ENDOCRINOLOGY

WRNMMC Pediatric DKA Clinical Practice Guideline

1. Suspect DKA

Defined based on following parameters:

Glucose >200 mg/dL **AND**
Venous pH <7.30 or HCO3 <15mEq/L **AND**
Ketonemia and ketonuria

2. Initial Evaluation

Include H&P, vitals, weight (kg) and labs to include:

Glucose, electrolytes, calcium, magnesium, phosphorus
Urinalysis
Blood ketones (i.e. Acetone)
CBC
pH (i.e. VBG)
Cultures, as indicated
EKG, if indicated (i.e. if serum potassium delayed)

3. Standard supportive measures per ED policy

Peripheral IV x 2 placement, continuous cardiorespiratory monitoring, PALS measures.

4. Volume Expansion

Initial Volume Expansion

Typically 10mL/kg NS over 1 hour.
May repeat if persistent hypotension and/or poor perfusion.
If in shock, consider initial 20mL/kg NS rapid bolus.

Subsequent Fluid Therapy

NS + 40 mEq/L potassium (20 mEq/L KCL + 20 mEq/L Kphos or 40 mEq/L KCl) at 1.5x maintenance therapy based on weight (kg).
May transition to ½ NS + 40 mEq/L potassium after 4-6 hours of subsequent fluid resuscitation.

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5. Insulin Therapy

Start insulin infusion 1-2 hours after starting fluid therapy as above.

Regular insulin 0.1 unit/kg/hour

Dilute 250 units regular insulin in 250mL NS, 1 unit = 1mL

Dose should remain at 0.1 unit/kg/hour until resolution of DKA, however if marked sensitivity to insulin occurs, dose may be decreased to 0.05 units/kg/hour or less provided that metabolic acidosis continues to resolve.

Do not bolus IV insulin – increases the risk of cerebral edema.

6. Monitoring

Maintain q1 hour blood glucose, vitals, intake/output and neurological checks.

Recommend q2 hour serum glucose, electrolytes, calcium, magnesium, phosphorus and pH.

Aim to keep blood glucose at 150-250mg/dL

Add Dextrose 5% to IV fluid when serum glucose falls to 250-300 mg/dL

Add Dextrose 10% or 12.5% if necessary to keep blood sugars 150-250 mg/dL

Bicarbonate administration is not routinely recommended due to risk of paradoxical acidosis.

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7. Cerebral Edema

A patient developing cerebral edema may exhibit any of the following clinical signs during the first 24 hours of DKA treatment: headache, change in level of consciousness/ responsiveness, unequal or dilated pupils, papilledema, delirium, incontinence, vomiting, bradycardia, increase in blood pressure (diastolic >90mm/Hg), abnormal respiratory pattern or respiratory arrest or sudden onset of polyuria (development of diabetes insipidus as a result of pituitary necrosis).

If cerebral edema is suspected, the following treatment should be employed immediately:

Reduce rate of IV infusion by one-third.

Elevate head of bed.

Hypertonic Saline (3%) 1 mL/kg over 15 minutes

Alternatively, give Mannitol 0.5-1 g/kg IV over 20 minutes and repeat if there is no initial response in 30 minutes to 2 hours.

Consider intubation and maintain pCO2 35-40 mm Hg. Hyperventilation (to a pCO2 <22 mm Hg) has been associated with poor outcome and is not recommended.

After treatment for cerebral edema has been started obtain a head CT to exclude other possible intracranial causes of neurologic deterioration (i.e. thrombosis, hemorrhage).

8. Transport Guidance

Call WRNMMCB PICU at 301-400-2010 for admission, to arrange PALS level transport, and for further guidance

References:

See ISPAD 2014 Consensus Statement. Wolfsdorf. Pediatric Diabetes 2014:15 (Suppl 20):154-179

***Clinical Practice Guideline Disclaimer Statement**: "This Clinical Practice Guideline is designed to provide clinicians a framework for evaluation and treatment of DKA. This Clinical Practice Guideline is not intended to establish a protocol for all patients with a particular condition not is it intended to replace a clinician's clinical judgement. A clinician's adherence to this Clinical Practice Guideline is voluntary. It is understood that some patients will not fit the clinical conditions contemplated by this Clinical Practice Guideline and that the recommendations contained in this Clinical Practice Guideline should not be considered inclusive of all proper methods or exclusive of other methods of care reasonably directed to obtaining the same results. Decisions to adopt any specific recommendation of this Clinical Practice Guideline must be made by the clinician in light of available resources and the individual circumstances presented by the patient."*

New onset labs: BMP, HbA1c, islet cell antibodies, insulin antibodies, thyroid antibodies, TFTs, endomesial antibody, TTG, IgA, beta-hydroxybutyrate, serum insulin, C peptide

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Hypoglycemia BG <50 mg/dL

- Work-up: Obtain critical sample prior to treatment:

  1st priority: electrolytes with serum glucose, insulin, free fatty acids, serum ketones (β-OH butyrate), GH, cortisol, acylcarnitine profile, ammonia, lactate/pyruvate

  2nd priority: Plasma amino acids, carnitine, C-peptide

  1st voided urine: ketones, urine organic acids, reducing substances, tox screen

  Tubes: Corvac-SST (multiple), Green (Na-heparin) – [acylcarnitine, PAA], Gray [lactate - ice/pyruvate, glucose], Lav- EDTA [ammonia – ice]

- Management: RULE OF 50s — Glucose 0.5-1 gm/kg IV bolus (PALS)

  D5 (0.05 g/ml) 10-20 ml/kg

  D10 (0.1 g/ml) 5-10 ml/kg – 2 ml/kg for neonates (0.2 gm/kg)

  D25 (0.25 g/ml) 2-4 ml/kg

  D50 (0.5 g/ml) 1-2 ml/kg

Adrenal Insufficiency/Crisis

1. Obtain IV access
2. Finger-stick blood glucose, stat electrolytes; ACTH and cortisol level if diagnosis is not known
3. NS 20 mL/kg bolus, use D5NS if hypoglycemia
4. Hydrocortisone (Solu-Cortef) 100 mg/m2 IV bolus
5. Continue dextrose-containing IV fluids
6. Continue hydrocortisone 100 mg/m2/day IV div q6 hours

Hypocalcemia

Cardiac monitor – prolonged QT on EKG

Calcium gluconate 60-100 mg/kg over 5-10 min slow IV push

Beware of bradycardia, asystole, hypotension, tissue necrosis

Correct low magnesium with Mag sulfate (50%) 25-50 mg/kg IV over 10-20 min

Hypercalcemia

Hydration: NS bolus 20 ml/kg IV, then D5NS + at least 20 KCl at 2x maintenance

Lasix 1 mg/kg IV q6 hours (watch K levels) – with caution, ensure adequate hydration

Bisphosphonate (pamidronate 1 mg/kg IV q4 hours) or calcitonin 4-8 IU/kg SQ q12 hours

For hypervitaminosis D: Prednisone 1-2 mg/kg/day (inhibits vit D dependent calcium absorption)

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Thyroid Storm

Support intravascular volume

B-blocker (unless CHF present): propranolol 2 mg/kg/day po div q6 hours or 0.1 mg/kg IV q10-20 min; contraindicated in asthma

Methimazole 0.5-1 mg/kg/dose q8 hours (blocks thyroid hormone synthesis)

Iodine: Lugols solution or SSKI 3-5 drops q8 hours, start 1 hour after methimazole (blocks thyroid hormone release)

Methyprednisolone 1 mg/kg IV q12 hours
anti-inflammatory effect, inhibits peripheral T4 → T3 conversion

Treat fever: acetaminophen, cooling blankets

Tanner Stages

	Female	Male	Pubic Hair
1	Pre-pubertal. No breast tissue	Pre-pubertal	Pre-pubertal
2	Areolar enlargement, breast bud	Testes enlarge (4ml); scrotum larger, skin reddened and coarser	Sparse, downy hair
3	Enlargement of breast and areola as single mound	Penis elongates, continued growth of testes and scrotum	Sparse, coarse hair
4	Projection of areola above breast as double mound	Growth of testes, penis length & breadth. Scrotum has increased pigmentation	Adult type hair, not on thighs
5	Adult. Areola is a part of breast contour, only nipple projects	Testes, scrotum, penis adult size	Adult type hair, spread to medial thighs