ORIGINAL RESEARCH PAPER

General Medicine

A STUDY ON CLINICAL AND BIOCHEMICAL PROFILE IN DIABETIC KETOACIDOSIS

KEY WORDS:

Dr. K. sathik Basha	MD., Assistant Professor, Department of General medicine, Government Villupuram Medical College, Villupuram, India.
Dr. a. ashok Kumar*	MD., Assistant Professor, Department of General medicine, Government Villupuram Medical College, India. *Corresponding Author

INTRODUCTION

Diabetes mellitus is a metabolic disorder of multiple aetiologies, characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat, and protein metabolism resulting from defects in insulin secretion, insulin action, or both.Diabetes mellitus is generally classified into Type 1 and Type2 diabetes. Type1 DM is a complete or near complete insulin deficient state due to autoimmune destruction of pancreatic beta cell. Type 2 DM is due to insulin resistance rather than complete insulin deficient.

Diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic state (HHS) are dangerous manifestations of diabetes mellitus representing two extremes in the spectrum of uncontrolled diabetic state.

The basic defect in the pathogenesis of DKA is insulin deficiency. Glucagon is a counter regulatory hormone which facilitates gluconeogenesis mechanism, hence hyperglycemia will occur. The absolute insulin deficiency and hyperglycemia leads to synthesis of ketone bodies such as acetoacetate and beta hydroxyl butyrate from hepatocytes, hence ketosis will occur.

Most patients with DKA recover when treated properly and if left untreated, patient may develop complications such as cerebral edema, thromboembolism, acute respiratory distress syndrome (ARDS), disseminated intra vascular coagulation (DIC), electrolyte abnormalities, myocardial infarction, infections, and acute circulatory failure.

Early identification of ketoacidosis and aggressive management with insulin, IV fluids and electrolytes replacement may change the outcome of the disease.

AIMS AND OBJECTIVES

- To study the incidence of DKA in poorly controlled diabetes by HbA1c level.
- To study the correlation between serum bicarbonate level and mean duration of hospital stay in DKA patients.
- To study the correlation of HbA1c level and mean duration of hospital stay in DKA patients.
- To study the correlation of serum osmolality and its effect on mental status.
- To study the outcome of DKA patients during treatment.

REVIEW OF LITERATURE

Diabetes Mellitus can be due to defective insulin secretion, insulin action, or both. The long term complications of diabetes are retinopathy, nephropathy, neuropathy with foot ulcers, Charcot joints, and autonomic dysfunction like postural hypotension, sexual dysfunction etc. The short term complications of diabetes mellitus are diabetic ketoacidosis and hyperosmolar hyperglycaemic state (2). Both are life threatening complications in uncontrolled diabetes.

DKA occurs in the setting of more severe insulin deficiency leading to hyperglycaemia and dehydration and also production of ketone bodies and acidosis.

EPIDEMIOLOGY

More than 20%of patients admitted for DKA have previously undiagnosed diabetes.

In recent studies, mortality rate was ranging from 2.5% to 9% among patients admitted with DKA have been reported.DKA is the one of the major causes of death in diabetic individuals, younger than 24 year old.Mortalityamong patients with DKA has been related to age, degree of hyperosmolarity, and severity of azotemia.

In both DKA and HHS, sub optimal level of insulin results in hyperglycaemia, further results in total body water deficit. When insulin deficient state becomes severe, ketoacidosis will occur. Type 2 diabetics develop ketoacidosis even without insulin deficient state due to presence of insulin resistance.

Any physiologic stress in the patient with type 1 diabetes may result in DKA, by elevating the levels of counter regulatory hormones.

MATERIALS AND METHODS

This prospective cross sectional study includes 50 patients with Diabetic ketoacidosis admitted in medicine ward and ICU in Government Rajaji Hospital, Madurai for 9 months. Type 1 and type 2 diabetic patients(Symptomatic/Asymptomatic) of both sexes were included in the study. The study includes both newly detected diabetic ketoacidosis patients as well as patients who were on treatment. The written informed consent obtained from each patient or their relatives .DKA is differentiated from Hyperosmolar Hyperglycemic state.

To diagnose the DKA, the following are essential:
1) High blood sugar (blood sugar more than 250 mg / dl)(13)
2) Ketosis
3) Acidemia(pH less than 7.3)

Biochemical investigations

Random blood sugar, Serum Electrolytes, Urine Acetone, Blood urea, and Serum Creatinine were measured to confirm the diagnosis. Urine ketone bodies were identified by Rothera's nitroprusside test.

The presenting symptoms were elicited by history and clinical examination.The precipitating factors of DKA such as inadequate insulin administration, Poor patient compliance, Infection, Infarction were assessed by history and clinical examination.

HbA1c level: In all the study patients, HbA1c level was measured by automated analyzer method   to find out the glycaemic control of past 3 months. Based on HbA1c levels the patients were divided into
Group I - 6.5-7.5%
Group II - 7.6-8.5%
Group III- 8.6 – 9.5%
Group IV- more than 9.6 %
These groups were compared to find the role of long standing poor glycemic control for development of DKA. In these groups the mean duration of hospital stay was recorded to find the effect of HbA1c level in outcome of the DKA patients.

Serum osmolality:

Serum Osmolality =2 × Na+ Blood sugar /18 + Blood urea /5.6.
The normal range of serum osmolality is 285-295 mOsm/kg.
According to their serum osmolality, the study group is divided into

Group A: Serum Osmolality less than 320 mOsm/ kg
Group B: Serum Osmolality more than 320 mOsm/kg

In each group, number of patients had the altered level of consciousness were counted . The values were compared among these groups to find the relationship between the serum Osmolality and mental alteration and outcome in DKA patients.

Serum bicarbonate:

According to their serum bicarbonate values,patients were divided into
Group I = 16 – 20 mEq/l
Group II = 11-15 mEq/l
Group III = ≤ 10mEq/l

In these three groups, the mean duration of hospital stay was recorded and the values were compared to find the correlation of serum of serum bicarbonate level and patient outcome.

RESULTS AND ANALYSIS

Among these 50 DKA patients, our data reveal that the incidence of DKA was higher in 21- 40 years of age. Our study shows that DKA is common in males (72%) compared to female population (28%).

- In this study, data shows that positive correlation between higher serum osmolality values and high incidence of mental confusion/ coma in DKA patients.
- Out of 50 patients, 47 patients (94%) were completely recovered from DKA and 3(6%) patients were died due to complications. This result shows that the mortality rate was 6 %.
- In our study, data show that the mean duration of hospital stay was increased in patients with low bicarbonate values.

S. no	Serum Bicarbonate levels in mEq/l	No. of DKA patients	Mean duration of hospital stay in days	"p" value	Significance
1	16-20	31	9.8	0.054	Not significant
2	11-15	12	12.06	0.004	significant
3	<10	7	14.2	0.001	Significant
Total		50			

- **Correlation of patient's HbA1c values with mean duration hospital stay:**

S. no	HbA1c level	No. of DKA patients	Mean duration of hospital stay	"p"value	Significance
1.	6.5-7.5	5	10.02	0.504	Not significant
2.	7.6-8.5	9	10.2	0.482	Not significant
3.	8.6-9.5	12	10.1	0.501	Not significant
4.	>9.6	24	9.9	0.511	Not significant

These results reveal that the HbA1c didn't have the correlation with mean duration of hospital stay in DKA patients.

DISCUSSION

In our study, among these 50 patients, 31 (62%) were type 1 diabetes and 19 (38 %) were type 2 diabetes. Diabetic ketoacidosis was more common among the type 1 diabetics.

In this study, the incidence of DKA was more in early period of diabetes (In 0-5 years duration of Diabetes, 22 patients developed DKA among 50 patients).This clearly showed that the incidence of DKA was not increasing in relation with increased duration of diabetes.

Our study showed that incidence of diabetic ketoacidosis was higher in patients with high HbA1c level.

Our study clearly indicates that the patient's serum osmolality was strongly correlates with their mental state

In this study, out of 50 patients, 3 (6%) patients died due to DKA complications.

Our results clearly shows, when the serum bicarbonate level decreases, the degree of metabolic acidosis also increases and affects the outcome of the DKA patients.
In this study, the mean duration of hospital stay was almost equal in all groups with various HbA1c levels. These results show that HbA1c level didn't have any correlation with the outcome of the DKA patients.

LIMITATIONS OF THE STUDY

In this study, urine acetone was used as a diagnostic method to detect ketoacidosis. Plasma ketone estimation was not done. The study population is small. DKA were not followed after the study.

CONCLUSION

- Duration of diabetes doesn't have any correlation with incidence of diabetic ketoacidosis.
- HbA1c level have a positive correlation with the incidence of DKA.
- High serum osmolality value is strongly associated with occurence of mental confusion/coma
- Low serum bicarbonate level is strongly associated with their prolonged stay in the hospital.
- HbA1c level doesn't have any correlation with the duration of hospital stay.

REFERENCES

1. Text book of internal medicine- Harrison's- 18th edition
2. API text book of medicine – ninth edition
3. Principle and practice of medicine- Davidson's- 21st edition
4. Daad Hassan akbar, clinical and biochemical aspects of diabetic acidosis and it's outcome; Journal of the Bahrain medical Society, vol 12, July 2000
5. Berhaneseyoum,MD- profile of diabetic ketoacidosis in a predominantly African American urban population; Ethnicity and disease journal, vol 17, 2007.
6. C Rajasoorya- diabetic ketoacidosis- a study of 33 episodes; Singapore med j 1993; vol 34: 381-384.
7. Afrosemuhamed- diabetic ketoacidosis: Comparison of clinical profile and biochemical profile; Indian journal of paediatrics, vol 21, 2004.
8. Sandeep kumarkanwal- clinical profile of diabetic ketoacidosis in Indian children; 1007/11-0634.
9. Ramaswamy Ganesh R- clinical profile and outcome of diabetic ketoacidosis in children; Indian journal of Pediatrics; ISSN; 0973-7693.
10. Balasubramanyam A- New profile of diabetic ketoacidosis: Type 1 vs Type2 diabetes and the ethnicity; Archives of internal medicine 1999,vol 159 .
11. Manual of medical therapeutics- Washington; 33rd edition.
12. Wachtel TJ, Hyperosmolarity and acidosis in diabetes mellitus, J Gen med 1991; 495- 502.
13. Diabetes mellitus- Joslin's; Indian edition- fourteenth edition.
14. Qari FA, clinical profile in diabetic ketoacidosis; Saudi med J, 991-998. 2007.
15. Tahboub I- A study on diabetic ketoacidosis and its outcome, East mediter health journal; 2000- 1035-8.
16. Habib HS- diabetic ketoacidosis and its outcome in children; Saudi med J 2005; 1936-6.
17. Snorgaard O – Diabetic ketoacidosis in Denmark; J internet med, 1989, 223-8.
18. Akhter J - A study on diabetic ketoacidosis in Aga Khan University; J park med association; 1993; 1993; 137- 9.
19. BonadioWa, Outpatient management of diabetic ketoacidosis. AJDC 1988; 142: 448- 450.
20. Soler Ng, Bennet ma. Potassium balance during treatment of diabetic ketoacidosis with special reference to the use of bicarbonate. Lancet 1972, 665- 667.