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INSTRUCTIONS

1. After carefully reading this lesson, study each question and select the one answer you believe to be correct. For immediate results answer online at www.CanadianHealthcareNetwork.ca.

2. To pass this lesson, a grade of at least 70% (10 out of 15) is required. If you pass, your CEU(s) will be recorded with the relevant provincial authority(ies). (Note: some provinces require individual technicians to notify them.)

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pharmacy PRACTICE + BUSINESS

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Blood glucose monitoring and diabetes management

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Learning objectives

Upon successful completion of this lesson, the pharmacy technician will be able to do the following:

1. Be familiar with blood glucose targets and the complications of high blood glucose levels
2. Explain how lifestyle factors can affect the development and progression of diabetes
3. Review symptoms of hypoglycemia and hypoglycemia management strategies
4. Outline basic features of the oral antihyperglycemic agents and the types of insulin used
5. Be familiar with various blood glucose monitors and test strips available on the market
6. Describe ways that registered pharmacy technicians can assist in the management of patients with diabetes

An educational service for Canadian pharmacy technicians, brought to you by Teva.

Overview

Diabetes is a disease that affects patients' glucose metabolism, leading to uncontrolled blood glucose levels. Insulin is a hormone produced by the pancreas that regulates glucose in the blood by inducing glucose uptake by cells in the body. There are three types of diabetes. Type 1 diabetes is an autoimmune disease where a patient's pancreas is destroyed by self-antibodies, leading to the inability to produce insulin. Type 2 diabetes is a metabolic disorder leading to insulin resistance, which results in decreased sensitivity and responsiveness to insulin, and therefore increased blood glucose levels.[1-3] Gestational diabetes is a temporary condition that occurs during a small number of pregnancies.[1-3] This lesson will focus on type 1 diabetes and type 2 diabetes. Canadian healthcare spends a significant amount of money on patients with diabetes, mainly due to the increased frequency of family physician, specialist and hospital visits associated with this population.[1] Being the most accessible healthcare professionals, pharmacists and pharmacy technicians can play a key role in diabetes management.

Epidemiology

Diabetes is a growing problem in today's society, both in Canada and on a global scale. In 2015 there were about 3.4 million Canadians living with diabetes; this is expected to increase to an estimated five million Canadians in 2025.[4] Type 1 diabetes is more prevalent in children, while type 2 diabetes is more prevalent in the adult population. Overall, type 2 diabetes makes up approximately 90% of cases.[3]

What is Diabetes?

Type 1 Diabetes

Type 1 diabetes is an autoimmune disorder in which the insulin-secreting cells (beta cells) of the pancreas are targeted by the patient's own antibodies, which leads to an insulin deficiency. This type of diabetes is most commonly diagnosed in children, but in some cases it may present later in life. Unfortunately there is currently no cure for type 1 diabetes, and no prevention strategies are known at this time because of the autoimmune nature of the disease.[1-3]

Type 2 Diabetes

Type 2 diabetes is a metabolic disorder

TABLE 1 - Self Monitoring of Blood Glucose Target Ranges[1,2]	
	Standard Target Range (mmol/L)
Fasting	4-7
Before Meals	4-7
2 Hours After Meals	5-10 (5-8 if A1C targets are not met)

Glycated hemoglobin (also known as A1C) is often measured by venous sample in a laboratory; however, home A1C monitors are also available for finger-prick testing. In addition, some pharmacies offer point-of-care A1C testing. Unlike SMBG, A1C testing is not time-sensitive, and can be done at any time of the day. A1C levels are an indicator of glycemic control over the previous three to four months, and do not directly translate to blood glucose levels.[5] For most patients with diabetes, an A1C of under 7% is the desired target of therapy.[1,2] For some patients a higher A1C target is given, typically between 7.1% and 8.5%. Patients with recurrent hypoglycemia, patients unaware of hypoglycemia, elderly patients with significant co-morbidities, limited life expectancy and/or high functional dependency are examples of cases where higher A1C targets are desired.[1,2] A1C tests are typically done every three months, but may be done less often for patients with well controlled and stable blood glucose levels.[1]

characterized by a reduced response to insulin. It is typically diagnosed in adulthood. Long-term high blood glucose levels as well as sedentary lifestyles, being overweight, smoking, and other factors can lead to this reduced response to insulin. Prevention of type 2 diabetes is mainly focused on lifestyle interventions, such as healthy eating and regular physical activity, to eliminate the risk factors for developing the disease.[1-3]

Secondary Complications

Diabetes is a major cause of cardiovascular disease. Patients with diabetes have an increased risk of stroke, coronary artery disease and peripheral vascular disease. In addition, patients are at risk of experiencing target organ damage, namely retinopathy (damage to the blood vessels in the eye), nephropathy (damage to the blood vessels in the kidneys) and neuropathy (nerve cell damage). Patients with diabetes are often prescribed medications to lower their risk of these long-term complications.[1-3]

Blood Glucose/ Glycated Hemoglobin Targets

Two tests are used to monitor diabetes: blood glucose concentrations and glycated hemoglobin. Blood glucose concentrations are measured most commonly by the patient by performing a finger prick that generates a small blood sample. The sample is applied to a test strip that is then read using a home blood glucose monitor (known as self-monitoring of blood glucose or SMBG). Patients are generally encouraged to test at least once daily when they are on oral antihyperglycemic medications such as gliclazide or glyburide, which have an increased risk of causing low blood glu-

cose (hypoglycemia). In addition, patients using once-daily long-acting (basal) insulin should test at least once daily, typically in the morning, to assess fasting blood glucose levels. Patients on multiple daily injections of both basal and mealtime insulin should test before every insulin injection. These testing regimens help to prevent hypoglycemia as well as aid in monitoring the efficacy of therapy.[1,2] Recommended blood glucose targets for diabetes patients are shown in Table 1. In some cases, blood glucose targets are modified based on the patient's comorbidities, if they are prone to hypoglycemia or are hypoglycemia unaware (do not experience symptoms when blood glucose levels are below 4 mmol/L).[1,2]

Hypoglycemia

Hypoglycemia, defined as blood glucose levels less than 4 mmol/L, can be extremely serious and require the attention of a healthcare professional to ensure patients' medications are working safely. Symptoms of hypoglycemia include shakiness, sweating, hunger, vision impairment, confusion, dizziness and drowsiness.[1,2] All diabetes medications can cause hypoglycemia, although some medications are more likely to cause it than others. Insulins and sulfonylureas (e.g., glyburide, gliclazide) are the most likely to cause low blood glucose.[1] Even patients with diabetes who do not take medications can suffer from hypoglycemia if they go too long without eating or engage in more physical activity. Other medications that can increase the risk of hypoglycemia include alcohol, beta-blockers, pentamidine injection, quinine/quinidine and tramadol.[2] It is important to keep these drugs in mind when reviewing a patient's profile, especially if they

TABLE 2 - Treatment of Mild to Moderate Hypoglycemia[1]	
Step 1	Consume 15 grams of rapidly absorbed sugar. Examples include: - ¾ cup of regular pop or juice - Glucose tablets - 6 Lifesaver candies - 1 tablespoon of honey
Step 2	Wait 15 minutes after taking rapidly absorbed sugar to test blood glucose levels. - If still under 4.0 mmol/L repeat step 1 - If over 4.0 mmol/L proceed to step 3
Step 3	If next scheduled meal is within an hour of hypoglycemic event, proceed with next meal as scheduled. If next scheduled meal is more than an hour away, a snack containing carbohydrates and protein should be eaten. Examples include: - Toast with peanut butter - Cheese with crackers

TABLE 3 - Examples of Food Glycemic Index Ratings[1]	
Low GI Rating	High GI Rating
Rye bread	White bread
Pumpernickel bread	Whole wheat bread
Barley	Potatoes
Oats	Corn flakes
Apples	Pineapple

are experiencing hypoglycemia.

Patient education about how to treat mild to moderate hypoglycemia is essential. Three steps should be followed, as shown in Table 2. For severe hypoglycemic events in unconscious patients, a 1 mg glucagon injection can be used instead of rapid-acting sugar.[1]

Lifestyle Interventions
Dietary Recommendations
Patients living with diabetes have very similar dietary recommendations to those without diabetes in regards to macronutrient (carbohydrates, fats and protein) consumption. Focus should instead be on consuming foods that have a low glycemic index (GI). Foods are rated by the GI based on how quickly they increase a patient's blood glucose levels, as well as the magnitude of this increase. Therefore, lower GI foods result in smaller blood glucose increases.[1] Examples of GI ratings can be found in Table 3.

Physical Activity and Weight Loss
Moderate intensity exercise has been shown to reduce the risk of cardiovascular disease and increase glycemic control in patients with diabetes. Completing 150 minutes of aerobic exercise weekly and resistance training twice weekly is recommended in order to achieve these outcomes and sustained weight loss.[1,2]

Alcohol Consumption
Alcohol avoidance is not necessary for patients with diabetes; however, caution should be used because alcohol has a delayed hypoglycemic effect and can potentially cause weight gain. Alcohol should be consumed with food to avoid hypoglycemic events. In addition, moderation is recommended, with a maximum alcohol intake of two standard drinks daily up to 10 weekly for men, and one standard drink daily up to five weekly for women.[1,2]

Smoking Cessation
Although smoking cessation won't directly improve blood glucose levels, smoking has negative outcomes, especially in patients with diabetes. High blood glucose levels as well as smoking have been shown to promote blood vessel hardening, which may cause long-term complications (discussed above) to develop at a younger age than in non-smoking patients with diabetes.[6] All patients who smoke should be counselled on these negative effects, and smoking cessation should be offered if patients are interested in quitting.

Pharmacological Management
Type 1 Diabetes
Insulin is the mainstay of treatment for type 1 diabetes. These patients have a normal response to insulin but produce little to no insulin; therefore, most oral agents are not effective and not indicated. Some medications, such as metformin, are sometimes used off-label in type 1 diabetes in order to enhance the body's responsiveness to insulin and to induce weight loss.[1]

Two types of insulin are used for supplementation: basal and rapid-acting (mealtime) insulin. Basal insulin is typically given once daily, usually at bedtime, and provides patients with a consistent level of insulin throughout the day. Mealtime insulin is used to manage carbohydrates consumed at meals. This type of insulin is usually administered within 15 minutes of starting a meal, and remains active for only a few hours. Rapid-acting insulins are typically favoured over short-acting insulins because of their shorter duration of action and, therefore, lower risk of hypoglycemia.[1] Main insulin types are detailed in Table 4.

Type 2 Diabetes
Type 2 diabetes management includes multiple types of medications due to the multifactorial nature of the disease. Many patients use multiple types of medications with different mechanisms of action to control their blood glucose levels. First-line therapy is metformin, unless contraindicated or not tolerated by the patient. Adding further medication requires analysis of blood glucose and/or A1C levels, as well as patient-specific factors such as contraindications, comorbidities and financial barriers. If the patient has a history of cardiovascular disease or significant risk factors, second-line therapy is the add-on of empagliflozin or liraglutide because of their additional cardiovascular benefits.[7] When patients are on mealtime insulin it is important to ensure they are not also on sulfonylureas because of the increased risk of hypoglycemia with concomitant use.[1] The main classes of antihyperglycemic medications are presented in Table 5. Technicians should keep in mind that several products contain combinations of drugs from different classes. Table 5 also includes

TABLE 4 - Main Insulin Types

Type of Insulin	Examples	Onset of Action	Time of Peak Effect	Duration of Action
Rapid-Acting Insulin (Mealtime)	Insulin aspart	10-15 minutes	1-1.5 minutes	3-5 hours
	Insulin glulisine	10-15 minutes	1-1.5 minutes	3-5 hours
	Insulin lispro	10-15 minutes	1-2 hours	3.5-4.75 hours
Short-Acting Insulin	Regular insulin	30 minutes	2-3 hours	6.5 hours
Long-Acting Insulin (Basal)	Insulin detemir	90 minutes	N/A	16-24 hours
	Insulin glargine	90 minutes	N/A	24 hours

TABLE 5 - Antihyperglycemic Agents[1,2]

Medication Class	Examples and Route of Administration	Mechanism of Action	Side Effects	Questions to Ask
Biguanides	Metformin (oral)	Decreases glucose production in the liver and increases sensitivity to insulin in muscle and fat cells	Nausea, vomiting, diarrhea	Do you experience any stomach pains or diarrhea while using this medication?
Sodium-Glucose Co-Transporter 2 (SGLT2) Inhibitors	Empagliflozin Canagliflozin Dapagliflozin (oral)	Prevent glucose reabsorption from the urine back into the body, causing it to be excreted in the urine	Increased urinary frequency, hypotension, increased risk of urinary tract infection	Do you urinate more frequently than before? Do you experience any dizziness throughout the day?
Sulfonylureas	Gliclazide Glyburide (oral)	Stimulate insulin secretion from the pancreas	Hypoglycemia	Do you ever feel, or wake up feeling, unwell, sweaty, jittery, shaking?
Dipeptidyl Peptidase-4 (DPP-4) Inhibitors	Linagliptin Saxagliptin Sitagliptin Alogliptin (oral)	Inhibit DPP-4 from degrading hormones responsible for stimulating insulin release from the pancreas after meals.	Diarrhea, constipation	Do you experience any stomach pains or diarrhea while using this medication?
Glucose-Like Peptide-1 (GLP-1) Agonists	Dulaglutide Exenatide Liraglutide (subcutaneous injection)	Synthetic hormones responsible for stimulating insulin release from the pancreas after meals.	Headache, nausea, diarrhea, vomiting, constipation	Do you experience any stomach pains, diarrhea or constipation while using this medication? Have you been experiencing any headaches?

questions that can be asked to monitor patients for side effects. Patients who answer "yes" to any of these questions should be referred to the pharmacist for follow-up.

Diabetes is a progressive disease, and in the later stages of type 2 diabetes, many patients are no longer capable of producing sufficient insulin to manage their blood glucose levels. In these cases, patients are supplemented with insulin injections as outlined in the previous section.[1,2]

Other medications
Patients with diabetes are also prescribed medications to help prevent secondary cardiovascular complications. These preventative medications include statins (e.g., atorvastatin) to reduce cholesterol, angiotensin-converting enzyme (ACE) inhibitors (e.g., ramipril) to reduce blood pressure and to protect the kidneys from long-term damage, and low-dose acetylsalicylic acid (ASA) to prevent major cardiovascular disease events in patients who have a cardiac history. Angiotensin receptor blockers (e.g., candesartan) may be used if the patient does not tolerate an ACE inhibitor, and clopidogrel can be used in place of low-dose ASA in cases of ASA intolerance.[1,2]

Optimizing Insulin Doses
Insulin dosing is a challenge for many patients as personalized dosing is required for each patient. Individual need, exercise levels, diet and other individual factors dictate a patient's target dose of insulin. SMBG results are the most valuable information we have when adjusting patient's insulin doses.[1,2]

Eliminating hypoglycemic events is the priority when adjusting a patient's insulin. If a patient suffers hypoglycemic events that cannot be explained by abnormal routines preceding the event, insulin adjustments should address low blood glucose levels and aim to eliminate them. Once hypoglycemic events are eliminated, or if patients do not suffer low blood glucose levels, insulin dosage adjustments should address times

TABLE 6 - Blood Glucose Meter Characteristics [9,10]

Blood glucose meter	On-screen pattern notification	Testing illumination and/or backlight	Sample size (μL)	Connectivity	Blood glucose test strips and expiry after unsealing	Other features
One Touch Verio IQ	Yes	Yes	0.4	USB	One Touch Verio Strips; 180 days	Need to recharge battery frequently. Large easy-to-read numbers.
One Touch Verio Flex	Yes	No	0.4	Bluetooth	One Touch Verio Strips; 180 days	Can sync with mobile device. Compact slim portable. Compatible with OneTouch app.
One Touch Verio	Yes	Yes	0.4	USB	One Touch Verio Strips; 180 days	Colour-coded range indicator.
One Touch UltraMini	No	No	1.0	USB	One Touch Ultra Blue; 180 days	Puts information in charts and graphs through OneTouch diabetes management software. Small and portable.
One Touch Ultra 2	No	Yes	1.0	USB	One Touch Ultra Blue; 180 days	Puts information in charts and graphs through OneTouch diabetes management software.
Accu-Chek Aviva Connect	No	Yes	0.6	Bluetooth/USB	Accu-Chek Aviva; According to expiry date	Connects to Accu-Chek Connect app, automatically transfers results to app. App can calculate insulin dose.
Accu-Chek Aviva Nano	No	Yes	0.6	Bluetooth/USB	Accu-Chek Aviva; According to expiry date	Can add meal markers and alarms. Small meter.
Accu-Chek Aviva	No	No	0.6	Bluetooth/USB	Accu-Chek Aviva; According to expiry date	Customizable hypoglycemia alarm
Accu-Chek Mobile	No	No	0.3	Bluetooth/USB	Accu-Chek Mobile; 90 days	Pre-loaded test strip cassette. Acoustic mode for visual impairment. Display available in multiple languages. Docking area on meter for lancing device.
Contour Next One	Yes	Yes	0.6	Bluetooth	Contour Next; According to expiry date	2nd chance sampling. Can add meal markers and alarms.
Contour Next	No	Yes	0.6	USB	Contour Next; According to expiry date	2nd chance sampling. Different language options. Larger buttons. Can add meal markers and alarms.
Contour Next Link	No	Yes	0.6	USB/Wirelessly compatible with insulin pumps	Contour Next; According to expiry date	2nd chance sampling. Only compatible with Medtronic insulin pumps.
Contour Next EZ	Yes	No	0.6	No	Contour Next; According to expiry date	2nd chance sampling. Large, easy to read display.
Freestyle Precision Neo	Yes	No	0.6	USB	FreeStyle Precision and FreeStyle Precision β-Ketone; Individually wrapped According to expiry date	Can re-apply blood within 5 seconds. Ketone testing. Suggestions for insulin dosing.

Blood glucose meter	On-screen pattern notification	Testing illumination and/or backlight	Sample size (µL)	Connectivity	Blood glucose test strips and expiry after unsealing	Other features
Freestyle InsuLinx	Yes	Yes	0.3	USB	FreeStyle Lite; According to expiry date	Can re-apply blood within 60 seconds. Plug and Play reports via FreeStyle Auto-Assist software. Touchscreen. Insulin calculator for rapid-acting insulin.
Freestyle Freedom Lite	No	No	0.3	USB	FreeStyle Lite; According to expiry date	Can re-apply blood within 60 seconds. Easy to hold, ergonomic design, large screen, large display. Programmable alarms.
Freestyle Lite	No	Yes	0.3	USB	FreeStyle Lite; According to expiry date	Can re-apply blood within 60 seconds. Similar features as Freedom Lite but more compact size.
Oracle	Yes	Yes	0.7	Data cable	EZ Health Oracle; 90 days	Audio function in English or French. Ketone testing.
Oracle Onyx	Yes	Yes	0.7	Data cable	EZ Health Oracle; 90 days	Need to request Data cable separately. Single button operation.
Dario	Yes	Yes	0.3	Directly to select smartphones/ web portal	Dario; 30 days	Designed to plug into smartphone (not supported by all phones). Insulin calculator for rapid insulin.
GE200 Blood glucose monitoring system	No	Yes	0.75	No	GE200; 120 days	Palm-sized, easy to hold, big buttons and extra-large device.
iBGStar	No	No	0.5	Directly to iPhone or iPod Touch	BGStar; 90 days	Connects to iPhone or iPod Touch. Analysis of data and features through iBGStar Diabetes Manager App.

of the day where patients are above their blood glucose target range.[1]

Basal insulins, such as insulin glargine and detemir, are usually dosed at bedtime, although they may also be used in the morning or twice daily (morning and bedtime). Because these types of insulins help regulate patient's fasting blood glucose levels, the best way to assess efficacy is to test blood glucose levels first thing in the morning before the first meal. If blood glucose levels are above target in the morning, dose increases may be indicated for basal insulin.

Multiple methods may be used to adjust insulin doses; small increases can be made by the pharmacy team with regular fol-low-up. Another method is patient-led titration, where patients are advised to increase basal insulin doses by 1 unit every day until they have three consecutive readings within target range. This method is typically reserved for patients who understand their pharmaceutical care very well, and are capable of independently making decisions.[1]

Mealtime insulin can be a greater challenge, as multiple factors affect the dose needed for individual patients. Intrinsic need for insulin, carbohydrate consumption and responsiveness to insulin are factors which affect a patient's optimal dose. Before initiating mealtime insulin, increased frequency of SMBG is recommended to assess the need for dose titrations. Patients are typically asked to test before and two hours after the meal(s) to which they will be adding mealtime insulin. Adjusting mealtime insulin requires looking at the patient's blood glucose level log and analyzing any patterns. If a patient is routinely over targets based on preprandial and 2-hour postprandial blood glucose levels as stated in Table 1, dose increases may be warranted.

Registered Pharmacy Technician's Role
Selection of Insulin Devices
In the past, insulin was a very intimidating medication due to the need to withdraw from a vial into a needle. Today, pre-filled

the capability of reporting trends, such as all meters from the One Touch Verio series as well as the FreeStyle Precision Neo. See Table 6 for more information on these and other blood glucose meters.[9,10]

In September 2017, FreeStyle is releasing a new glucose monitoring system known as FreeStyle Libre. This monitoring system will consist of a wearable interstitial glucose sensor that is replaced every 14 days, which eliminates the need for routine finger pricking to perform blood testing. Testing blood glucose levels is recommended in times of rapid glucose level change, when hypoglycemia occurs or when any symptoms experienced do not correlate with the interstitial glucose level detected. To measure interstitial glucose levels, patients must simply wave the Libre Reader within 4 cm of the sensor, which displays current interstitial glucose levels, data from the last 8 hours, as well as an arrow that indicates whether glucose levels are currently trending upwards or downwards.[11]

insulin pens and reusable pens with cartridges provide patients with a quicker and easier way to inject their insulin. In addition, needle tips used today are relatively painless when used correctly.

Most types of insulin are available in either pre-filled pens or in cartridges to be used with a reusable pen. Pre-filled pens offer convenience as they are disposable when empty. Reusable pens require patients to remove empty cartridges and to insert new ones. Technicians can assist patients in choosing the most suitable insulin devices. Patient preference is the most important factor when choosing an insulin pen. For patients with coordination or cognitive impairments, pre-filled pens may be desirable due to the simplicity and convenience of use.

Needle tips for insulin pens are available in different lengths: 4, 5, 6, 8 and 12 mm. Needle tips measuring 4-6 mm are used for the majority of patients due to decreased pain at the injection site compared to longer needle tips. 8mm needle tips may provide patients with some comfort in some cases, such as patients using large insulin doses. Needle tips longer than 8 mm are not recommended for insulin injections.[8]

Selection of Blood Glucose Meters

Many different blood glucose meters are available on the market. Patients would benefit from pharmacy technician assistance with meter selection. Multiple factors can influence a patient's best choice of blood glucose meter, such as manual dexterity, visual impairment, technical aptitude and health literacy.

For patients who have trouble with manual dexterity, a larger meter is usually preferred for ease of handling versus smaller meters. Try suggesting larger meters to this patient population to avoid difficulties with small meters and strips. For patients with visual impairment, Oracle is the only blood glucose meter available that has audio capabilities. The Oracle communicates blood glucose levels to patients by spoken voice, and also has a large display for those with some visual acuity. Also, for patients with visual impairment, the Contour Next offers second chance sampling. Similarly, FreeStyle meters allow you to apply more blood to the strip if you didn't get enough the first time.

Younger patients, as well as patients who have advanced health literacy skills, may benefit from technically advanced meters. The Dario meter is advantageous for those who always carry their smartphones, since it plugs into and directly integrates into the smartphone. Patients may appreciate the convenience of not having to carry a meter daily. Other more technically advanced meters are the One Touch Verio Flex and the Contour Next One meters, which connect to applications on smartphones by Bluetooth, providing average and trend data. Other meters also have

Insulin Device and Glucose Meter Training

Pharmacy Technicians can help educate patients on how to properly use and maintain insulin devices and blood glucose meters. Training patients on how to properly use insulin pens is essential to ensure they are receiving the correct dose from their injections. This includes checking that is done, needle tips are attached correctly, and that the cartridge is inserted correctly in reusable pens. Blood glucose meter training is also essential. This includes performing tests, proper strip insertion, using the lancing device, proper application of blood samples to the test strip and biohazard material disposal. In addition, technicians can show patients how to navigate the monitor for results and trends, and can periodically re-assess the patient's injection and testing techniques. Patients who have difficulty with any aspect of blood glucose monitoring

should be referred to the pharmacist.

Technicians should also encourage the use of a blood glucose log. This helps the patient and the pharmacy team analyze blood glucose levels for trends, and helps reinforce the need for consistent monitoring by the patient. It is also important to remind patients of the importance of routine blood glucose monitoring if their log or meter shows evidence of inconsistent testing.

Drug Storage

Technicians may be in charge of drug storage in the dispensary. It is important to ensure that any insulin or other refrigerated medications received be stored as soon as possible in the refrigerator between 2 and 8 °C. This helps avoid temperature damage to the medication, including breakdown of the active ingredient and reduction in efficacy.

Patient education on drug storage is also important. Patients should be instructed to keep all insulin products in the refrigerator, with the exception of the pen or cartridge they are currently using. All insulin products are stable for one month at room temperature, with the exception of insulin detemir, which is stable for 42 days at room temperature.[12]

Medication Adherence and Tolerability

Screening for adverse effects of medications and episodes of hypoglycemia are important roles that technicians can help fulfill. Asking questions as outlined in Table 5 can help identify patient intolerance to their antihyperglycemic medications and the need for referral to the pharmacist for follow up. In addition, monitoring patient refill timing is important to help determine if patients are adherent with their medication.

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QUESTIONS

Please select the best answer for each question and answer online at eCortex.ca for instant results.

1. A patient who is known to have diabetes approaches the counter and reports they are not feeling well. They report they missed lunch today and are feeling dizzy. You see they are sweating and their hands are shaking. This patient is likely experiencing;
a) Stroke
b) Hunger pain
c) Hyperglycemia (high blood glucose)
d) Hypoglycemia (low blood glucose)

2. People who are overweight have diabetes
a) True
b) False

3. A patient using basal insulin at bedtime and mealtime insulin comes into the pharmacy with their blood glucose logbook. You notice that they are routinely above target in the morning and at suppertime, and have had 3 low blood glucose levels before lunch this week. What might you suggest to the pharmacist to help this patient?
a) Reduce basal insulin at bedtime
b) Reduce mealtime insulin at breakfast
c) Increase mealtime insulin at breakfast
d) Reduce mealtime insulin at lunchtime

4. Patients with type 2 diabetes are at risk of developing all of the following EXCEPT:
a) Retinopathy
b) Type 1 diabetes
c) Neuropathy
d) Nephropathy

5. Which of the following are considered standard blood glucose level and A1C targets for type 2 diabetes patients?
a) Fasting blood glucose: 4-7 mmol/L, Postprandial blood glucose: 5-10 mmol/L, A1C: 7.0
b) Fasting blood glucose: 5-10 mmol/L, Postprandial blood glucose: 4-7 mmol/L, A1C: 7.0
c) Fasting blood glucose: 4-7 mmol/L, Postprandial blood glucose: 5-10 mmol/L, A1C: 8.5
d) Fasting blood glucose: 4-7 mmol/L, Postprandial blood glucose: 5-8 mmol/L, A1C: 7.0

6. A patient at your pharmacy with type 2 diabetes currently uses metformin, gliclazide, ramipril (an ACE inhibitor), rosuvastatin (a statin) and basal insulin. They have received a new prescription for mealtime insulin today because of continued high blood glucose levels. Which of their current medications should be assessed by the pharmacist?
a) Metformin
b) Basal insulin
c) Gliclazide
d) Ramipril

7. The advantage of rapid-acting insulin over short-acting insulin is its shorter duration of action, therefore decreasing the risk of hypoglycemia
a) True
b) False

8. Empagliflozin and liraglutide are considered second-line therapy to be added to metformin for patients with type 2 diabetes and cardiovascular disease because of:
a) Their cost
b) Their convenience
c) Their cardiovascular benefits
d) Their A1C lowering benefits

9. Sulfonylureas help lower blood glucose levels by:
a) Increasing insulin resistance
b) Increasing the excretion of insulin produced by the pancreas
c) Inhibiting glucose reabsorption by the kidneys, causing glucose to be excreted in the urine
d) Acting directly on glucose in the blood

10. Glucagon injection is used for patients who:
a) Have very high blood glucose levels
b) Do not want to take insulin
c) Are unconscious because of hypoglycemia
d) Have high blood pressure

11. A patient with type 2 diabetes is to start mealtime insulin next week. The doctor is interested in trying the insulin at suppertime, and they asked that the patient increase their frequency of SMBG before starting. The patient is wondering what time(s) of the day they should be testing, because the doctor did not tell them. What time(s) of the day should they be testing their blood glucose levels?
a) Two hours after supper and at bedtime
b) Before supper only
c) Two hours after supper only
d) Before and two hours after supper

12. A patient comes into your pharmacy complaining of multiple urinary tract infections (UTIs) in the last 6 months. Which of her following medications can increase a patient's risk of UTI?
a) Gliclazide
b) Empagliflozin
c) Insulin lispro
d) Liraglutide

13. The standard A1C target used for patients with type 2 diabetes is 7.0. Which of the following circumstances would warrant a higher target (8.5)?
a) Limited life expectancy
b) A patient with frequent hypoglycemia
c) A patient with a high level of functional dependency
d) All of the above

14. One method of basal insulin titration is where the patient increases their insulin dose by 1 unit every day. When would their insulin dose titration be considered complete?
a) When they have 3 consecutive days where fasting blood glucose readings are within target
b) When they have 3 consecutive days where all postprandial blood glucose readings are within target
c) When they have their first ever fasting blood glucose reading within target
d) When they have reached the insulin dose they desire to use

15. Registered pharmacy technicians can help with patient's diabetes care by:
a) Educating patients on the proper use of blood glucose meters and/or insulin devices
b) Screening patients for side effects from their antihyperglycemic medications
c) Assisting in patient selection of blood glucose meters and/or insulin devices
d) All of the above

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