

SICK DAYS, STRESS DAYS AND HOSPITAL STAYS

Jamie R. Wood, MD
Associate Professor of Pediatrics
Case Western Reserve University
Medical Director, Diabetes Program
Rainbow Babies & Children's Hospital
University Hospitals of Cleveland



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OUTLINE

- Sick Days
 - Goals of management
 - What happens when we are sick
 - Sick Day Rules
 - Hypoglycemia management
- Stress Days
 - Outpatient surgery
- Hospital Stays
- Cases

GOALS OF SICK-DAY MANAGEMENT

- Prevent ketosis(ketone formation)
- Prevent diabetic ketoacidosis (DKA)
- Prevent hypoglycemia (low blood glucose)
- Prevent dehydration
- Prevent ED visits
- Prevent hospitalizations



EXAMPLES OF SICK-DAYS

- ◉ Gastroenteritis (vomiting/diarrhea)
- ◉ Febrile illness
- ◉ Upper-respiratory infection
- ◉ Asthma exacerbation
- ◉ Emotional distress
- ◉ Trauma, surgery
- ◉ Pump failure



SICK-DAY MANAGEMENT AND DKA

- 90% of individuals who are admitted to hospital for DKA have established diabetes
- ~50% of hospital admissions for DKA could have been prevented with improved outpatient sick-day management
- Need initial education at diagnosis and on-going self-management education
 - Illness is rare and often long time lag between initial education and first illness
 - Families need to practice sick-day management
 - Guidelines are often counterintuitive

WHAT HAPPENS WHEN WE ARE SICK?

○ Enhanced release of stress hormones:

- Epinephrine (adrenaline)
- Norepinephrine
- Glucagon
- Cortisol
- Growth hormone



○ Stress (counter-regulatory) hormones:

- Increase glucose production by liver
- Induce a state of insulin resistance
- Decrease glucose use by body
- Stimulate formation of ketones

Counter-regulatory Hormones

Peripheral Tissues

Insulin Resistance

Lipolysis (adipose)

Liver

Glucose Production

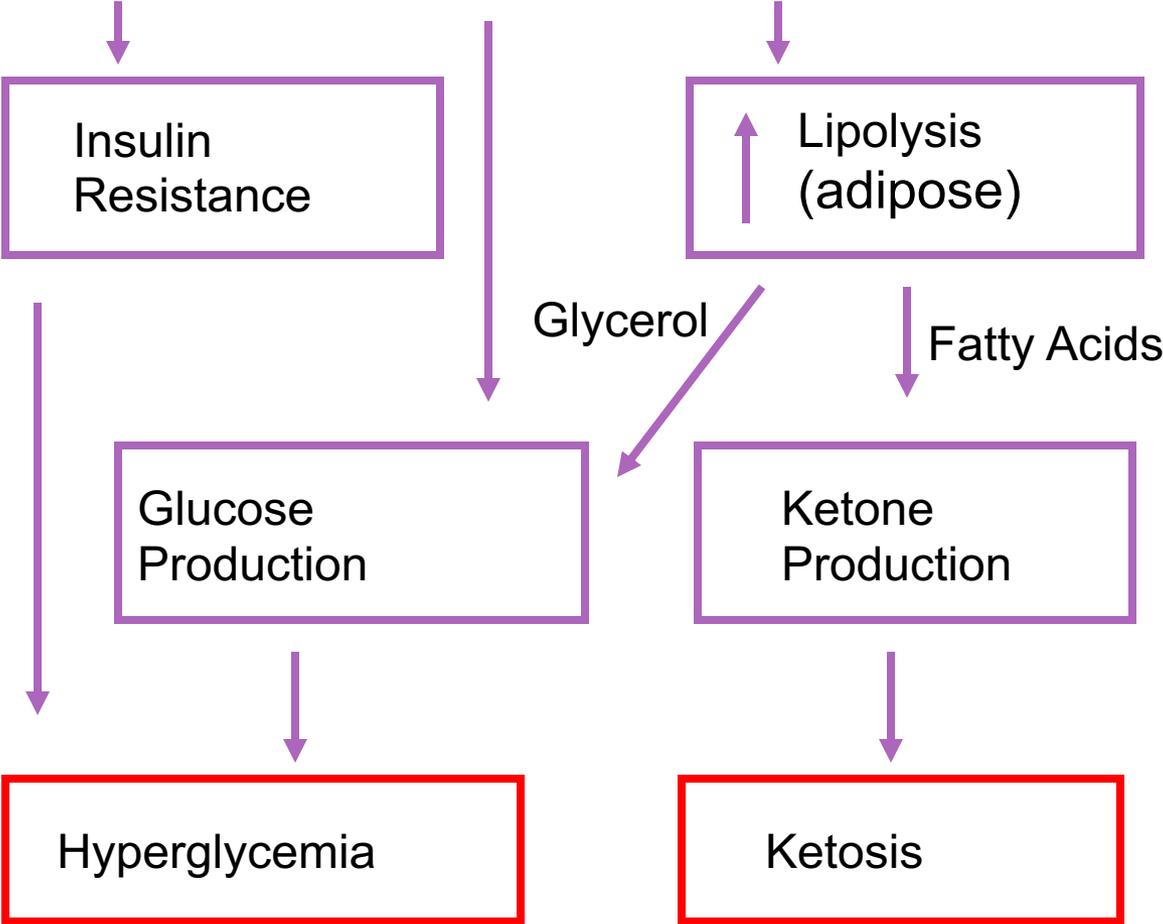
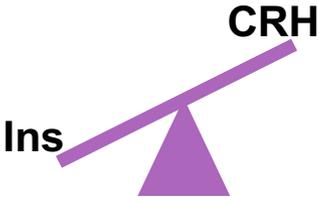
Ketone Production

Hyperglycemia

Ketosis

Glycerol

Fatty Acids



KETONES AND DIABETES

- Body makes ketones when it cannot use carbohydrate for energy and has to use fat instead
 - Starvation (in people with and without DM)
 - Insulin omission – can't move glucose into cells without insulin – body has to use fat for energy instead
 - Relative insulin deficiency in face of stress/illness



β-Hydroxybutyrate Reading	Interpretation
1.6 to 3.0 mmol/L	Readings above 1.5 indicate you may be at risk of developing diabetic ketoacidosis or DKA. Contact your healthcare provider immediately for advice
0.6 to 1.5 mmol/L	Readings between 0.6 and 1.5 may indicate the development of a problem that may require medical assistance. Follow your healthcare provider's instructions.
Below 0.6 mmol/L	Readings below 0.6 are in the normal range.

URINE VS. BLOOD KETONES

○ Urine

- Cheaper
- More readily available
- Measure acetoacetate
- Take longer to turn positive and longer to return to normal (compared to blood)
- More likely to develop late hypoglycemia when corrections are given for persistent ketones that haven't cleared yet

○ Blood

- More expensive
- Not always covered by insurance
- Measure beta hydroxybutyrate
- Rise and fall more quickly
- Use has decreased ED visits and hospitalizations when compared to urine ketones



BLOOD KETONES

○ Precision Xtra Blood Ketone Meter

β -Hydroxybutyrate Reading	Interpretation
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0.6 to 1.5 mmol/L	Readings between 0.6 and 1.5 may indicate the development of a problem that may require medical assistance. Follow your healthcare provider's instructions.
Below 0.6 mmol/L	Readings below 0.6 are in the normal range.

LARGE

1 - 1.5=Moderate
0.6-1=Small



SICK DAY CUPBOARD

- Carb containing beverages and bland food
 - Sprite, ginger ale, 7-up, Gatorade, jello, sherbert, pudding, clear broth soup, popsicles, crackers
 - Ketone strips
 - Thermometer
 - Ibuprofen/Tylenol
 - Anti - nausea (Zofran) - call doctor before giving
 - Anti - diarrheal - call doctor before giving

SICK-DAY RULES (1)

○ NEVER OMIT INSULIN

- Most individuals need MORE insulin on sick-days because of relative insulin deficiency caused by increased counter-regulatory hormones
- BG level and presence of ketones help to determine booster insulin dosage
 - Negative or trace ketones - give normal correction
 - Small ketones - increase correction by 25%
 - Moderate or large ketones - increase correction by 50%



SICK-DAY RULES (2)

- Preventing Dehydration and Hypoglycemia
 - Encourage fluid intake
 - Frequent, small amounts
 - 1 tablespoon every 5 minutes
 - 1 ounce every 15 minutes
 - 4 ounces every hour
 - If glucose > 150 mg/dL - sugar free fluids
 - Water
 - Diet soda, diet Snapple, popsicles, power aid zero
 - Crystal light
 - If glucose < 150 mg/dL - sugar containing fluids
 - Gatorade, PowerAde, Regular soda, Pedialyte, Popsicles, Jello

SICK-DAY RULES (3)

◉ Monitor frequently

- Check BG at least every 2 hours (or CGM)
- Check urine ketones with each void
 - Or
- Check blood ketones every 2-4 hours
- Keep track of frequency of urination
- Keep records - sick-day log book



SICK-DAY RULES (4)

- Provide Supplemental Booster Dose of Rapid-Acting Insulin
 - Dose determined by BG and ketone level
 - Can be repeated every 2-3 hours
 - If ketones negative or trace → give normal correction
 - If ketones small → give 25% more
 - If ketones moderate or large → give 50% more
 - Temporary basal increase (↑ by 15-20%) can be helpful if BG persistently high
 - If ketones are developing and on pump, give correction via syringe until you are sure that insulin pump is working

The Humalog logo is written in a purple, cursive script.The NovoLog logo features the word "Novo" in black, a stylized orange and yellow swoosh above the letter "o", and "Log" in black with a registered trademark symbol.The Apidra logo consists of four horizontal blue and purple lines above the word "APIDRA" in a bold, blue, sans-serif font with a registered trademark symbol.

SICK-DAY RULES (5)

○ Treat Underlying Triggers

- Infection - antibiotics
- Antipyretics (fever reducer)
- Analgesics (pain reliever)
- Anti-emetics (anti-nausea)
- Breathing treatments
 - consider giving extra rapid-acting insulin with albuterol or xopenex treatments (0.5 to 1 unit)
- Call primary care doctor



SICK-DAY RULES (6)

- ◉ Vomiting is presumed to be due to diabetes until proven otherwise
- ◉ Vomiting is often related to ketoacidosis



WHEN TO CALL FOR HELP

- Vomiting more than 2-4 hours in duration
- Moderate or large ketones
- BG > 300 mg/dL or positive ketones for more than 12 hours
- Signs of dehydration:
 - Dry mouth or skin
 - Cracked lips
 - Sunken eyes
 - Weight loss
- Signs of DKA
 - Nausea, abdominal pain, vomiting
 - Chest pain, difficulty breathing
 - Ketotic (fruity) breath
 - Altered consciousness, lethargy

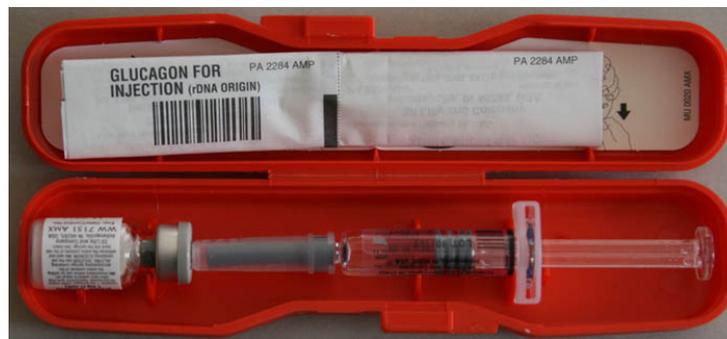


HYPOGLYCEMIA AND SICK-DAY

- If hypoglycemia develops, insulin doses may need to be decreased but insulin still needs to be given
 - Rapid acting insulin more likely to be reduced than basal
 - Temporary basal decrease on insulin pump very useful (decrease by 10-25%)
 - If BG < 100-150 mg/dL give small sips of sugar containing beverages and correct every 2-3 hours if glucose > 200 mg/dL
 - Helpful in preventing starvation ketones
 - Helpful if unsure will keep down liquids

LOW DOSE (MINI DOSE) GLUCAGON

- Helpful when child unable or unwilling to take oral carbs to treat hypoglycemia because of fatigue, nausea, vomiting
- 1 unit on insulin syringe per year of age up to a maximum of 15 units
- Glucagon is mixed up and then drawn and administered with insulin syringe
- Glucagon when mixed with diluent is good for 24 hours
- Can be repeated



STRESS DAYS

- Outpatient surgery - wisdom teeth removal



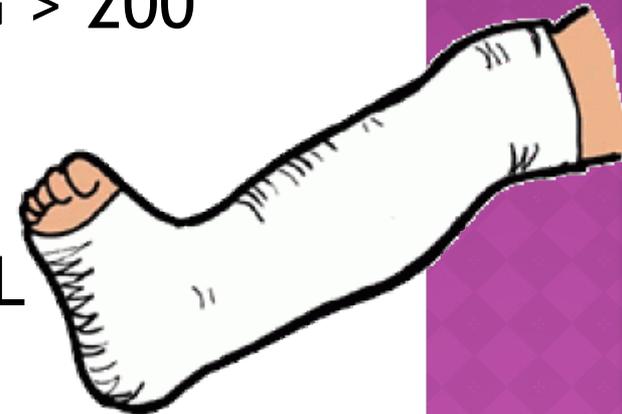
OUTPATIENT SURGERY

- ◉ Request that surgeon asks for perioperative recommendations from your diabetes team
- ◉ Request that your child is scheduled first case of the morning
- ◉ Request clear NPO (nothing by mouth) instructions in regards to time and type of fluid
 - e.g. clear liquids allowed up to 3 hours before procedure
- ◉ Call diabetes team or schedule office visit to review plan well in advance



OUTPATIENT SURGERY

- Determine if basal insulin (Lantus/Levemir) or insulin pump basal rate needs to be reduced night prior to procedure
 - Consider reducing if tending to go low overnight or wake up low in morning to avoid having to treat lows when unable to eat or drink (NPO)
- Check BG overnight and upon awakening
- Give correction dose of insulin if BG > 200 mg/dL
- Repeat BG every 2 hrs when NPO
- Repeat correction if BG > 200 mg/dL



i got plastic surgery done

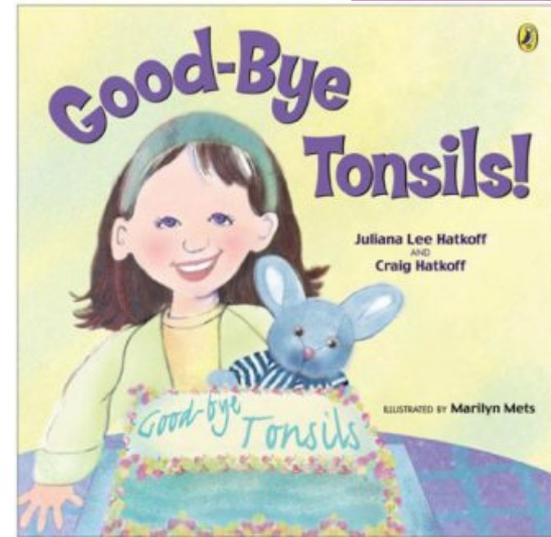


OUTPATIENT SURGERY

- ◉ While under anesthesia BG should be checked every 1-2 hours to detect hypoglycemia/hyperglycemia
- ◉ Anesthesia and procedure will elicit a stress response and will result in high BGs more commonly than low BGs
- ◉ If on insulin pump and BGs running low or high, can use temporary basal decrease or increase
- ◉ If on continuous glucose monitor, anesthesiologist may be willing to use it

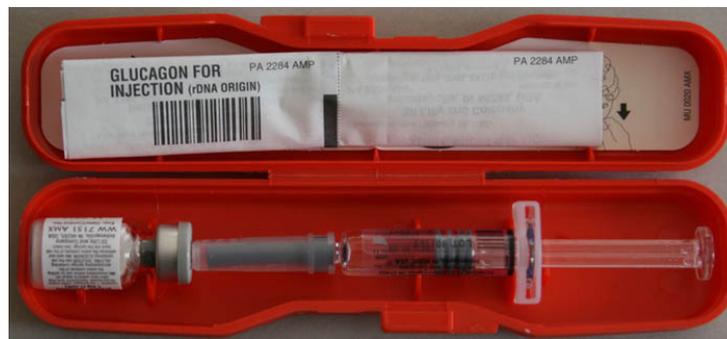
OUTPATIENT SURGERY

- Once procedure is over, patient needs to be able to demonstrate that they can drink and keep down fluids prior to discharge home
- Put together sick day cupboard with bland, carb containing food:
 - Sprite, ginger ale, 7-up, Gatorade, jello, sherbert, pudding, clear broth soup (chicken broth), popsicles
- Aggressively control pain
- Check BG every 2 hours
- Check ketones periodically
- Make sure you have glucagon handy



LOW DOSE (MINI DOSE) GLUCAGON

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HOSPITAL STAYS



- ◉ Can be related or unrelated to diabetes
- ◉ If possible, have child admitted to hospital where your diabetes team works
- ◉ If not possible, have admitting doctors call and consult with your diabetes team
- ◉ It is OK to ask for a transfer
- ◉ YOU are the expert, if something doesn't seem right, ask and advocate for your child
- ◉ Many hospital (nurses and doctors) will be unfamiliar with insulin pumps and sensors

HOSPITAL STAYS

- ◉ If unable/not allowed to eat/drink - remember that basal insulin still needs to be continued
- ◉ Frequent monitoring of BG every 2-4 hours with corrections as necessary
- ◉ If on pump, many hospitals will ask parents to manage pumps in close collaboration with staff
 - Tell nurse about every bolus, temp basal, change of setting so that it can be documented
- ◉ Request to use own lancet device - less painful
- ◉ Will not be able to use home BG meter
- ◉ If on sensor, many hospitals will allow you to continue using it but will require finger stick BGs on hospital BG meter as well

HOSPITAL STAYS

- ◉ Carb counts done by hospital kitchen/cafeteria may not be accurate
- ◉ Will need to bring your own pump/sensor supplies
- ◉ Most hospitals do not allow insulin pens
- ◉ Most hospitals only have one rapid acting insulin on formulary (can bring home supply)
- ◉ Take the opportunity to teach, educate, and raise awareness of type 1 diabetes

CASE #1

- Olivia is a 3 year old with T1DM for 1 year on injections with Lantus/Humalog. Olivia has had fever for 24 hours up to 102, woke up in morning vomiting (x2), and has had one episode of diarrhea.



CASE #1 CONTINUED

- She is pale and quiet, but alert. Breathing normal. Mucous membranes are moist, skin and eyes okay. Has voided twice in 6 hours. BG 305 mg/dL, urine ketones large.
 - What should Olivia's parent(s) do?

AUDIENCE POLL

Which one of the following should her parents NOT do?

- A. Check BG and ketones
- B. Determine insulin dose based on BG and ketone level
- C. Check BG and give insulin according to home scale
- D. Give fever reducer
- E. Offer sips of sugar free fluids

CASE #1 CONTINUED

- Small, frequent amount of sugar free fluids
- Give correction every 2-3 hours, increase by 50% for large ketones
- Check ketones with each void or blood ketones every 2-3 hours
- Call for help if unable to keep down fluids, becomes lethargic or dehydrated, ketones don't clear
- Fever control

CASE #1 CONTINUED

- Three hours later...
 - BG 105 mg/dL, ketones still large
 - No more vomiting
 - Diarrhea becoming more frequent
 - Doesn't want to eat
- What should they do now?

AUDIENCE POLL

What should they do now?

- A. Give more insulin for the large ketones
- B. Switch to carbohydrate containing fluids
- C. Continue carb free fluids
- D. Glucose is in range, so stop checking

CASE #1 CONTINUED

- ◉ Reassure that ketones will take a while to clear, continue to check each void
- ◉ Switch to sips of sugar containing liquids, avoid fruit juices (make diarrhea worse)
- ◉ Check BG every 1-2 hours
- ◉ Assess hydration status, frequency of urination
- ◉ Combination of giving more carbs with insulin will help clear ketones

CASE #1 CONTINUED

- The next morning Olivia is no longer vomiting but is still having diarrhea. BGs have been starting to trend down and she is still unwilling to eat. Ketones small. Was taking fluids okay, but now refusing to drink juice to treat a low of 58 mg/dL.
- What do you recommend?

CASE #1 CONTINUED

- Low dose (mini dose) glucagon
 - 3 units on an insulin syringe
 - 1 unit for every year of life
 - Can repeat using same kit for 24 hours
 - If persistent lows, may consider decreasing Lantus dose that evening or not giving all of insulin for carb coverage

CASE #2

- Jackson is a 16 year old wrestler with type 1 diabetes on a pump with most recent A1c of 8.3%. Had wrestling tournament, BG a little high at bedtime but didn't correct because goes low after tournaments. Woke up with nausea, vomiting, high BG and large ketones.

TRUE OR FALSE (AUDIENCE POLL)

It is ok to give correction dose plus booster dose through insulin pump.

- A. TRUE
- B. FALSE

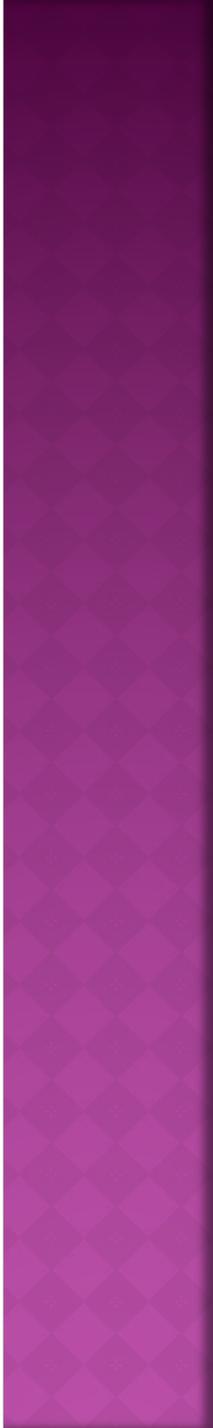
CASE #2 CONTINUED

- ⦿ Check BG - 456 mg/dL
- ⦿ Check ketones - LARGE
- ⦿ Give 50% more correction via SYRINGE
- ⦿ Change infusion set and insulin in reservoir
- ⦿ Increase basal by 25% for four hours
- ⦿ Encourage fluids
- ⦿ Check BG q 2 hours and ketones q void

SUMMARY OF SICKDAY RULES:

1. NEVER OMIT INSULIN
2. PREVENT DEHYDRATION
3. FREQUENT MONITORING OF BG and KETONES
4. BOOSTER INSULIN DOSES
5. TREAT UNDERLYING TRIGGERS
6. VOMITING IS DKA UNTIL PROVEN OTHERWISE
7. CALL FOR HELP AND GUIDANCE

THANK YOU!!!



QUESTIONS??
DISCUSSION