ADULT DIABETIC KETOACIDOSIS PRESCRIPTION CHART

University Hospitals of Leicester NHS
NHS Trust

Patient's addressograph

For more information refer to UHL guidelines on DKA management. Abridged version available on pages 2 & 3 of this chart. Monitoring chart on page 4.

Date …… Ward ……

Consultant ……

Patient's weight (kg) ……

1) INTRAVENOUS FLUIDS should be commenced via a large IV cannula (green or grey). If there is a problem with intravenous access critical care support should be requested immediately. Be aware of any fluids that may have already been given in the ambulance or ED.

Sodium chloride 0.9%		Rate mL / hour (circle as appropriate)	Prescriber & bleep No.	Administered by	2nd Nurse check	Time & date commenced
1st Litre over 1hr	Sodium chloride 0.9% 500ml/30mins	1000 / other *……				
	Sodium chloride 0.9% 500ml/30mins					

*** A slower rate and reduced volume of infusion should be considered when patients are under 25 years of age or over 70 years of age, pregnant, patients with heart or known chronic kidney failure (eGFR <30mL/min and dialysis patients - refer to nephrologist on call).**
If systolic BP <90mmHg give 500ml over 15minutes (see Box A, Action 2 on page 2)

	STANDARD INFUSION RATE; AMEND ACCORDING TO PATIENTFLUIDSTATUS	Rate mL / hour (circleas appropriate)	Potassium Check potassium & correct as appropriate (circle as appropriate)	Prescriber & bleep No.	Administered by	2nd Nurse check	Time & date commenced
2nd Litre over 2hrs	Sodium chloride 0.9% 500ml/hr	500 /	Nil / 20mmol in				
	Sodium chloride 0.9% 500ml/hr	other……..	500ml other…….				
3rd Litre over 2hrs	Sodium chloride 0.9% 500ml/hr	500 /	Nil / 20mmol in				
	Sodium chloride 0.9% 500ml/hr	other……..	500ml other…….				
4th Litre over 4hrs	Sodium chloride 0.9% 500ml/2hrs	250 /	Nil / 20mmol in				
	Sodium chloride 0.9% 500ml/2hrs	other……..	500ml other…….				
5th Litre over 4hrs	Sodium chloride 0.9% 500ml/2hrs	250 /	Nil / 20mmol in				
	Sodium chloride 0.9% 500ml/2hrs	other……..	500ml other…….				
6th Litre over 6hrs	Sodium chloride 0.9% 500ml/3hrs	166 /	Nil / 20mmol in				
	Sodium chloride 0.9% 500ml/3hrs	other……..	500ml other…….				
7th Litre over 6hrs	Sodium chloride 0.9% 500ml/3hrs	166 /	Nil / 20mmol in				
	Sodium chloride 0.9% 500ml/3hrs	other……..	500ml other…….				

By 24 hours the ketonaemia and acidosis should have resolved. Continue IV fluids if patient is not yet eating & drinking as per clinical judgment. If using in combination with 10% glucose remember to review rate to avoid fluid overload

⚠ **Risk of hypoglycaemia if fixed rate IV insulin is not switched to variable rate insulin infusion or S/C insulin once blood ketones < 0.6mmol/L.**

MONITOR PATIENT FOR FLUID OVERLOAD AND CEREBRAL OEDEMA

Any sudden deterioration in the patient's level of consciousness should be considered as likely cerebral oedema until definitively proven otherwise

⚠ **Risk of hypoglycaemia. When blood glucose < 14 mmol/L prescribe 10% glucose 500mL at 125mL/hour to run alongside sodium chloride**

Review rate of sodium chloride infusion to avoid fluid overload, eg. likely to need to reduce rate of Sodium chloride 0.9% if 10% glucose running at 125ml/hr

	Rate mL / hour (circle as appropriate)	Prescriber & bleep No.	Administered by	2nd Nurse check	Time & date commenced
10% glucose 500ml	125 / other ……				
10% glucose 500ml	125 / other ……				
10% glucose 500ml	125 / other ……				
10% glucose 500ml	125 / other ……				

2) POTASSIUM PRESCRIPTION ADVICE (If rate of potassium exceeds 10mmol/hour, cardiac monitoring is essential.)

Potassium level in first 24 hours (mmol/L)	Potassium replacement in mmol / 500mL of infusion solution
Over 5.5	Nil
3.5 to 5.5	20mmol / 500mL **Risk of hypokalaemia** if potassium not added to IV fluids
Below 3.5	Senior review, since additional potassium needs to be given

3) INSULIN (Human soluble insulin e.g. Human Actrapid)

Give stat dose of soluble insulin either s/c or i/m ONLY if likely to be a delay > 15 mins in starting fixed rate IV insulin infusion. Start IV insulin infusion via a pump, containing 50 units soluble insulin in 50mL 0.9% sodium chloride at a continuous fixed rate of 0.1 units/kg/hour (Max dose of 15 units per hour). If unable to weigh patient then estimate weight. Monitor ketones and capillary blood glucose hourly and adjust rate as per guidance over page. If patient normally takes long acting insulin such as Glargine (Lantus, Abasaglar, Levemir, Tresiba,Toujeo) or NPH insulin (Insulatard, Humulin I, Insuman Basal) subcutaneously, continue this at the usual dose and time, prescribe on in-patient drug chart.

INSULIN	InitialratemL/hour	Prescriber & bleep No.	Administered by	2nd Nurse check	Time & date commenced
Stat dose of 10 units soluble insulin sc or im (assess need)					
Soluble insulin 50 units in 50mL Sodium chloride 0.9% iv					
Soluble insulin 50 units in 50mL Sodium chloride 0.9% iv					
Soluble insulin 50 units in 50mL Sodium chloride 0.9% iv					

(Hackett)51610217SJ

Adapted from chart used at Countess of Chester Hospital NHS Foundation Trust

ADULT DIABETIC KETOACIDOSIS-PRESCRIPTION CHART

Abridged ADULT DIABETIC KETOACIDOSIS (DKA) MANAGEMENT GUIDELINES

CONFIRM DIAGNOSIS OF DKA - all of following present:

- Significant ketonuria (>2+) or blood ketone >3mmol/L
- Blood glucose >11mmol/L or known diabetes mellitus
- Bicarbonate <15mmol/L and/or venous pH <7.3

NB. Risk of euglycaemic DKA has been identified with use of SGLT-2 inhibitors (dapagliflozin, canagliflozin, empagliflozin). See full guidance 1.8

IMMEDIATE ACTIONS:

- Rapid ABC with measurement of RR, temp, pulse, BP, NEWS, GCS, and pulse oximetry
- Capillary blood glucose check and blood ketones
- Obtain urgent IV access and commence IV fluids (Box A action 2) - if there is a problem request critical care support
- Stat dose of 10 units soluble insulin sc or im (ONLY if likely to be a delay > 15 mins from diagnosis, in starting fixed rate IV insulin infusion)
- Venous sample for - U&Es, blood ketones, bicarbonate measured by venous blood gas, FBC
- Urinalysis for ketones

The presence of one or more of the following may indicate severe DKA - obtain immediate senior review and consider admission to HDU/ITU:

- Blood ketones above 6mmol/L
- Venous bicarbonate level below 5mmol/L
- Venous or arterial pH below 7.0
- Hypokalaemia on admission (below 3.5mmol/L)
- Anion gap above 16 [$(Na^+ + K^+) – (Cl^- + HCO3^-)$]
- GCS less than 12 or abnormality on AVPU scale or NEWS > 6
- Oxygen saturation below 92% on air (assuming normal baseline respiratory function)
- Systolic BP below 90 mmHg
- Pulse over 100 or below 60 bpm

BOX A: Immediate management upon diagnosis: (0 to 60 minutes)

(t=0 at time intravenous fluids are commenced)

Action 1	**Urgent initial assessment as above**
Action 2	**Commence 0.9% sodium chloride infusion via infusion pump** • Systolic BP on admission above 90 mmHg Prescribe fluids and follow fluid replacement schedule on page 1 • Systolic BP on admission below 90 mmHg Hypotension is likely to be due to low circulating volume, but consider other causes such as heart failure, sepsis, etc. Give 500mL of 0.9% sodium chloride solution over 15 minutes. If SBP remains below 90mmHg this may be repeated whilst awaiting senior input. In practice most patients require between 500 to 1000mL given rapidly. Once SBP above 90mmHg follow fluid replacement schedule on page 1.
Action 3	**Give stat dose of 10 units soluble insulin s/c or i/m - prescribe on page 1 (ONLY if delay > 15 mins from diagnosis, in starting IV insulin infusion)**
Action 4	**Potassium replacement** ⚠ Hypokalaemia and hyperkalaemia are life threatening conditions and are common in DKA. Potassium is often high on admission but falls precipitously upon treatment with insulin. Add potassium as per schedule on page 1 when U&Es known.
Action 5	**Commence fixed rate intravenous insulin infusion (IVII)** 0.1unit/kg/hr based on actual or estimated weight - prescribe on page 1 (Max dose of 15 units per hour) Use 50units human soluble insulin (Actrapid) in 50ml sodium chloride 0.9% If patient usually takes long-acting insulin analogue (Lantus, Abasaglar, Levemir, Tresiba, Toujeo) or NPH insulin (Insulatard, Humulin I, Insuman Basal) then continue at usual dose and time Insulin may be given through same line as iv fluids using a Y connector.
Action 6	**Complete full history and clinical examination** Consider ITU/HDU if above guidelines indicate severe DKA
Action 7	**Considerfurtherinvestigations** CXR, ECG, MI screen, MSU, blood cultures
Action 8	**Establish monitoring regimen and ensure senior review occurs (SpR / Consultant)** Use 24 hour DKA monitoring form on page 4 Capillary glucose, U&Es (including venous bicarbonate and potassium) to be repeated at 60 minutes ⚠ Replace potassium appropriately Continuous pulse oximetry and cardiac monitoring if required
Action 9	**Prescribe thromboprophylaxis on main drug chart - if indicated** **Consider precipitating cause and treat appropriately**
Action 10	**Refer to Diabetes Team** Diabetes nurses may be contacted by electronic referral via ICE or DSN helpline x4919; diabetes SpR available during normal working hours via LRI switchboard
Action 11	**Ward location and supervising consultant** Patients should be managed initially on the AMU in the Acute Care Bay (unless ITU/HDU bed required). Once stabilised transfer to one of the Diabetes wards, under the care of a Diabetes consultants if possible
Action 12	**Intravenous bicarbonate is veryrarelynecessary** If pH <7.0 and not improving contact critical care team

BOX B: Management from 60 minutes to 6 hours

Aims	• Venous bicarbonate rise of at least 3 mmol/L/hr OR rate of fall of ketones of at least 0.5mmol/L/hr and blood glucose fall of at least 3 mmol/L/hr (until level is below 11 mmol/L) • Maintain serum potassium in normal range • Avoid hypoglycaemia
Action 1	**Re-assess patient and continue to monitor vital signs - ensure that patient has had a senior review (SpR/Consultant)** • Consider urinary catheterisation if incontinent or anuric (ie not passed urine by 60 minutes) • Consider nasogastric tube if patient obtunded or if persistently vomiting • If oxygen saturation falling measure ABGs and request (or repeat) CXR, give O_2 • Document accurate fluid balance including urine output (minimum desired output = 0.5ml/kg/hr)
Action 2	**Review metabolic parameters** • Measure and record hourly capillary blood glucose (lab glucose if meter reading 'HI') and blood ketone levels • Measure venous blood gas for pH, bicarbonate and potassium at 60minutes, 2 hours and 2 hourly thereafter • Repeat U&Es at 60 minutes, 2 hours and 2 hourly in first 6 hours • Complete DKA monitoring chart on Page 4 for all monitoring parameters.
Action 3	**Assess response to treatment with insulin infusion, rate may need review if:** • Venous bicarbonate not rising by at least 3mmol/L/hr or blood ketone level not falling by 0.5mmol/L/hr • Plasma glucose not falling by at least 3 mmol/L/hr • If ketone level, bicarbonate or glucose not correcting as expected check iv lines, volumes of fluid remaining, look for insulin infusion pump malfunction. Blood ketones should fall by at least 0.5 mmol/l per hour (until < 0.6 mmol/l) • If pump working and connected but metabolic response inadequate, increase insulin infusion rate by 1 unit/hr increments until targets achieved • Continue IVII until venous pH >7.3 and/or venous bicarbonate >15 mmol/L and/or blood ketones <0.6 mmol/l and patient eating and drinking • Do not rely on urine ketone clearance to indicate resolution of DKA because they are slowly cleared and may be present when DKA resolved
Action 4	**Continue fluid and potassium replacement via infusion pump** • Follow fluid replacement schedule on Page 1 - when blood gluscose is less than 14mmol/L **add** 10% glucose at 125 ml/hr to run alongside 0.9% sodium chloride - review fluid prescription to avoid fluid overload. • If potassium outside reference range, re-assess potassium replacement (as page 1) and check hourly. If abnormal after further hour seek senior medical advice.
Action 5	**For those with newly diagnosed Type 1 diabetes** • Prescribe and administer Levemir® insulin at a minimum total dose of 0.25 units/kg s/c. The total dose can be given either once daily or split to twice daily. This will help to mitigate against rebound ketones when IV insulin stopped. See full DKA guidance for advice on discharge doses.

BOX C: 6 to 12 HOURS

BOX D: 12 to 24 HOURS

By 24 hours the ketonaemia and acidosis should have resolved. If not improving seek senior review

Aims	• Ensure clinical and biochemical parameters are continuing to improve or are normal • Continue IV fluid replacement and iv insulin infusion until acidosis corrected and patient is eating and drinking • Avoid hypoglycaemia • Re-assess for complications of treatment such as fluid overload and cerebral oedema • Treat precipitating factors as necessary
Action 1	**Re-assess patient, monitor vital signs** • If patient not improving seek senior advice • Ensure referral made to Diabetes team - Diabetes nurses may be contacted electronically via ICE or contact diabetes SpR during normal working hours via LRI switchboard
Action 2	**Review biochemical and metabolic parameters** • At 6 hrs check venous pH, potassium, bicarbonate and glucose • Resolution of DKA defined as venous pH >7.3 and/or blood ketones <0.6 mmol/l (do not use bicarbonate as a surrogate marker at this stage) • If DKA not resolved refer to Action 3 in Box B **Review biochemical and metabolic parameters** • At 12, 18 and 24 hrs check venous pH, potassium, bicarbonate and glucose • Resolution of DKA defined as venous pH >7.3 and/or blood ketones <0.6 mmol/l (do not use bicarbonate as a surrogate marker at this stage) • If remains acidotic (pH<7.3 and/or HCO3 <15 check blood ketones as may be alternative cause of persisting acidosis • If DKA not resolved refer to Action 3 in Box B and if in normal working hours, contact diabetes SpR via LRI switchboard
Action 3	When DKA resolved review insulin infusion to maintain capillary glucose 5-10 mmol/l andswitch back to subcutaneous insulin when eating and drinking. (Use a **variable rate** insulin infusion if not eating / drinking). Conversion to subcutaneous insulin in a newly diagnosed patient with Type 1 diabetes is best managed by the Specialist Diabetes Team. In patients previously known to have Type 1 diabetes their previous regimen is usually restarted; if on basal bolus regimen give usual pre-meal fast acting insulin and take IVII down 30 minutes later (ensuring that they have been receiving long acting insulin), if on bd pre-mixed insulin re-introduce before breakfast or evening dose and discontinue IVII 30 minutes later.

MONITORING CHART FOR ADULT PATIENTS IN DIABETIC KETOACIDOSIS

Chart No.

Name ……

Ward ……

TREATMENT AIM: Venous bicarbonate to rise by 3mmol / L / hr
Blood ketones to fall by at least 0.5mmol / L / hr
Blood glucose to fall by at least 3mmol / L / hr

RESOLUTION OF DKA: Venous Bicarbonate >15mmol / hr, Blood ketones <0.6mmol / L and pH > 7.3

Date:																									
Hours from start		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Clock time																										
Capillary Glucose (mmol/L) (measure hourly and plot result on graph)	40 30 20 15 10 5																									
Start 10% glucose when glucose <14mmol/L →																										
⚠ Hypo risk if 10% glucose not started promptly																										
Insulin (0.1 unit/kg/hr)**(units/hr)**																										
0.9% sodium chloride (ml/ hour)																										
10% glucose (ml/ hour)																										
Blood ketone																										
Venous pH																										
Venous Potassium (mmol/L) ⚠																										
Venous Bicarbonate (mmol/L)																										