Protocol for the Acute Management of Diabetic Ketoacidosis in Adults

**STAGE 1**

**IMMEDIATE MANAGEMENT (On Presentation)**

**HOUR 1**

**STEP 1: Initial Investigations**
- IV cannula
- U&Es, blood glucose (BG), venous gases

**STEP 2: Fluid Replacement**
- Normal saline, 1000ml/hour

**STEP 3: Start Insulin**
- Soluble, 6 units/hour IV

**STEP 4: Other Interventions**
- Fluid balance chart
- Monitor conscious level
- Consider cardiac monitoring
- Nasogastric tube if protracted vomiting and/or unprotected airway

**ON-GOING MANAGEMENT**

**HOURS 2-4**

**STEP 1: Re-assess Patient, Monitor Vital Signs**
- Cather if oliguric
- Continue normal saline
- 1000ml/hour for Hour 2
- 500ml/hour for Hours 3 and 4
- Add in 10% dextrose 100ml/hour when BG ≥14mmol/L
- Add potassium unless anuric
  20mmol/L if level < 3.5 mmol/L
  40mmol/L if level > 3.5 mmol/L

**STEP 2: Further Monitoring, Continuation of Insulin**
- Insulin 3 units/hour or rate to maintain BG (9-14 mmol/L)
- Convert back to usual subcutaneous insulin when biochemically stable and feeling
- Stop IV fluids and insulin 30 minutes after subcutaneous insulin

**STAGE 2**

**ON-GOING MANAGEMENT**

**HOURS 2-4**

**STEP 1: Re-assess Patient, Monitor Vital Signs**
- Cather if oliguric
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**STAGE 3**

**SUBSEQUENT MANAGEMENT**

**STEP 1: Re-assess Patient, Monitor Vital Signs**
- Allow oral intake if bowel sounds present
- Measure bicarbonate twice daily until within reference range
- Continue 10% dextrose plus 20mmol/L KCL, 100ml/hour to maintain BG, in conjunction with normal saline ≤250ml/hour until bicarbonate in reference range and patient is eating
- Convert potassium infusion to maintain within reference range and continue to monitor twice daily

**STEP 2: Continuation of Insulin**
- Insulin 3 units/hour or rate to maintain BG (9-14 mmol/L)
- Convert back to usual subcutaneous insulin when biochemically stable and feeling
- Stop IV fluids and insulin 30 minutes after subcutaneous insulin

**STAGE 4**

**CONTINUING CARE**

**STEP 1: Refer for Specialist Review Before Discharge**
- To determine cause of DKA episode
- For diabetes education and review of knowledge and understanding of condition

**STEP 2: Patient Not to be Discharged**
- Biochemically normal
- Eating normally and established on normal sub-cutaneous insulin
- Ensure that a copy of patient discharge letter is sent to patient's diabetes care team

**STEP 3: Follow-Up**
- Arrange appropriate follow-up contact with Diabetes Specialist Nurse (DSN) within one week of discharge
- Ensure patient has a formal clinic appointment
- Ensure that a copy of patient discharge letter is sent to patient's diabetes care team

**STAGE 4**

**CONTINUING CARE**

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Supported by The Scottish Diabetes Group
STAGE 1 Immediate Management

1. Acute Management of Diabetic Ketaoacidosis in Adults
   This protocol is for the acute management of diabetic ketoacidosis in patients 18 years and over. Paediatric Management Guidance is available from http://www.bsped.org.uk

2. Warning
   Due to the significant mortality that this condition carries, the following clinical signs would indicate the need for close monitoring within a Medical High Dependency setting. Always discuss these clinical signs with senior team members.
   • Respiratory rate > 20/min
   • Pulse > 90/min
   • Systolic BP < 100 mmHg
   • Circulatory compromise - pale, sweaty, cool or clammy peripheries - mottling indicates severe circulatory compromise
   • Temp > 38ºC or < 36ºC
   • GCS < 8

Medical High Dependency Setting
   It is acknowledged and recognised that not all hospitals in Scotland will have a Medical High Dependency Unit (MHDU). However, this type of facility is recommended.

STAGE 2 On-going Management

3. Signs of Cerebral Oedema
   Children and adolescents are at the highest risk of cerebral oedema
   How it will present
   • Headaches
   • Reduced conscious level.
   How to take action
   • Monitoring for signs of cerebral oedema should start from the time of admission and should continue until up to at least 12 hours after admission.
   • Administer IV mannitol (100ms of 20% over 20 minutes) or dexamethasone 8mg (discuss with Consultant).
   • Undertake CT scan to confirm findings.
   • Consider ITU (an indication for checking arterial blood gases).
   • If there is a suspicion of cerebral oedema or the patient is not improving within 4 hours of admission, call Consultant.

4. Fluid Replacement
   Avoid using 0.45% (half normal) saline as there is no evidence to suggest that this is of benefit in the management of DKA.
   • Start Insulin
   • Use any soluble insulin e.g Velosulin, Actrapid, Humulin S, Humalog, Novorapid, Hyruin.
   • Concentration should be 50 units of insulin in 50mls normal saline through a syringe driver.

5. Other Interventions
   Guidance on Bicarbonate
   There is no evidence to support the use of bicarbonate unless there is evidence of cardiogenic shock or other lactic acid-generating conditions.

6. Other Interventions

STAGE 3 Subsequent Management

7. 8. Re-assess Patient, Monitor Vital Signs
   Potassium Replacement
   40mmolA, KCL must be in 1 Litre of fluid. Under no circumstances should KCL be administered at a rate greater than 20mmol/hour.
   Introduce Dextrose
   Dextrose should be introduced in conjunction with normal saline. Evidence for using 10% is lacking and mainly anecdotal. However, at this concentration, higher insulin levels can be maintained with enhanced clearance of ketones.

9. 10. Further Monitoring, Continuation of Insulin
   Laboratory Blood Glucose Testing
   While there is no specific evidence to avoid a rate of stop of blood glucose level of 5mmol/hour, there may be an increased risk of cerebral oedema if blood glucose levels drop too quickly.
   If BG is >14, the rate of insulin should be increased and if BG is 14, the rate of dextrose should be increased.

Continuation of Insulin
   It is reasonable to use a point-of-care glucose meter to monitor blood glucose level if the previous laboratory blood glucose value is less than 20 mmol/L.

11. Consider Precipitating Factors
   Common causes include:
   • Omissions of insulin
   • Infection
   • Newly diagnosed
   • Myocardial infarction
   • Combination of the above.

STAGE 4 Continuing Care

   Specialist Review
   Some or all of the following professions should be part of the Diabetes Specialist Review Team:
   • Diabetes Specialist Nurse (DSN)
   • Dietician
   • Doctor specialising in diabetes.

Problems Contributing to DKA Episode
   Some or all of the following may have contributed to the DKA-episode:
   • Errors in insulin administration
   • Fauly equipment
   • Practical problems.

Diabetes Education
   Some or all of the following aspects should be considered and discussed between practitioner and patient:
   • Revision of patient knowledge and understanding of the condition
   • Review of “Sick Day Rules”
   • Equipment – pens and insulin
   • Home blood-glucose monitoring
   • Diet.

15. 16. 17. Refer for Specialist Review After Discharge
   Specialist Review
   Some or all of the following should be considered and discussed between practitioner and patient:
   • Advice on weight management
   • Home blood-glucose monitoring
   • Diet
   • Assessment of vascular and cardiovascular risk.

18. 19. 20. Refer for Review and Discharge
   Specialist Review
   Some or all of the following should be considered and discussed between practitioner and patient:
   • Further advice on weight management
   • Other issues related to lifestyle

STAGE 5 Review and Discharge

1. 2. 3. 4. Review for Discharge
   Specialist Review
   Some or all of the following should be considered and discussed between practitioner and patient:
   • Further advice on weight management
   • Other issues related to lifestyle

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