Management of Diabetic Ketoacidosis

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As in any medical emergency follow ABC with simultaneous resuscitation. Specifically in DKA:

1. Confirm the diagnosis

- Capillary blood glucose test > 11 mmol/L **D**
- Urinary or plasma ketones **K**
- pH < 7.3 or bicarbonate < 15 mmol/L **A**

2. History and Examination

- Obtain as much information about the patients diabetes (date of diagnosis, medication, known complications etc)
- Identify any precipitating causes (change in insulin, intercurrent infection, MI)
- Asses the degree of dehydration (BP, CRF time, tissue turgor, temperature of extremities)
- Assess level of consciousness using GCS

3. Investigations

- Bloods U+E, glucose, bicarbonate, LFT, CPM
  FBC
  Arterial/ venous blood gases
  Cardiac enzymes
  Blood cultures
- CXR preferably portable
- ECG
- Cultures MSU + other appropriate cultures e.g. CSF if meningitis suspected

4. Management (see flow chart)

- **Fluids** are a critical part of treating DKA. Adults with DKA generally need an average of 6L rehydration. Keep a fluid balance chart ± urinary catheter if output poor. Consider CVP if fluid status difficult to assess clinically or likely to need ICU support
- **Insulin** is needed to help switch from a catabolic to an anabolic state which will result in uptake of glucose into tissues and the reduction of gluconeogenesis. The end result is to switch off the production of free fatty acid and ketones.
- **Potassium replacement**: Hypo and hyperkalaemia are potentially life threatening conditions during the treatment of DKA. Check K^+ after 2 hours and at 4, 8,12,16 and 24 hours or until transfer to subcutaneous insulin. Check magnesium levels at 12-24 hours.
- **Oxygen**: should be given and oxygen saturations monitored (aim for > 96%).
- **Nasogastric tube** should be inserted as gastric dilation common with ↑ risk of aspiration
- **Conscious level.** If GCS reduced position patient in recovery position and consider intubation for airway protection (less than 8 intubate)
- **Antibiotics** if infection suspected (see antibiotic protocol)
- **Heparin prophylaxis**

Remember to reassess the patient frequently during the first few hours (clinical status, volume status, HGT, potassium and sodium, blood gases) and adjust management according to any clinical changes.

Most patients with DKA will have Type 1 diabetes however it can occur in those with Type 2, this is known as ketosis-prone type 2 diabetes.

DKA MANAGEMENT FLOWCHART

FLUIDS

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

In shock (sBP < 100 mmHg)

- Severly depleted – give 500ml 0.9% saline over 15 mins
- Repeat until sBP > 100mmHg (if BP fails to respond after 3 doses may need ITU support)
- **Do not give K^+ in 1st litre or if K^+ > 5.5 mmol/L**
- All subsequent fluid for the next 24 hrs should contain KCL unless urine output is <30ml/hr

Not shock (sBP > 100 mmHg)

- Recommended fluid

0.9% Saline 1L	Over 1 hrs
0.9% saline with KCl	Over 2 hrs
0.9% saline with KCl	Over 2 hrs
0.9% saline with KCl	Over 4 hrs
0.9% saline with KCl	Over 4 hrs
0.9% saline with KCl	Over 4 hrs

- Recommended K^+ replacement

K^+ Level mmol/L	KCL per litre fluid mmol/L
>5.5 mmol/L	nil
2.5 – 5.5	40 mmol/L
<2.5	60 -80mmol/L and seek senior advice

If serum K^+ exceeds 5.5mmol/L, omit KCL replacement but repeat measurements hourly as glucose + insulin will cause serum K^+ to fall

- Glucose to run concurrently with 0.9% saline in first 15hrs

When HGT <15mmol/L start:

5 % glucose 1L with KCL 20mmol over 8 hours

When HGT <7mmol/L start:

10% glucose 500ml with KCL 10mmol over 4 hours

INSULIN

Use fixed rate insulin infusion to suppress ketosis

Immediate

- Do not give a stat dose of insulin
- Start an insulin infusion pump with 50 units actrapid in 50 ml 0.9% saline
- Infuse IV at fixed rate of 0.1 unit/kg/hr (e.g. 7mls / hr if wt is 70 kg)

Hourly

- Review patient response to insulin infusion after 1 hour
- If HGT not dropping by 5mmol/hr increase infusion rate by 1 unit/hr
- Repeat increase hourly if necessary to achieve reduction in HGT
- Continue fixed rate insulin until venous pH > 7.3 & bicarbonate > 18

When stable (pH >7.3)

- If eating and drinking regularly change to S/C insulin regimen
- Stop IV insulin 1 hr afterwards
- If not change to IV sliding scale (guide only)

HGT	Insulin (units/hr)
4.1 – 6	1
6.1 – 8	2
8.1 – 10	3
>10	4

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

MONITORING

Pulse, BP, O_2 sats, urine output and HGT should be monitored and recorded in the notes

First 15 Hours

- Measure HGT hourly
- Venous blood gases (0, 2 ,4, 8 and 12 hrs) and before stopping fixed rate insulin regime
- Monitor hourly urine output
- Consider urinary catheter if no urine output at 6hrs

15 to 30 Hours

- Continue to measure HGT hrly
- Continue to measure 12 hourly aim of K^+ 4-5mmol/L
- Check magnesium level

Note

- 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