These guidelines are for the treatment of adults with diabetic ketoacidosis and are designed to allow both prescriptions and relevant observations to be recorded together. The guideline should be adapted to the clinical situation where necessary. Seek advice from senior clinician/diabetes specialty units in cases of uncertainty. This guideline should not be used in children (<18 years) even if they have DKA, seek specialist advice.

**ENTRY (diagnostic) CRITERIA:** (Tick boxes if criteria present, if none re-consider diagnosis).

- Glucose: >11mmol/L
- Bicarbonate: <18mmol/L and/or venous pH <7.35*
- Ketones: ≥3mmol/L or urine ketones ≥2+*  
  
  *Note: The standard of care is venous bicarbonate. Arterial blood gases should ONLY be considered in patients with impaired consciousness.

**EXIT (resolution) CRITERIA**

- Resolution of ketonaemia (<0.6mmol/L). This should occur within 24 hours, and
- Correction of acidosis (venous bicarbonate >18mmol/L), and
- Patient eating and drinking normally, and
- Treatment/resolution of underlying or precipitating cause (where appropriate), and
- Discharge planning including planned diabetes review post-discharge

### New principles of management of DKA

1. Aim is to correct the cause of the acidosis, i.e. the ketonaemia
2. Insulin is given as a standard dose per kg until ketones are cleared (<0.5mmol/L).
3. Aim to cease high-dose fixed rate insulin infusion as soon as ketones are cleared and convert to subcutaneous insulin (see reverse for guide). If intravenous insulin is still required (eg: not yet eating/drinking) convert to [Adult Intravenous Insulin Infusion Chart](#) with dextrose as per separate protocol.
4. Monitor bedside capillary ketones and glucose with appropriate meters
5. Use normal saline for resuscitation, not colloid
6. Continue usual subcutaneous basal insulin in addition to IV insulin or start basal insulin at outset if newly diagnosed
7. Give normal saline and dextrose together if ketones are still present (>0.6mmol/L) and glucose is <14mmol/L
8. Where available, ensure early diabetes specialist team review and appropriate post-discharge follow-up

### Observation ►

<table>
<thead>
<tr>
<th>Date Time</th>
<th>Fluid</th>
<th>Additives/Batch No</th>
<th>Volume Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LINE 1:</strong> Intravenous 0.9% Sodium Chloride (With potassium as per instruction above)</td>
<td></td>
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</tr>
<tr>
<td><strong>LINE 2:</strong> Intravenous INSULIN Infusion –0.1units/kg/hr</td>
<td></td>
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**Checked by:**  

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**ESSENTIAL INITIAL RESULTS AND ASSESSMENT OF SEVERITY**

**Blood ketones**
- Capillary ketones: 3 – 6 mmol/L
- Venous ketones: >6 mmol/L

**Venous pH**
- 7.1 – 7.35
- <7.1 (be aware of initial K+; if low (<3.5 mmol/L) call for senior advice immediately)

**Serum Creatinine**
- <150 μmol/L

**Blood pressure**
- ≥90 mmHg

**Serum Osmolality**
- ≥300 mosmol/kg

**ESSENTIAL INITIAL RESULTS AND ASSESSMENT OF SEVERITY**

**MANAGEMENT RECORD**

**Glasgow Coma Scale**
- <15

**Blood ketones**
- ≥4 mmol/L

**Blood glucose**
- ≥17 mmol/L

**Blood bicarbonate**
- ≤3 mmol/L

**Venous (or arterial) pH**
- ≤7.1

**Severely reduced heart rate or cardiac arrest**
- ≥160 bpm

**Initial management (1st Hour – Fluids/Potassium/Insulin)**

1. Establish 2 large bore intravenous cannulas
2. Administer 500-1000mL of normal saline over 15 minutes if systolic blood pressure <90mmHg
3. If systolic BP remains <90mmHg, consult for senior clinician advice. Consider septic shock and heart failure as potential causes and ICU involvement
4. If systolic BP >100mmHg, proceed with normal saline according to the table below. Adjust the rate of fluid replacement according to the age/fixed/glucose/creatinine level of the patient. Fluid replacement and use clinical judgement.
5. Consider urinary catheter if no urine passed for 2 hours or infection.
6. Consider nasogastric tube and aspiration if conscious state impaired
7. Consider thrombophlebitis in the elderly or “high risk” patient
8. Look for and treat likely precipitants of DKA: Screen for infection, silent ischaemia.

**Note:** WCC is often elevated in DKA and does not reflect infection.
9. Consider critical care (HDU/ICU) involvement if severe DKA (as above): young (<18 years old); pregnant; GCS <3; shocked

**Severe initial results and assessment of severity**

- Capillary ketones ≥6 mmol/L
- Venous bicarbonate ≤3 mmol/L
- Venous (or arterial) pH ≤7.1
- Potassium ≤3 mmol/L
- Blood Glucose ≥17 mmol/L
- Blood bicarbonate ≤3 mmol/L
- Venous (or arterial) pH ≤7.1

**Parameter ▼**

- Glasgow Coma Scale
- Blood pressure
- Serum Osmolality
- Creatinine
- Blood ketones
- Blood glucose
- Blood bicarbonate
- GCS

**Severity ►**

- Mild to Moderate
- Severely reduced heart rate or cardiac arrest

**Less than (<) 3.5 mmol/L**
- Require concurrent 10% dextrose
- Concurrent 10% dextrose

**Greater than (>) 3.5 mmol/L**
- No requirement

**KETOSIS MANAGEMENT GUIDELINES (DKA)**

**Initial treatment**

**1.** Bolus (meal-time) insulin – 4 to 6 units of rapid-acting insulin analogue

**2.** Suggested starting doses:

- For patients with known diabetes on multiple daily injections:
  - Commence fixed rate intravenous infusion at 0.1 units/kg/hour.
  - Once ketones have been cleared, if patient is eating and drinking normally, continue variable rate IV infusion.

- For patients on CSII (insulin pump) therapy:
  - Cease IV insulin infusion 30 mins after recommencing pump
  - If appropriate, recommence pump when ketones cleared and patient eating and drinking

- For patients with newly diagnosed type 1 diabetes:
  - Commence fixed rate insulin until ketones are cleared (<0.6mmol/L)
  - Then, if patient is eating and drinking normally, transfer to subcutaneous insulin therapy.

**Importantly**

- Insulin starts working immediately.
-RACTs will drop rapidly with treatment. Use additional glucose (10% dextrose when BGL<14mmol/L) rather than reducing insulin infusion.
- Potassium levels will drop rapidly with fluid and insulin replacement.
- Hyperkalaemia and hypokalaemia are potentially lethal. Monitor carefully.

**KETOSIS MANAGEMENT GUIDELINES (DKA)**

**Bolus (meal-time) insulin**

- Commence fixed rate intravenous infusion at 0.1 units/kg/hour.

**Variable rate IV infusion**

- Once ketones have been cleared, if patient is eating and drinking normally, continue variable rate IV infusion.

**Fixed rate intravenous insulin infusion chart**

- Use fixed rate IV infusion chart (Guidelines on review of form) with diet to avoid hypoglycaemia.

**On-going management considerations**

1. Measure capillary ketones and glucose hourly.
2. Repeat VBG 1 hour after initial treatment and then 2 hourly until DKA resolved.
3. Aim to reduce ketones by 0.5mmol/hr.
4. If ketones and glucose are not falling as expected check infusion rates.
5. Seek senior advice early.
6. Be prepared to have NAC and NAC for cardiac arrest.

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**KETOSIS MANAGEMENT GUIDELINES (DKA)**

**Conversion to subcutaneous insulin**

Once ketones have been cleared, if patient NOT yet eating and drinking normally, continue variable rate IV insulin. Once patients are eating and drinking normally, transfer to subcutaneous insulin therapy.

**1.** For patients with known diabetes on daily injections:
- Commence variable basal insulin with next meal
- Cease IV insulin infusion 30 mins after injection
- If no basal/basal insulin has been given for >24 hours aim to convert to subcutaneous insulin with evening meal and give usual basal dose OFF insulin at breakfast with usual basal dose and then give remainder of dose with evening meal.

**2.** For patients on CSII (insulin pump) therapy:
- Consider pump failure as a cause of DKA before resuming pump.
- Seek advice from specialist diabetes team
- If appropriate, recommence pump when ketones cleared and patient eating and drinking
- Cease IV insulin infusion 30 mins after recommencing pump

**3.** For patients with newly diagnosed type 1 diabetes:
- Commence basal insulin (eg: Lanturn or Levemir 10 units once-a-day) on day of admission
- Start basal insulin with next meal
- Cease IV insulin infusion 30 mins after injection

**Guidelines for subcutaneous insulin**

**Adult Intravenous Insulin Infusion Chart**

<table>
<thead>
<tr>
<th>BGL (mmol/L)</th>
<th>Rate of Insulin Infusion (units/kg/hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5</td>
<td>0.1</td>
</tr>
<tr>
<td>5-10</td>
<td>0.1</td>
</tr>
<tr>
<td>10-14</td>
<td>0.2</td>
</tr>
<tr>
<td>&gt;14</td>
<td>0.3</td>
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- Insulin starts working immediately.
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- Hyperkalaemia and hypokalaemia are potentially lethal. Monitor carefully.

**KETOSIS MANAGEMENT GUIDELINES (DKA)**

**Treatment of underlying precipitants**

1. Note: Elevated WCC, fever and abdominal pain occur commonly on DKA and do not necessarily indicate the presence of infection or intra-abdominal pathology.
2. Careful examination and screening for underlying causes and regular monitoring and re-evaluation is necessary.
3. Consider underlying causes such as sepsis (including lower limb cellulitis, meningitis), silent ischaemia and toxins (alcohol).
4. If infection is present refer to local antibiotic guidelines

**Serious complications of DKA**

1. Potassium – Both hyperkalaemia and hypokalaemia are potentially life-threatening. Monitor carefully. Expect a decline in K+ with treatment. Seek advice early.
2. Hypoglycaemia – Glucose can fall rapidly with treatment. Use additional glucose (10% dextrose when BGL<14mmol/L) rather than reducing insulin infusion.
3. Cardiac oedema – especially younger patients, is rare but has a high mortality. Seek specialist advice early.
4. Pulmonary oedema – is uncommon but caustic fluid resuscitation is necessary if co-existing cardiac or renal impairment.