

Advanced Strategies for Diabetes Management: Case Presentations



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**PRESENTED BY IHS Division of Diabetes
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Mr. A.

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- 69 year old man diagnosed with DM2 13 years ago. You have been seeing him for the past 6 years. Because of snow-day cancellations, your recent illness and clinic construction, you haven't seen him for 8 months.
- A1c has ranged from 10 to >14
- He takes NPH 35 units hs and Regular 15 units bid
- He has:
 - Proliferative retinopathy, s/p laser, stable on eye
 - CKD, gfr 28
 - Distal sensory neuropathy, wears DM shoes, no amputations

Mr. A (continued)

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- Mr. A's sister recently started dialysis, and this has made Mr. A start to think about his own poor diabetes control.
- He calls your office to make an appointment to discuss this.

Mr. A (continued)

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- **What do you say to him?**
 - A. **Congratulate him on his commitment to improve his diabetes control. Suggest that he begin an exercise program, follow the diet plan he received at his last visit with the nutritionist, and take his insulin as prescribed.**
 - B. **Order labs, make an appointment for him to see the eye doctor and nutritionist, ask him to check his sugars various times during the day and to take his medication the way he's been doing.**
 - C. **Tell him to have labs drawn that were previously ordered, make an appointment for him to see the eye doctor and nutritionist and ask him how he is really taking his meds.**

Mr. A (continued)

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- You know Mr. A has been sedentary, eats in an unhealthy fashion, and has probably not been taking his medications regularly. If he suddenly does all the things he's supposed to be doing, he'll be at serious risk for hypoglycemia.
- Rapidly improving his DM control and certain types of exercise (e.g. valsalva) could worsen his retinopathy.
- Tight control in patients with established microvasc complications, heart di, DM >20 years, risk of lows, elderly with no complications: may be okay to have lower targets?

Mr. B

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- 51 year old man diagnosed with DM2 when he presented to the emergency room 6 months ago with acute cholecystitis. His glucose was 399 mg/dl and his A1c was 9.4%. He had not been receiving regular health care.
- He received a continuous intravenous infusion of Regular insulin during his hospital admission, and was discharged on Detemir 20 units bid and aspart 10 units tid with meals. During his hospitalization he was found to have no evidence of microvascular disease.
- He is referred to you for ongoing care.

Mr. B (continued)

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- Six months after surgery, his A1C is 6.8, his BP and lipids are well controlled, he has lost 23 lbs and his BMI is 28. He walks for 2 miles 5 days a week and bicycles with his grandchildren on weekends. He and his wife have gone to cooking classes and they eat vegan meals 3 days a week.
- You should:

Mr. B (continued)

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- A. Clone him.
- B. Ask him to talk with Mr. A.
- C. Hire him on the spot as a diabetes educator.
- D. Congratulate him on the wonderful efforts he's made to improve his health status, and advise no change in DM medications. Ask him to check his sugars random times and record. Schedule him to return to see you in 3 months.
- E. Discuss other options for DM management.

Mr. B (continued)

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- **Discuss other options for DM management:**
 - He's on a complicated schedule, taking 5 injections per day. Although his sugars are well-controlled he may do well with a simpler treatment regimen.
 - You could consider trial of oral agents- if he's just using insulin sensitizers, not at risks for lows, may not need to test glucose as often (or at all???).
 - You could inquire as to his eating schedule, and see if a simpler insulin regimen might be effective.

Ms. C

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- Ms. C is a 28 year old casino floor manager.
- She had gestational DM during her fourth pregnancy one year ago, and was treatment with NPH insulin bid and NL qid.
- After delivery, she started metformin. Subsequently, pioglitazone, sitagliptin, and glimiperide were added.
- She eats 3 meals (prepared at home) , avoids processed and “junk foods” and carbohydrate intake is consistent.
- She is very active at work and walks, swims and plays ball with her children.
- When she sees you in your office, her A1c is 8.9.

Ms. C (continued)

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- You suggest:
 - A. Adding acarbose.
 - B. Starting bid Detemir and tid Lispro.
 - C. Appointment with nutritionist and exercise counselor to see if lifestyle changes could improve glucose control.
 - D. Starting 70/30 insulin at a dose of 6 units bid acB and acS and having her adjust the dose according to algorithm.
 - E. Starting Exenatide.

Ms. C (continued)

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- Acarbose usually lowers A1c by no more than 0.8%, so alone it wouldn't be effective (ASIDE: hypoglycemia would need to be treatment with glucose; it is IMPOSSIBLE to easily find what types of food can be used).
- Ms. C is already very active (as floor manager and mom of four) and eats three healthy carb-consistent meals/day- additional lifestyle changes may not be able to decrease her A1c by 1.9%.
- Exenatide can decrease A1c by about 1%; Ms. C is not overweight so it's unique advantage over other therapies would not be necessary.

Ms. C (continued)

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- **Hippocrates said if a condition can be treated in several different ways, one should chose the one that's “least troublesome.”**

Ms. C (continued)

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- **INITIATE^{plus} Trial, published in Am J Med November 2009.**
- **A1c \leq 7 % achieved within 3 months in patients treatment with bid basal/prandial 70/30 (NPH/Aspart) and adjusted according to algorithm (a decrease in A1c of 2.5%) .**
- **Start with 6 units 70/30 15 min acB and acS (Dr. Bergenstal recommended 0.2 units/kg if a1c $<$ 9, 0.4 units/kg if a1c $>$ 9; better starting point for very insulin resistant patients).**
- **Patients ate tid and checked sugars acB and acS only.**
- **Intensive dietary and exercise counseling did not seem to increase efficacy of regimen ??**

Ms. C (continued)

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- **Insulin titration Algorithm: Start patient on 6 units 70/30 acB and acS and adjust as follows:**

<u>Glucose acB and acS</u>	<u>Adjustment</u>
• <80 mg/dL	- 3 units
• 80-110 mg/dL	No change
• 111-140 mg/dL	+ 3 units
• 141-180 mg/dL	+ 6 units
• > 180 mg/dL	+ 9 units

Ms. C (continued)

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- Ask patients to titrate breakfast dose of 70/30 based on pre-supper sugars q 2-3 days.
- Ask patients to titrate supper dose of 70/30 based on fasting sugars x q2-3 days.
- This is an amazingly confusing concept. Draw pictures showing that the morning 70/30 is responsible for normalizing the supper sugar, and the supper 70/30 is responsible for normalizing FBS.

Ms. C (continued)

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- **What would you do about her oral agents?**

Ms. C (continued)

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- A. Stop all orals.
- B. Continue all orals.
- C. Stop half the orals (put names of each on scraps of paper, fold, put into large bowl, shake, pick two to stop; continue those in bowl).
- D. Stop sitagliptin b/c it's non-formulary and \$\$, continue metformin and pioglitazone, stop glimiperide b/c could inc risk of hypoglycemia.

Ms. C (continued)

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Ms C returns to your office 1 month after starting 70/30 with adjustments per algorithm.

- She is taking 32 units of 70/30 with bfast and 22 units with supper. FBS and acS range from 100-125 mg/dL. She is not having any low sugars.
- At the time of your visit, it is about 2 hours since Ms. C took her morning insulin and ate breakfast. Her POC glucose is 278 mg/dL.

Ms. C (continued)

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- She reports that she sometimes checks her sugar after breakfast and supper, and it “is always up in the 200’s, sometimes higher. But I don’t worry about it because it’s back down before supper and in the morning”.

Ms. C (continued)

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Your best strategy would be to:

- A. Accuse Ms. C of eating too much carbohydrate and refer her to nutritionist.
- B. Tell her that she was NOT asked to check her sugars after meals, and that's what happens when you don't follow directions. Refer to behavioral health to help with adherence with health provider instructions.
- C. Ask your nurse to show Ms. C how to mix Aspart with 70/30, and have her add 8 units of NL to her current doses of 70/30.
- D. Submit a non-formulary request.

Ms. C (continued)

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- Post-prandial sugars are important, and may correlate more closely with vascular complications than pre-prandial readings (*Clin Diabetes* April 2002).
- Dr. Bergenstal suggested not necessary to focus on pc gluc to effect nl A1c.
- 70/30 is manufactured as a combination b/c most people on NPH and aspart (or reg) need about 70% of the former and 30% of the latter (Lilly's 75/25 is approximately equivalent).
- There's no way to adjust her 70/30 to decrease her post-prandial sugars without making her go low in the morning and before supper.
- Remember: there is often a difference in ac/pc glucoses- some patients start with IFG, others with IGT.

Ms. C (continued)

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- **Submit a NFR for 50/50 insulin, a mixture of 50% HL or Regular and 50% NPH.**
- **This combination is exactly what a patient like Ms. C needs: it gives a higher proportion of prandial insulin for better pc coverage.**
- **She can substitute the 50/50 for 70/30 in the dose titration algorithm.**
- **Some patients need lunch-time dosing of either prandial or prandial/basal insulin. The only way you'll know this for sure is to have the patient check various times during the day.**

Moral of the story

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- Although treatment with a basal insulin and meal-time rapid acting insulin is the most physiological approach (other than an insulin pump), it's cumbersome and requires strong patient commitment to learn to estimate carbohydrate content of meals and inject multiple times during the day.
- It's not for everyone; for many patients simpler is better, especially when it works.

D.D.

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- D.D. is an active 14 year old honor student with a BMI of 54 (5 feet 1 inches; 285 lbs). She has had DM x 2 years although she was “borderline” before her diagnosis. Her LFT’s have been abnormal, and recent biopsy showed extensive fatty infiltration and one area with early cirrhosis. She also has HTN and hyperlipidemia.
- She does not wake during the night to eat, she has missed meals without becoming ill (e.g. when ill, if wakes up too late for breakfast), is not Cushingoid, and mom reports “a specialist” told her patient does not have Prader-Willi.
- Her weight was >95th %-ile at birth and she’s climbed steadily above the curve since the age of 18 months
- Her A1c is 9.2%
- She has slightly increased albuminuria, a nl GFR, normal retinae and intact sensation in her feet

D.D. (continued)

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- D.D takes metformin 1000 mg bid, detimir 50 units bid, and lispro 25 units tid with meals.
- When she comes in to see you, she says that even though her sugars are still high, she is NOT going to increase her insulin b/c she gains weight every time she does.

D.D. (continued)

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- The worst option would be:
 - A. Increase detemir to 60 units bid and lispro to 30 units tid, register her for kick-boxing classes, and tell her that insulin does NOT make her gain weight.
 - B. Refer her for bariatric surgery.
 - C. Refer her to the nutritionist to start patient on a one week no-carb diet. Cut pt's insulin doses in half and urge D.D. to monitor her sugars carefully as they may get very low and she may need to decrease her insulin further.
 - D. Start her on u-500 insulin: 16 units acB and acS.

DD. (continued)

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- Option “A.” would probably have been most people’s choice until recently. But it’s a short-sighted approach. This child has major serious health problems and you need to address them.

D.D. (continued)

- **Option “B.” Bariatric surgery:**
 - **This is a treatment option for DM that is more consistently assoc with cure than treatment with medications, diet and exercise alone.**
 - **Bariatric surgery has a greater chance of curing DM2 if it is performed early in the disease process.**

D. D. (continued)

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- American Academy of Pediatrics has listed bariatric surgery as an option for morbidly obese adolescents since 2003.
- Criteria:
 - BMI > 40 with comorbidities, >50 without.
 - s/p 6 mos of organized wt loss program.
 - Completion of majority or skeletal maturity (> 13 years in girls, > 15 years in boys).
 - Major centers: Columbia (NYC), Texas Children's, Vanderbilt (Nashville, TN), Stanford (CA).

D.D. (continued)

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- Recent study published in *JAMA* 2010, (303) looked at adolescents (aged 14 to 18) with BMI > 35 who underwent gastric banding . After two years >50% weight loss was seen in 84% of the surgical patients and 12% of the lifestyle patients. Mean wt loss was 76 lbs (28.3% total body wt, 80% excess body wt) compared with mean wt loss of 6.6 lbs (3.1% total body wt, 13.2% excess wt loss).

D.D. (continued)

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- **January 2009 *Pediatrics*: 78 adolescents with DM2-11 had gastric bypass surgery, 67 had “routine management.”**
- **10/11 surgical patients had remission of DM2. Patients lost avg 34% body weight/ none of teens in routine management group lost weight or had cure of DM.**
- **March 2007 *Archives of Pediatrics and Adolescent Medicine*: adolescents undergoing any type of bariatric surgery have fewer complications than adults.**

D.D. (continued)

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- 18 adverse events occurred in the lifestyle intervention group in 11 participants (44%); 7 adolescents did not complete the study and one patient was admitted on eight occasions to the hospital.
- In the surgical group, 9.5 adjustments to saline volume in the band were performed, and 12 patients (48%) experienced a total of 13 adverse events, including eight revisional surgeries in seven patients (28%).

D.D. (continued)

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- **Diabetes Care Suppl Feb 2008, S297 (adults).**
- **30 day op mortality 0.1% for purely restrictive procedures, 0.5% for gastric bypass.**
- **Swedish Obesity Study showed a 9 year mortality rate of 9% in DM patients s/p gastric bypass (Roux en Y) vs. compared with 28% for matched controls.**
- **Retrospective analysis of 8,000 patients s/p gastric bypass x 7 yrs showed 40% decrease in all-cause mortality, 92% decrease in DM-related death, 56% decrease in fatal CAD, 60% decrease in cancer deaths. Deaths not caused by this disease were 58% higher.**

D.D. (continued)

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- **Low-carb sensitization diet:**
 - For very insulin-resistant patients on escalating doses of insulin, following a zero-carb diet for a week can restore insulin sensitivity and bring insulin requirement down fairly rapidly.
 - Anticipate insulin requirements will decrease and possibly cease.
 - When carbs are reintroduced, the need for insulin will return.
 - The dose will gradually need to be increased but it may take 6-9 months to reach current dose.

NEJM May 12, 2003 A Low Carb Diet as Compared with a Low Fat Diet in Severe Obesity

D.D (continued)

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- **Make sure patient understands that carbs are very important components of a balanced diet and should not be eliminated permanently.**
- **Try to convince patient to add high-fiber, unprocessed carbs when she re-introduces carbs into her diet. Let her know that this will help keep her insulin needs down for a longer period of time.**

D.D. (continued)

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- U-500 humulin Regular insulin is 5x as concentrated as any other (U100) insulin.
- It's delivered via a standard insulin syringe
- When high volumes of insulin are injected, absorption can be uneven, and insulin degradation can occur. Injecting more insulin in a smaller volume will solve this problem.
- U-500 Humulin Regular insulin behaves like 70/30 insulin: there is a peak that starts within 30 min of injection then levels out and lasts for 8-10 hours.

D.D. (continued)

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- **To calculate the dose:**
 - Count the total # units U-100 insulins in current dose (175).
 - Divide this # by 5 to get the volume of U-500 that is the equivalent amount ($175/5 = 35$ units).
 - Have the patient take as 2 doses ($35/2 = 18$ units) of 18 units each.
 - B/c u-500 insulin is absorbed much more reliably than her current insulin, consider giving a lower starting dose, e.g. 16 units acB and acS to avoid lows.

D.D. (continued)

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- Have her inject 16 units about 30 min before b'fast and supper.
- She can titrate her dose in the same way Ms. C did with the 70/30 insulin OR have her increase by 1-2 units every 2-3 days until target sugars are met.
- Consider having patient follow “zero-carb” diet for a week; u-500 insulin might not be necessary.

D.D. (continued)

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- As D.D. and her mom are gathering their coats and purses and getting ready to leave your office, her mom mentions that D.D.'s grades have been “slipping.”
- At a recent parent conference, D. D.'s teacher told her that D. D. doesn't seem to be paying attention in class and falls asleep if the room is too warm.

D.D. (continued)

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- What would be the appropriate response?
 - A. Tell her mom that adolescents commonly go through a rebellious phase, and reassure her D.D. will settle down and get back to her studies soon.
 - B. Start Prozac and refer D. D. to Behavioral Health.
 - C. Order a sleep study.
 - D. Order a cbc, iron, b12, chemistries and thyroid function tests.
 - E. Ask D. D. a few questions.

D.D. (continued)

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- Adolescent rebellion, depression, and sleep apnea could be the culprits, alone or in combinations. But you need to ask her questions that might point to anemia, hypothyroidism, renal or worsening liver disease, hypoglycemia, frequent nocturia, disturbance by loud music, arguing, crowded sleeping conditions, bed bugs, even abuse. You need to get lab tests.
- Further questioning reveals symptoms strongly consistent with OSA and exam shows “kissing tonsils”; you refer D.D. for overnight oximetry and ENT consultation.

D.D. (continued)

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- As you're turning the door knob and getting ready to leave the room, D.D.'s mom mentions that her youngest child, 5 year old G.G., is getting "chubby", and she wonders if there's any way to "prevent her from ending up like D. D."?
- Your response should be:

D.D. (continued)

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- A. Throw your stethoscope across the room and say “I don’t have time to deal with this now, you need to ask all your questions at the beginning of the visit” and stomp out of the room.
- B. Tell her not to worry, you’ll cross that bridge when and if you come to it.
- C. Suggest that she start “a little” metformin, pioglitazone, and ACE.
- D. Refer G. G. and her mom for a nutrition visit and suggest buying a jungle gym.
- E. Burst into tears and say “I don’t know what to tell you”, then throw your stethoscope across the room and stomp out.

D. D. (continued)

F. Say “That’s an excellent question! Several studies have looked at diabetes prevention. We’re in the process of talking with the tribal officials and representatives, health care providers, nutritionists, and patient representatives to find some answers. We need to make healthy, unprocessed, “whole” food more affordable and available than burgers, fries, Little Debbie Cakes, and packaged food-like substances with multiple unpronounceable ingredients and various health claims. We need to dare to discuss vegetarian and vegan meals.

D.D. (continued)

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“We need to surround every school by a 10-foot high fence one or two miles in diameter with doorways too small for a motorized vehicle to fit through leading to an obstacle-course pathway to the school door. We need to put exercise equipment in our waiting rooms (and train patients to safely use them). We could get rid of chairs in school and use exercise balls instead, and we need to have everyone fidget more!”

DM Care in the IHS in 2010

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It's unbelievably complicated; every patient is different and there's no Universal Algorithm for their care; there's a continuous onslaught of new (and often conflicting) info every day; multiple co-morbidities pile onto the already-double-digit POV's at every visit; the meds are expensive and have side effects; the patients and their families carry a huge burden of monitoring, medication compliance, dietary restrictions, activity prescriptions and frequent lab testing; we keep changing our minds about our recommendations; complications keep happening, etc, etc, etc.

DM Care in 2010

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- It's what we do.
- The challenges stimulate us every day, we're motivated because we care for strong, resilient people who share their lives and their lands in the most breathtakingly beautiful places in the world.
- And it's an honor and privilege for which I'm thankful every day.