Summer 2013

Reading

CEPCP

Professional Development:
Diabetic Emergencies

The Call

It should not have been as irritating as it was, but the comment sent a wave of irritability over him. It was an innocent enough sentence, “I really need to get off on time today, I have plans after work.” But it was irritating for several reasons. One, Frank was irritating in general. Second, saying things like that virtually guaranteed that they were NOT going to get off on time (even a newbie would know that). Third, Frank continuously made plans to do stuff right after shift and then became angrier than his usual baseline level of anger (which was higher than a normal person’s) when they ended up with overtime. Drew would then have to listen to Frank rant and rave blaming everyone from management to dispatch for his plans being ruined. “You shouldn’t make plans after work Frank”, Drew said and continued driving.

This is why Drew was not even a little bit surprised, later, when the base pager sounded about ten minutes before the night-crew was due to show up. Frank was ranting too much for Drew to hear much of the call information but it was a code 4 to a nearby low-income apartment complex that Drew was quite familiar with. As he pulled out of the base and flipped on the emergency lights, neither Drew nor Frank were aware of the potential trap they were heading into. The outcome would be determined by their ability to think clearly through their disappointment of a late call, as well as years of bad habits and misinformation. It has been said that often, when life hangs in the balance, it is not apparent to anyone involved until after the fact, when 20:20 vision makes the precariousness of the situation crystal clear.

". . . 62 year old male, unresponsive, history of diabetes, he is clammy and pale." the dispatcher updated in a detached, monotone voice.
"This might work out then.", Frank said looking nervously at his watch.

They were let into the building by another resident who was exiting. She looked at the stretcher loaded with equipment roll by and said, "Oh my goodness, I hope everything is alright.", in a questioning voice, clearly wanting more information.
"So do we ma'am.", Frank said with tension in his voice.
The apartment was better kept than most others in the building. There was a faint smell of Lysol in the air and the place looked clean and uncluttered albeit not modern. The woman who opened the apartment door was in her sixties and was visibly shaken. "I just got home from work, I don't know what has happened, he has been doing so well lately, he has even been watching his weight." She had a nearly pleading tone in her voice.

The patient was reclined in a lazy-boy in the living room. An overturned coffee cup lay on the floor. For a moment Drew wondered if the patient, also in his sixties, might be choking but the loud snoring respirations clarified that the airway was not obstructed by anything other than the patient's tongue. He looked ghostly pale, was literally dripping of sweat and clearly, profoundly unconscious. "So, he is a diabetic?", Frank asked as a matter of greeting and started unzipping the pouch that holds the glucometer. "Yes, he is, but he is not on insulin or anything.", she answered. Drew was becoming concerned, warning bells were sounding in his head.

By the time Drew had managed the airway (with a naso-pharyngeal airway), applied the oxygen and secured the BP cuff to the patient's arm, Frank triumphantly announced "1.0 mmol! Ma'am, we are going to give your husband some sugar in his vein and he will be just fine", Frank at least sounded happy for the first time today.
"He is not my husband, he is my brother but thank you".
"Has this ever happened before?", Drew asked, still feeling a bit unsettled.
"No, never."
"Can you show me the medications your brother is on?"
"Sure, they just added another pill for his diabetes, I will get them."
As she disappeared into the hallway Drew watched Frank toss the IV sharps into the sharps container.
"I'm in!".
"What is your husbands name ma'am?", Frank yelled in the direction of the hallway no doubt anticipating the great awakening.
"My *brother's* name is Harvey!", she yelled back, now clearly annoyed.

Diabetes

Without a doubt diabetic emergencies are one of the most common emergencies paramedics respond to. Most commonly when blood sugar levels dip too low but also when levels get high. A patient with diabetes needs to frequently measure their blood sugar and then balance food intake, physical activity and medications (that act to lower blood sugar levels). It is a precarious balance; too much blood sugar and all the long-term complications of diabetes materialize, but let the sugar go too low and run the risk of losing consciousness. With type 2 diabetes on the rise and treatment guidelines pushing patients to keep their blood sugar even lower, paramedics are guaranteed to continue to encounter hypoglycemic patients.

This reading package will review the basics of diabetes and discuss some of the common treatment options and complications. It will provide information that is invaluable when treating the patient who's blood sugar has dropped in order to ensure the safe treatment and disposition of the patient.

Starvation in the Land of Plenty

There are many different types and classifications of diabetes, the one thing they all have in common is the end-result of high blood sugar levels. When we eat, food is broken down to simple sugars, which cells can use for fuel. The simple sugars are transported in the blood to the cells where they cross the cell membranes, enter into the cells and are utilized for metabolism. However, the human body has a very cool system that is constantly monitoring supply and demand and is able to store excess sugar, release stored sugar as well as enhance or impair entry of sugar into the cells. It is mind-blowing when you think about it.

Insulin is one of the key messengers in this control system. Like an army of building managers, insulin is released into the blood when sugar levels are high and run around unlocking all the doors to the cells, letting the sugar inside so the sugar can do what it has to do rather than hanging around the hallways (blood vessels). Insulin even heads down into the basement storage area (liver) and stuffs all the extra sugar down there (renamed glycogen now). Hence **insulin is responsible for lowering the blood sugar to normal levels following a meal.**

Glucagon is the other messenger, like a socially starved janitor, it wanders the empty hallways trying to increase the hallway crowd again by locking doors to prevent the sugars from entering the cells. Glucagon also releases some of the glycogen, inviting it back into the circulation. Hence **Glucagon increases blood sugar levels to normal levels between meals.**

Type 1 Diabetes

In type 1 diabetes the insulin is gone. The cells that produce it (the beta cells of the pancreas) have been destroyed, usually by the body turning on itself, confusing the beta cells with a pathogen and destroying them. Very bizarre but true. The consequence is not difficult to imagine. Returning to our building manager analogy, the building is flooded with people but there is nobody there to unlock the doors. The hallways are soon filled with an angry mob that are scraping the walls and drawing graffiti. Very destructively they pick at the drywall, poke holes in it and cause general mayhem. Yet inside the cells it is quiet and very, very lonely. The “hallway” damage is the vessel damage with resultant heart, kidney, eye and nerve problems that haunt diabetics worldwide.

Type 1 diabetes makes up about 5-10% of diabetes cases and often develop early in life (sometimes referred to as juvenile onset diabetes) (Association, 2010). In infants and children the beta cell destruction is very rapid. Often there are no symptoms detected until 85-90% of cells are destroyed. In many cases the diagnosis is not made until the child ends up with ketoacidosis (Association, 2010). Because of the wide-spread beta cell destruction and absence of insulin, the only treatment option for most type 1 diabetics is insulin injections. Hence why type 1 diabetes is sometimes referred to as *insulin dependent diabetes* (although type 2 diabetics can also become insulin dependent). In summary, type 1 diabetes is a problem of ever rising blood sugar due to a lack of insulin.

Type 2 Diabetes

Type 2 diabetes have a variety of causes. In some cases a diet high in sugar and simple carbohydrates may lead to an exhaustion of the insulin receptors to the point of them becoming resistant. It is like the people inside our apartment block get so sick of having insulin constantly coming around unlocking their doors and letting sugar in that they finally put the chains on from the inside. Insulin can unlock the door all it wants but sugar is not getting in. So insulin is available but there is still tons of sugar mingling in the vessels causing damage.

As the disease progresses the insulin system finally starts to shut down. The building managers come to the realization that there are too many of them as it is, and they are not doing much

good anyway, so they pack up and go home. This is reflected in the body as beta cell destruction that often occurs in type 2 diabetes.

In other cases the type-two diabetes is caused *primarily* by low insulin levels due to beta cell destruction from a variety of causes.

Typically type 2 diabetes begins gradually in later years of life and is linked to obesity.

In summary, type 2 diabetes is a problem of rising blood sugar levels either due to cells becoming insulin resistant (with normal levels of insulin available) and/or a lack of insulin.

The Ps

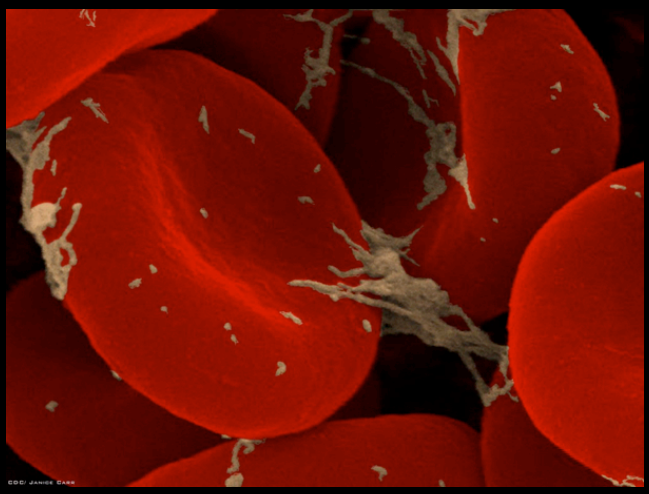
As we can conclude from the above descriptions, regardless of the type of diabetes the end-result is a high level of sugar inside the blood vessels but a low level of sugar inside the cells, hence ***starvation in the land of plenty***. This condition (hyperglycemia) causes some very characteristic signs and symptoms.

First, the sugar has a strong, sponge-like ability to draw fluid with it. Fluid can pass easily through cell membranes so the sugar literally draws the fluid out of the cells as it passes by in the vessels. The kidneys are good at regulating the fluid balance so, sensing the higher fluid levels in the vessels, dumps the excess into the bladder. This leads to a lot of peeing (polyurea) by the hyperglycemic patient.

However, the cells are dehydrated (since the sugar so rudely sucked the fluid out of them) so they trigger thirst. Hence the hyperglycemic patient becomes very thirsty and drinks a lot (polydipsia).

We also mentioned above how inside the cells it is lonely and the cells are starving, so they trigger hunger and the hyperglycemic patient tends to eat a lot (polyphagia).

A1C



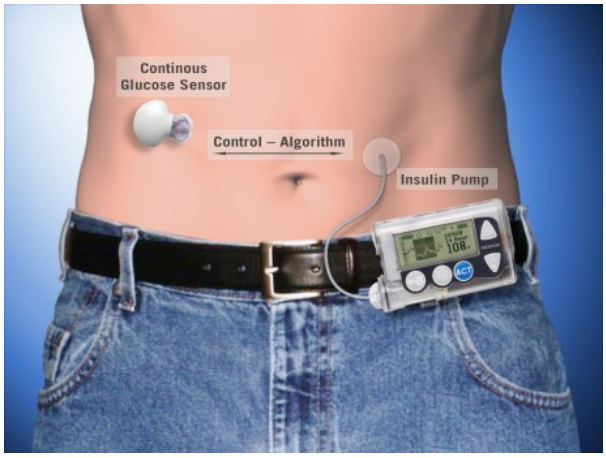
The problem with traditional blood sugar measurements is that they are truly a 'snapshot' of the blood sugar level at the time of measurement.

As I am sure paramedics know, more than anyone, the blood sugar level can vary a lot over a fairly brief period of time. So, a single reading doesn't really mean a whole lot when physicians and patients want to know how well the blood sugar is being controlled in general. It would be much more useful to find out what the average blood sugar has been over the past few months, that is where A1C comes in. Hemoglobin change in a very predictable way when exposed to glucose, they become "glycated" (I swear I am not making that up, it's a real word). By measuring the glycated hemoglobin the average blood sugar level over the past few months can be determined. How cool is that?

Treating Diabetes

"Treating" diabetes is a misnomer since the current strategy focus more on modifying the effects of the diabetes (lowering the blood sugar), than actually treating the cause. Type 1 diabetes is most commonly treated with insulin injections. Although the modern use of pumps and synthetic insulin have no doubt improved the quality of life of diabetics, it is remarkably similar to what Banting and Best came up with in 1921 at University of Toronto by grinding dog pancreas and injecting the goo into dogs they had rendered diabetic by surgically removing their pancreas'.

One of the biggest challenges of a diabetic patient is balancing activity, food intake and insulin. The balance is difficult since lowering the



blood sugar too much renders the patient combative, unconscious or in a seizure (hypoglycemic). But too much in the other direction and the patient runs the risk of blindness, kidney failure, heart problems, extremity amputation and other nasty side-effects.

Metformin

Type 2 diabetics have a wider range of treatment options available to them. The first step is usually diet and exercise, sometimes along with metformin. Metformin works by lowering glucose production by the liver and increases the cell's sensitivity to insulin (Bosi, 2009). Metformin has other positive effects as well and is thought to protect the beta cells (where insulin is made)(Bosi, 2009).

Metformin is also less likely than other treatment options to cause hypoglycemia (Bosi, 2009). The risk of hypoglycemia in a diabetic treated with metformin and diet alone is negligible (Holstein, Plaschke, Vogel, & Egberts, 2003).

Glyburide

Even though diet, exercise and metformin does a great job for many type 2 diabetics, they often have a progression of their illness and their blood glucose levels will begin to rise again. At that time it is usually time to turn the attention to the insulin levels which may have begun to go down (metformin does nothing to increase insulin levels).

However, before adding insulin through needles or pumps there are ways of whipping the beta cells into increasing production. As you may recall, in type 2 diabetes the beta cells are not destroyed to the same degree as they are in type 1 diabetes, so putting the pressure on them may do the trick (for a while at least). Glyburide is one of the most common of such drugs. It belongs to a family referred to as sulphonylureas and is often used in type 2 diabetics to increase the body's insulin production. Increasing insulin production is exactly what the diabetic patient needs in order to facilitate the movement of sugar from the blood into the cells.

The major drawback with long acting sulphonylureas such as glyburide (chlorpropamide is another one) is the significant risk of hypoglycemia, not just hypoglycemia but prolonged, recurrent hypoglycemia. This point cannot be overstated, diabetics on a sulphonylurea

that are treated with dextrose on scene must never be signed off.

Meglitinides

Another oral medication used for type 2 diabetes is meglitinide. Other names for meglitinide are repagalinide (GlucoNorm) and Nateglinide (Starlix).

The drug is very similar to sulphonylureas in that it works in the pancreas to increase insulin excretion. However, a much shorter duration of effect, as well as being triggered by glucose, makes it a much safer drug. Because of its short duration of effect it is usually taken with meals to deal specifically with the rise in blood sugar that follows food intake.

Hypoglycemia

Possibly the most common diabetic emergency that EMS providers manage is hypoglycemia. As discussed above, hypoglycemia is a side-effect of the treatment of diabetes. When insulin moves the sugar into the cells (and into storage) the blood sugar drops. The brain is one of very few privileged organs that do not need insulin to use sugar. But it is also not able to store glucose, so when the blood sugar is low, the brain starves.

The glyburide that Harvey recently started taking had been working well to increase production of insulin. Hence more of Harvey's blood sugar had been moved into the cells. Combined with Harvey's valiant efforts to curb his calorie intake it had left the blood glucose level dangerously low. At around 2 pm Harvey's blood sugar reached 3.7 mmol (of course he had no idea, he wasn't measuring it). This was also when his brain first took notice and began to react. Glucagon, epinephrine, growth hormone and cortisol was released as a defense against the lower sugar level.

By 2:45 pm Harvey was starting to feel a bit strange. He was watching TV and found that his hands were getting cold and moist. He even turned the thermostat up a few degrees and noticed as he did so that his hands were trembling. He was also getting very hungry but decided not to succumb to his habitual snacking. He sat back down on the couch and continued watching the golf game. He couldn't shake the feeling of nervous jitteriness. He was breaking out in a cold sweat. Harvey had no idea but his sugar had now dropped to 3.2 mmol and the epinephrine is what was causing the unsettled feeling. The epinephrine was meant to release stored glucose and inhibit the release of insulin, but it wasn't working well for Harvey. His sugar was continuing to drop. He also had no idea that he was now in, what experts refer to as, mild hypoglycemia. If he had recognized the symptoms he could have treated himself by simply eating something.

By 3:30 pm Harvey was having difficulty seeing the score of the golf game. He blinked, lifted his glasses up and down but could not figure out why his vision was blurry. He was also getting very sweaty and felt hot. He picked up his empty coffee cup and looked at it. He needed to eat, what could he eat? He thought about it, maybe he could order something. He picked up the remote control and wondered what he could order. He tried dialing a number and was surprised when the TV suddenly became full of static. The numbers on the buttons looked weird, and blurry. Harvey's blood sugar had now dropped to 2.7 mmol and any hope of him helping himself had vanished. Harvey's life was now at risk. His unhealthy heart, full of plaque, straining at the best of times, was now being whipped into a frenzy by the soaring epinephrine levels. Harvey was beginning to panic. Just as he decided he needed to get some help things went black. The last thing he remembered was his heart pounding noticeably, it was causing a dull pressure to spread through his chest.

The progression of Harvey's signs and symptoms are caused by two classifications of symptoms, neurogenic and neuroglycopenic (see Table I). The neurogenic symptoms are mainly caused by the epinephrine release and often precede the neuroglycopenic symptoms. Because the

Table I. Classification of hypoglycaemic symptoms

Neurogenic	Neuroglycopenic
Adrenergic	Difficulty in thinking
Tremulousness	Confusion
Palpitations	Drowsiness
Anxiety	Weakness
Cholinergic	Warmth
Sweating	Difficulty in speaking
Tingling	Clumsiness
Hunger	Odd behaviour
	Seizure
	Coma
	Death

neurogenic symptoms do not affect a person's ability to think, they can serve as a valuable warning sign and prompt the diabetic patient to eat something. Unfortunately elderly patients often have a blunted response to epinephrine and may not experience the neurogenic symptoms. It is not uncommon for elderly patients to have blood sugars as low as 2.2 mmol without any symptoms (Bramlage et al., 2012). Additionally, the use of beta-and/or ACE inhibitors can further blunt the neurogenic symptoms rendering the diabetic unaware that their blood sugar is dangerously low (Chelliah & Burge, 2004).

Even though the causes of hypoglycemia are varied, the most common cause is injecting too much insulin (Chelliah & Burge, 2004). Missing a meal or increasing exercise levels without adjusting the insulin dose are also common causes of hypoglycemia (Chelliah & Burge, 2004).

Table II. General risk factors for hypoglycaemia in elderly patients with type 2 diabetes mellitus

Advanced age
Polypharmacy
Recent hospitalisation
Use of sulfonylurea and/or insulin
Poor nutrition or fasting
Intercurrent illness
Chronic liver, renal or cardiovascular disease
Prolonged physical exercise
Alcohol (ethanol)
Endocrine deficiency (thyroid, adrenal, pituitary)
Loss of normal counter-regulation
Hypoglycaemic unawareness

Insulin Shock Therapy

Back in the 1940s and 1950s insulin shock therapy was used extensively for treating a variety of psychiatric conditions. Essentially a large dose of insulin was given and the patient was left to seize, sweat and fight for up to an hour. Seems crazy now but it was accepted practice back in the day.

Scan these QR codes to view a couple of YouTube videos of actual insulin shock therapy being done

For patient's that do not take insulin, a long acting sulphonylurea such as glyburide is the most common cause (Chelliah & Burge, 2004). Additionally there are many general risk factors for developing hypoglycemia (see table II).

The Danger of Glyburide

One very important consideration regarding the pre-hospital management of hypoglycemia, is the dangers of glyburide (and other long acting sulphonylureas). The long duration of effects make rebound hypoglycemia a very real risk. Signing off a patient who takes glyburide is very, very risky and should be avoided at all cost. As this case illustrates:

An 82 year old man accidentally took his wive's glimepiride (a sulphonylurea that is considered safer than glyburide). He took an 8 mg dose (the maximum recommended daily dose) with dire consequences. When EMS found him unconscious in his house his blood sugar was too low to register. The medics gave him 1 mg of Glucagon and 30 minutes later, at the hospital, his blood sugar was only 1.7 mmol. An amp of dextrose was given but an hour later the blood sugar was dropping again so a second amp was given and a continuos dextrose infusion was started. It wasn't until the next day that his blood sugar began holding on its own (Yates, Neoh, Konpa, Fullinfaw, & Colman, 2009). Most experts suggest prolonged monitoring in the ED or even hospital admission following hypoglycemia involving a sulphonylurea (Holstein et al., 2003; Tsai, Lin, Hsu, Cheng, & Chu, 2011). Hence a pre-hospital dextrose administration is insufficient even if the patient promises to eat something.

The Severe Hyperglycemias

On the other end of the spectrum we find the severe hyperglycemic conditions; Diabetic Ketoacidosis (DKA) and Hyperglycemic Hyperosmolar State (HHS). The mortality of these conditions are high with as many as 1 in 10 patients with DKA and half of patients with HHS dying from the condition. The underlying derangements are the same in both conditions. In a non-diabetic person, insulin and glucagon act to inhibit each other. When a person eats and the blood sugar rises, insulin is released and inhibits glucagon release. It makes perfect sense, since glucagon counteracts what insulin does it would

HHS	DKA
Usually occurs in older, obese type 2 diabetics. Takes days or weeks to fully develop. Often occur in elderly patients with decreased renal function who do not have access to water.	Usually occurs in younger, lean patients with type 1 diabetes. Develops within a day or so. Deep, rapid respirations (Kussmaul's). Acetone breath.
Both	
Polyurea, Polydipsia. Abdominal pain with nausea and vomiting. Dehydration (more pronounced in HHS).	

not make sense to have both at work at the same time.

We have already established that the diabetic patient has little or no insulin. Consequently glucagon is not inhibited. So even when blood-sugar levels are high, glucagon continues to break down stored sugar, even breaking fats down to sugar, further adding to the already high sugar levels. Epinephrine and cortisol (stress hormones) are also released and also break down glycogen and fats to sugar. When fats are broken down to sugar it creates fatty acids that are converted to ketone bodies in the liver. The end result is severe dehydration as the sugar draws fluid out of the cells into the vessels where it is eventually peed out. In DKA a state of acidosis is reached as well. You might be asking yourself how much fluid loss can occur form HHS or DKA. The numbers may surprise you, 5 - 7 liters in DKA and 7 - 12 liters in HHS!

There is usually a precipitating factor to these conditions. Most commonly it is an infection that triggers DKA or HHS, but any major event such as an MI, CVA or acute pancreatitis may also set it off. Failing to take enough insulin is another cause.

Treatment is aimed at correcting the sugar, electrolytes, fluid and pH, all of which are seriously

This is a posting from a Diabetes discussion forum (www.todiabetes.org) where an individual with diabetes recalls her experience with DKA.

(the BS values are in mg/dl 200 = 11.1 mmol, 600 = 33.2 mmol)

Thursday afternoon: By 2 pm, I all of a sudden felt like I was getting the flu. It wasn't a gradual, "Oh I think I might be coming down with something" feeling, but rather a "Wow, I'm totally sick" feeling. Stopped at a store on the way home, I remember standing in line and feeling terrible, and feeling my heart bust out of my chest. I made it home and promptly laid down to nap, thinking I could sleep this off (because I truly have no time to be sick) My BG were a little high, in the low 200's so I wasn't too concerned. I corrected and went to nap.

Thursday 8pm: Slept all afternoon, and woke up feeling worse. Ate some soup, took more insulin for my rising BG and laid back down. Noticed I was thirsty, so started drinking lots of water.

2 am: Woke up in a daze. I was home alone. Couldn't think straight. Felt super nauseous, vomited violently twice. Blood sugar hit mid 400's. Took lots of insulin, laid back down because that was all I could do. I remember telling myself that I should check my pump/call my doc/ call someone/ do something. Then I went back to sleep.

6 am: After fitful sleep, BG hit high of 600. Lots more vomit. I was scared but still not thinking straight. Still home alone. Somewhere in my cloudy head I got myself to change my infusion on my pump, thinking something had to be terribly wrong because I had taken so much insulin and my BG just kept rising. Put a call into my doc, naively hoping it was just a flu/bug.

8 am: BG began to slowly come down; around 400 at this point. Vomited again (but for the last time, thankfully). Doc called and told me to go to ER NOW! Again, I was alone and knew I couldn't drive. My friend came and brought me in.

9 am: At ER, they took me right in and put me on IV, Potassium. Slept most of the time when not answering questions/giving blood. Diagnosed with DKA.

12 am: BG had fallen to around 230 average, finally admitted to floor for observation and IV.

out of sorts in these patients. The only component that can be started in the pre-hospital phase is the fluid therapy. However, unless the patient appears to be seriously dehydrated and hemodynamically unstable it is probably best to wait and let the hospital staff manage it since any fluid given will influence all the other factors they must correct. Also, cerebral edema and adult respiratory distress syndrome (although rare) are potential complications from the fluid therapy in HHS and DKA patients. The risk of cerebral edema is much higher in the pediatric population, hence why a patch is required to administer a bolus to those patients.

Meanwhile Back at the Call

Even before Frank had pushed the entire amp of dextrose Harvey was starting to stir. He coughed a few times and looked around with a suspicious, startled look.

"Harvey, we are the paramedics, your sugar went low.", Frank yelled. Drew could not figure out why Frank was yelling. He did the same thing when speaking to people that couldn't speak good English, or anyone elderly (whether they were hard of hearing or not). Drew looked at the glyburide bottle prescribed 4 days ago. He was convinced it was the culprit.

"Drew, can you go grab the laptop?", Frank said, predictably.

"No Frank, the laptop is not happening, Harvey is coming to the hospital".

Frank's face became flushed, he hated being second-guessed.

"Harvey, do you want to come to the hospital, or would you rather your wife make you something to eat here?".

"My wife?", Harvey suddenly looked disoriented again.

"He means your sister but you need to come with us to the hospital, the medication you started recently puts you at risk for your blood sugar dropping again"."Is that what happened, my blood sugar went too low?"

"Yes, you will need to be monitored at the hospital until things stabilize."

Frank was setting up the stretcher, still looking a bit flushed.

Later, at the hospital, Drew decided to clear the air.

"Sorry Frank, it just wouldn't have been safe leaving him."

"I know Drew. I appreciate you stepping in sometimes. I know about the whole oral diabetic medication stuff, I just didn't think about it.".

"Sorry about your plans tonight, I guess you will be late".

"That's a small price to pay in the grand scheme of things." Frank said and submitted the ACR.

Bibliography

Association, American Diabetes. (2010). Diagnosis and classification of diabetes mellitus. *Diabetes care, 33*(Suppl 1), S62-S69.

Bosi, E. (2009). Metformin--the gold standard in type 2 diabetes: what does the evidence tell us? *Diabetes, Obesity & Metabolism, 11 Suppl 2*, 3-8. doi: 10.1111/j.1463-1326.2008.01031.x

Bramlage, Peter, Gitt, Anselm K., Binz, Christiane, Krekler, Michael, Deeg, Evelin, & Tschöpe, Diethelm. (2012). Oral antidiabetic treatment in type-2 diabetes in the elderly: balancing the need for glucose control and the risk of hypoglycemia. *Cardiovascular Diabetology, 11*, 122-122. doi: 10.1186/1475-2840-11-122

Burge, M. R., Sood, V., Sobhy, T. A., Rassam, A. G., & Schade, D. S. (1999). Sulphonylurea-induced hypoglycaemia in type 2 diabetes mellitus: a review. *Diabetes, Obesity & Metabolism, 1*(4), 199-206.

Chelliah, Aruna, & Burge, Mark R. (2004). Hypoglycaemia in elderly patients with diabetes mellitus: causes and strategies for prevention. *Drugs & Aging, 21*(8), 511-530.

Corley, B. T., Davenport, C., Delaney, L., Hatunic, M., & Smith, D. (2011). Hypoglycaemia-induced myocardial infarction as a result of sulphonylurea misuse. *Diabetic Medicine: A Journal Of The British Diabetic Association, 28*(7), 876-879. doi: 10.1111/j.1464-5491.2010.03226.x

Holstein, A., Plaschke, A., Vogel, M. Y., & Egberts, E. H. (2003). Prehospital management of diabetic emergencies--a population-based intervention study. *Acta Anaesthesiologica Scandinavica, 47*(5), 610-615.

Rendell, Marc. (2004). The role of sulphonylureas in the management of type 2 diabetes mellitus. *Drugs, 64*(12), 1339-1358.

Tsai, Shih-Hung, Lin, Yen-Yue, Hsu, Chin-Wang, Cheng, Chien-Sheng, & Chu, Der-Ming. (2011). Hypoglycemia Revisited in the Acute Care Setting. *Yonsei medical journal, 52*(6), 898-908.

Yates, C., Neoh, S., Konpa, A., Fullinfaw, R., & Colman, P. (2009). Factitious hypoglycaemia. *Internal Medicine Journal, 39*(12), e15-e17. doi: 10.1111/j.1445-5994.2009.02100.x