Diabetic Ketoacidosis Care Pathway 1
0 – 4 Hours Emergency Management

Time of Arrival	:	Location		Date	/ /

Aim: To improve the acute management of diabetic ketoacidosis in adults aged 16 and over
Definition: Severe uncontrolled diabetes with:
a) ketonaemia/ketonuria; b) metabolic acidosis;
c) usually with hyperglycaemia
Severe DKA = pH less than 7.1 or H^+ greater than 80 mmol/L or HCO_3^- less than 5 mmol/L

DKA

AFFIX PATIENT LABEL

Consultant/Senior physician should be called immediately if:
- Cerebral Oedema
- Hypokalaemia on admission (less than 3.5 mmol/L)
- Severe DKA
- Reduced conscious level

1. Immediate actions	✓
Confirm diagnosis (H^+ > 45 or HCO_3^- <18 or pH <7.3 on **venous gas**)	
Check U&Es, laboratory blood glucose, capillary or urinary ketones	
Confirm patient ≥16 years – IF NOT, DISCUSS WITH PAEDIATRIC TEAM URGENTLY	
Record time of arrival	

2. Management 0 – 60 minutes	✓
Commence IV 1 litre Sodium Chloride 0.9% over 1 hour within 30 minutes of admission	
Time and sign fluid commencement (on reverse)	
Commence soluble insulin IV 6 units/hour within 30 minutes of admission	
Time and sign start of insulin (on reverse)	
Record SEWS	

Other interventions to be considered	✓		✓
ECG and consider cardiac monitor		Blood cultures	
Record GCS score		Central line	
Insert catheter if oliguric		Chest X-ray	
MSSU		DVT prophylaxis	
If protracted vomiting insert NG tube		**If deteriorating, consultant or senior physician called**	

3. Ongoing Management (1 – 4 hours)								✓
Record: SEWS		ECG		GCS				
Time and sign ongoing Sodium Chloride 0.9% replacement (on reverse)								
Hour 2: 1 litre Sodium Chloride 0.9% + Potassium Chloride (KCL)								
Hours 3 & 4: 500mls Sodium Chloride 0.9% per hour + Potassium Chloride (KCL)								
Review Potassium (K^+) result Prescribe KCL in 500ml Sodium Chloride 0.9% bag as: *(not to be administered at a rate of >20 mmol/hour* *Unless discussed with ST4 or above)*				None if anuric or K+ greater than 5 mmol/L 10 mmol if between 3.5 – 5 mmol/L 20 mmol if less than 3.5 mmol/L				
Check finger prick glucose hourly	1hr		2hrs		3hrs		4hrs	
Lab glucose, U&Es and HCO_3^- at:			2hrs				4hrs	

If Blood Glucose falls to ≤14 mmol/L in first 4 hours	✓
Commence 10% Glucose 500mls with 20 mmol KCL at 100ml/hr	
Continue Sodium Chloride 0.9% at 400mls/hr + KCL (as per table above) until end of hour 4	
Reduce insulin to 3 units/hour	
Maintain blood glucose >9 mmol/L and <14 mmol/L adjusting insulin rate as necessary	
If blood glucose <9 mmol/L adjust insulin to maintain level between 9 and 14 mmol/L (see appendix)	
If blood glucose >14 mmol/L see appendix	
Progress on to second DKA Care Pathway "4 hours until discharge"	

! PLEASE COMPLETE DKA FLOW CHART (OVERLEAF) AT PRESENTATION AND HOURLY THEREAFTER !

Authors: NHS Scotland, Dr F.W. Gibb, Dr S. Ritchie & Dr. K Adamson

Diabetic Ketoacidosis Care Pathway 1
0 – 4 Hours Emergency Management

Fluid (Potassium) prescription sheet

	FLUID	VOL (ml)	RATE	PRINT NAME	SERIAL NO	TIME BEGUN	GIVEN BY
DATE	POTASSIUM	DOSE (mmol)		SIGNATURE	BATCH NO		
A	Sodium Chloride 0.9%	500ml	1L/hour			:	
B	Sodium Chloride 0.9%	500ml	1L/hour			:	
C	Sodium Chloride 0.9%	500ml	1L/hour			:	
D	Sodium Chloride 0.9%	500ml	1L/hour			:	
E	Sodium Chloride 0.9%	500ml	500ml/hr			:	
F	Sodium Chloride 0.9%	500ml	500ml/hr			:	

Once Blood Glucose <14 mmol/L start Glucose 10%

G	Glucose 10%	500ml	100ml/hr			:	
	KCL	20 mmol					
H	Glucose 10%	500ml	100ml/hr			:	
	KCL	20 mmol					
I						:	

Intravenous Insulin Prescription

DATE	TIME	INSULIN RATE (units/hr)	TYPE OF INSULIN	PRINT NAME	GIVEN BY
				SIGNATURE	
	:	6 units/hour when blood glucose >14 mmol/L	ACTRAPID		
	:	3 units/hour when blood glucose <14 mmol/hr	ACTRAPID		

Supplementary notes

1. Guidance on bicarbonate
Do not use bicarbonate.

2. Potassium Replacement
KCL should not normally be administered at a rate of >20mmol/hour. In patients with end stage renal failure, be particularly careful and discuss with a Consultant/ Senior Physician before using.

3. WBC Count
The WBC count is often raised in DKA and antibiotics should only be administered if there is clear evidence of infection.

4. Blood Glucose >14 mmol/L
If Blood Glucose rises >14mmol/L do not stop glucose, adjust insulin to maintain level between 9 and 14 mmol/L (see appendix)

5. Signs of Cerebral Oedema
Adults up to the age of 25 may be at risk of cerebral oedema. Consider if • Headaches• Reduced conscious level. • Monitoring for signs of cerebral oedema should start from the time of admission and should continue until up to at least 12 hours after admission

• Administer IV mannitol (100mls of 20% over 20 minutes) or dexamethasone 8mg (discuss with Consultant) • Undertake CT scan to confirm findings; • Consider ITU (an indication for checking arterial blood gases) • If there is a suspicion of cerebral oedema or the patient is not improving as expected /within 4 hours of admission, call Consultant.

6. Laboratory Blood Glucose Testing
It is reasonable to use a point-of-care blood glucose meter to monitor blood glucose level if the previous laboratory Blood Glucose value is <20 mmol/L .

7. Insulin Management
Insulin should be prescribed, beginning at 6 units/ hour. Rate will generally be reduced with time depending on clinical circumstances, presence of long acting insulin and to avoid a fall of >5mmol/L as rapid falls in Blood Glucose may be associated with cerebral oedema.

Do not stop glucose once started

Authors: NHS Scotland, Dr F.W. Gibb, Dr S. Ritchie & Dr. K Adamson

Diabetic Ketoacidosis Care Pathway 2
From 4 hours until discharge

Time pathway started	:
Location	
Date	/ /

AFFIX PATIENT LABEL

DKA

Subsequent Management	✓
Review Blood Glucose results and U&Es	
Prescribe usual long acting subcutaneous insulin (if relevant) along with IV insulin (Detemir, Glargine, Insulatard, Humulin I *etc.*) at patient's usual times	
Continue Sodium Chloride 0.9% + Potassium Chloride (KCL) at 250 mls/hr until Blood Glucose <14 mmol/L	

When Blood Glucose falls <14 mmol/L (if not fallen in first 4 hours)	✓
Commence Glucose 10% with 20 mmol KCL at 100 ml/hour	
Reduce Sodium Chloride 0.9% to 150 mls/hour + KCL (according to Potassium [K^+] table below)	
Reduce insulin to 3 units/hour	
Maintain Blood Glucose >9 mmol/L and ≤14 mmol/L adjusting insulin rate as necessary	
Review U&Es	
Review K^+ result and replace KCL in 500ml Sodium Chloride 0.9% bag as: •None if anuric or >5mmol/L •10 mmol if level 3.5 – 5 mmol/L •20 mmol if level <3.5 mmol/L	
Measure and record Lab Blood Glucose, U&Es and $HCO3^-$ 4 hourly for 24 hours (Measure Lab Blood Glucose 2 hourly if Blood Glucose >20 mmol/L 8 hours ☐ 12 hours ☐ 16 hours ☐ 20 hours ☐ 24 hours	
Convert back at next convenient meal time to usual subcutaneous insulin regimen when: •HCO_3^- within normal reference range •Patient eating normally Stop IV fluids and IV insulin 30 minutes after usual injection of pre-meal subcutaneous insulin	
Phone/refer for specialist diabetes review before discharge. If not available, ensure specialist team receives a copy of the discharge summary	
Do not discharge until HCO_3^- normal (unless discussed with the diabetes team), established on usual subcutaneous insulin regimen and eating normally	

When Blood Glucose rises >14 mmol/L after glucose commenced	✓
•Continue glucose 10% with 20 mmol KCL at 100ml/hr •Continue Sodium Chloride 0.9% at 150 mls/hr + KCL •Increase insulin to maintain Blood Glucose >9 mmol/L and ≤14 mmol/L •When blood glucose ≤14 mmol/L adjust insulin rate as necessary to maintain Blood Glucose >9 and <14 mmol/L **(see Appendix for "Guidance on Adjusting Insulin Infusion Rate" for this Care Pathway)**	

Good Clinical Practice
Record SEWS and GCS Score. Finger prick Blood Glucose hourly
Review other investigations
If not improving at start of this pathway / after 4 hours: •Check that equipment is working •Confirm venous access is secure •Check non-return valve on pump •Replace 50ml syringe with fresh Sodium Chloride 0.9% and insulin •Call Consultant / Senior Physician if all the above is working and the patient still deteriorating

ENSURE INSULIN IS PRESCRIBED BEFORE PATIENT LEAVES HOSPITAL

! PLEASE COMPLETE DKA FLOW CHART AT PRESENTATION AND HOURLY THEREAFTER !

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Diabetic Ketoacidosis Care Pathway 2
From 4 hours until discharge

Fluid (Potassium) prescription sheet

	FLUID	VOL (ml)	RATE	PRINT NAME	SERIAL NO	TIME BEGUN	GIVEN BY
DATE	POTASSIUM	DOSE (mmol)		SIGNATURE	BATCH NO		
A	Sodium Chloride 0.9%	500ml	250ml/hr			:	
B	Sodium Chloride 0.9%	500ml	250ml/hr			:	
C	Sodium Chloride 0.9%	500ml	150ml/hr			:	
D	Sodium Chloride 0.9%	500ml	150ml/hr			:	
E	Sodium Chloride 0.9%	500ml	150ml/hr			:	
F	Sodium Chloride 0.9%	500ml	150ml/hr			:	
G	Sodium Chloride 0.9%	500ml				:	

Once Blood Glucose <14 mmol/L start Glucose 10%

H	Glucose 10%	500ml	100ml/hr			:	
	KCL	20 mmol					
I	Glucose 10%	500ml	100ml/hr			:	
	KCL	20 mmol					
J						:	

Intravenous Insulin Prescription

DATE	TIME	INSULIN RATE (units/hr)	TYPE OF INSULIN	PRINT NAME	GIVEN BY
				SIGNATURE	
	:	6 units/hour	ACTRAPID		
	:	3 units/hour	ACTRAPID		
	:				

Supplementary notes

1. Continuation of Insulin It is reasonable to use a point-of-care blood glucose meter to monitor blood glucose level if the previous laboratory blood glucose value is less than 20 mmol/L.

2. Consider Precipitating Factors
Common causes include:
- Omissions of insulin
- Infection
- Newly diagnosed
- Myocardial infarction
- Combination of the above.

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Diabetic Ketoacidosis Care Pathway 2
APPENDIX

**** Guidance on adjusting insulin infusion rate to maintain blood glucose to more than (>) 9mmol/L and less than or equal to (≤) 14 mmol/L**

•Initially insulin will be infused at 6 units / hour and reduced to 3 units / hour once blood glucose is ≤ 14 mmol/L.

•***The aim is to maintain blood glucose levels >9mmol/L and ≤ 14 mmol/L***.

•If the blood glucose rises to >14mmol/L following the commencement of IV **Glucose 10% (dextrose),** and IV insulin is running at 3 units / hr, increase the insulin infusion rate to 4units / hr, checking the **blood** glucose (BM) hourly. If the glucose remains elevated after 1 hour, the IV insulin infusion rate can be increased to 5 units / hr.

•If blood glucose falls to <9mmol/L then reduce the insulin infusion rate to 2 units / hr, checking the **blood** glucose (BM) hourly. It is essential to maintain an adequate infusion of insulin during treatment of diabetic ketoacidosis (DKA) and therefore the insulin infusion rate should not reduce below 2 units / hr.

•In the situation where the blood glucose is <9mmol/L and insulin is running at 2 units / hr, increase the rate of infusion of Glucose 10% (**dextrose)** to maintain glucose in target. If this occurs, ensure:
1) IV access is secure
2) The infusion pumps are functioning correctly,
3) Glucose 10% (**dextrose)** is prescribed and running correctly
4) Replace the 'insulin infusion' 50ml syringe with fresh Sodium Chloride **0.9%** and insulin

DO NOT STOP IV Glucose 10% (DEXTROSE) INFUSION ONCE IT IS COMMENCED

Amendments to the insulin rate can be prescribed in the chart below if there is insufficient space in the care pathway:

Intravenous Insulin Prescription

DATE	TIME	INSULIN RATE (units/hr)	TYPE OF INSULIN	PRINT NAME	GIVEN BY
				SIGNATURE	
	:				
	:				
	:				
	:				

AFFIX PATIENT LABEL

DKA patient data flow chart

First 12 hours

		Presentation	After 1 hour	After 2 hours	After 3 hours	After 4 hours
	Time (use 24hr clock)	:	:	:	:	:
OBSERVATIONS	Mental status (AVPU)					
	Respiratory rate					
	SaO_2 (%)					
	Inspired O_2 (%)					
	Temperature (°C)					
	Blood pressure (mmHg)	/	/	/	/	/
	Heart rate					
	Urine output (ml/hr)					
	SEWS Score					
BIOCHEMISTRY	Glucose: Lab [L], Gas [G], BM [B]					
	Urine ketones					
	Capillary ketones					
	Serum sodium (mmol/l)					
	Serum potassium (mmol/l)					
	Serum $HCO3^-$ (mmol/l)					
	Hydrogen ion: Venous [V] or Arterial [A]					
FLUIDS & INSULIN	Insulin (units infused in last hour)					
	0.9% Saline (ml infused in last hour)					
	10% Dextrose (ml infused in last hour)					
	KCL (mmol infused in last hour)					
	Total fluid infused (litres)					
	Staff nurse responsible for care (initial)					
	Doctor responsible for care (initial)					

! HIGHLIGHTED BOXES ARE MANDATORY !

AFFIX PATIENT LABEL

eced Edinburgh Centre for Endocrinology & Diabetes

NHS Lothian

After 5 hours	After 6 hours	After 7 hours	After 8 hours	After 9 hours	After 10 hours	After 11 hours	After 12 hours
:	:	:	:	:	:	:	:
Mental status (AVPU)							
Respiratory rate							
SaO_2 (%)							
Inspired O_2 (%)							
Temperature (°C)							
Blood pressure (mmHg) /	/	/	/	/	/	/	/
Heart rate							
Urine output (ml/hr)							
SEWS Score							

Glucose: Lab [L], Gas [G], BM [B]							
Urine ketones							
Capillary ketones							
Serum sodium (mmol/l)							
Serum potassium (mmol/l)							
Serum $HCO3^-$ (mmol/l)							
Hydrogen ion: Venous [V] or Arterial [A]							

Insulin (units infused in last hour)							
0.9% Saline (ml infused in last hour)							
10% Dextrose (ml infused in last hour)							
KCL (mmol infused in last hour)							
Total fluid infused (litres)							

Staff nurse responsible for care (initial)							
Doctor responsible for care (initial)							

! HIGHLIGHTED BOXES ARE MANDATORY !