

**Clinical guideline for**

**Management and Treatment of Diabetic Ketoacidosis**

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**DIABETES KETOACIDOSIS (DKA) MANAGEMENT**

**This protocol is designed for the treatment of DKA.It is not designed for patients with high blood sugar who have no evidence of Ketoacidosis**

1. **Confirm diagnosis of DKA:** pH < 7.3

Bicarbonate < 18 mmol/l

Glucose > 11

Urine ketones > 2+

Capillary ketones > 3 mmol/l

2. **Baseline Investigation** MED A bloods, blood gases with lactate,  
 MSU and blood culture. ECG/CXR

The potassium needs to be back within 1 hour.

1. **Assessment** ABCDE

Nasogastric tube is the best protection of airway if vomiting or semi-conscious patient.

Evidence of infection   
 Patient with Severe DKA –should be referred to ICU.

**Severity of DKA**

If one or some of the following parameters are present this  
 may indicate severe DKA:

Blood ketones over 6 mmol/L

Bicarbonate level below 5 mmol/L

Venous/arterial pH below 7.1.

Hypokalaemia on admission (under 3.5 mmol/L

GCS less than 12 or abnormal AVPU scale

Oxygen saturation below 92% on air (assuming normal baseline respiratory function

Systolic BP below 90 mmHg

Pulse over 100 or below 60 bpm

Anion gap above 16 [Anion Gap = (Na+ + K+) (CI + HCO3)]

**INTRAVENOUS FLUIDS**

Start fluid resuscitation as priority while awaiting insulin

Treat dehydration with 6 litres of 0.9% sodium chloride in all patients

**In Shock** (SBP<100mmHg)

* Severely depleted – give 500 ml of  
  0.9% sodium chloride IV over 15 to  
  20 minutes
* Repeat until SBP > 100mmHg (maximum of 3 doses)
* **Do not** give potassium chloride in  
  first litre or if serum potassium  
  (K+) > 5.5 mmol/L on ABG
* All subsequent fluid for the next 24 hours should contain KCLunless urine output is < 30ml/hr or serum potassium remains in excess of 5.5 mmol/l.If there are concerns a

catheter will be required

**Not Shocked** (SBP > 100mmHg)

* Recommended fluid

|  |  |
| --- | --- |
| **0.9% Sodium Chloride 1L** | **Over 1 hours** |
| **0.9% Sodium Chloride 1L With potassium chloride** | **Over 2 hours** |
| **0.9% Sodium Chloride 1L With potassium chloride** | **Over 2 hours** |
| **0.9% Sodium Chloride 1L With potassium chloride** | **Over 4 hours** |
| **0.9% Sodium Chloride 1L With potassium chloride** | **Over 4 hours** |
| **0.9% Sodium Chloride 1L With potassium chloride** | **Over 6 hours** |

* Recommended potassium   
  replacement in DKA

|  |  |
| --- | --- |
| **Potassium Level** | **Replacement/litre fluid** |
| >5.5 mmol/L | Nil |
| 4.5 – 5.5 mmol/L | 20 mmol/L |
| 3.5 -4.5 mmol/L | 40 mmol/L 2 hours |

If < 3.5 → contact ICU if at the beginning of treatment

* Glucose **to run concurrently with 0.9% sodium chloride in the first   
  15 hours**
* When Blood Glucose less than 15mmol/L start:

|  |  |
| --- | --- |
| 5% glucose 1L | Over  8 hours |

* When Blood Glucose less than 7 mmol/L start:

|  |  |
| --- | --- |
| 10% glucose 1L | Over  8hours |

If serum potassium exceeds 5.5 mmol/L omit potassium but repeat measurements hourly as glucose + insulin will cause serum potassium to fall and replacement is highly likely to be needed.

**Fluids may need to be reduced and give continuously in elderly, pregnant, heart or kidney failure.**

**INSULIN**

Use fixed rate insulin infusion to suppress ketosis

**Immediate**

* Do NOT give a stat dose of insulin
* If the patient normally receives glargine or detemir continue at their usual dose
* Start an insulin infusion pump with 50 units Actrapid made up to 50 ml with 0.9%   
  Sodium chloride.
* Infuse IV at **fixed rate** of 0.1 unit/kg/hr i.e 0.1 ml/kg/hr (e.g. 7 mls/hr if wt is 70kg)

**Hourly**

* Review patient response to insulin infusion pump after 1hr by ABG/ketones.
* If capillary ketones and not dropping by 0.5 mls/l./hour, increase insulin infusion rate by 1 unit/hour and review again in 2 hours (Review BM and bicarbonate as well).
* Continue **fixed rate** insulin until ketones < 0.6 mmol, venous pH > 7.3 and bicarbonate >18.

**When Stable** (Ketones < 0.6, pH > 7.3)

* If patient is eating and drinking regularly change to S/C insulin regimen,
* Stop IV insulin pump 1 hour after eating and first dose of rapid acting s/c insulin
* If not, change to IV sliding scale (guide only)
* BG Insulin (units/hr)  
  4.1 – 6 1

6.1 - 8 2  
8.1 - 10 3  
 > 10 4

(call doctors to adjust s/scale if BG > 10 for 2 hrs)

* Ensure long acting insulin is prescribed and given.

**Patients on continuous insulin pumps:**

Stop continuous insulin pump

Treat DKA following hospital protocol.

**MONITORING**

SOS needs to be recorded hourly

**First 15 Hours**

* Measure capillary glucose and ketones hourly
* Check serum potassium and venous blood gas (0,2,4,8 and 12 hrs) and before stopping fixed rate insulin regime
* Monitor urine output
* Consider urinary catheter if no urine output at 6 hrs or if shock present

**15 to 30 Hours**

* Continue to measure glucose hourly
* Measure capillary ketones every 2 hours
* Continue measuring K+ 12 hourly aiming to keep K+ between 4 – 5 mmol/L

**Note**

* All patients with DKA should have thromboprophylaxis
* Bicarbonate is rarely, if ever, needed to correct the acidosis of DKA. Decision to administer should be made by a senior doctor and it should never be given if pH > 7.0

There is no evidence that bicarbonate therapy affects outcomes or improves metabolism

* Replacement of phosphate does not improve outcomes.

**\*** *KCl = potassium chloride*

*BG = blood glucose  
 SBP = Systolic Blood pressure  
 K+ = serum potassium  
 > = above  
 < = below  
 Glucose = dextrose*

# **DKA PROFORMA AND PRESCRIPTION CHART**

|  |
| --- |
| NAME:  UNIT NO: *Fix label here*  DOB: |

**CONFIRM DIAGNOSIS OF DKA:**

Blood Glucose > 11 Actual Blood Glucose

1. pH < 7.3
2. Bicarbonate < 18 mmol/l
3. Urine ketones > 2+
4. Capillary ketones > 3 mmol/l

**If all not positive, contact Endocrine/Medical SpR on call for advice.**

Previously known Diabetes? **YES/NO**

If yes: **Type 1 / Type 2**

Usual Treatment for Diabetes: Insulin type Long acting:

Short acting:

Oral Hypoglycaemic:

**INVESTIGATIONS:**

1. Med A Bloods **(URGENT** for K+) 4. Blood Culture
2. Blood gases with lactate 5. ECG
3. MSU 6. CXR

NAME:

UNIT NO: *Fix label here*

DOB:

NAME:

UNIT NO: *Fix label here*

**ANY INDICATORS OF SEVERE DKA?-CALL ITU**

1. Blood Ketones >6 mmol/l
2. Bicarbonate < 5 mmol/l
3. Venous/Arterial pH < 7.1
4. K+ < 3.5 mmol/l on admission
5. GCS < 12 or abnormal AVPU scale
6. O2 saturation < 92% on air

(assuming normal baseline respiratory function)

1. Systolic BP < 90mmHg
2. Pulse > 100 or < 60 bpm

1. Anion gap > 16 (Anion Gap= (Na+ + K+ )- (Cl- + HCO3 -))

**FLUID PRESCRIPTION IN DKA:**

NAME:

UNIT NO: *Fix label here*

DOB:

VOLUME OF FLUID GIVEN PRE-HOSPITAL:

FOR ED PATIENTS:

1. Take down fluids commenced by ambulance crew.
2. Note volume of fluid given pre hospital.
3. Commence fluids as per protocol:

If SBP < 100 commence RESUSCITATION FLUIDS (to maximum 1.5l INCLUDING prehospital fluids).

If SBP >100 commence REHYDRATION FLUIDS from the start regardless of prehospital fluid.

**RESUSCITATION FLUIDS: SBP < 100mmHg**

Give Normal Saline 500ml over 15-20 mins and repeat until SBP >100mmHg (maximum 1.5 l) then move to REHYDRATION FLUIDS (below).

# 

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Volume | Rate/Duration of administration | Start time | Signature |
| Normal Saline | 500ml | 15-20 mins |  |  |
| Normal Saline | 500ml | 15-20 mins |  |  |
| Normal Saline | 500ml | 15-20 mins |  |  |

# **DO NOT ADD POTASSIUM TO RESUSCITATION FLUIDS.**

CONSIDER URINARY CATHETERISATION.

Caution in Elderly patients/ Renal impairment/ Heart failure - they may require slower fluid resuscitation.

Name:

Unit No: *Fix label here*

DOB

# **FLUID CHART: Add Potassium as appropriate.**

Not shocked (SBP > 100 mmHg

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Fluid bag** | **Volume** | **Rate Duration of administration** | **Start time** | **Signature** |
| **Normal saline**  **Potassium …………mmols** | **1 litre** | **Over 1 hours** |  |  |
| **Normal saline**  **Potassium ………….mmols** | **1 litre** | **Over 2 hours** |  |  |
| **Normal saline**  **Potassium …………mmols** | **1 litre** | **Over 2 hours** |  |  |
| **Normal saline**  **Potassium …………mmols** | **1 litre** | Over 4 hours |  |  |
| **Normal saline**  **Potassium …………mmols** | **1 litre** | Over 4 hours |  |  |
| **Normal saline**  **Potassium …………mmols** | **1 litre** | **Over 6 hours** |  |  |
| **Normal saline**  **Potassium ………….mmols** | **1 litre** | **Over 6 hours** |  |  |
| **Normal saline**  **Potassium …………mmols** | **1 litre** | **Over 6 hours** |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Potassium Results/Serum/**  **Venous BG** | **Admission** | **2 hours** | **4 hours** | **8 hours** | **12 hours** |

Name:

Unit No:

DOB

START TIME SIGNATURE

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **50 mls Normal Saline** | **50 units Actrapid** | **As per sliding scale** |  |  |
| **5% Dextrose** | **1 litre** | **As per sliding scale** |  |  |
| **10% Dextrose** | **1 litre** | **As per sliding scale** |  |  |

Caution in 1) Elderly patients

2) Renal impairment

3) heart failure

They may require slower fluid Resuscitation

KCl-None until potassium levels are known

|  |  |  |  |
| --- | --- | --- | --- |
| Serum K+ | < 3.5 – 4.5 | 4.5 – 5.5 | > 5.5 |
| Administration rate mmol/l | 40  (over 2 hour) | 20 | Nil |

**Insulin Sliding scale: Continue Levimir/ Lantus with the Sliding Scale**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Insulin units/hour  Fixed rate | N/Saline |  | 5%  Dextrose/hr | 10%  Dextrose/hr |
| Fixed rate 0.1 unit kg/hr – 0.1 ml/kg/hr |  | BM > 15 | 0 |  |
|  | Continue to maintain | BM 15 - 7 | 125 ml/hr |  |
|  | fluid resuscitation | < 7 change to | → | 125 ml/hr |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

|  |
| --- |
|  |

**Doctor’s Signature:**

**Nurse Management of DKA patient**

Name:

*Fix label here*

D.O.B.

Unit No:

1. **Hourly Capillary Ketones and BM . Complete chart and adjust insulin rate. If ketones not falling by 0.5 ml/hour contact a doctor.**
2. **Check that bloods U/E’s and Venous BG) are taken at 0,2,4,8,12.**
3. **Normal Saline as charted**
4. **Dextrose as chart ed once BM <15**
5. **Urinalysis**
6. **Monitor urine output (Consider Catheter)**
7. **LONG ACTING INSULIN SHOULD BE CONTINUED**

**When ketones <0.6, pH >7.3 and patient eating and drinking regularly discuss with doctor about change to s/c insulin regime.**

**Great Western Hospital NHS Foundation Trust**

*Addressograph fix label*

**Urinalysis:**

**Monitoring Plan for Diabetic Ketoacidosis**

**Check BM & Ketones hourly**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time | 00-01 | 01-  02 | 02-  03 | 03-  04 | 04-  05 | 05-  06 | 06-  07 | 07-  08 | 08-  09 | 09-  10 | 10-  11 | 11-  12 | 12-  13 | 13-  14 | 14-  15 | 15-  16 | 16-  17 | 17-  18 | 18-  19 | 19-  20 | 20-  21 | 21-  22 | 22-  23 | 23-  24 |
| BM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Unit of Insulin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Dextrose |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| N/Saline  Rate |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| C.Ketones |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

NB: Indicates total units of insulin in 24 hours

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time | 00-01 | 01-  02 | 02-  03 | 03-  04 | 04-  05 | 05-  06 | 06-  07 | 07-  08 | 08-  09 | 09-  10 | 10-  11 | 11-  12 | 12-  13 | 13-  14 | 14-  15 | 15-  16 | 16-  17 | 17-  18 | 18-  19 | 19-  20 | 20-  21 | 21-  22 | 22-  23 | 23-  24 |
| BM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Unit of Insulin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Dextrose |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| N/Saline  Rate |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| C.Ketones |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |