, doctor's note, nurse's note, lab results and death certificates) were reviewed.

3.3 Population

3.3.1 Source of population

All DM patients visiting TikurAnbesa specialized hospital adult Emergency departmentfrom January 2011 to January 2013.

3.3.2 Study population

Selected DKA patients visiting TikurAnbesa specialized hospital adult Emergency department from January 2011 to January 2013.

- **Inclusion criteria**
  - All selected DKA patients aged greater than12 years

- **Exclusion criteria**
  - DKA patients aged less than or equal to12 years
  - DKA Patients card that had inadequate data (>20% incomplete)

3.4 Variables

- **Dependent variable**

  Clinical feature

  Laboratory feature

- **Independent variable**
  - Socio demographic variables

  Age

  Sex

- Precipitating factors
  - Diabetic type

3.5 Samlple size and samling procedure

Sample size was determined by using the formula below by using proportion 90%, 95% CI.

$n= Z^2p(1-p)/W^2$

$=[1.96]^2[0.9][0.1]/[0.05]2$

=138.24

138.24/1+ (138.24/400)

=103.16Where

n=desired sample

z=level of significance at 95% confidence interval

p=An estimate of the proportion of DKA patients

d=marginal error

In this study we consider P= 90% (proportion of DKA (360) patients among DM patients (400) within one year.)

Sampling procedure

Sampling frame which include 360 patients with DKA was prepared. Then after with random start every third patient card was reviewed.

3.6 Data collection procedure

Data was collectedby the principal investigator using prepared checklist,. The checklist prepared based on available data in the card and modified after doing pretest.

3.7 Operational Definition

DKA patients :-diabetic patients with urine ketone positive.

Dehydration:-Dehydration signs like dry buccal mucosa or dry lips, Or systolic BP less than 90 mmHg or MAP less than 65 mmHg.

Poly symptoms:-polyuria (Frequent urination), polydipsia (Frequent thirst), polyphagia (excessive hunger) for a day or more than a day.

Decreased level of consciousness:- patients who give response only for verbal or painful stimuli.

Coma:- patients who are unresponsive to any stimuli.

3.8 Data Analysis

Datawas cleaned, coded and analyzed by using SPSS version 19 .The result was displayed by using frequency tables and charts.Chisquare test and logistic regression was used to test the association between dependent and independent variables.

3.10 Ethical consideration

Theproposal was presented to Addis Ababa University Emergency department and ethicalclearance was obtained from the college, IRBand from the hospital administrations. During card review patient confidentiality was kept.

3.11 Dissemination plan

After presenting the study result to Addis Ababa University Emergency department, the finding will be disseminated to concerned bodies such as service providers, policy makers and other concerned stake holders. Attempt will be made to report the finding on journals.

4- RESULT

4.1 Demographics

A total of 103 subjects with diabetic ketoacidosis were studied. The mean (±SD) age was 30.9(12.11), range (16 to 66) for females and 28.4(14.4), range (13 to 73) for males. More than half of the patients 53(51.5%) were females and 50(48.5%) males. Most of patients 85(82%) were from Addis Ababa. More than half of patients 56(54.4%) were referred by hospital or health center where the rest 47(45.6%) were self-referral.

Majority of study subjects 77(74.8%) were type I diabetic and 26(25.2%) were type II. Among the participants 23(22.3%) were newly diagnosed diabetes where 80(77.6%) were known. most of study subjects 33(41.25%) had been diabetics for less than five years and most of study subjects 38(36.9%) were in the age group of 13 – 20.

Table1- **Distribution of DKA patients by their socio-demographic characteristics at TikurAnbesa hospital Emergency department, January 2011 – January 2013, Addis Ababa, Ethiopia.**

variable	**Group**	**Frequency (n=103)**	**Percent %**
Age	13 - 20 21 - 30 31 - 40 41 – 50 >50	38 29 15 11 10	36.8 28.1 14.5 10.6 9.7
sex	Female Male	53 50	51.5 48.5
Residential area	Addis Ababa Around Addis Ababa Far from Addis Ababa	85 4 14	82.5 3.9 13.6
Referral	- Hospital/ health center - Self-referral	56 47	54.4 45.6

4.2 Precipitating factors

The most common precipitating factor for known diabetes was infection 36(45%), followed by treatment non adherence 24(30%).The most diagnosed site of infection were genitourinary system 14(38.8%), respiratory system 12(33.3%), Acute febrile illness including malaria 4(11.1%), acute gastroenteritis 4(11.1%)and meningitis2(5.5%). From newly diagnosed diabetes 4(17.3%) precipitated by infection and 1(4.3%) by stress. The most diagnosed clinical feature were polydipsia 63(61.2%). 8(7.8%) study subjects were in coma during presentation to the ED where 12(11.7%) had altered level of consciousness and 27(26.2%)were dehydrated. Observed 68(66%) of study subject's random blood sugar were between 250 – 500mg/dl. The mean (±SD) random blood sugar was 430(± 110.5), range 195 to 600.

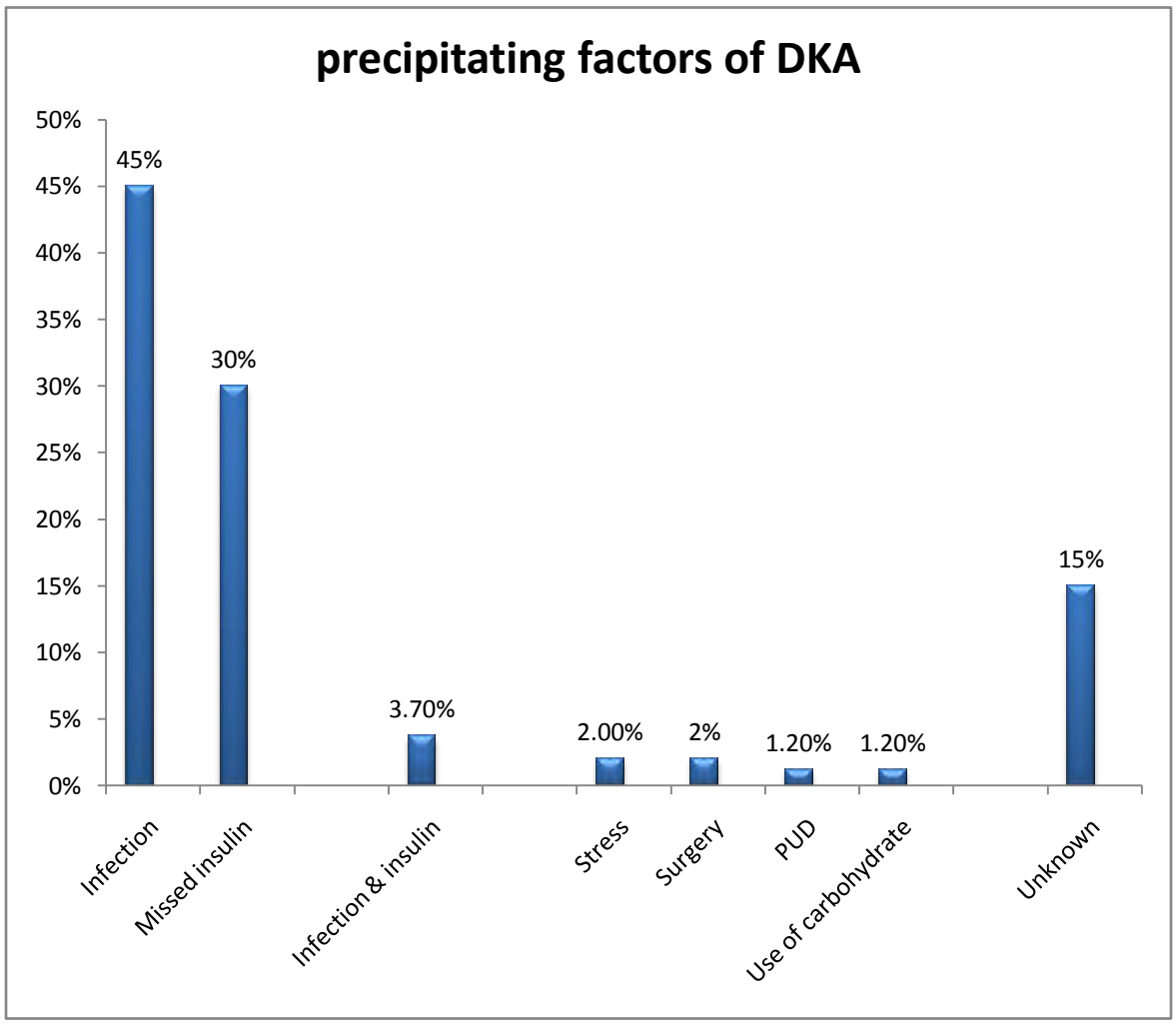

Figure 1-Percentage distribution of precipitating factors of known diabetic, DKA patients at TikurAnbesa hospital Emergency department, January 2011 – January 2013, Addis Ababa, Ethiopia

4.3 Clinical and laboratory presentation

Of the 103, 43(41.7%) of study subject's urine ketone level at admission were +2. At admission for 54(52.4%) of study subjects serum potassium electrolyte test was determined and 17(31.4%) had below 3.5mEq/L. Of 55(53.4%) of study subjects who had complete blood count investigation 26(47.3%) had leukocytosis (>10,000) even if 36(45%) had overt infection.

Table 2- frequency distribution of clinical feature of DKA patients at TikurAnbesa hospital Emergency department, January 2011 – January 2013, Addis Ababa, Ethiopia.

Variable	Frequency (n=103)	Percent %
Polydipsia	63	61.2
Polyuria	62	60.2
Polyphagia	21	20.4
Nausea and vomiting	58	56.3
Kussmaul breathing	37	35.9
Fruity breath	1	1
Dehydration	27	26.2
Abdominal pain	28	27.2

coma	8	7.8
Decreased level of consciousness	12	11.2
Fever	28	27.2
headache	11	10.7
Epigastric pain	15	14.6
Body weakness	19	18.4
palpitation	3	2.9

Table 3- Frequency distribution of Laboratory feature of DKA at TikurAnbesa hospital Emergency department, January 2011 – January 2013, Addis Ababa, Ethiopia.

Variable	**Level**	**Frequency**	**Percent (%)**
Blood sugar level	<250 mg/dl	3	2.9
	250-500 mg/dl	68	66
	>500 mg/dl	32	31.1
Urine ketones	+ 1	12	11.6
	+2	43	41.7
	+ 3	38	36.8
	+ 4	10	9.7
Potassium level at time of admission	<3.5 mEq/L	17	31.5
	3.5 - 6 mEq/L	35	64.5
	>6 mEq/L	2	3.7
WBC count	<10,000/µL	29	52.7
	>10,000/µL	26	47.3

Factors associated with Diabetic acidosis

The mean (SD) age of subjects with type I DM was significantly lower than type II DM patients, $p < 0.001$. There was no significant association between mean blood glucose level and sex, $p > 0.05$.

From studied subjects, Type I DM patients were 8.7 times more likely to show polyuria symptom (OR=8.7, 95% CI: 1.37, 55.97, $p < 0.02$). Type I DM study patients were four times more likely to had polydipsia symptom than type II (OR=4.1, 95%CI: 0.84, 20.12).According to this study male patients developed dehydration twice than females (OR=2.0, 95% CI: 0.74, 5.37). Type I DM patients developed dehydration 2.7 times more likely than type 2 diabetics (OR=2.7, 95% CI: 0.44, 17.31). According this study DKA patients precipitated by stress were 3.4 times more likely to had dehydration (OR=3.4).

Study subjects in the age group of 41- 50 were 5 times more likely to develop kussmual breathing than patients in age group of 13 – 20 ,31 – 40 and > 50 (OR = 5.01,95% CI: 0.35,71.85). Study subjects in the age group of 21 – 30 were less likely to had kussmual breathing than patients in the age group of 41 -50 (OR =2.4,95% CI:0.17,33.93). Type I diabetics had kussmual breathing twice than type II diabetics (OR=2.1, 95%CI: 0.41, 11.2).

Type I diabetics had nausea and vomiting 2.7 times more likely than type II diabetics (OR=2.7, 95% CI: 0.55, 13.91). Study subjects in the age group of 21 - 30 had abdominal pain two times more likely than those in other age group (OR=2.06, 95%CI: 0.19, 22.21). Studied male patients

were 26 times more likely to had decreased level of consciousness than females (OR =26.3, 95%CI: 2.38, 29.0, p<0.01). Studied DKA patients precipitated by surgery were three times more likely to had decreased level of consciousness than those precipitated by other (OR=3.0,95%CI:3.09,3.09).Study subjects in the age group of 13 -20 were six fold likely to hadfever than those in the other age group (OR=6.3, 95%CI: 0.56, 72.9). Type I diabetics were 2.8 times more likely to be febrile than type II (OR=2.8, 95%CI: 0.06, 0.73). Study patients in the age group of 13 – 20 were 5.6 times more likely to had headache than those in other age group (OR =5.6,95%CI:0.07,451.4). Type I diabetics were three times more likely to had body weakness than type II (OR=3.0, 95%CI: 0.45, 20.0).Study patients in the age group of 13 –20 and 21 - 30 were less likely to had body weakness than those in the age group of 31 – 50 and above 50 (OR=0.24,95%CI:0.01,4.09 and OR=0.19,95%CI:0.01,3.21 respectively). Male studied patients were less likely to had body weakness than females (OR=0.51, 95%CI: 0.14, 1.75). Polyphagia was 3.4 times more likely seen in study patient aged 21 – 30 (OR=3.4, 95%CI: 0.26:46.4). According to this study, there is no significant association between coma and all independent variable.

There is a true association between potassium level at admission and DM type. Type I 11(64.7%) had < 3.5 mEq/L , $p < 0.03$. There is also significant association between age, and leukocytosis. Studied patients in the age group of 13 – 20, 14(48.2%) were more likely to show leukocytosis (>10000 WBC), $p < 0.02$. Type II diabetics were less likely to had leukocytosis (>10,000 WBC) 2(6.8%), $p < 0.02$.

Table4. The association between clinical features of DKA and dependent variablesatTikurAnbesa hospital Emergency department, January 2011 – January 2013, Addis Ababa, Ethiopia.

Variables	DKA clinical features		
	Number (%)	OR (95% CI)	p value
Polyuria			
age			
13 - 20	23(60.5)	0.040	0.032*
21 – 30	18(62.5)	0.057	0.049*
31 – 40	8(53.3)	0.077	0.075
41 – 40	6(54.4)	0.163	0.169
>50	7(70)		
Sex			
Male	33(60)	1.76	0.248

Female	29(54.7)			
DM type				
Type I	49(63.6)		8.78**	0.022*
Type II	13(50)			
Polydipsia				
age				
13 - 20	25(65.8)		0.745	0.797
21 - 30	19(65.5)		0.879	0.908
31 – 40	8(53.3)		0.831	0.872
41 – 40	6(54.5)	1.475	0.726	
>50	5(50)			
Sex				
Male	31(62)	1.01	0.975	
Female	32(60.4)			
DM type				
Type I	51(66.2)	4.12**	0.079	
Type II	12(46.2)			
Polyphagia				
age				
13 - 20	7(18.4)		0.655	0.99
21 - 30	9(31)		0.773	1
31 – 40	1(6.7)		0.2	1
41 – 40	2(18.2)		0.844	1
>50	2(20.2)			

Sex			
Male	33(60)	0.975	0.978
Female	29(54.7)		
DM type			
Type I	16(20.8)	0.044	1
Type II	5(19.2)		
Dehydration			
age			
13 - 20	13(34.2)	1.33	0.832
21 - 30	9(31)	1.07	0.956
31 – 40	2(13.3)	0.49	0.639
41 – 40	2(18.2)	0.919	0.952
>50	1(10)		
Sex			
Male	16(32)	2.006**	0.166
Female	11(20.8)		
DM type			
Type I	24(31.2)	2.768**	0.276
Type II	3(11.5)		
Precipitating factors			
Infection	8(22.2)	0.875	0.920
Missed insulin	7(29)	0.834	0.894
Stress		3.416**	0.997
Surgery		0.768	0.855

Kussmual				
age				
13 - 20	14(36.8)	1.886	0.640	
21 - 30	13(44.8)		2.466**	0.501
31 – 40	4(26.7)	1.146	0.926	
41 – 40	5(45)		5.016**	0.235
>50	1(10)			
Sex				
Male	20(40)		0. 86	0.763
Female	17(32.1)			
DM type				
Type I	31(40.3)		2.16**	0.359
Type II	6(23.1)			
Precipitating factors				
Infection	8(22.2)		0.819	0.879
Missed insulin	15(62.5)		4.389	4.389
Stress	2(66.7)		1.873	1.87
Surgery	1(100)		4.53**	0.227
Nausea & vomiting				
age				
13 - 20	21(55)		0.493	0.544
21 - 30	18(62.1)		0.770	0.820
31 – 40	9(60)		0.510	0. 544
41 – 40	5(45.5)		0. 863	0.890

>50	5(50)			
Sex				
Male	27(54)		0.801	0.636
Female	31(58.5)			
DM type				
Type I	46(59.7)		2.801**	0.213
Type II	12(46.2)			
Abdominal pain				
age				
13 - 20	10(26.3)		1.902	0.605
21 - 30	10(34.5)		2.069 **	0.548
31 – 40	5(33.3)		1.713	0.650
41 – 40	1(9.1)	0.245	0.321	
>50	2(20)			
Sex				
Male	15(30)	1.78	0.273	
Female	13(24.5)			
DM type				
Type I	22(28.6)	0.656	0.618	
Type II	3(23.1)			
coma				
age				
13 - 20	5(13.2)		1.902	0.99
21 - 30				

31 – 40	1(6.7)	6.74	0.979
41 – 40	1(9.1)	10.517	1
>50	1(10)		
Sex			
Male	4(22)	0.31	0.369
Female	4(7.5)		
DM type			
Type I	8(10.4)	1.22	0.979
Type II	3(23.1)		
Decreased level of consciousness			
age			
13 – 20	2(5.3)	0.109	
21 – 30	4(13.5)	0.304	
31 – 40	2(13.3%)	0.142	
41 – 40	2(18.2)	0.154	0.952
>50	2(20)		
Sex			
Male	16(32)	26.307 **	0.166
Female	11(20.8)		
DM type			
Type I	24(31.2)	0.553	0.276
Type II	3(11.5)		
Precipitating factors			
Infection	5(13.9)	0.567	0.998

Missed insulin	3(12.5)	0.656	0.988

*P-value<0.05, **OR>1

5.DISCUSSION

Among 103 diabetic ketoacidosis patients the mean age was 30.9 for males & 28.4 for females. This result is consistent with Kenya national hospital study report [21], the Kenya national hospital study include DKA patients aged 12 and above like this study. More than half of studied DKA patients (51.5%) were females and this result is similar with the report of Denmark study which shows female was the major risk group of DKA[19].However in Johannesburg hospital, South Africa study,male patients were the major[28].The possible explanation for the discrepancy could be, their study include only patients with severe DKA which is different from this study samples. Among the studied 103 subjects majority of DKA patients were type I (74.8%). This report is consistent to worldwide study[26], to the study of soroka medical center, Israel [17]and also similar to the report of Nigeria hospital [29]which shows that DKA mostly occurs in type I diabetics. However the report from Johannesburg hospital shows that type II were more likely to develop DKA [28]. This difference is may be due to, the Johannesburg study include only severe DKA and according to worldwide study, severe DKA is mostly occur when DKA is precipitated by trauma, surgery or infection where these factors are more common in type II with DKA [26].From 103 subjects, 23(22.3%) were diagnose with DM at the time of ED presentation due to DKA for the first time. This finding is almost similar to the report of Grand

memorial hospital, Atlanta (25%)[27].However this finding is higher than the report of Yekatit hospital, Addis Ababa(6.8%) in 1979[11]. The possible reason for this difference may be due to, the Yekatit hospital study include very small sample (n=44) that may not cover many cases.

Majority of patients 33(41.2%) had been diabetics for less than five years and this implies that DKA is not a chronic complication. Majority 38(36.9%) of DKA patients were in the age group of 13 – 20 which indicates that DKA is mostly affecting young and productive generation.

The most common DKA precipitating factor for known diabetic patients was infection 36(45%) followed by missed insulin medication 24(30%). However the report from Kenya national hospital study shows that infection is the second precipitating factor following missed insulin therapy [21]andthe study from Abdul Aziz hospital, Saudi Arabia[16],the report from southern Brazil hospital[18]also shows that poor compliance to continue treatment was the leading precipitating factor.This discrepancy indicates that infection was more common in this study area. This finding is also different from Yekatit 12 hospital report which says omission of insulin is the leading precipitating factor[11]. The reason for this discrepancy may be due to insulin inaccessibility, unavailability and scares of health facility were majorly seen before 34 years than today.

The most noticed infection site was genitourinary system 14(38.8%) including sexually transmitted disease (candidiasis) followed by respiratory system 12(33.3%) which is similar to the study finding in Sub Sahara study [20].However report from Kenya national hospital shows that respiratory system was the most common site of infection followed by genitourinary[21]. Acute febrile illness including malaria was the third site of infection 4(11.1%).This finding is lower than the report from illorin hospital, Nigeria (76%)[22]which indicates that study patients of this study were less affected by acute febrile illness.2(5.5%) were precipitated by meningitis which is lower comparing to illorin hospital finding[22]. 3(3.75%)were precipitated by both infection and missed insulin treatment and this is lower than report from Kenyan national hospital(6.4%)[21].12(15%) develop DKA with unknown precipitating factor and this almost

similar to report from Yekatit 12 hospital(15.9%). Heavy use carbohydrate contributes only 1.25% as precipitant factor, which is very low when compared to the result from southern Brazil hospital.

More than 26% patients were dehydrated which is less when comparing to Kenya national hospital report (75%)[21]. The difference is may be due to that,using different criteria to classify a patient as dehydrated. Only 7.8% were in coma and 11.7% had decreased level of consciousness which is less comparing to Kenya national hospital report (22%),(90%) [21]. This difference is may due to, using different criteria to classify level of consciousness.

Only 54(52.4%) of studied patients potassium electrolyte were measured in the first day of admission. This shows that half of DKA patients were manage with giving little emphasis to potassium electrolyte imbalance. However it is high comparing to report from Yekatit where serum potassium was not measured at all[11]. Of 54 who get test 31.4% were hypokalemic and 2(3.7%) were hyperkalemic, this is almost similar to Nigerian urban hospital report [29].

Even if only 45% had overt infection, for more than half (53.4%) complete blood count were done. Of those 47.3% had leukocytosis and this is lower comparing to report from Kenya [21]. The deference is may be due to, complete blood count is done for all study subjects in Kenya and not for this study all subjects even if infection is the leading precipitating factor.

6- Limitation of the study

- Since this study is retrospective,based on medical chart data's, it has its own limitation associated to poor documentation. Also, many other socio-demographic and economic DKA precipitating factors couldn't be assessed.

- There was some difficult to compare findings, due to dearth of study in Ethiopia and inaccessibility to others country study report.

- This finding is based on patient data on the card, according to the physician diagnosis. There may be a misdiagnosis of DKA for type II diabetics in place of hyperglycemic hyperosmolar state which has similar manifestation with DKA except ketosis symptom like nausea, vomiting, abdominal pain and kussmaul respiration.

7-CONCLUSION

This study indicates that Diabetic ketoacidosis is a common fatal metabolic disorder in TikurAnbesa hospital. About 77.8% Occurred in known diabetic patients and 25.2% were newly diagnosed diabetic patients. The most suffered age group was 13 – 20. The most common DKA precipitating factors was infection and missed insulin.Some DKA clinical features have significant association with variables like age sex, DM type and with precipitating factors.

Practice of early potassium measurement is 54(52.4%) and from those who get test 31.4% were hypokalemic and Of 55(53.4%) of study subjects who had complete blood count investigation 26(47.3%) had leukocytosis.

8-RECOMMENDETION

Based on the findings and the conclusions, the following recommendations were forwarded for respective stake holders.

To Hospitals or health care givers

Successful treatment of DKA requires frequent monitoring of patients, correction of hypovolemia and hyperglycemia, replacement of electrolyte losses, and careful search for the precipitating cause.Therefore, professionals have to be well trained and familiar to DKA diagnosis and management.

Healthcare givers and Professionals should educate DM patients since the majority of DKA cases occur in patients with a known history of diabetes and this acute metabolic complication should be prevent through early detection and by the education of patients.

The diabetic association centerand diabetes follow up outpatient diagnosis department should

strongly educate about the precipitating factors and signs of DKA during follow up time to facilitate early health seeking.

The health facilities should fulfill and organize equipment (like glucometer, dipstick) in the ED to facilitate rapid investigation and patient management.

To ministry of health

In diabetic populations DKA is preventable by improving patient education and access to care.

The frequency of hospitalizations for DKA has been reduced following diabetes education programs, improved follow-up care and access to medical advice. Novel approaches to patient education incorporating a variety of healthcare beliefs and socioeconomic issues are critical to an effective prevention program.

Ministry of health should prepare and train health worker to increase public awareness and greater medical alertness to reduce the high rates of DKA associated mortality.

It is important to raise awareness in the public about early diagnosis, treatment, predisposing and precipitating factor through educational campaigns.

To the researcher

Since this is a preliminary study, further investigation should be continued to find out factors associated to diabetic ketoacidosis and methods of better management to greatly reduce hospital admission and mortality.

Acknowledgment

I would like to acknowledgeAddis Ababa University to financethe study. My sincere gratitude also goes to my advisors,Sofia Kebede(MD, EM), Yonas Abebe (BSc, EMCCMSc,)for their guidance and constructive comments throughout the research work.I will also like to appreciate the cooperation i got from the hospital and for all those who helped for the accomplishment and success of this research.

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Check list to assess precipitating factors and clinical-laboratory features of DKA patients, atTikurAnbesa hospital Emergency department,January 2011 – January 2013, Addis Ababa, Ethiopia

1-Patient identification

1	Card number		
2	Age	(year)	
3	Sex	Male	

		Female	
4	Address		
5	Referred by	Self-referral	
		Hospital/health center	
6	DM type	Type I	
		Type II	
7	Known diabetic	For how long	(months)
8	Newly diagnosed		

2- Precipitating factors

1	Infection	Infection site	Respiratory system	
			Genitourinary system	
			Septicemia	
			other	
2	Missed insulin			
3	Trauma			
4	heavy use of carbohydrate			
5	Stress			

6	Other	
8	unknown	

3- Clinical features

1	polyuria	
2	Polydipsia	
3	polyphagia	
4	Dehydration	
5	Kussmaul breathing	
6	Fruity breath	
7	Nausea and vomiting	
8	Abdominal pain	
9	Decreased level of consciousness	
10	coma	
11	Fever	
12	Headache	
13	Other	

4- Laboratory features at admission

1	Blood sugar level	
2	Urine ketone level	
3	Potassium level	
4	White blood cell count	

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