

Pediatric Diabetic Ketoacidosis (DKA) Pathway

Child with Suspected DKA--First 60 minutes

Initial Assessment



- ABC, VS, level of dehydration
- Mental status, GCS, neuro exam
- Risk for cerebral edema
- Continuous monitoring, VS q 15 min, I&O Q1H
- If patient on a subcutaneous insulin pump, remove patient owned insulin pump

IV Access



- Obtain 2 PIVs
- If unable to obtain PIV after 2 RN attempts, attempt ultrasound guided PIV
- Consider obtaining a central line before placing IO

Initial Labs



- For any suspected DKA: POC glucose, VBG, BMP, Mg, Phos, UA, HbA1c, serum ketones (β -hydroxybutyrate), amylase, lipase, β -hCG if applicable, CBC if infectious workup indicated

Rehydration



- **NS 20 mL/kg bolus given over 1 hour** (Repeat as needed for hemodynamic stability)
- **DO NOT ADMINISTER INSULIN BOLUS**
- **DO NOT ADMINISTER SODIUM BICARBONATE**

First 2 Hours in PICU

PICU Admission



- Order set found under "**Pedi DKA Admission Orders to PICU**"
- Vital signs and neurochecks Q1H
- NPO and strict I&O
- Initiate insulin drip and IV fluids per 2-bag system (*See appendix A*)
- Endocrine consult
- If patient on a subcutaneous insulin pump, remove patient owned insulin pump

Insulin Orders



- Start insulin at 0.1 units/kg/hr
*Consider insulin at 0.05 units/kg/hr IF patient: <1 yo OR new onset diabetic
- Regular insulin 50 units in 50 mL 0.9% NaCl (1 unit/mL)
- Prime tubing with 1 mL of insulin solution prior to starting infusion
- Do not titrate insulin infusion

Definition of DKA

Hyperglycemia	<ul style="list-style-type: none"> • Glucose >200 mg/dL
Ketosis	<ul style="list-style-type: none"> • Ketonuria AND/OR • Ketonemia (β-Hydroxybutyrate >3 mmol/l)
Acidosis	<ul style="list-style-type: none"> • Serum pH <7.3 AND/OR • HCO_3^- <15 mmol/L

Cerebral Edema

Signs/symptoms


- Headache
- Vomiting
- Altered mental status

Risk Factors

- Initial pH <7.0
- Hypocapnea
- Markedly low serum osmolality
- Fluid overload
- Bicarbonate administration
- New onset
- <5 years of age

Treatment

- Mannitol 0.5-1 g/kg over 20 min OR
- Hypertonic saline 5 mL/kg over 30 min

PICU Admission Labs	<ul style="list-style-type: none"> • VBG, CMP, Mg, Phos, POC glucose • <i>If not obtained in ED:</i> HgbA1c, UA, β-hydroxybutyrate, amylase, lipase, β-hCG if applicable, CBC if infectious workup indicated • <i>If new onset diabetic:</i> TSH, Free T4, Glutamic acid decarboxylase antibody, Islet cell IgG, Thyroid peroxidase antibody, Celiac panel, insulin antibody • <i>If initial K>6,</i> obtain EKG
	
Ongoing PICU Labs	<ul style="list-style-type: none"> • Q1H POC glucose while on insulin drip, q4h BMP, Mg, Phos, q8h serum β-hydroxybutyrate



Resolution of DKA

Indication for Transition to SQ Insulin	<ul style="list-style-type: none"> • Serum pH>7.25 or serum bicarbonate >14 • Dehydration corrected • Patient is alert and appropriate • Patient is breathing comfortably • Patient indicates interest in eating • Timing coincides with breakfast, lunch, or dinner **If patient on insulin pump, notify endo prior to transition
SQ Insulin Monitoring	<ul style="list-style-type: none"> • POC glucose before each meal, before bedtime, and 0200 • Notify provider if serum glucose <80 or >350
Pediatric Diabetic Diet	<ul style="list-style-type: none"> • _____ kcal/day = 1000 kCal + (100 kcal x age in yrs), <i>MAX of 2400 kcal/day</i> • Other diet restrictions: 2 g sodium restriction, please ensure timely meals and snacks
Insulin	<ul style="list-style-type: none"> • Start insulin glargine/insulin aspart regimen per Endo recommendations
How to Transition to SQ Insulin	<p>Immediately prior to first meal:</p> <ul style="list-style-type: none"> • Administer insulin glargine per Endo recommendations • Obtain POC glucose • Discontinue insulin drip • Discontinue IV fluids or remove dextrose from fluids • Allow patient to eat • Count carbs for food consumed • Administer insulin aspart for pre-meal blood sugar correction plus carbs consumed <p>Immediately prior to next scheduled meals:</p> <ul style="list-style-type: none"> • Obtain POC glucose and count carbs • Administer insulin aspart for pre-meal blood glucose plus pre-meal carbs

References

- Baker K., *et al.* Effect of volume of fluid resuscitation on metabolic normalization in children presenting in DKA. *Journal of Emergency Medicine*. April 2016. 50(4): 551-559.
- Children's Hospital of Orange County. Diabetic Ketoacidosis Critical Care Guideline. www.choc.org. October 2017.
- Children's Hospital of Richmond. Clinical Guideline DKA. www.chrichmond.org. August 2018.
- Flood, K., *et al.* Implementation and Evaluation of a Diabetic Ketoacidosis Order Set in Pediatric Type 1 Diabetes at a Tertiary Care Hospital. *Canadian Journal of Diabetes*. 2019.
- Glaser, N., *et al.* Fluid treatment for children with diabetic ketoacidosis. *Pediatric Diabetes*. 2019. 20:10-14.
- Srinivasan, V., *et al.* ED Pathway for the Evaluation/Treatment of the Child with Suspected DKA. www.chop.edu. February 2019.

Appendix A

Intravenous Fluids: 2-Bag System

- Initiate fluids per 2-bag system with total fluid rate at 1.5x maintenance rate
- Order for total fluid goal rate at _____ mL/hr
- Adjust IV fluid rate of each bag hourly according to serum glucose monitoring per table below:

*****Notify provider if serum glucose <100 mg/dL and run D10 containing fluids at 100%**

*****Notify provider if serum glucose drops >100 mg/dL in 1 hour**

*****Notify provider if change in mental status**

- If total fluid goal rate is changed, provider must enter new orders for bag 1 and 2 to reflect new rates. Do not discontinue/reorder current orders

If Potassium is <6.0 mmol/L:

	Bag 1 (% of Total Fluid Rate)	Bag 2 (% of Total Fluid Rate)	
Serum Glucose (mg/dL)	NS + KCl 20 mEq + KPhos 13.6 mMol per 1000 mL	D10 NS + KCl 20 mEq + KPhos 13.6 mMol per 1000 mL	Final Dextrose Concentration (%)
>300	100%	0%	0
251-300	75%	25%	2.5
201-250	50%	50%	5
151-200	25%	75%	7.5
<150	0%	100%	10
<80	Give 2 mL/kg bolus of D25W		

If Potassium is ≥6.0 mmol/L:

	Bag 1 (% of Total Fluid Rate)	Bag 2 (% of Total Fluid Rate)	
Serum Glucose (mg/dL)	NS (1000 mL)	D10 NS (1000 mL)	Final Dextrose Concentration (%)
>300	100%	0%	0
251-300	75%	25%	2.5
201-250	50%	50%	5
151-200	25%	75%	7.5
<150	0%	100%	10
<80	Give 2 mL/kg bolus of D25W		

After 8 hours, IF anion gap <16 mmol/L, HCO₃ >10 mmol/L and not rising, consider:

	Bag 1 (% of Total Fluid Rate)*	Bag 2 (% of Total Fluid Rate)*	
Serum Glucose (mg/dL)	NaCl 77 mEq + NaAcetate 77 mEq + KCl 20 mEq+ KPhos 13.6 mMol per 1000 mL	D10 + NaCl 77 mEq + NaAcetate 77 mEq + KCl 20 mEq + KPhos 13.6 mMol per 1000 mL	Final Dextrose Concentration (%)
>300	100%	0%	0
251-300	75%	25%	2.5
201-250	50%	50%	5
151-200	25%	75%	7.5
<150	0%	100%	10
<80	Give 2 mL/kg bolus of D25W		

* Fluids can be found in “**Pedi Compounded IV Fluids**” order set