Study of Hyperglycaemic States and it's Outcome

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Abstract

Diabetic coma is a reversible form of coma [1] found in people with diabetes mellitus. It is a medical emergency. Two different types of hyperglycaemic states are identified: 1) Diabetic ketoacidosis (DKA) and 2) Hyperglycemic Hyperosmolar State(HHS). Hyperglycemic emergencies continue to be important causes of morbidity and mortality among patients with diabetes. The cause of death in patients with DKA and HHS rarely results from the metabolic complications of hyperglycemia or metabolic acidosis but rather relates to the underlying medical illness that precipitated the metabolic decompensation. Thus, successful treatment requires a prompt and careful search for the precipitating cause (s). A study done by Osuntokun et al [2] in 1971 in Ibadan reported DKA as the single major cause of death in diabetics. Necropsy studies carried out 5 years later in Ibadan by Smith and Adetuyibi [3] showed that 43% of deaths in acute decompensated diabetics were due to DKA. A mortality rate of 60% for HHS was reported from Ile-Ife in 2000 by Kolawole and Ajayi [4]. A study for this Diabetic Coma in India is untouched, this study is to fill the lacuna in that regard finding the factors associated with outcome and on emphasis on the determinants of outcome.

Keyword: Diabetic Keto Acidosis(Dka); Hyperglycaemic Hyperosmolar State(Hhs); Diabetes Mellitus(Dm).

Introduction

DKA is reported to be responsible for more than 100,000 hospital admissions per year in the United States [5] and accounts for 4–9% of all hospital patients with diabetes. The incidence of HHS is lower than DKA and accounts for <1% of all primary diabetic admissions [5]; this series outcome was mortality rate of 2–5% for DKA, and ~15% for HHS [5,6].

DKA is the most common cause of death in children and adolescents with type 1 diabetes and accounts for half of all deaths in diabetic patients <24 years of age [7].

Nearly 44 lakh Indians in their most productive years — aged 20 to 60 years — aren't aware that they are diabetic, a disease that exposes them to heart attack, stroke, amputations, nerve damage, blindness, kidney disease and diabetic coma; even death.

Diabetes is fast gaining the status of a potential epidemic in India with more than 62 million diabetic individuals currently diagnosed with the disease [8].

With this much of diabetic burden on us there is an urgent need to know the morbidity, and even mortality associated with diabetes and risks associated with the determinats and diabetes itself.

With this background information the present study is planned to know the prevalence, clinical findings and outcome of HHS, DKA in department of Emergency Medicine at Jayadeva Jagadguru Murugarajendra Medical College (JJMMC), Davangere.

Objectives of the Study

- To ascertain the clinical factors associated with outcome.
- Emphasis on the determinants of outcome.

Source of Data

Patients with diabetic emergency admitted in Emergency ward of Bapuji Hospital attached to J.J.M. Medical College, Davangere.

A total of minimum 34 patients admitted to the Accident and Emergency unit of Bapuji Hospital attached to J.J.M. Medical College, Davangere, who fulfilled the criteria for diabetic emergencies, will be selected. The information extracted includesocio demographic, clinical, and laboratory data, as well as hospitalization outcome.
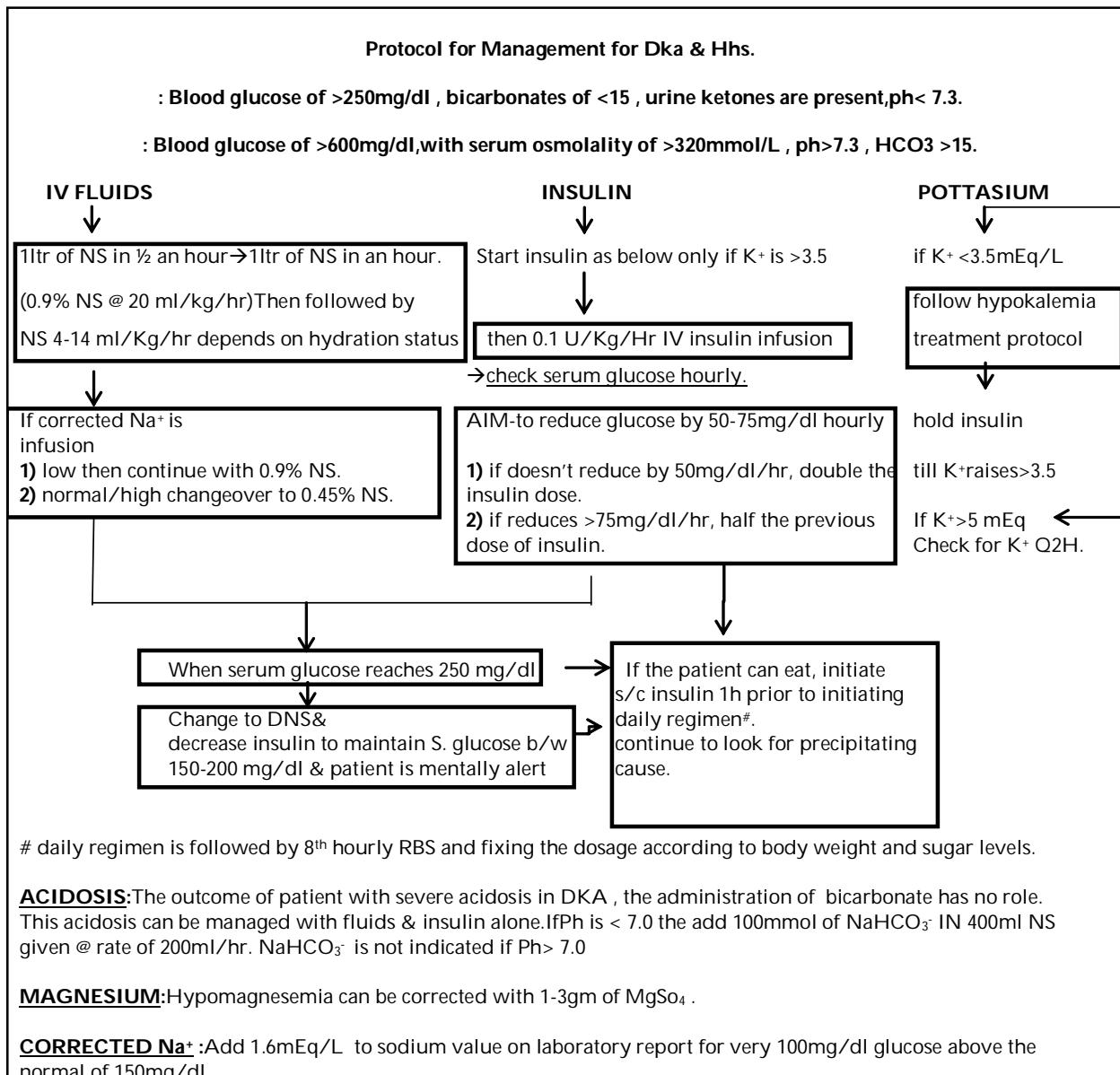
Inclusion Criteria

1. Both sex.

2. Patients of any age group including Type 1 DM and Type 2 DM.

3. A: for DKA Subjects were recruited if they met the following criteria:

- random plasma glucose RBS > 17 mmol/L (300 mg/dL),
- ketonuria of 2+ or more, and
- serum bicarbonate of less than 18 mmol/L

B: for HHS

- RBS > 25 mmol/L (450 mg/dL) and
- Plasma osmolality > 320 mOsmol/L with insignificant ketonuria

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Protocol for Management for Dka & Hhs.

: Blood glucose of >250mg/dl , bicarbonates of <15 , urine ketones are present,ph< 7.3.

: Blood glucose of >600mg/dl,with serum osmolality of >320mmol/L , ph>7.3 , HCO3 >15.

IV FLUIDS	**INSULIN**	**POTTASIUM**
↓	↓	↓
1ltr of NS in ½ an hour→1ltr of NS in an hour. (0.9% NS @ 20 ml/kg/hr)Then followed by NS 4-14 ml/Kg/hr depends on hydration status	Start insulin as below only if K+ is >3.5 ↓ then 0.1 U/Kg/Hr IV insulin infusion →check serum glucose hourly.	if K+ <3.5mEq/L follow hypokalemia treatment protocol ↓ hold insulin
↓ If corrected Na+ is infusion **1)** low then continue with 0.9% NS. **2)** normal/high changeover to 0.45% NS.	AIM-to reduce glucose by 50-75mg/dl hourly **1)** if doesn't reduce by 50mg/dl/hr, double the insulin dose. **2)** if reduces >75mg/dl/hr, half the previous dose of insulin.	till K+raises>3.5 If K+>5 mEq Check for K+ Q2H.

When serum glucose reaches 250 mg/dl →   If the patient can eat, initiate s/c insulin 1h prior to initiating daily regimen#.

Change to DNS& decrease insulin to maintain S. glucose b/w 150-200 mg/dl & patient is mentally alert

continue to look for precipitating cause.

daily regimen is followed by 8th hourly RBS and fixing the dosage according to body weight and sugar levels.

ACIDOSIS: The outcome of patient with severe acidosis in DKA , the administration of bicarbonate has no role. This acidosis can be managed with fluids & insulin alone.IfPh is < 7.0 the add 100mmol of $NaHCO_3^-$ IN 400ml NS given @ rate of 200ml/hr. $NaHCO_3^-$ is not indicated if Ph> 7.0

MAGNESIUM: Hypomagnesemia can be corrected with 1-3gm of $MgSo_4$.

CORRECTED Na+ : Add 1.6mEq/L to sodium value on laboratory report for very 100mg/dl glucose above the normal of 150mg/dl.

Inclusion criteria is based on the diabetic emergencies fitting into DKA and HHS protocol formulated in Emergency Deparment, JJM Medical College, Davangere.

Exclusion Criteria

1. Pregnant women due to the gravid state.

2. Patients with pulmonary edema,which includes pulmonary edema of cardiac failure and chronic kidney disease.

Results

3. Refusal of consent to participate in study.

Investigations

Investigations such as haematological & urine test.

- Blood-FBS, RBS, CBC, Sodium, Potassium, Magnesium, Chloride, Phosphate, Creatinine, Osmolality, Plasma ketones, S. Bicarbonate, Arterial Ph, Arterial Pco2, Anion gap.

- Urine-Ketone bodies, routine.

Type 2: Diabetes mellitus with hyperglycaemic state.

| Sepsis | Defaulting | ACS | Newly Detected | | CVA | Ayurvedic Medications |
			With Sepsis	With Alcoholism		
5	4	3	3	2	2	3

Sepsis includes pneumonia, urosepsis, cellulitis.

Defaulting includes not adhering to the prescribed medications, non availability of OHAs/INSULIN.

ACS; Acute coronary syndrome includes both STEMI & NSTEMI.

Ayurvedic Medications include discontinuing allopathy drugs and taking ayurvedic medications.

CVA includes both hemorrhagic as well as ischaemic stroke.

Total Number of T2 Dm With;

DKA=22.

HHS=2.

Death= 1(SEPSIS) Patient with HHS.

Recovered = 2. (Including 20 Patients with DKA and 1 Patient with HHS)

- Patients with sepsis and hyperglycaemic state, treated for DKA/HHS and treatment directed towards sepsis.

- With ACS, treated for DKA/HHS and treatment with angiogram & angioplasty.

- With defaulting/ayurvedic medications, treated for DKA/HHS and treatment directed adherence to OHAs/INSULIN was councelled.

- With CVA, treated for DKA/HHS and treatment for CVA accordingly.

Type 1: Diabetes mellitus with hyperglycaemic state

Newly Detected	Defaulting	Sepsis
2	3	7

Sepsis includes pneumonia,urosepsis,cellulitis.

Defaulting includes not adhering to the prescribed medications, non availability of INSULIN.

Total number of t1 dm with;

DKA=12.

HHS=0.

DEATH=0.

Recovered =12 (12 patients with DKA and 0 patient with HHS)

- Patients with sepsis and hyperglycaemic state,

treated for DKA/HHS and treatment directed towards sepsis.

- With defaulting medications, treated for DKA/ HHS and treatment directed towards adherence to INSULIN was councelled.

Discussion

Many cases of DKA and HHS can be prevented by better access to medical care, proper patient education, and effective communication with a health care

provider during an intercurrent illness. Paramount in this effort is improved education regarding sick day management, which includes the following:

1. Early contact with the health care provider.

2. Emphasizing the importance of insulin during an illness and the reasons never to discontinue without contacting the health care team.

3. Review of blood glucose goals and the use of supplemental short- or rapid-acting insulin.

4. Having medications available to suppress a fever and treat an infection.

5. Initiation of an easily digestible liquid diet containing carbohydrates and salt when nauseated.

6. Education of family members on sick day management and record keeping including assessing and documenting temperature, blood glucose, and urine/blood ketone testing; insulin administration; oral intake; and weight. Similarly, adequate supervision and staff education in long-term facilities may prevent many of the admissions for HHS due to dehydration among elderly individuals who are unable to recognize or treat this evolving condition.

The observation that stopping insulin for economic reasons is a common precipitant of DKA [9,10] underscores the need for our health care delivery systems to address this problem, which is costly and clinically serious. The rate of insulin discontinuation and a history of poor compliance accounts for more than half of DKA admissions in inner-city and minority populations [9,10,11]. Several cultural and socioeconomic barriers, such as low literacy rate, limited financial resources, and limited access to health care, in medically indigent patients may explain the lack of compliance and why DKA continues to occur in such high rates .These findings suggest that the current mode of providing patient education and health care has significant limitations.

Significant resources are spent on the cost of hospitalization. DKA episodes represent >1 of every 4 USD spent on direct medical care for adult patients with type 1 diabetes and 1 of every 2 USD in patients experiencing multiple episodes [12]. Based on an annual average of 135,000 hospitalizations for DKA in the U.S., with an average cost of 17,500 USD per patient, the annual hospital cost for patients with DKA may exceed 2.4 billion USD per year [13]. A recent study [14]. reported that the cost burden resulting from avoidable hospitalizations due to

short-term uncontrolled diabetes including DKA is substantial (2.8 billion USD). However, the long-term impact of uncontrolled diabetes and its economic burden could be more significant because it can contribute to various complications. Because most cases occur in patients with known diabetes and with previous DKA, resources need to be redirected toward prevention by funding better access to care and educational programs tailored to individual needs, including ethnic and personal health care beliefs. In addition, resources should be directed toward the education of primary care providers and school personnel so that they can identify signs and symptoms of uncontrolled diabetes and so that new-onset diabetes can be diagnosed at an earlier time. Recent studies suggest that any type of education for nutrition has resulted in reduced hospitalization [15].

Conclusion

Among the study sample size of 34 including Type 1 and Type 2 DM,

- 12 patients were of Type 1 DM, 22 patients were of Type 2 DM.

- 28 patients diagnosed with hyperglycaemia had DKA.

- 2 patients diagnosed with hyperglycaemia had HHS.

- The inciting/stress factors causing hyperglycaemic state were – sepsis, defaulting, alcoholism, ayurvedic medications, acute coronary event, cerebrovascular accident and newly diagnosed diabetes.

- Among the patients who have come across in this study; majority i.e- 15 patients out of 30 patients had hyperglycaemic state due to sepsis.

- The major factor for DKA/HHS in this study would be attributed to sepsis.

- The treatment was directed towards management of DKA/HHS according to the protocol formulated in Emergency Medicine Department of JJM Medical College, Davangere; along with the treatment directed towards the inciting/stress factor causing hyperglycaemic state.

- *Country medicine/local medicine*-patients are unaware that these medications can contribute to DKA/HHS and awareness regarding this should be brought into the knowledge of patients and those attenders.

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