

DKA



APEM 2016.2
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Definition

How do you define DKA?

Definition

- Hyperglycaemia (BGL > 11mmol) and
- Venous pH < 7.3 and/or HCO₃ < 15 mmol/l
- Presence of ketonaemia / ketonuria

Severity

How do you classify severity?

Severity

	Venous pH	HCO ₃
Mild	<7.3	<15
Moderate	< 7.2	<10
Severe	< 7.1	<5

Wolfsdorf, C.M.E., Daneman, D., Dunger, D., et al. (2009), 'ISPAD clinical practice consensus guidelines 2009 compendium: Diabetic ketoacidosis in children and adolescents with diabetes', *Pediatric Diabetes*, Vol. 10 (12): pp. 118-133

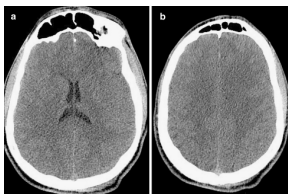
DKA adults v kids?

What is the main difference in DKA management between adults and kids?

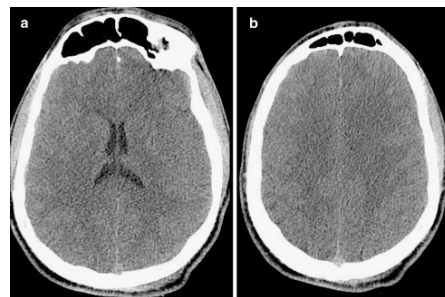


DKA – adults v kids

- Rate of fluid hydration
- Risk of cerebral oedema



How common is cerebral oedema?



Risk of cerebral oedema

0.3 – 1% of all DKA episodes in children

Craig et al. National evidence-based clinical care guidelines for type 1 diabetes in children, adolescents and adults. 2011

Risk factors for cerebral oedema?



Risk factors for cerebral oedema

- New onset Type 1 diabetes
- Elevated serum urea nitrogen
- Severe dehydration
- Severe DKA (pH < 7.1)
- Age < 5 years
- Reduced level of consciousness

DKA in kids

DKA management in children really revolves around preventing cerebral oedema through the judicious replacement of fluids, electrolytes and insulin

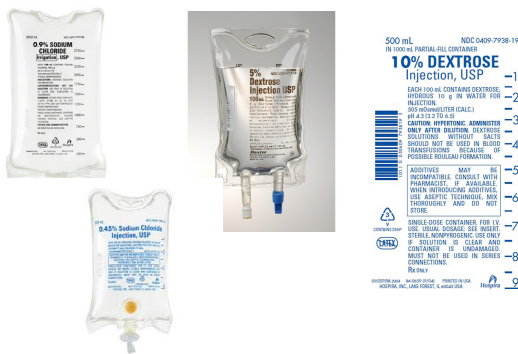
Fluids

Do you give a bolus of fluids to start?

Fluid bolus

- Fluid boluses only to be given if shocked
- 10ml/kg normal (0.9%) saline
- No shock = No bolus
- If > 20ml/kg given -> think sepsis
- In calculating hourly rate of fluids, incorporate bolus into calculations

Which fluids?



Fluids

- Normal (0.9%) saline is the fluid of choice
- No evidence to support colloids over crystalloids
- Do not use hypotonic saline
- Add K+ (40mmol KCl to 1L) unless anuric or K+ > 5.5
- Add glucose (start with 5% dextrose normal saline SOLUTION) when BGL < 15 mmol/l

Rehydration

- Rehydration over 48-72 hours
- Incorporate deficit, maintenance and bolus into calculations
- Deficit = % dry x 10 x weight (kg)

IVF

- 6yo girl presents with severe DKA
- You assess her to be 10% dehydrated
- Calculate her IVF therapy
- She does not receive a bolus of IVF

Make a plan and document

- Severe DKA pH <7.1
- Go slow – plan to correct hydration 72 hours
- Deficit = % dry x 10 x weight (kg)
- Weight = (age +4) x 2 = 20kg
- Deficit = 10 x 10 x 20 = 2000mL

Maintenance 4 / 2 / 1 rule

- 4ml/kg for 1st 10kg
- 2ml/kg next 10kg
- 1ml/kg for the rest of weight
- 20kg girl:
40 + 20 = 60ml/hr maintenance

Maintenance for 24 hours

- 100ml/kg for 1st 10kg
- 50ml/kg next 10kg
- 25ml/kg next 10kg

$$(100 \times 10) + (50 \times 10) = 1500\text{ml} / 24\text{hours}$$

$$= 62.5\text{ml} / \text{hr}$$

Calculation

- Total over 72 hours = maintenance + deficit
 - = $(1500 \times 3) + 2000$
 - = $6500 / 72$
 - = $90\text{ml} / \text{hr}$
- Between 90-100ml/hr acceptable
- Monitoring clinical response + laboratory parameters

NaHCO₃ ?



NaHCO₃

- Consider only if pH < 6.9 AND shock with circulatory failure
- Only used to improve cardiac contractility in severe shock

Insulin

- Short acting insulin for infusions (actrapid or Humulin R)
- Add 50u of insulin to 50ml NaCl
- Start infusion at 0.1u / kg /hr

Insulin

- No insulin bolus
- No evidence to support lower infusion rate initially 0.05u / kg / hr
- Obese patients – start infusion based on ideal body weight

Cerebral Oedema

- Most common 4-12 hours after treatment started, but can happen at any time
- Usually sudden onset rapid neurological deterioration
 - ALOC
 - Headache
 - Vomiting
 - Bradycardia
 - Hypertension
 - Cranial nerve palsy
 - Abnormal posturing



Cerebral oedema management

- Same as raised ICP
- Elevate head of bed to 30°, keep head in midline
- High flow O₂ via NRBM
- Reduce IVF rate
- Mannitol (1g/kg) over 20 mins or hypertonic saline 3% (5ml/kg) over 15 mins
- Intubation and ventilation
 - CO₂ 35-40mmHg

