



# Adult Diabetic Ketoacidosis (DKA) Guideline

## 1. Guiding Principles

This guideline describes the management of patients who present to a WA Country Health Service (WACHS) South West (SW) hospital with diabetic ketoacidosis (DKA).

## 2. Guideline – DKA Management

**2.1** Confirm the diagnosis of DKA. Obtain venous blood gases (VBG), capillary ketone +/- capillary glucose levels.

Diagnosis criteria

- Glucose: **greater than** 11mmol/L or known diabetes
- Ketones: **greater than** 3mmol/L
- Acidosis: pH **less than** 7.3 or bicarbonate **less than** 15mmol/L

DKA Severity Assessment:

Parameter	Severity	
	Mild to Moderate*	Severe^
Systolic blood pressure	<b>greater than</b> 90mmHg	<b>less than</b> 90 mmHg
Venous pH	7.1 to 7.35	<b>less than</b> 7.1
Capillary ketones	3 to 6 mmol/L	<b>greater than</b> 6 mmol/L
Blood bicarbonate	10 to 18 mmol/L	<b>less than</b> 10 mmol/L
Glasgow Coma Scale	15	<b>less than</b> 15
Serum Potassium	<b>greater than</b> 3.5mmol/L on admission	<b>less than</b> 3.5mmol/L on admission

\* Discuss patient with medical team prior to admission to ward (not for direct admission)

^ If any of the following is present, early senior medical officer advice must be sought for consideration of admission to HDU.

**2.2** Implement emergency management, if required. Determine appropriate location for patient's management. Refer to medical team, diabetes educator and dietitian.

**2.3** Commence volume replacement with sodium chloride 0.9%.

**If systolic BP less than 90mmHg:** 1 litre of sodium chloride 0.9% solution over 15 minutes. If systolic BP remains **less than** 90mmHg give a further 1 litre of sodium chloride 0.9% and continue resuscitation under medical direction.

**If the systolic BP is greater than 90mmHg:** Prescribe fluid replacement as per table below.

10	Fluid	Potassium Concentration by Blood Level			Sodium chloride 0.9% infusion rate	
		Greater than 5.5 mmol/L	3.5 to 5.5 mmol/L	Less than 3.5 mmol/L  Senior review required	WITHOUT concurrent 10% glucose (mL/hr)	WITH concurrent 10% glucose (mL/hr)
1 <sup>st</sup>	1L sodium chloride 0.9%	Nil	Nil	Nil	1000	875
2 <sup>nd</sup>	1L sodium chloride 0.9%	Nil	40mmol	40mmol	500	375
3 <sup>rd</sup>	1L sodium chloride 0.9%	Nil	40mmol	40mmol	500	375
4 <sup>th</sup>	1L sodium chloride 0.9%	Nil	40mmol	40mmol	250	125
5 <sup>th</sup>	1L sodium chloride 0.9%	Nil	40mmol	40mmol	250	125
6 <sup>th</sup>	1L sodium chloride 0.9%	Nil	40mmol	40mmol	167	125

**2.4** Manage electrolytes, supplement as required and monitor.

**Potassium** - goal between 4 and 5.5mmol/L

- Serum potassium **greater than** 5.5mmol/L – nil replacement
- Serum potassium 3.5 to 5.5mmol/L – replace with 20mmol potassium chloride in 500mL (i.e. 40mmol/L) using premixed bags
- Serum potassium **less than** 3.5mmol/L - senior advice is required.

Prescribe required electrolyte on the [Intravenous Fluid Treatment Chart MR 176](#)

**2.5** Commence insulin infusion with supplemental glucose infusion

**Insulin** - Commence insulin as a **fixed rate intravenous infusion** at a dose of 0.1units/kg/hr of actual body weight; caution if dose calculated to exceed 15 units/hr. Prepare insulin as Actrapid™ 50 units in 50mL sodium chloride 0.9%.

**Continue** the patient’s regular long acting subcutaneous basal insulin.

If a patient has a personal Continuous Subcutaneous Insulin Infusion pump, this should be disconnected until DKA resolves. Follow individual manufacturer’s instructions to ensure correct cessation of pump and prevent pump damage.

Prescribe required fixed rate insulin infusion on the South West Adult Diabetic Ketoacidosis (DKA) Treatment & Monitoring Chart MR 157D

**Glucose** - Commence glucose infusion as per table below.

BGL	Fluid	Recommended Infusion Rate
14mmol/L to 24mmol/L	Glucose 5%	80 to 125mL/hr
8mmol/L to 14mmol/L	Glucose 10%	80 to 125mL/hr
4mmol/L to 8 mmol/L	Glucose 10%	125 to 200ml/hr
<b>Less than</b> 4mmol/L	Glucose 10%	999mL/hr for 15 minutes, then 150mL/hr and medically reassess the patient/

Prescribe required glucose on the [Intravenous Fluid Treatment Chart MR 176](#)

- 2.6** Treat any precipitating illness.
- 2.7** Monitor parameters and record data on the South West Adult Diabetic Ketoacidosis (DKA) Treatment & Monitoring Chart MR157D. For patients in Bunbury ICU record on the ICU 24-hour Flow Chart.
- 2.8** Monitor fall in ketones and glucose levels.

Aim for a reduction in ketones of at least 0.5mmol/L per hour.

Fixed rate insulins infusion should be continued until the following targets are met

- Blood ketones **less than** 0.6mmol/L
- Glucose **less than** 14mmol/L
- Bicarbonate **greater than** 15mmol/L or venous pH **greater than** 7.3

- 2.9** In the absence of ketonaemia, if the patient is not eating and drinking, transition to variable rate insulin infusion in conjunction with glucose 10% solution.

The variable rate insulin infusion should be commenced based on the patient's blood glucose level.

Prescribe on the [MR157A WACHS Insulin Infusion Order Chart](#)

If the patient is maintaining oral intake, they may transition directly from the fixed rate insulin infusion to subcutaneous insulin without the requirement of a variable rate insulin infusion.

- 2.10** Return patient to routine care when all of the following are achieved:

- Diabetes is controlled with subcutaneous insulin
- Ketone levels are maintained **less than** 0.6mmol/L
- Venous bicarbonate is maintained **greater than** 15mmol/L
- Patient is managing oral intake.

There should be an overlap between the insulin infusion and the first injection of rapid-acting insulin. Patients should be recommenced on a bolus subcutaneous insulin regimen at a meal time and monitored. If no adverse events occur the intravenous insulin infusion should be ceased 30 to 60 minutes after the meal.

Prescribe on the [MR156A WACHS Insulin Subcutaneous Order and Blood Glucose Record – Adult Form](#)

The patient's basal (long acting) subcutaneous insulin regimen should have been continued during their DKA treatment. If this has been ceased, specialist advice should be sought for the transition back to subcutaneous insulin.

- 2.11** Review diabetes management plan and follow up prior to discharge. This should include review by the diabetes educators and potential outpatient follow-up.

### 3. Monitoring

Measure capillary ketones and glucose hourly.

Repeat VBG one (1) hour after initial treatment and then two (2) hourly until DKA resolved.

Aim to reduce ketones by 0.5mmol/hour.

Monitor patients urine output and fluid balance hourly to ensure appropriate hydration. If patient has an elevated temperature, monitor hourly until resolved.

If ketones and glucose are not falling as expected, check all infusion lines.

Bicarbonate is **not** helpful and is potentially dangerous. This is only to be used in ICU.

Potassium level to be monitored, as a minimum, prior to commencement of potassium replacement and prior to commencement of each new potassium containing infusion. That is at time 0 and prior to 1hour, 3 hours, 5 hours, 9 hours, 13hours and 19hours post treatment commencement, until DKA resolves.

### 4. Information for conversion of patients who are eating and drinking normally to subcutaneous insulin

For patients with known diabetes on multiple daily injections:

- Recommence usual bolus or premixed insulin with next meal.
- Cease IV insulin infusion 30 minutes after injection.
- **Note:** If no basal insulin has been given for **greater than** 24 hours aim to convert to subcutaneous insulin with evening meal and give usual basal dose **or** convert at breakfast with half usual basal dose and then give remainder of dose with evening meal.

For patients who are on an insulin pump therapy:

- Consider pump failure as a cause of DKA before restarting pump.
- Seek advice from specialist diabetes team.
- If appropriate, recommence pump when ketones cleared and patient eating and drinking.
- Cease IV insulin infusion 30 minutes after recommencing pump.

For patients with newly diagnosed type 1 diabetes:

- Commence basal insulin on the day of admission.
- Start bolus insulin with the next meal.
- Cease IV insulin infusion 30 minutes after injection.
- Suggested starting doses:
  - Bolus (meal time) insulin – 4 to 6 units of rapid acting insulin analogue.
  - Basal (once a day) insulin – 10 units of Lantus or Levemir.

### 5. DKA in Pregnant Women

Pregnant patients with diabetes are more prone to severe and rapidly progressive episodes of DKA at lower glycaemic levels and can even develop DKA with 'normal' BGL.

Foetal mortality from maternal DKA is as high as 30% and complications include fetal hypoxia, acidosis, preterm delivery and neonatal intensive care unit admission.

In addition to usual care pregnant women with DKA should also receive the following;

- Consultation with Obstetric team and Paediatrician regarding possible imminent delivery. Consultation with specialist Endocrinologists as required.
- Women who meet the criteria for severe DKA or have sepsis should be managed in ICU.
- Continuous foetal monitoring should be considered.

### 6. Definitions

<b>DKA</b>	Diabetic Ketoacidosis
<b>ICU</b>	Intensive Care Unit
<b>VBG</b>	Venous Blood Gases
<b>BGL</b>	Blood Glucose Level

### 7. Roles and Responsibilities

**Prescribers** are responsible for appropriate prescribing for, monitoring and review of patients with DKA.

**Nursing/Midwifery** are responsible to ensure appropriate administration of prescribed products, monitoring and escalation of care as required.

**All Staff** are required to work within policies and guidelines to make sure that WACHS is a safe, equitable and positive place to be.

### 8. Compliance

Failure to comply with this guideline may constitute a breach of the WA Health Code of Conduct (Code). The Code is part of the [Employment Policy Framework](#) issued pursuant to section 26 of the [Health Services Act 2016](#) (HSA) and is binding on all WACHS staff which for this purpose includes trainees, students, volunteers, researchers, contractors for service (including all visiting health professionals and agency staff) and persons delivering training or education within WACHS.

WACHS staff are reminded that compliance with all policies is mandatory.

### 9. Evaluation

Monitoring of compliance with this guideline is to be conducted as required, with assessment of incidents relating to the management of adult patient with diabetic ketoacidosis with the target being zero.

### 10. Standards

[National Safety and Quality Health Service Standards](#) (Second edition 2017) – 1.7, 4.13,4.15

### 11. Legislation

[Medicines and Poisons Act 2014 \(WA\)](#)

## 12. References

1. Group Expert. Diabetic Ketoacidosis. Therapeutic Guidelines: Endocrinology (eTG complete). West Melbourne, Australia: Therapeutic Guidelines Limited; 2013.
2. Fiona Stanley Hospital Adult Diabetic Ketoacidosis Guideline (accessed Oct 2018)
3. Rockingham Peel Group Diabetic Ketoacidosis (DKA) Adult (Acute) Guideline (accessed Oct 2018)
4. Armadale Kalamunda Group Adult Diabetic Ketoacidosis Guideline (accessed Oct 2018)

## 13. Related Forms

[MR 176 Intravenous Fluid Treatment Chart](#)

[MR156A WACHS Insulin Subcutaneous Order and Blood Glucose Record – Adult Form](#)

MR 157D South West Adult Diabetic Ketoacidosis (DKA) Treatment & Monitoring Chart

## 14. Related Policy Documents

WACHS [High Risk Medications Procedure](#)

WACHS [Medication Administration Policy](#)

WACHS South West [Handling and Supply of Concentrated Potassium-Containing Solutions Procedure](#)

## 15. Related WA Health System Policies

[WA Clinical Alert \(Med Alert\) Policy MP 0053/17](#)

[WA High Risk Medication Policy MP 0078/1/8](#)

## 16. Policy Framework

[Clinical Governance, Safety and Quality](#)

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<b>Contact:</b>	Naomi Lillywhite, Regional Chief Pharmacist South West		
<b>Directorate:</b>	Medical Services	<b>EDRMS Record #</b>	ED-CO-17-30028
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