

Adrenal Insufficiency	
PowerPlan/Ordersets	MICU adrenal stim testing, Endo AMB adrenal disorders
Definition	<p>Impaired secretion of the adrenal glucocorticoid and/or mineralocorticoid hormones either by adrenal destruction, dysgenesis, impaired steroidogenesis, or deficient stimulation.</p> <ul style="list-style-type: none"> • Primary: failure to produce adrenal cortical hormones including cortisol and aldosterone. <ul style="list-style-type: none"> ■ Cortisol deficiency leads to hypotension and hypoglycemia. ■ Aldosterone deficiency leads to hypotension, hyponatremia, hyperkalemia. • Secondary: Pituitary dysfunction leads to impaired release of ACTH and subsequent cortisol deficiency, particularly in situations of physiologic stress • Tertiary: Hypothalamic dysfunction leads to impaired release of corticotropin releasing hormone (CRH) and subsequent decreased ACTH production
Presentation	N/V, abd pain, salt craving, fatigue, dizziness, syncope, orthostatic hypotension; in infants: poor feeding, lethargy
Diagnostic Studies	<p>Chemistry: ↓ Na, ↑ K, ↓ Glu, metabolic alkalosis, ketonemia, or ketonuria, Antibodies against 21-hydroxylase for autoimmune AI,</p> <p>↑ ACTH >100pg/mL w/ ↓ cortisol < 10 µg/dL</p> <p>Early morning (4-8am) cortisol: < 3 µg/dL suggestive. > 18 µg/dL rules out</p> <p>Cosyntropin stimulation test: (can be performed at any time)</p>
Acute Treatment	<ul style="list-style-type: none"> • Hydrocortisone 50 mg/m²/dose (max 100 mg/m²) IV x1 then 25 mg/m²/dose IV Q6hr, Normal saline bolus then 1.5 to 2 x maintenance of dextrose containing isotonic fluids <ul style="list-style-type: none"> ■ In addition to glucocorticoid effect, hydrocortisone also has some mineralocorticoid effect, so aldosterone replacement (fludrocortisone) is not required while a patient is on stress dose hydrocortisone (but this is not true of prednisolone, prednisone, or dexamethasone, which have no mineralocorticoid activity) • Stress dose steroids: Hydrocortisone 50 – 100 mg/m²/day divided q6 hours (IV, PO or IM) <ul style="list-style-type: none"> ■ Give for fever > 101F, surgery or anesthesia, vomiting/dehydration, fracture ■ Give in times of stress, until adrenal recovery has been confirmed
Maintenance Therapy	Cortisol 6-20 mg/m ² /day divided 2-3 times per day depending on etiology; For primary AI, fludrocortisone acetate 0.05-0.2 mg PO qday, Salt supplementation may be required in infants

Diabetic Ketoacidosis	
PowerPlan/Ordersets	DKA ICP order set, MICU DKA order set, NODM CPG order set, Also see DKA card - note: 2-bag method card PENDING
Definition	Plasma glucose > 200 mg/dL AND acidemia (venous pH < 7.3, arterial pH < 7.35, or venous HCO ₃ < 15 mmol/L) AND moderate or large ketonuria or ketonemia (the presence of ketones in the blood)***
Pathophysiology	Hyperglycemia → ↑ plasma osmolality → osmotic diuresis ; ↓ Insulin → impaired K entry into cells ; Decr phosphate intake; ↓ Insulin + met acidosis → phosphate shift out of cells; ↓ Na, ↓ K, ↓ Phos
Presentation	Hyperglycemia, vomiting, abd pain, dehydration, AMS Hx: Wt loss, polyuria, polydipsia
Diagnostic Studies	<p>D stick, VBG, CBC, Chem 10, serum osmolality and beta-hydroxybutyric acid, HgbA1C, UA, EKG. Consider pancreatic autoantibodies if new onset, if not clearly type 1 diabetes.</p> <ul style="list-style-type: none"> ■ Consider ABG in very ill patient ■ Check D sticks q1 and VBG, Chem 10 and beta-hydroxybutyric acid q2h until anion gap closes ■ Check UA q void

Diabetic Ketoacidosis continued on next page →

Diabetic Ketoacidosis

Treatment

IV fluids (+/- dextrose), Insulin

NS Bolus: Initially give **10-20 mL/kg NS bolus**; may repeat if persistent hypotension

- **Fluid Selection:** Fluids at **1.5-2x maintenance** if **corrected serum Na < 135 mEq/L**; slow rate if signs of cerebral edema
- Use **2-Bag Method Calculator** (in reference text of DKA PowerPlans): Bag 1 NS plus electrolytes
Bag 2: D12.5 0.45% NS plus electrolytes, hung together w/ insulin on a trifuse. Rates of each fluid are titrated to the **goal dextrose concentration**:

Goal Dextrose Concentration	
Blood Glucose (mg/dL)	Goal Dextrose
>300	0%
276-300	5%
251-275	7.5%
201-250	10%
≤ 200	12.5%

❖ Target Blood Glucose: 150 – 250 mg/dL

❖ Do not lower the insulin dose unless BG is still ≤ 200 mg/dL while on D12.5% at 2x maintenance. Discuss with endocrine.

Table 1

Plasma K (mEq/L)	IV fluid K [] (mEq/L)
<3	40-60
3-4.5	30-40
4.6-5	20
>5	0

- Na (corrected Na should remain normal or move towards normal. If decreases by > 1mEq/hr, evaluate for evolving cerebral edema)
- **Add K based on Table 1:** Use K acetate and K phosphate, NOT KCl because of risk of hyperchloremia and non-gap metabolic acidosis. Max K that can be given is 80 mEq/L.
- **Phosphate Content:** max phosphate is 20 mEq/L Kphos at 2x maintenance to avoid causing hypocalcemia
- DO NOT give HCO₃ as increases the risk of cerebral edema

Insulin: DO NOT give bolus of insulin (see how to order insulin below)

- After initial fluid bolus and repeat glucose measurement, start infusion of regular insulin 0.05-0.1 units/kg/hr (50 units regular insulin in 50 ml NS)
- Continue insulin infusion until anion gap is closed and patient is ready to eat
- Transitioning from IV to subQ: Make sure patient has **meal in front of them before turning off drip**, give Humalog (see table below for amount), turn off insulin infusion and IV fluids 30 minutes later and have patient eat

Diabetic Ketoacidosis

Subcutaneous Insulin Regimen

Subcutaneous Insulin Regimen:

Total Daily Dose (TDD) (unit/kg/day):

	No DKA	DKA
Age < 6y or A1c < 7%	0.15 - 0.25	0.5 - 0.75
Prepubertal	0.25 - 0.5	0.75 - 1
Pubertal	0.5 - 0.75	1 - 1.2
Postpubertal	0.25 - 0.5	0.75 - 1

A. Basal - bolus regimen (recommended initial regimen):

- ~50% of TDD as long acting insulin (Lantus) once daily
- ~50% of TDD as rapid acting insulin (Humalog) divided in meals

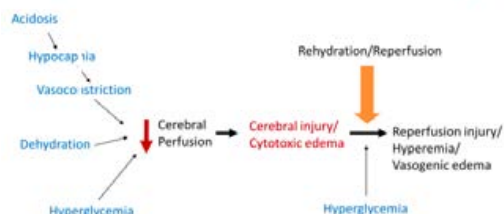
B. Split - mixed insulin regimen:

- 2/3 TDD QAM (1/3 Humalog + 2/3 NPH)
- 1/3 TDD QPM (1/3 Humalog Qdinner & 2/3 NPH bedtime)

Sliding Scale:

Humalog	BG 250 - 400	BG > 400
None - Small Ketones	5-10% TDD	10-15% TDD
Mod - Large Ketones	10-15% TDD	15-20% TDD

Hypothetical Model of DKA-related Cerebral Injury



Cerebral Edema: Peak incidence is 8-12 hours after initiation of therapy, but can occur as late as 24 hours

- Treat Empirically: reduce IV fluid infusion rate, raise HOB by 30 degrees, give mannitol 1 g/kg IV over 20 mins, repeat as necessary, consider 3% saline, 2-3 ml/kg IV, repeat as necessary, transfer to ICU, consider intubation, consider STAT head CT once airway is stabilized

Important Formulas

- Corrected Na: $\text{serum Na} + (1.6 \times [\text{plasma glucose} - 100] / 100)$
- Anion Gap: $\text{serum Na} - (\text{Cl} + \text{HCO}_3)$ **Note: use serum Na, NOT corrected Na
- Effective Osmolarity: $2[\text{measured Na} + \text{glucose}/18]$

How to order subcutaneous insulin at BCH

1. Either type insulin into search tab (or get to this via the NODM admit plan)
2. If not going through NODM, click "insulin .SC injection regimen orderset"
 - a. You will first be required to select frequency of POCT checks, parameters for RN to notify MD about glucose levels. Now for the insulin...
3. You will most likely order scheduled glargine (Lantus). You will then most likely order lispro (Humalog) for the correction factors and carbohydrate ratios. **These are nested ordersets and can be confusing**
 - a. Scroll down to correction factor and select box "insulin lispro 100 unit/mL correction factor Orderset". Then scroll down to insulin: carbohydrate ratio and select box "insulin lispro 100 unit/mL carbohydrate ratio orderset"
 - b. ***make sure to click both before clicking "OK" in bottom right***
4. You will then be directed to the nested orderset where you can type in the times of day and doses that you want to give the correction factor and carb ratio
 - a. For correction factor you will have to decide if same CF for all times of day versus different times (ex, different for daytime meals vs at night). Click OK and then you will be prompted to carb ratio orderset
 - b. Again you will have to decide if same CR for all times of day versus different times