SaTH DKA MANAGEMENT PATHWAY JUNE 2010

0 to 60 minutes: Immediate management upon diagnosis			
A) IV access and initial investigations	B) Restoration of circulating volume	C) Potassium replacement	D) Commence fixed rate IV insulin infusion (IVII)
• Rapid ABC • Large bore IVI and ***START FLUID REPLACEMENT*** (see B) • Assess vital signs (temp, BP, HR, sats) • GCS: a drowsy patient requires critical care input • Perform initial investigations: blood ketones, venous and capillary glucose, U&Es, venous blood gases, FBC, infection screen as indicated	*SBP < 90mmHg* *Likely due to low blood volume but consider other causes eg. sepsis* Give 500ml 0.9% saline over 10-15 mins. May be repeated. If no improvement SEEK SENIOR ASSESSMENT. MAY NEED ITU. *SBP > 90mmHg* *Typical regimen for 70kg fit adult* 0.9% saline 1000ml over 1hr 0.9% saline with KCl over 2 hrs (x2) 0.9% saline with KCl over 4 hrs (x2) *Reassess needs at 12 hours. Slower rates should be used in young adults, elderly, CCF*	HYPOKALAEMIA AND HYPERKALAEMIA ARE LIFE THREATENING AND COMMON IN DKA. If K > 5.5 mmol/l give no potassium If K 3.5 - 5.5 give 40mmol/l KCl If K < 3.5 seek senior review - higher infusion rates are indicated.	• If weight not available, estimate (kg) • If pregnant, use present weight (seek senior advice) • Start fixed rate IVII via pump. Use 50 units soluble insulin (Actrapid, Humulin S) made up to 50ml with 0.9% saline. • Infuse at 0.1 units/kg/hr (eg. 7ml/hr if 70kg) • If patient usually takes Lantus or Levemir insulin, continue this at usual dose and time. • Insulin may be given in same line as IV fluid, providing a Y-connector with one-way, anti-siphon valve is used.

60 minutes to 6 hours: Metabolic and clinical review and stabilisation		
A) Re-assess patient; monitor vital signs	B) Review metabolic parameters	C) Identify/treat precipitating factors
• Consider urinary catheter if anuric • Consider NG tube if obtunded or vomiting • If O_2 sats falling, perform arterial blood gases and request/repeat CXR • Regular obs and EWS charting as appropriate • Accurate fluid balance (minimum urine output 0.5ml/kg/hr) • Cardiac monitoring if DKA severe • Give LMWH as per NICE guidance (CG 9 Jan 2010)	• Measure blood ketones and capillary glucose hourly • Review response to IVII by calculating rate of fall of ketone level hourly... • If ketones not falling by at least 0.5 mmol/l/hr increase IVII rate by 1 unit/hr until rate achieved; • If ketones not falling as expected, check pump, infusion tube, connections etc. • Measure venous blood gas pH, bicarbonate and potassium at 60 mins, 2 hrs and 2 hrly thereafter. Check appropriateness of potassium replacement hourly. • Continue fixed rate IVII until ketones < 0.3mmol/l, venous pH >7.3 and/or venous bicarbonate > 18mmol/l. • If glucose falls < 14mmol/l commence 10% glucose at 125ml/hr alongside 0.9% saline.	Review CXR, urinalysis and ECG and treat as appropriate.

6 to 12 hours: Aim for resolution of ketoacidosis		
A) Re-assess patient; monitor vital signs	B) Review metabolic parameters	C) Is DKA resolved?
• Continue IV fluids and insulin • Continue to monitor electrolytes • If no clinical improvement seek senior advice • Ensure referral to diabetes team has been made - if not, refer when next appropriate (ie. following PTWR)	• At 6 hours, check venous pH, bicarbonate, potassium, and blood ketones and glucose. • ***Resolution is defined as: ketones < 0.3mmol/l, with venous pH > 7.3***	• If DKA resolved, convert back to subcutaneous insulin. • If DKA not resolved, continue with section B) in the 60 minutes to 6 hour box, uptitrating insulin as necessary.

12 to 24 hours: By 24 hours the ketonaemia and acidosis should have resolved	
Expectation	Aim
• By 24 hours the ketonaemia and acidosis should have resolved. • Patients should be eating and drinking and back on their normal insulin. When restarting subcutaneous insulin, ensure injection (ideally fast acting insulin) given before IVII taken down (usually 30 minutes later).	• If patient not eating and drinking and no ketonaemia, move to a standard variable rate IVII. • Reassess for complications of treatment, eg. cerebral oedema • Treat precipitating factors as necessary. • Ensure diabetes team involved.

Based on NHS Diabetes:The Management of Diabetic Ketoacidosis in Adults June 2010 at www.diabetes.nhs.uk

SaTH Guideline for the Management of Diabetic Ketoacidosis

June 2010

Definition and Diagnosis

Diabetic ketoacidosis consists of the biochemical triad of ketonaemia, hyperglycaemia and acidosis.

Ketonaemia 3 mmol/l and over or significant ketonuria (>2+ on standard urine sticks)

Blood glucose >11 mmol/l or known diabetes mellitus

Bicarbonate (HCO3-) <15 mmol/l **and/or** venous pH <7.3

Rationale for Best Practice - the New Paradigm

The availability of near-patient blood ketone testing is an important advance in the management of diabetic ketoacidosis. The resolution of DKA depends upon the suppression of ketonaemia, so measurement of blood ketones has supplanted the measurement of blood glucose as a marker of biochemical improvement. This also allows monitoring of patients presenting with more modest elevations of blood glucose (euglycaemic diabetic ketoacidosis). There has also been an increased recognition that the availability of blood gas analysers allows rapid access to electrolyte results, as well as venous bicarbonate and pH assays, which closely follow arterial values. Early involvement of the Diabetes Specialist Team shortens patient stay and improves safety.

Recommended Changes in DKA Management

- Measurement of blood ketones, venous (not arterial pH) and bicarbonate, and their use as treatment markers;
- Replacing 'sliding scale' insulin with weight-based fixed rate intravenous insulin infusion;
- Use of venous blood rather than arterial in blood gas analysers;
- Monitoring of electrolytes on the blood gas analyser with intermittent laboratory confirmation;
- Continuation of long-acting insulin analogues (Lantus or Levemir) as normal;
- Involvement of the diabetes specialist team as soon as possible.

Assessment of severity

One or more of the following may indicate severe DKA - consider discussion with seniors and involvement of critical care:

- Blood ketones >6 mmol/l or bicarbonate level <5 mmol/l or venous/arterial pH <7.1
- Hypokalaemia on admission (under 3.5 mmol/l)
- GCS less than 12 or abnormal AVPU scale
- Oxygen saturation <92% on air (assuming normal baseline respiratory function)
- Systolic BP below 90 mmHg
- Pulse >100 or <60 bpm
- Anion gap above 16 *(Anion gap = $[Na^+ + K^+] - [Cl^- + HCO_3^-]$*

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