HYPOGLYCEMIA: TYPES, CAUSES, AND AWARENESS

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3/3/2018

WHAT IS HYPOGLYCEMIA REALLY AND WHY DO WE CARE?

- Abnormally low glucose. But, what’s normal?
- 2004 Chinese study used subcutaneous continuous glucose monitoring system (CGMS) to measure glucose levels in 43 people with normal glucose tolerance and no h/o symptoms c/w hypoglycemia:
  - Avg lowest daily BS = 70 mg/dL
  - 21% of individuals had excursions to <50
  - 0.5% of all recorded values were <50
WHY DO WE CARE?

In people without diabetes: Almost NEVER an emergency. The metabolically normal body/brain is good at keeping glucose from going dangerously low (EXCEPTION = insulinoma)

BUT! Different in diabetes:
- Potential for blood sugars to drop VERY low
- Risk of seizure, heart arrhythmia, coma, death
- Need to leave time to respond/treat, so we target avoiding lows that would be normal in people without diabetes

WHY DO WE REALLY CARE?

CAUSES OF HYPOGLYCEMIA IN DIABETES

Bottom-line: Too much insulin OR certain oral diabetes meds for the situation:
- Eating less
- Exercising more
- Insulin needs have changed over time

Definite risk of hypoglycemia:
- **INSULIN**
- Sulfonylureas (glipizide, glyburide, glimeperide)
- Meglitinides (glinides)
- Pramlintide

Little or no hypoglycemia risk:
- Metformin
- SGLT2 inhibitors (flozins)
- DPP4 inhibitors (gliptins)
- GLP1 agonists (tides)
- Thiazolidenediones (glitazones)

MEDICATIONS
OTHER CAUSES/CONTRIBUTORS

Exercise
- Intense: can first cause high blood sugars, then lows for up to 24 hours after exercise
- Moderate: lows during and after exercise

Other causes
- Illness
- Weight loss
- Other medications
- Adrenal insufficiency
- Liver problems

CATEGORIES OF HYPOGLYCEMIA

Severe hypoglycemia = <40, 45, 54, 55 depending on where you look

What about symptoms?

SYMPTOMS OF HYPOGLYCEMIA

BUT: hypoglycemia unawareness!

CASE:
- 74 yo man with type 1 diabetes in clinic for follow up
- Recently had surgery to remove several feet of damaged intestines
- Lost 20 pounds during the admission, but he was sent home on the same doses of insulin as before
- In clinic he seemed completely fine, but did admit that he was having “some low blood sugars” without any symptoms
- Blood drawn that morning showed a glucose of 33
- On the way home he ran into a lightpole in a parking lot. At the time of the accident he was about 1 mile off the route to his home. He could not remember why he was in that area at all. He had had no symptoms to alert him that his blood sugar was low.
HYPOGLYCEMIA UNAWARENESS:

- Development of symptoms at lower blood sugars or not at all
- Failure to develop symptoms of hypoglycemia in time to take action to prevent severe hypoglycemia
- Happens when low blood sugars happen more than a few times a week and the body adjusts
- Common in diabetes (about 25% of people with diabetes have some degree of it), but it is preventable and usually reversible if low sugars are avoided

HYPOGLYCEMIA: TYPES, CAUSES, AND AWARENESS

- Risk Factors
- Prevention
- Detection
- Treatment
WHAT'S MY A1C??

HYPOGLYCEMIC RISK FACTORS

PATIENT CHARACTERISTICS
- Older age
- Female gender
- African American ethnicity
- Longer duration of diabetes
- Neuropathy
- Kidney impairment
- Previous hypoglycemia
- Tight Control

BEHAVIORAL
- Using “old” insulin regimens
- Missed meals
- Taking insulin after the meal
- Overcorrecting a high blood sugar in between meals
- Exercise

PREVENTION

Advances in the Care of Persons With Diabetes
- Development of insulin analogues
- Insulin pump therapy
- Home Glucose Monitoring
- Use of Continuous Glucose Monitoring

“OLD” INSULIN REPLACEMENT STRATEGY

INSULIN EFFECT

MEALS
PHYSIOLOGIC INSULIN REPLACEMENT

INSULIN EFFECT

Morning
Afternoon
Evening
Night

Lispro/Aspart/Glulisine
Lispro/Aspart/Glulisine
Lispro/Aspart/Glulisine
Glargine/Detemir
(Lantus/Levemir)

MEALS

Morning
Afternoon
Evening
Night

Lispro/Aspart/Glulisine
Lispro/Aspart/Glulisine
Glargine/Detemir
(Lantus/Levemir)

NEWEST LONG ACTING INSULINS

LANTUS
TOUJEO
TRESIBA

INSULIN EFFECT

www.EPICconferences.org

NEAREST LONG ACTING INSULINS

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INSULIN PUMPS

OmniPod
Medtronic
T-Slim
VGo

BASAL INSULIN NEEDS VARY THROUGHOUT THE DAY

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Lantus and Levemir are registered trademarks of Sanofi-aventis Pharmaceuticals, Inc.
The insulin pump delivers basal and bolus insulin precisely and can be easily customized to meet individual requirements.

- **Bolus insulin delivery**
- **Basal insulin delivery**
- **Dual Wave**
- **Bolus for brunch**
- **Basal reduced to help prevent nocturnal hypoglycemia**
- **Temporary basal during walking to help prevent hypoglycemia**
- **Basal programmed to help prevent dawn phenomenon**

**Schematic representation only.**

Dual Wave is a registered trademark of Medtronic MiniMed, Inc.

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**Home Continuous Glucose Monitoring Devices**

- **Libre**
- **Medtronic**
- **Dexcom**

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**CGM Reveals Insights Beyond Finger Stick Testing**

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**Pump Therapy with “Low Glucose Suspend” or “Suspend Before Low” Features**

- **LGS Start (2 minutes):** Insulin infusion stops; alarm sounds
- **LGS End (2 hours):** Insulin infusion resumes
- **Emergency Alarm (2 minutes):** If user does not respond, siren turns on and pump displays emergency message
- **Re-suspend (6 hours):** If cycle is not interrupted and sensor glucose is still below the preset threshold value
- **LGS Threshold Setting**

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Reduced Glycemic Variability
Modal Day Sensor Glucose Tracings

Hybrid closed loop resulted in:
- Increased time in range
- Reduced time spent low and high
- Reduced variability
- Less post-prandial excursion

Median and Interquartile Range of SG Values / Day & Night

All Patients
Adolescents
Adults

HYPOGLYCEMIA TREATMENT
- 15/15 Rule depending on degree of Hypoglycemia (most adults 11-2 gms; most kids 6-10 grams)
- Always carry Rapid Acting Glucose
- Glucagon