

Caring for the Diabetic Athlete

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 Neither I, Ian McKeag, nor any family member(s), have any relevant financial relationships to be discussed, directly or indirectly, referred to or illustrated with or without recognition within the presentation.



- Gain a deeper understanding of the pathophysiology of diabetes mellitus
- Understand the impact of exercise on those with diabetes mellitus
- Better understand the risks of diabetes in athletes, and to identify the warning signs
- Acquire a foundation of knowledge to better care for the diabetic athlete, to prevent adverse events, and keep them active

Before We Dive In

The ATC can be the most influential figure in a young athlete's life

• Likely 2nd only to the player's Coach

Players, Coaches, and Parents will be coming to you with a LOT of questions

Good Data vs Hypothesis vs "Google"

Know your limits

- Depends on the State
- Depends on the urgency



Before We Dive In

Understand what you're involved in

- Rx Meds vs OTC
- Storage requirements for the meds your players are taking
 - Even if you can't legally give these medications

Make a list with all meds/players

- "Diabetic Care Plan"
 - More on this later

Ask players about their health; their compliance; their control; etc.

If you care then they should too

• To these players: You represent the "healthcare side of athletics" more



Introduction to Diabetes Mellitus

*DM1 = Type 1 Diabetes Mellitus **DM2 = Type 2 Diabetes Mellitus

The Numbers

Prevalence

- Estimations from 6.8-15.3%
- >90% are DM2
- DM2 use to be "adult on-set" but that can no longer be used due to increasing pediatric DM2

Estimated age-adjusted prevalence of diagnosed diabetes by race/ethnicity and sex among adults aged ≥18 years, United States, 2013–2015

Men

Women

Al/AN - American Indian/Alaska Native.

AI/AN

0

Note: Error bars represent upper and lower bounds of the 95% confidence interval.

Aslan

Data source: 2013–2015 National Health Interview Survey, except American Indian/Alaska Native data, which are from the 2015 Indian Health Service National Data Warehouse.

Black, non-Hispanic

Race/Ethnicity

Hispanic

White, non-Hispanic

Types of Diabetes

Type 1 Diabetes Mellitus (DM1)

- 5-10% of adult cases
- Autoimmune destruction of beta cells (pancreas)
- Younger patients = more rapid loss of beta cell function
 - More likely to initially present with severe Sxs



Figure: Not too dramatic until you realize that this is only showing a 14yr range

Types of Diabetes

Type 2 Diabetes Mellitus (DM2)

- >90% of adult cases
- Cause: Insulin Resistance and/or Deficiency



Prediabetes

 Refers to initial presence of insulin resistance without fully meeting the diagnostic criteria for DM2

Types of Diabetes

Latent Autoimmune Diabetes in Adults (LADA): "Type 1.5 Diabetes"

- Will eventually progress to DM1
- Initial Sxs are similar to DM2
- Age: Usually >30 yrs

Other Types

 There are dozens of other causes of diabetes mellitus, but these are exceedingly rare



Basic Treatment for Diabetes

Type 1 Diabetes

- Injectable Insulin
 - Syringe
 - Continuous Pump
- Diet Coordination
- Exercise



Type 2 Diabetes

- Lifestyle Modification
 - Diet
 - Exercise
 - Weight Loss
- Medications
 - Metformin (initial)
 - Other
 - Oral and/or injectable



Diabetes & Exercise

Diabetes: Role of Exercise

- Use/mobilization of "fuel" (glucose and other molecules)
- Greater reliance on carbohydrates as intensity increases

Aerobic exercise

• Improves BG and insulin sensitivity (short term: 24-72hrs)

Resistance Training

- Mild long-term impact found
- Short-term improvement in fasting BG

• Aerobic/Resistance Training Combo

 BG Control: Some evidence that this could be more effective than aerobic exercise alone both acutely and chronically

Diabetes: Role of Exercise

DM2 Specific

- Glucose uptake in skeletal muscle (via insulin) typically occurs at rest and is impaired for those with DM2
- Exercise stimulates glucose uptake in muscle via separate, secondary pathway



Tricky Things to Consider

- Exercise Induced Hypoglycemia
 - A risk for those taking insulin or insulin secretion stimulating meds
- Post Exercise Hyperglycemia
 - Normal response to intense aerobic exercise
 - Exercise stimulates glucose production

Management of the Diabetic Athlete

Type 1 Diabetic Athlete

Require Insulin

Always

Dietary management is very important

- Avoiding extremes of hyper/hypoglycemia
- Carbohydrate counting

Athlete (and loved ones) should be trained to:

- Use glucose monitor
- Give insulin injections
- Recognize/treat hypoglycemia

Encouraged to wear medical identification

Bracelet/necklace



Type 1 Diabetic Athlete

Continuous Glucose Monitoring

- Preferred monitoring system
- LAG TIME: can be up to 9-10 minutes
 - Finger stick for acute sideline use still recommended



Injectable insulin

- Pens, syringe/needle, needle free injectors, etc.
- Multiple types of insulin: each has its own duration of onset and effect.

Other equipment:

- Glucometer
- Glucose test strips
- Urine/blood ketone test strips
- Emergency Glycogen pen

Type 2 Diabetic Athlete

Controlled via insulin or insulin secretagogues

- Ie. Sulfonylureas and Meglitinides
- Higher risk of hypoglycemia
- Encourage carbohydrate supplementation prior to exercise

NOT using insulin or insulin secretagogues

 Very uncommon to experience hypoglycemia



What Are We Afraid Of?

***BG = Blood Glucose

Immediate Hypoglycemia

- During or shortly after exercise
- Most common
- Inadequate caloric intake or too much insulin administration



Delayed Hypoglycemia

- Prolonged vigorous exercise
- Typically 6-12hrs
- Can be severe if glycogen stores are not restored sufficiently



Symptoms

- Adrenergic:
 - Hunger, anxiety, sweating, tremor, tachycardia, palpitations
- Neuroglycopenic:
 - Fatigue, weakness, slurred speech, decreased coordination, blurred vision, dizziness, AMS, seizure, death



Treatment

- Mild/Moderate:
 - Remove from play
 - Check BG
 - Sugary beverage/fruit juice/glucose tablet (10-15g)
 - SMALL complex carbohydrate

• Severe:

- Glucagon injection/glucose containing IV
- Buccal sugar (maybe)
- Call EMS [ALWAYS]



Prevention

- Insulin injection
 - Correct dosing
 - Account for exercise
 - Do NOT inject into exercising muscles
- Proactive dietary planning
 - Calorie/carb replacement
 - Before, during, and after exercise



HYPERglycemia: BG >180

- Do not exercise if ketones are present
- BG > 180: glucose begins spilling into urine; increasing risk of dehydration
- Dehydration causes worsening BG levels



HYPERglycemia: BG >180

Symptoms

- Hyperglycemia:
 - Polyuria, polydipsia, nocturia, blurred vision, weight loss
- Hyperosmolar Hyperglycemic State:
 - Severe hyperglycemia, severe dehydration, AMS
 - (-) Ketoacidosis
 - Uncontrolled DM2

• DKA:

- Nausea, vomiting, fatigue, confusion, somnolence, tachycardia, <u>tachypnea</u>, <u>sweet smelling breath</u>
- (+) Ketoacidosis
- Medical emergency
- DM1; VERY rare in DM2



Managing Your Diabetic Athletes

Preparing for the Season: ATC's Supplies

- Simple carbohydrates:
 - Glucose tabs, sugar packets, fruit juice, non-sugar-free sports drink, etc.
- Glucometer w/ test strips & lancets
- Glucagon injection kit
- Ketone test kit (urine or blood)
- "Sharps Container"
- Spare batteries



- Easy to read
- Easy to reference
- Not just for the diabetic athletes
- Should NOT need parents phone numbers
- Find a way to make HIPAA compliant



Preparations For Practice

Setting Expectations

- Blood Glucose Parameters
 - BG levels in which athlete should not participate
 - Agreed upon by Athlete, ATC, and team physician
 - Inform coach



Physician Involvement

- Discuss changes to insulin regimen on days with more exercise
 - Athletes should relay this information to the ATC/coaching staff
 - If they can't why?
 - Endurance athletes may reduce their insulin demand by >80%

Preparations For Practice

Diabetic Care Plan

- Each athlete should have one for practices/games
 - BG monitoring guidelines
 - Insulin guidelines
 - Med List
 - Hypoglycemia recognition and action plan
 - Hyperglycemia recognition and action plan
 - Emergency contacts

 Should be provided at the same time as the athlete's BG monitoring equipment/supplies

Pregame/Pre-Exercise

Pre-exercise:

- BG = 100-250
 - Generally safe
 - BG: 120-180 range is relatively common for DM1 patients
- BG Trend
 - Monitor BG 2-3 times, 30 min apart prior to exercise



Pregame/Pre-Exercise

Pre-exercise:

- BG <100
 - Consider additional carbohydrate supplementation
- BG >180
 - Consider non-sugary fluid intake (ie. Water)
 - Increased monitoring for hyperglycemia and ketosis

- Avoid exercise
 - BG >250 + ketosis
 - BG >300 w/o ketosis



Game Time/During Exercise

- Check BG every 30 minutes
- Have simple and complex carbohydrates available



Postgame/Post-Exercise

Monitor BG

- Every 2hr for up to 12 hours
 - Assessing for Delayed Hypoglycemia
 - Can be severe if glycogen stores are not restored after vigorous exercise
- ~1.5g carb/kg immediately after endurance training





- Exercise and Type 2 Diabetes, Medicine & Science in Sports & Exercise: December 2010
 Volume 42 Issue 12 p 2282-2303 doi: 10.1249/MSS.0b013e3181eeb61c
- https://journals.lww.com/acsmmsse/Fulltext/2010/12000/Exercise_and_Type_2_Diabetes__American_College_of.18.as px
- <u>https://www.uptodate.com/contents/effects-of-exercise-in-adults-with-diabetes-mellitus?search=diabetes%20exercise&source=search_result&selectedTitle=1~150&us_age_type=default&display_rank=1
 </u>
- Schmelzeisen-Redeker, Günther et al. "Time Delay of CGM Sensors: Relevance, Causes, and Countermeasures." *Journal of diabetes science and technology* vol. 9,5 1006-15. 4 Aug. 2015, doi:10.1177/1932296815590154

Questions?