INSULIN CALCULATIONS CHEAT SHEET

Test how ready you are for the exam with the Insulin Calculation/Titration Quiz in the Free Quizzes section!

Note: TDD=Total daily Dose ICR=Insulin to Carbohydrate Ratio ISF=Insulin Sensitivity Factor or ICF=Insulin Correction Factor
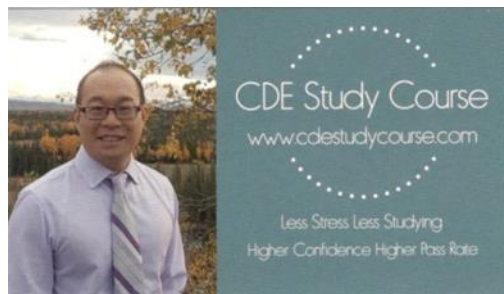
Insulin Calculation	Example	How to understand
ICR: 500/TDD (basal and bolus combined)	One of your patients with type 2 diabetes is on 20 units of Toujeo (concentrated glargine) once daily and 10 units of FIASP (aspart) three times a day with each meal. The patients total daily dose is 20+10+10+10=50 so 500/50= 1 unit per 10 grams of carbohydrate	This equation assumes that an average person consumes 500 grams of carbohydrate per day. The higher the TDD the higher the insulin resistance. Higher insulin resistance means the patient needs more insulin for every carbohydrate they consume. For the CDE™ exam use this equation. In real life I don't find this equation very accurate. 500 grams of carbohydrate is equal to 33 slices of bread! Please see the two alternate ways of calculating insulin to carb ratio at the end
ISF or ICF (same thing): If on rapid acting insulin: 100/TDD If on regular or fast acting insulin: 83/TDD	Your patient is on Apidra (glulisine) 20 units three times a day and Xultophy (degludec/liraglutide) 40 units/1.44mg once daily. 20+20+20+40=100 so 100/100= 1 mmol/L drop for every 1 unit of rapid insulin	These equations were originally developed by Dr Paul Davidson in Atlanta, Georgia based on his experience with treating patients with diabetes. For regular insulin he developed the 83 rule. Because the blood sugar tends to drop faster and farther on rapid acting insulins, like Humalog (lispro) and Novorapid (aspart), the 100 rule is used. These equations predict how much one unit of insulin drops blood sugar.
	Your patient is on Humulin R (regular insulin) 7 units three times a day with each meal and 20 units of Toujeo (concentrated glargine) once daily. 7+7+7+20=41. 83/41= 2 mmol/L drop for every 1 unit of regular insulin.	
Switching from BID (twice daily) basal insulin dosing = reduce dose by 20%	You have a patient who takes 50 units of NPH insulin twice daily. You switch him to Lantus (glargine) once daily. So 50+50=100 x 0.8 = 80 units of Lantus (glargine) once daily	This was originally part of the Lantus monograph. When switching to twice daily NPH to once daily Lantus, researchers usually reduced the dose by 20%. Since then it has become a general insulin adjustment rule to reduce the dose by 20% when switching from twice daily basal insulin to once daily basal insulin. In my own practice, I have found that if you switch insulin and the patient experiences hypoglycemia then you lose the patient's trust. Afterwards the low, they are less receptive to your suggestions. So, it's better to be safe than sorry

Switching from multiple daily injections to continuous subcutaneous infusion = reduce TDD by 25% then split 60/40 bolus/basal	You have a patient who is switching onto an insulin pump. Currently she is on Humalog 5 units three times a day with meals and Basalglar (glargine) 85 units once daily. So 5+5+5=85= 100 TDD. 100 x 0.75= 75 units. 75 x 0.6= 45 bolus so 45/3= 15 units bolus with each meal and 75 x 0.4= 30 units of basal NOTE: Insulin pumps only use rapid insulin	A normal pancreas secretes insulin monomers (the active form of insulin) throughout the day and in response to meals. Basal insulin does not simulate normal pancreas secretion as well as an insulin pump. After injection, basal insulin forms a depot in the subcutaneous layer of the skin where it slowly disassociates into monomers. Some of the basal insulin is degraded as it sits and disassociates. Insulin pumps simulate normal pancreas secretion better by pumping small amounts of rapid acting insulin that disassociate rapidly into monomers. So, you use a lower dose with an insulin pump because the insulin is used more efficiently.
A1c to average blood glucose= ((A1c-6) x2) + 6 = average BG in mmol/L	You have a patient who has an A1c of 10%. His average BG is: ((10-6) x 2) +6= average 14 mmol/L	There is usually a question on the exam where a patient says his A1c is X% and asks what is his average mmol/L? This is an easy formula to learn for the exam and in real life.
Basal insulin start= Start with 10 units once daily	10 units is the suggested starting dose for basal insulin starts. You can choose a lower dose if the patient is elderly or patient's body weight is normal to low	See Appendix 9 on pg S317 on the 2018 Diabetes Canada guidelines for more information
Bolus insulin start= Start with 2-4 units	Start with 2-4 units at one meal of the day. You do not need to start with all three meals. The StepWise study showed that patients get the most benefit with the first bolus dose at a meal and get less benefit with each additional bolus dose at meals.	See Appendix 9 on pg S317 on the 2018 Diabetes Canada guidelines for more information
Mixed insulin start= 5-10 units once or twice daily	Usually, people are started on 5-10 units with breakfast and supper. Remember the older regular insulin mixes need to be taken 30 minutes before meals.	See Appendix 9 on pg S317 on the 2018 Diabetes Canada guidelines for more information

Switching from Multiple Daily Injections (MDI) to Twice daily Mixed insulin. Add bolus insulin together then divide dose by 2. Add basal insulin together then divide dose by 2. Find the closest matching insulin ratio and dose twice daily.	Your patient wants less injections and wants to switch to Humalog Mix 25 twice daily. He is currently on Humalog (lispro) 40 units three times a day with meals and Levemir (detemir) 120 units in the morning. Bolus: 40+40+40=120 / 2 = 60 units twice daily Basal: 120 /2 = 60 units twice daily. So, 120 units twice daily at a 50:50 basal/bolus ratio. 100 units of Humalog Mix 25 contains 25 units of Humalog which acts as bolus and 75 units of protamine-bound Humalog which acts as basal insulin. This does not match the patient's basal bolus ratio. A better choice for this patient would be Humalog Mix 50 which contains a 50:50 bolus/basal ratio. You switch this patient to Humalog Mix 50 120 units twice daily.	Protamine is a protein that stabilizes the insulin hexamer and slows its disassociation into insulin monomers (the active form of insulin). Protamine is now synthesized but was originally extracted from fish sperm! Now you will always remember why these insulins are cloudy! Mixed insulins such as Humulin 30/70 and Novolin 30/70 (and their various combinations such as 40/60 and 50/50) are regular insulin (which acts as bolus) combined with regular insulin bound with protamine (which acts as basal). Humalog Mix 25 and Novomix 30 (and their various combinations) are combinations of rapid acting insulin (which acts as bolus) and rapid acting insulin bound to protamine (which acts as basal)
Alternate Method for ICR based on weight <u>Weight (lbs) ICR</u> <60 1:30 60-80 1:25 81-100 1:20 101-120 1:18 121-140 1:15 141-170 1:12 171-200 1:10 201-230 1:8 231-270 1:6 >270 1:5	You have a patient who is obese and weight 250lbs. He would like to start carbohydrate counting. He is on multiple daily injections for his insulin. He takes Tresiba (degludec) once daily and Humalog U-200 (concentrated lispro) three times a day. He wonders how much insulin he should take per gram of carbohydrate he consumes. Looking at the table you determine that he should take 1 unit per every 6 grams of carbohydrate he consumes.	This table assumes that as a person weight increases, they are more insulin resistant and therefore need a more insulin to cover carbohydrates. While I have found that this theory works as a general rule, I have never found this table to be accurate enough to use in real life. I have also never seen on the exam as well.

Alternate Method for ICR based on pre and post prandial blood sugar readings. Use the Beyond the Basics guide to calculate carbohydrate content in grams.	Below is your patient's food diary and blood glucose log:	You need to calculate the ICR used and then compare
	Pre-breakfast=6.8 Had 2 slices of white toast and a glass of diet coke. Took 5 units of Admelog. 2-hour PC BG= 3.9	2 white toast = 30 carbs. Diet coke = 0 carbs. Total carbs= 30/5 Admelog= 1:6 ICR. Pt went low so too much
	Pre-lunch= 5.2 Had 2 cups of salad, 2 medium apples and 3 boiled eggs. Took 2 units of Admelog. 2 hr PC BG= 7.9	Salad= 0 carbs, 2 medium apples= 32 gram of carbs, 3 boiled egg= 0 carbs. Total carbs= 30/2 Admelog= 1:16 ICR. Pt was on target after meal, so this is a good ICR
	Pre-supper= 5.8 Had a 6 oz steak, 1 cup of mashed potatoes, 1 cup of salad, 1 cup of boiled rice and a cup of unsweetened tea. Took 5 units of Admelog. 2 hr PC BG= 12.7	Steak=0 carbs, mashed potatoes= 57 gram, salad= 0 carbs, boiled rice= 39 gram, tea= 0 gram. Total carbs= 96 grams/5 Admelog= 1:20 ICR. Pt was above target so not enough.
		Comparing all the different ICR the patient used it seems that the 1:15 ratio is best. For more questions, please check out the free quizzes I have on my website. Note that the number of carbohydrates for the food is completely made up for the question.

Note that most of my students have mentioned my exam questions are harder than the May exam. Being familiar with these calculations will probably be more than you need to know for the exam. Thanks

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