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DIAGNOSIS AND TREATMENT OF DIABETIC KETOACIDOSIS IN CHILDREN AND ADOLESCENTS

Pediatrics

KEYWORDS: Diabetic ketoacidosis; Child; Clinical features;

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ABSTRACT

Type I diabetes mellitus is the most common endocrine- metabolic disorder of childhood and adolescence and diabetic ketoacidosis (DKA) can be life threatening. The study aims at identifying precipitating factors, states epidemiological features and describes clinical presentations in children with DKA admitted to Pediatric Intensive Care Unit (PICU), Rajendra Institute of medical sciences,Ranchi. The hospital records of 80 children admitted to PICU with DKA between May 2016 and January 2017 were reviewed. Age at admission ranged between 8 months and 14 years (mean = 10.7 years). Female to male ratio was 1.22:1. A family history of diabetes (either type 1 or 2) was reported in 59 (74%). The leading precipitating factor for DKA was infections (82.1%). An episode of DKA was the first clinical presentation of diabetes among 52(65%). The common presenting symptoms were: vomiting in 57(71.3%) and abdominal pain in 53 (66.3%). All children were dehydrated. Other signs included acidotic breathing and tachypnea each in 60%. Only two children were comatose (2.5%). Three of presenting cases were initially misdiagnosed as acute appendicitis before correct diagnosis was established. Cerebral edema occurred in one child. There were no deaths. DKA is an important cause of hospital admissions in our hospital, and 65% of newly diagnosed cases present with DKA. More effort should be put to prevent and reduce the incidence of DKA at initial presentation and later.

OBJECTIVES: DIAGNOSIS AND TREATMENT OF DIABETIC KETOACIDOSIS IN CHILDREN AND ADOLESCENTS

INTRODUCTION

Definition Of Diabetic Ketoacidosis

DKA is defined as hyperglycemia (serum glucose concentration > 200 mg/dL), with metabolic acido¬sis (venous pH < 7.3 or serum bicarbonate [HCO3] concentration < 15 mEq/L), and ketonemia or ke¬tonuria.3 The severity of DKA is determined by the degree of acidosis.4

Type I diabetes mellitus (DM) is the most common endocrine-metabolic disorder of childhood, and adolescence [1]. WHO announced DM as one of the main threats to human health in the 21st century [2]. Diabetic ketoacidosis (DKA) is an acute metabolic complication that can be life-threatening and is the major source of mortality and morbidity in this disorder [3, 4]. Frequent causes include stress and infection in a new diabetic or a missed insulin dose in an established diabetic [5]. Ketoacidosis usually develops slowly, but when vomiting occurs it can develop in a few hours [5]. Classic symptoms often are absent in toddlers; and dehydration of 10% in children and up to 15% in infants is common [5]. Some patients (especially children) do not like to have injections [5]. DKA has been reported to occur also in type 2, mainly under stressful conditions such as surgery or infections [6,7]. Approximately 25 to 40% of children with type I DM will initially be diagnosed upon presentation with ketoacidosis [8]. DKA may occur in association with near normal glucose levels. Some patients have the desire to try local medicines [8]. The WHO projected to have almost "221" million cases in the year 2010 and up to "285" million cases in the year 2025 [9]. Many patients will have recurrence of their DKA [10]. The number of episodes of DKA is a significant outcome measure for diabetes care [11]. Pediatric DKA requires rapid recognition, yet gradual organized treatment [13]. Cerebral edema is an uncommon (occurs in 1%) but devastating complication of DKA in children, with a mortality that has remained constant for decades, and no guidelines have been shown to eliminate its risk [14,15]. Ideally severe DKA should be treated in intensive care units, especially if bicarbonate therapy is contemplated [16]. Treatment of children with DKA uses significant health care resources and the best way to avoid it is through involvement and close follow up by a multidisciplinary team of health care professionals with experience in dealing with diabetes in children and adolescents [7,19]. The ESPED, UK stated that: in early management of DKA, use of lower dose of insulin might be safer, especially in patients with PH<7.1 and when fluid boluses are needed for dehydration [16].

This retrospective study was carried out at Rajendra Institute of medical sciences,Ranchi, where records of all children admitted with DKA to our PICU were reviewed and analyzed. All children diagnosed as DKA will usually be admitted to our PICU. Our objective was to state prevalence, precipitating factors and other epidemiological features, and describes the clinical characteristics among these children, stating complications and time of improvement.

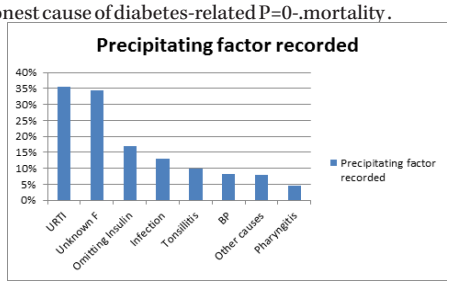
MATERIALS AND METHODS

Hospital records of all children admitted with DKA to our PICU over a 9 months period from May 2016 to January 2017 were reviewed. Clinical, laboratory and other data at the time of admission and during stay in PICU were collected and analyzed.

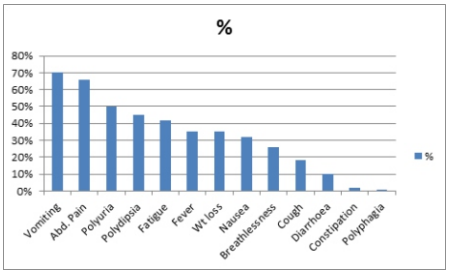
RESULTS

The number of admitted children to our Pediatric Department, during the 9 months of the study, was 2540. The number of all children admitted to our PICU in the study period was 540, 80 of whom were admitted with DKA from all cases admitted to PICU and 0.94% from total children admitted to our Pediatric Department in the same period). The age of children in the study ranged between 8 months and 14 years, with a mean of 10.7 years. Those older than 10 years were 34 (42.5%) and only 3(3.75%) were infants ≤ one year of age. Those aged > one year up to 10 years were 43(53.75%). Female to male ratio was 1.22:1 (55% were females and 45% were males). A family history of diabetes was positive in 59(74%) of children with DKA. Among these 31(52.5%) were from 1St degree relatives, whereas siblings accounted for 25.4%, fathers 24% and only 3.1% from mothers. Grandfathers and grandmothers each accounted for 35% of this positive family history of diabetes. Many of our admitted children (40.6%) had more than one diabetic relative.Childhood infections were the commonest and

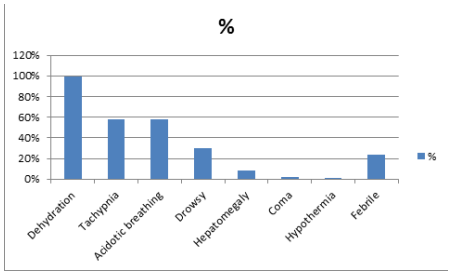
leading precipitating factor for the development of ketoacidosis (82.1%). Poor compliance with omission of insulin was the second factor (17.9%). Reported infections included upper respiratory infections, bronchopneumonia and tonsillitis. Urinary tract infection and vaginal candidiasis were rare causes vomiting and abdominal pain were the commonest presenting symptoms [12. Thus polyuria and polydipsia might not be well appreciated. All our patients were dehydrated with 43.4% having severe degree. It could well be that our patients arrived relatively late to the hospital or most of them were vomiting. In our study almost 31.3% of cases had altered level of consciousness with two (2.5%) being comatose. This is similar to a German experience where almost 23% had altered level of consciousness, with 10.9% of them being comatose ; but is unlike the experience of another Indian center where only 12.2% were said to have been drowsy with no cases of coma .Three of our children were initially diagnosed as "Acute Appendicitis" but fortunately the correct diagnosis was made before surgical intervention. We therefore concur with the recommendation that diabetes should be ruled out in all cases of acute abdomen. In their study in Paris, Blanc et al [30] found that misdiagnosis was more frequently observed in children with DKA than in children without DKA [30-32]. As noted in our results, 88.7% of our admitted children with DKA recovered at a time between 12 and 24 hours following management. This is comparable to a report from Miami Children's Hospital, USA in 1996 which revealed that acidosis was corrected within 6 hours in children admitted with DKA in 69% of mild cases and in 11% of moderate cases . We had only one case of clinical cerebral edema, who fortunately recovered completely. Our figure is similar to reports from UK and USA where less than 1% of cases developed cerebral edema . Cerebral edema accounts for 20% of diabetes-related deaths. No deaths occurred in our admitted children. The mortality rate from DKA in Developed Countries is from 0.15% to 0.31%, with higher rate (13%) being reported from Developing Countries where infections remains as one of the most important precipitating factors for DKA [7]. In a study done in Saudi Arabia no deaths occurred in children with DKA [22]. DKA was reported to be the principal cause of hospital admissions in Sudan, with infections, particularly malaria as the commonest cause of diabetes-related P=0-.mortality .



1.Precipitating factors for development of DKA



2.Symptoms at the time of admission to PICU



3. Profile of signs of our admitted patients.

CONCLUSION

Diabetic ketoacidosis (DKA) is an important cause of hospital admissions in our hospital and 65% of newly diagnosed cases presented with DKA. Girls were facing more risk. Positive family history of diabetes was significant in as many as 3/4 of our children and consanguinity was reported among 40% of children`s parents. Infections are the most common precipitating factor; therefore, preventive measures aiming at childhood infections can help in reducing significantly the incidence of DKA.Vomiting and abdominal pain are the commonest presenting symptoms, with only 2.5% presenting with coma. Current availability of intensive care facilities, as well as standardized guidelines for management, has resulted in management outcome and complications similar to the experience in Developed Countries.We had no mortalities, and almost all cases recovered within 12-24 hours.More efforts should be put to prevent and reduce the incidence of DKA at initial presentation and later on. We also recommend that diabetes should be ruled out in all cases of acute abdomen.

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