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STUDY ON DIABETIC KETOACIDOSIS

[1]Dr G.Jaisimha Reddy, [2]Dr Swapna K

[1] Assistant Professor, Department of General Medicine, Dr. Patnam Mahender Reddy Institute of Medical Sciences, Chevella, Ranga Reddy Dist., Telangana, India.

[2*] Assistant Professor, Department of Dermatology, Dr. Patnam Mahender Reddy Institute of Medical Sciences, Chevellam, Ranga Reddy Dist., Telangana, India.

*Corresponding author

Dr Swapna K,

Assistant Professor,

Department of Dermatology,

Dr. Patnam Mahender Reddy Institute of Medical Sciences,

Chevellam, Ranga Reddy Dist.,

Telangana, India.

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ABSTRACT

Introduction: Diabetic ketoacidosis (DKA) is a hyperglycaemic emergency associated with major morbidity and mortality. It has been shown that treating patients admitted with DKA using an integrated care pathway, or protocol, reduces time taken to initiate management thus optimising care. Review management of DKA in relation to recent guidelines.

Aim: To assess DKA protocol is in our Hospitals during acute management of DKA patients.

Materials and methods: Patients admitted at our hospital with 'Diabetes Ketoacidosis' between November 2021 to April 2022 were screened from the medical records. 44 Patients were identified with 'Diabetes Ketoacidosis ' and included in the audit. Data obtained from patients medical records were collected according to a pre-set proforma. Diagnostic criteria used, pH < 7.30 , serum bicarbonate < 18 and GRBS >250 mg/dL. Statistical analysis was performed.

Results: Total number of 44 cases reviewed. 2 were Incorrectly coded as DKA. 2 were impending DKA. Time to resolution -mean 16.6 hrs, time to S/C insulin -42.8 hrs. Discontinuation of FRII as per protocol-patients (87.5%). FRII in the first 60 minute in 87.5%(25-78%). Hypoglycaemia management was done to all patients1 out of 8 patients had hypoglycaemic episode. Which was appropriately managed. Discontinuation of insulin infusion as per protocol- patients (100%). Initiation of insulin and IV fluid bolus therapy as per protocol however fluid maintenance and insulin titration not adhered 62% and 50%. Potassium replacement was given to all patients.

Conclusion: The findings indicated that there was awareness of the new DKA protocol. It was referred to and placed in clinical notes but not always followed. Management of patients with DKA within the first hour was compliant. It was found that using a protocol does help to standardise initial management of patients but further education is needed and referral criteria need clarifying. Access to 24-hour specialist services may also help to optimise management.

INTRODUCTION

Diabetic ketoacidosis (DKA) is a hyperglycaemic emergency associated with major morbidity and mortality. It is, however, a potentially reversible condition which requires rapid recognition and initiation of treatment. Mortality rates of 3.9% were reported in Birmingham, UK for the period 1971– 1991(1). This figure rises to over 90%, if DKA is

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complicated by cerebral oedema (2). It is a condition that should not be underestimated. Diabetic ketoacidosis is defined clinically as an acute state of severe uncontrolled diabetes that requires emergency treatment with insulin and intra- venous fluids. Biochemically it is defined by the triad of metabolic acidosis, hyperglycaemia and ketonuria.

It usually occurs in type 1 diabetics but has also been reported in type 2 diabetics. Precipitating factors such as infection or non-compliance with treatment should be elicited. Up to 25% of cases occur in newly presenting type 1 diabetics and this may delay initial diagnosis of DKA. Management comprises of fluid resuscitation and insulin therapy. Rapid fluid and potassium replacement are essential. Patients may have lost over 5 l of water by the time they present to hospital. Initial fluid replacement is 2 l in the first 2 h followed by 1 l over 2 h and 2 hourly electrolyte measurements until stabilised (3).

Best outcomes for DKA are seen in patients who are initially managed in a intensive care Unit (ICU), and this is a widespread practice in the USA (4). However, this is obviously not possible in hospitals with more limited resources and ward-based care is usually appropriate. Severe cases should be referred to intensivists and ideally cared for in a ICU setting where close monitoring of fluid balance and electrolytes can be performed. Early input from diabetes specialist services should also be sought.

It has been shown that the use of an integrated care pathway or DKA protocol improves the administration of fluid in the acute setting (4). It also reduces variation in practice and is associated with a shorter hospital stay (5). Every hospital should have its own, readily accessible, guidelines for fluid and insulin prescribing in DKA. However, despite the existence of such a protocol, a study from Scotland found that 70% of the patients had a delay in treatment (6).

A new protocol for the management of DKA was devised based on current literature and introduced in our hospital. An audit was conducted to assess whether the trust protocol was being followed during the acute management (first 4 h) of DKA patients.

MATERIALS AND METHODS

Patients admitted at our hospital with ‘Diabetes Ketoacidosis’ between November 2021 to April 2022 were screened from the medical records. Patients were identified with ‘Diabetes Ketoacidosis ’ and included in the audit. Data obtained from patients medical records were collected according to a pre-set proforma. Diagnostic criteria used, pH < 7.30 , serum bicarbonate < 18 and GRBS >250 mg/dL. Statistical analysis was performed.. We reviewed the use of the protocol and extracted information from medical documentation and fluid balance charts.

We reported data as number (percentage), mean (SD), or median (IQR) and conducted all analyses using SAS statistical software version 9.4

RESULTS

The time frame audited was from November 2021 to April 2022.. We found there were 57 episodes of DKA identified via clinical cases during this period. : Total number of 44 cases reviewed. 2 were Incorrectly coded as DKA. 2 were impending DKA and 1 patient where notes were unavailable for audit.

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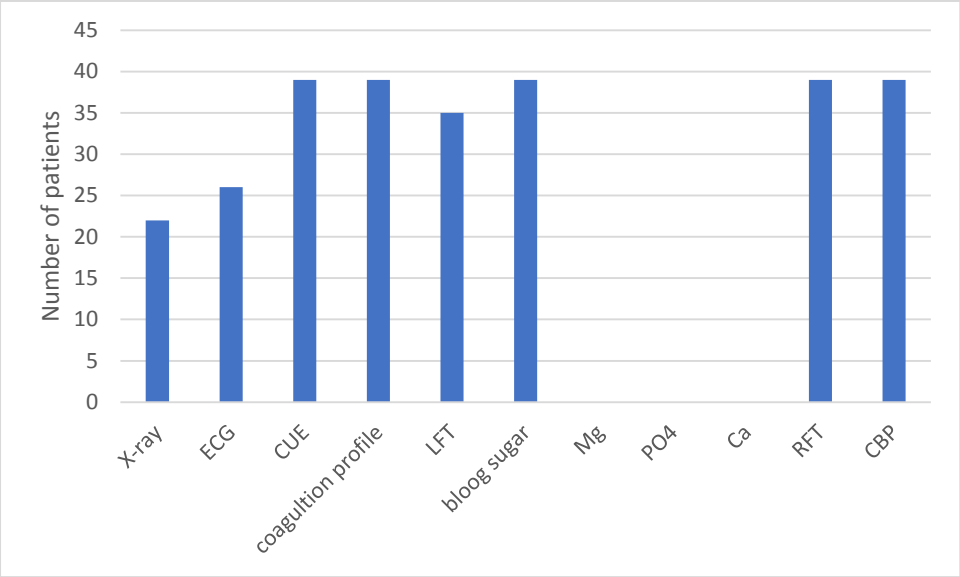
In total, 39 episodes of adult DKA managed at our hospital were audited for adherence to the new protocol. This was made up for all 39 individual patients, 8 of them had multiple admissions. Each episode was audited separately for protocol adherence.

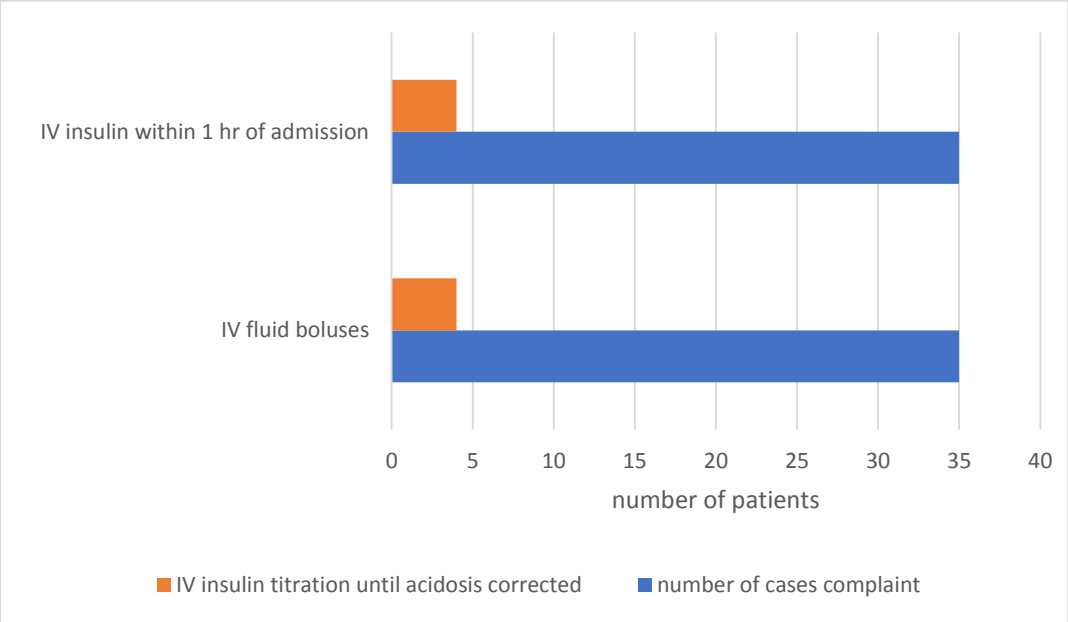
Figure-1: Baseline biochemical tests



The tests included in the adult were CBP, Renal function test , Ca, PO4, Mg, blood sugar, blood ketones, LFT, Coagulation profile, urine analysis, blood and urine culture if indicated , CXR, ABG, or VBG, ECG and cardiac enzymes if indicated.

All cases having done these tests. Blood ketone check 100%, VBG and CBG(2 had HI readings), 100% CBG and VBG. Anion gap measured in all patients.

Figure-2: Intravenous fluids and insulin bolus therapy



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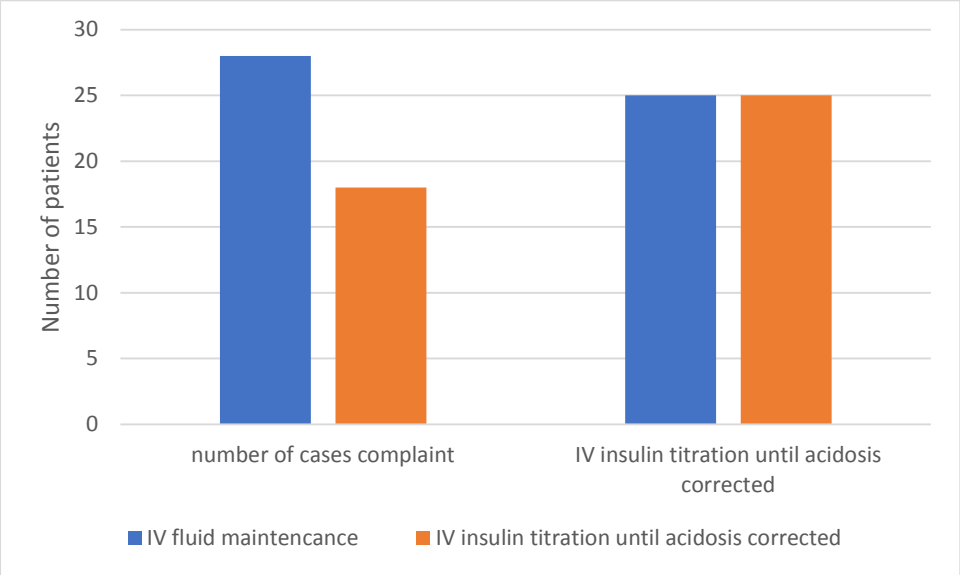
Initiation of insulin and IV fluid bolus therapy as per protocol however fluid maintenance and insulin titration not adhered 62% and 50%.

Figure-3: Intravenous and insulin maintenance therapy.



Initiation of IV fluids in the first 60 minutes in all patients(39-73%).

Serum electrolytes to be sent Q2 hours, until corrected Na and K are normal
Serum electrolytes to be sent Q4 hours , until insulin infusion stopped.

Time to resolution -mean 16.6 hrs, time to S/C insulin -42.8 hrs

Discontinuation of FRII as per protocol-patients (87.5%).

FRII in the first 60 minute in 87.5%(25-78%)

Hypoglycaemia management was done to all patients1 out of 8 patients had hypoglycaemic episode. Which was appropriately managed.

DISCUSSION

DKA is the most common acute hyperglycemic emergency among people with diabetes and is associated with significant morbidity and health care cost.[1,4] The ICU is a scarce resource that can become critically strained during seasonal influenza surge or as evidenced by the COVID-19 pandemic.(7,8) The findings indicated that there was awareness of the new DKA protocol and it had been referred to and placed in clinical notes. Resuscitation and management over the first hour of admission had been compliant as most patients received the correct flu- ids, insulin sliding scale and initial investigations to elicit precipitants. However, management over hours 2 until 4 was less well done. Patients did not have the correct fluids prescribed and electrolyte monitoring was neglected. Discontinuation of FRII as per protocol-patients (87.5%) . Discontinuation of insulin infusion as per protocol- patients (100%). Initiation of insulin and IV fluid bolus therapy as per protocol however fluid maintenance and insulin titration not adhered 62% and 50%. Appropriate use of blood ketone measurement and VBG 100%. Potassium replacement was given to all patients.

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It remained unclear from the documentation as to why management after the first hour of admission was so variable. Even though the protocol had been placed in most patient notes, it had not been used as a check-list to ensure tests were carried out at the right times and that the appropriate fluids were being prescribed. The protocol encourages the admitting physician to use their clinical judgement at all times and this may explain the variation in treatment. As each clinical case was being evaluated individually, management therefore also differed. However, clear documentation of this was not provided.

Another reason for this variability may be as a result of inefficient handover of patients. Most of the patients were initially admitted to the Emergency department where management was started before being transferred to the Acute Medical Unit and then on to the specialist diabetic ward. Although nursing staff hand over patients as they are transferred from ward to ward, medical staffs are rarely notified. Therefore, management plans are not reviewed in a timely manner, mistakes are not rectified and further monitoring is neglected. This highlights how DKA is a condition that is underestimated by both medical and nursing staff.

Another concerning finding was that less than half of patients in DKA needing a ICU referral were actually referred. This may have been because of inadequately defined parameters on the protocol leaving ICU referral mainly down to clinical judgement of the admitting physician. However, poor documentation meant that no evidence of the physician's reasoning was provided, such as improvement of the patient's clinical condition following initial resuscitation. The hesitation to ask for more specialist input may also come from the perception that DKA patients do not warrant a ICU bed. Again this emphasises how DKA is underestimated. These patients need close monitoring and fluid resuscitation. The literature shows that all DKA patients would benefit from ICU admission (4), however, this is rarely possible. High risk patients should always be reviewed by intensivists even if this does not result in transfer to ICU. (9,10)

Levetan et al. also found that patients managed by diabetologists tend to have a lower re-admission rate (11). This helps to reduce both the early and late complications of DKA as treatment is more focussed and directed. Management by a diabetic specialist team can also improve patient education about the dangers of DKA and how to prevent it. Our audit found that 25% of patients had multiple admissions of DKA within the 5 month period studied, indicating poor diabetic control and possibly poor compliance. Follow up with the diabetes team including the specialist nurse and a consultant is part of the Sherwood Forest Hospitals DKA protocol, however, this part of the protocol was not audited. Further audit needs to be conducted to assess this and ensure that these patients are receiving appropriate follow up to optimise continuity of care. Although little conclusive evidence exists to firmly prove that specialist involvement during the first 4 h of management of DKA is beneficial, it has been shown that it leads to better patient education, reduction in re-admission rates and fewer complications. This indicates that it does lead to better patient outcomes and so would be a valuable resource.

CONCLUSION

It has been found that using an Integrated Care Pathway, or protocol, did help to standardise the initial management of DKA patients at our hospital. There was widespread awareness of the protocol and the first hour of management was carried out with good compliance. However, further education is needed to ensure good handover between doctors and clear documentation of decisions at all times to standardise subsequent management. ICU referral

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criteria also need further clarification. Having access to a 24-h specialist diabetes advice service may also help with the acute management of DKA, with diabetes follow up to ensure continuity of care.

Study limitations

Short duration of study. Difficult to interpret the timing of fluids, insulin prescriptions. Inadequate and unclear documentation

Summary and recommendations

Don't forget the K in DKA - Early and appropriate potassium replacement. Attention to avoidance of hypoglycaemia. Review of metabolic process and progress. Strengthening education programme – Nursing and medical staff. Appropriate use of blood ketone measurement and VBG. Review of the protocol to adapt to recent changes in DKA guidelines (recent JBDS). and simplify insulin regime(FRIII).

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