1 - Choosing an AID System: Which Superhero Do You Want in Your Corner?

John Pemberton (00:09.944)

Welcome to the Glucose Never Lies podcast where science meets real life experience to empower diabetes management. I'm John Pemberton. I've lived with type 1 diabetes since 2008 and have spent nearly 20 years mastering both the science and art of managing it. Through personal experimentation, published research and my work as a diabetes specialist dietician, I've gained deep insights into what truly makes a difference. When my son Jude tested positive for type 1 diabetes antibodies,

I realised that all the knowledge in my head was wasted if I couldn't communicate it in a way that was clear, actionable and easy to come back to. So I built the Glucose Nevelise Education Programme, a free online resource designed to teach people diabetes management exactly the way I'd want people to understand it if they were looking after my son. After battling a functional motor disorder for many years and recently experiencing a major depressive episode, I was eventually pulled out of that hole by my friends, family and professionals who helped me get back to being me.

That experience taught me the power of giving and this podcast is my way of giving back. My co-host Louise is a highly experienced diabetes nurse with over 20 years in the field. She brings a wealth of knowledge and her superpower is making complex diabetes science accessible and practical for everyday life. She is the best diabetes nurse I have ever worked with and there have been some good ones. Most importantly, she keeps me in check and keeps the podcast on point. So if you're living with diabetes or supporting someone who is,

We want to make things easier, clearer, and importantly, more enjoyable. We hope you enjoy the content. If you do, please share it with those who may like it too. As a disclaimer, the information shared on the Glucose Nebulize podcast is for informational and educational purposes only. While we discuss strategies and insights for diabetes management, this podcast is not a substitute for professional medical advice. Always consult your healthcare team before making any changes to your diabetes plan.

That done with, let's get into the content.

John Pemberton (02:13.987)

first ever episode of the Glucose Never Lies podcast. This is going to be the first of a six part on AID systems. So we're first going to welcome my co-host Louise Collins. Hi everyone. And so Louise is going to join me today and what we're going to go through on this first episode is just a real basic introduction to automated incident delivery systems, what they are, the benefits, and then certainly within the UK and most of the world, the four available systems. And then once we've done that,

we'll sort of talk about a decision-making criteria that you may consider if you're currently thinking about selecting a system. So just as a basic overview of what the situation is, I guess this is never been a better time to work within diabetes. Up until this point, there's been so much required from the user, even if using continuous glucose monitoring, there's so many decisions to make to get a 70 % time in range. Whereas these systems making those decisions independent of the user,

is making a huge difference. don't know, Lou, what have you seen from your practice? I would probably say this is the most exciting time that we've seen in terms of working with children and young people in these systems. The relief when you see families coming back to clinic after being initiated on the system, the overnight control that they can have, not

having to go through an algorithm in their mind before they go to bed in terms of what is the glucose, do we need to give some insulin, how much insulin on board, et cetera, et cetera. It's just been absolutely amazing. Yeah, I'd second that. think you can't get enough of someone coming back saying, I've slept for the first time and I don't know how many years and the relief and the bags under the eyes slowly disappearing. So that's all good news.

So guess that comes to what is automated insulin delivery systems. So it's generally three components. There's an insulin pump that obviously delivers the insulin. There's a continuous glucose monitor that provides a continuous glucose monitoring and readings. And then there's an algorithm that's housed somewhere in some systems that's on the pod and actually within the pump. On some systems, it's within an app that's within the phone. But either way, you've got an algorithm that is essentially doing the magic of looking at where the glucose levels are, where they're going, taking into account things like insulin that's been given and carbs on board.

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And then make an adjustment every five to 12 minutes to why they give more insulin, give less insulin or keep the insulin steady. And especially overnight, that's where the magic really happens. Cause you don't have food. You don't have activity unless you're getting very lucky. And then essentially it's kind of able to keep the glucose level pretty much between five and seven, most of the nights. But then during the day that is when you throw food and activity and the rest of it in, there are still challenges. So it's not exactly user free yet.

but it is such an upgrade on the user having to make all those decisions. So essentially, that's mainly done by adjustments of basal insulin, but each of these systems generally has some form of auto correction bolus where if the glucose level is rising quickly, it will stick extra insulin in and to get on top of those with sort of automated corrections. But it still requires the user to dial in the carbohydrates at meal times. And I guess that's something we've seen a bit of. Yeah. So

Just to sort of clarify a few points there, John. So with these systems, they're all made up of three component parts, essentially. So we've got the sensor, we've got the insulin pump, and there's an algorithm in some shape or form. And those three things all need to be present for this AID system to work. And we definitely need to enter carbs in when we're eating carbs, just to confirm that as well.

Yeah, I mean, some people can get away without entering carbs, but essentially when we teach the young people who we support, you can probably get 40 to 50 % time in range by not putting carbs in at all, which is going to be a HbA1c of around about 64, 69 or 8 8.5%. But obviously we know for the best management and the lowest risk of complications in the future, the more that you put the carbs in, the more likely you are to get towards 78 % in range.

the more likely your HbO and Cst between 42 and 52, which is six to sort of 7%. So you're still required to put the carbs in, but really that's it in terms of the vast majority interaction on a daily basis. So mainly four interactions with your diabetes in a day rather than the previous 15 or 20 that you would have to do to get that level of control. So that's a massive change. And obviously you can see how that can give that headspace.

John Pemberton (06:58.638)

to be able to do other things rather than make those decisions all on your own or with your child or teenager. So we're going to introduce you to the four available systems in the UK and they're generally available most places in the world. Now I've been practicing for this podcast and I've kind of bucketed the four systems into superheroes so I'm going to see if this makes any sense to you but we'll hopefully give them some idea because when you're making a decision on what system to use the first thing is to say

There is no bad choice. There is no bad superhero. You will do well on any single one of the systems. So you can't make a bad choice. You can only make a good choice. But if you want to make a good choice into a great choice, then you might want to think about some of these things that just tailor the system towards the way that you want to live your life. So hopefully this will give you bit of a clue. So I would say the tandem T-Slim with control IQ is a bit like Spider-Man, which is with great power comes great responsibility.

And by that, what I mean is you as the user or the healthcare team, you have to set the parameters for the system to work. So you have to set a basal rate and keep that up to date. And you might need to do different basal rates for different times of the day. And you also need to keep on top of the main thing, which is the correction factor. What we've learned over the last year or two from the research in our own practices, if you keep on top of making that correction factor stronger as the young person gets older,

It will make sure that the control IQ algorithm is aggressive enough to maintain timing range. If you don't keep on top of that, it can very easily slip and the timing range goes lower. And sometimes the user can then think, what am I doing wrong? And they're doing nothing wrong. It's just the fact that we haven't kept the algorithm up to date. So I don't know what you've watched in your thoughts on that. Absolutely. And I would say in our practice, when we implemented AID systems,

Tandem was really the first one that we started to use initially. And totally agree with John in the fact that when you've got these patients coming back to clinic, we'd be looking at say 50, 55 % time in range as opposed to when we were reviewing them quite frequently, they were like at 70, you know, they'd get that initial improvement to 70, 75 % time in range. And you'd almost feel that

John Pemberton (09:19.318)

something was going wrong or the family would think that the system's not working for them and it's very it became apparent that we needed to keep these settings up to date which is a massive training and learning point for your team that you really need to ensure that there is engagement in doing that and also that that and also the research and the research papers

and those papers that talked about that incident sensitivity being the key driver, even overnight when in sleep mode and things like that. absolutely would agree with that. And then you get the good control again. that's really been a lot of learning for us. Yeah, I think one thing to consider with this is it's fantastic for people who've got a really diverse circadian rhythm. So we've had, we've done it off label with a few younger children and we keep seeing with younger kids.

They have a real big insulin resistance sort of in the late evening requiring quite high insulin doses. And then all of sudden it drops off to being very sensitive overnight. And what we find is some of the other systems are not able to manage that because they can't jump between sensitivities. But with the control IQ, for example, had one young chap who was on 0.2 units up until five or 6 PM. And then all the way up to 0.7 units with a really aggressive correction factor up until midnight. And then back to 0.1, a really weak factor.

So the T-SIM really just allow a personalization the same as it would do for someone who is really busy on the weekend. They could have a less aggressive set of settings and you can even have a different settings profile for the weekend. So it really does allow a lot of personalization, but the downside is that means you have to have either a user or a care team completely in tune with that. And if in some requirements change frequently, you've got to keep on top of that. So there is a big trade-off to consider as a user.

Absolutely. So the second one, we're going to talk about the Medtronic 7-HGG. So I've classified the Medtronic 7-HGG as the Hulk. So the reason why I've done that is it is the most aggressive

system in managing post meal highs. So what you can do is set an active insulin time really short and a target glucose as low as 5.5. And what that will mean is that if the glucose level goes high after meals, the auto correction start as soon as the glucose level is predicted to go above 6.7.

John Pemberton (11:40.758)

So can imagine that that is going to be putting in a lot of insulin post meal if you're rising to make sure you don't go that high after eating. So that is fantastic in managing post meal control, but that also means there's going to be a lot of insulin on board after meals. And if you're looking at the younger children or people who've got very erratic movement patterns, that amount of insulin on board can become on the downside. And that's where the Hulk can potentially turn into a little bit too aggressive and end up with a lot of hypos.

my experience, think our experience has been people have got very consistent lifestyles. This works really good, really well with because it gets on top of those post meal highs. Anyone with quite sporadic activities becomes a problem because of so much insulin on board after eating. Yeah, I absolutely agree with John on that fact. And I think things that are more challenging with this system is the fact that you've only got one target glucose across the 24 hours. So again,

thinking about your younger children, where you can make those adjustments, how the algorithm learns over six days, those sorts of things. That all plays into quite a regimented lifestyle where things are pretty much the same. So thinking more about your more sedentary, maybe teenagers, moving on to adulthood. But that is certainly one of the challenges that we found with the system.

So I think you can get probably the highest timing range with this system, but there are some downsides in terms of potential higher hypoglycemia. And also I'll talk a little bit after when we talk about sensor choice. Sometimes 70 % on one system isn't the same as 70 % timing range of another system, but we'll get onto that a little bit later. So the next one is the Cambridge system. So I've designated this as Batman, and that's because Batman has a lot of tools, a lot of tricks, and if you use them effectively, can be exceptionally good as a superhero.

And why do I say that? Well, you've got a very sophisticated algorithm that takes a lot of inputs. Roman Havorka and the team have really worked well at kind of, it's the most well-researched AID system out there, hands down, has the greatest age range of indication. And it also has the greatest opportunity to personalize it to yourself. It's got things such as ease off for if you need to relax the insulin, boost if you need to give...

John Pemberton (14:02.208)

more insulin, you've got the add meal function to put in hypo treatment so that you don't, it system doesn't react if you go a little bit high after eating and you've got solely absorbed meal as well for these high fat meals. So the insulin that you put in only starts to be given when the glucose level starts to go for that delayed high after that fat and protein kicks in, which in theory sounds amazing.

but you've got to use all those tools to get the most out of it. And certainly the people that we support, a lot of them don't use that amount of functionality and sometimes it's overbearing. But obviously, again, if you want to get the highest timing range, it does have those options. So I don't know. Yeah, absolutely. So I think from an education point of view, it's about being able to provide, you know, it is about putting your carbs in at meal times.

but knowing when to add a hypo treatment in and explaining that in the fact that if we do add that hypo treatment in, you're announcing it to the algorithm. So therefore, ordinarily, if we had a treatment, our glucose levels would rise, but it enables the algorithm because it knows that that was for a hypo treatment. It won't be as aggressive to try and bring that glucose level down and then cause another hypo later on. But it's just about...

ensuring that families know how and when to use those things. And certainly, high fat, high protein meal, there's another feature that can be used for that. And I suppose, yeah, it has the most sophisticated algorithms. But certainly seeing it with some of our younger children and the fact that it's licensed in pregnancy demonstrates such

such high control that you can gain through using the system. Yeah, I mean you can set the target down as low as 4.4 so for pregnancy and people wanting really tight control being able to target down as low as there really does make a difference in getting those extra few percentage points timing range. So again a fantastic option again if you're willing to put in the effort with all those things you can certainly get a lot out of that. So our last one we're going to go through in terms of our superhero analogies is the Omnipod 5 so I'll put here Iron Man.

John Pemberton (16:17.1)

I guess sleek, sexy, and everything happens underneath the hood, which is to say that the algorithm is housed within the pod itself, which means that although you need a controller and potentially a phone for the sensor, you don't have to have those two things with you for the magic to happen. The sensor talks directly to the pod and ups and downs the insulin accordingly. So that is quite appealing. First of all, it's the only tubeless option. And second, the algorithm actually is within the pod. that means that the

the automated insulin adjustments continue to happen at all times, which people do like that for that reason. And again, you can have with this system, you can have different personal glucose targets or target levels across the day, which certainly for some of our younger children,

again, we'll have tighter levels overnight, say 6.1, which is as low as it goes and a little bit higher during the day of say 7.2 to manage some of that sporadic activity. So it does have those nice things, I guess from the flip side of that,

It is very safety minded in the fact it looks 60 minutes into the future. So it can pause the insulin earlier than you would expect potentially. And obviously as Ironman, Ironman is the, the Playboy billionaire is a little bit more expensive if you're more than 65 units of insulin a day and you require more than one part every three days. Again, that has some challenges depending on where your funding kind of comes from. So again, there are kind of pros and cons for everything. And this gives us a bit of an overview to sort of walk through.

So now we've introduced the kind of, or do want to say anything about the Omnipod 5? No, I guess from our sort of service use, it's from a teaching point of view, it's one of the easiest systems to teach and get going on once we've got things like creation of Omnipod IDs and those sorts of things. So it's simple and easy to use, easy to read the downloads, those sorts of things. And I guess that is probably why

It's very popular at the moment. Yep. So now we're giving you a brief introduction to the four systems and the pros and the cons. And hopefully the superhero analogy is giving you bit of something to of put that framework around. We're just going to walk through some of the key things that we discuss with the families and young people that we support so that you can get a bit of an idea of decision-making criteria. So the first thing we kind of pop down is what is the continuous glucose monitor that's compatible with the system that you're using?

John Pemberton (18:44.822)

So CGM accuracy is kind of my thing and there'll be a separate sort of podcast series on that. But let's do a slight introduction here to say there are CGM systems that have ICGM approval and those that do not. And the difference between a system that has ICGM approval and doesn't is really the robustness of the performance for the ICGM approved sensors.

is without doubt the highest standard that's currently available. It's very accurate in the hypo range, the in target range and the high range. So you can be assured with a system like that, it is going to be given the most accurate readings. And those are the type of sensors that are allowed to be used with more than one system. So they'll be able to used interoperably. So the ones that are available at the moment, the Dexcom G6, the Dexcom G7, the Freestyle Libre 2 Plus and the Freestyle Libre 3 Plus. So those are the ones that I see Gem approved.

Just to clarify that, if I was thinking about what system I want to use, it would be about choosing a system that incorporated one of those sensors in theory. Yeah. And so really, the systems, the only other one that is available

for an AID system that's not an ICGEM approved is the Medtronic 780G, which is generally either now the Guardian sensor for or the Simplera, which is still a very accurate sensor. It just doesn't have ICGEM approval. Although there is some evidence at the moment which has been done comparing the T-SIM control IQ with the 780G. And what they found is that the 780G has definitely got higher time in range, say 75 % compared to the control IQ at 68%.

Yet the HbA1Cs are exactly the same, which when we talk about in the CGM series, what you can find is if a continuous glucose monitor is better at predicting capillary glucose, it generally captures after meal glucose highs much more effectively than the CGM system that reads closer to venous glucose, where once that the difference between capillary and venous glucose is capillary glucose is about 10 % higher generally than venous glucose.

John Pemberton (20:52.994)

So that is just something to think about is that your higher timing range might not necessarily translate into a lower HBA1C, but kind of more to come on that. Essentially, there is no massively thing to kind of consider there other than an ICGM sensor would be the most accurate, although the other systems are accurate. And then I guess some of the other distinctions between...

the continuous glucose monitors is between the Dexcom and the Freestyle Libra is the Dexcom you can calibrate and the Freestyle Libra you cannot. So do you want to, should we just clarify what calibration is for people who might not? Yes. So calibration is essentially what we call a nudge, nudging where the sensor is back in line with where the fingerprint glucose is. So we know that sensors are in generally very accurate, but sometimes maybe one to five times a month they can be

out by quite a bit and you feel different to what your sensor is reading, you do a finger prick and then you're like, wow, it's out by let's say three. And what you would like to do ideally is to nudge the sensor back to where the capillary finger prick glucose is so you feel confident because we know that the finger prick glucose is still more accurate than the CGMs. This only really applies to people who do a finger prick when they feel like that. If you don't do a finger prick, it doesn't really matter what you choose. But what we found with some of the people who we support is

when they do that fingerprint and it's out by three, if they've got no way of calibrating it or nudging it back to where the sensor is, they lose a bit of confidence for a bit in the sensor accuracy, especially when it's making these automated decisions. So you can do that with Dexcom and the Medtronic sensors. You can't do that with the Freestyle Libre. So if that's something that's important to you, that might be something that pushes you into a certain decision criteria or not. The only thing to say with that is,

You'd want a blood glucose meter that's a ISO standard and accurate. You'd want to do a proper hand wash and check your finger prick twice and take the average to be sure it's a good sample before you start putting that into the system and calibrating. So there are a few things to consider with that and we'll discuss that in a future episode. And that's probably something that's worth thinking about if you are parents of particularly young children with

John Pemberton (23:11.374)

whereby hypos and such things come with absolutely no awareness and things that actually whether you can calibrate or the accuracy of your sensor or sometimes you don't get as long out of sensors or you see a deterioration in the accuracy that's probably something that's worthwhile considering. So just to run through what sensors are available with what system the T-SIM with control IQ you can use the Dexcom G6, the Dexcom G7 and in some parts of the world also the Freestyle Libre 2.

For the Medtronic 780G, you can just use either the Medtronic Guardian 4 or the Simplera. You can use the Guardian 3 as well, but it's mainly the Guardian 4 and Simplera at the moment. The Cambridge system, you can use the Dexcom G6 and the Freestyle Libra 3, and soon to be the Dexcom G7. And then finally, the Omnipod 5, the Dexcom G6, the Dexcom G7, and the Freestyle Libra 2 as well. So you can see that the...

pretty much available for most of the systems. So that's good news because it's not so much of a deal breaker, but hopefully that's given you some thoughts about continuous glucose monitor, the thing that drives these automated insulin delivery systems. You want to be confident that it's a system you feel comfortable with and that you're able to use the functionality to its best. Absolutely.

So I guess the second question is once you've decided on your sort of system and which CG or which CG you're going to run with it is kind of how much control do you want over the algorithm? So if you want a lot of control, just like we discussed, the control IQ is probably the best for you. You can have different basal rates, different correction factors for different times of day, different profiles for the weekend. You've got ultimate flexibility to mold the therapy to what you need. But as we said, that means that then you've got to keep

all of those settings and all of those profiles up to date and if you're a young person who's developing and instant changing all the time that can be some challenge to keep on top of that. Yeah I guess with the control IQ one of the things that some of the service users see is that their glucose level going up quite a lot after

John Pemberton (25:13.912)

post-prangely and it seems to take longer to come down but that is about getting those sense settings right, the sensitivity right and also the timing of the bolus right. I think that's one of the things that people would say they've noticed that sometimes it rises a little bit too high post-prangely and there's necessarily a lot that you can do apart from that correction that...

comes in every hour, but it's only 60%. Isn't it? So I'll get moving your backside is the easiest way. That'll bring it down like a rate of knots. So yeah, if you want a lot of control, the control IQ, then probably second the Cambridge system, as we discussed before, you have a lot of control over putting ad meals and ease offs. Yeah. So a lot of control from that perspective. But if you want more of a plug and play and your 780 G or the,

Omnipod 5 is probably easier because it's the simplest one once you get going. So the next thing is really how strong do you your algorithm to be post meal? As we've said, the 780G probably offers you the strongest option for there with a very low active instant time at two hours and a very tight target. So if post meal control is something that's of real importance to you and you've got a fairly structured lifestyle that doesn't include a lot of sporadic activity after eating, that will be a great choice.

Probably on the flip side, just as Louise has mentioned, the control IQ has an active instant time set at five hours, which means it can be a bit sluggish in responding to higher glucose levels after eating. Obviously you can optimize the correction factor, but a lot of people do find that a bit of a challenge. And as a healthcare professional, you might find some ghost carbs two to three hours after eating, where people have to do that to get on top of corrections that they know that they need.

Yeah, absolutely. You've probably put that a lot better than I do. And then finally, you know, a big, a big consideration for some people is tube, tube. You know, do do you want a tube? Do you not want a tube? If you, if a tube is a deal breaker, then the Omnipod 5 is obviously they're going to be the only system for you. But I would say take a little time to think about it before you just jump and think, yeah, it's either a tube, it's no tube for me. I'm going to have that because if you do choose a pump with a tube,

John Pemberton (27:29.294)

or a system that has a pump with a tube, there are loads of ways to get around some of the common challenges. Some of the common challenges people will say is I want to go to the toilet, kind of pull my pants down and then, you know, kind of dangles on the floor and during the night. The easiest way to get around all of this is just to have a waistband that you would have for putting your phone in while you run and just pop it in there. It gets rid of all the problems. You don't end up with it sticking out the door handles in the night. doesn't dangle down. And also if you

do go for a system with a tube, you can unclip it any time. So if you've got a pod, it's on you and it's there and it isn't coming off. Now, sometimes you don't want something to be visible and to be seen. And sometimes it can get in the way of things, thinking, you know, nighttime activities, might not be able do it. You want that something sticking in and being in the way. you know, having the ability to unclip and actually be free of the system for periods of time actually can be an advantage.

I think sometimes people superficially look at tube versus no tube and think that there's always an easy solution to manage it. And actually there are some time downsides of having the pod, which is certainly bigger than a cannula in terms of its spacing. Yeah. And I think, you know, when you put the pod on in theory, that's where it's going to stay for those three days. Whereas obviously there's that flexibility, as John said, with moving your tube to pump around and wherever you store it and things.

So really, that's hopefully giving you an overview. In the show notes, we've put a link through to the AID system guide on the glucose nevel lies, which talks through each of the superheroes in more detail. We've also put a comparison chart on there, which will tell you about CGM compatibility, how the algorithms are adjusted, and what targets can be set, tubing versus no tubing, pros and cons, which will kind of just summarize what we've discussed hopefully over the last sort of 20 to 30 minutes or so.

And hopefully that's been helpful in terms of introducing this concept. And then what we want to do in the next few episodes is actually deep dive a little bit closer on each of the individual systems. So we'll do a single episode on the control IQ, single episode on the 780, single episode on the Cambridge system and a single episode on the Omnipod 5. And then we'll round off this series by going through our top tips to optimize control, regardless of which system that you're on.

John Pemberton (29:50.606)

So hopefully that's been helpful Louise, has that been alright as a first episode for you? it's good. It's good. Alright, so we'll see you guys in the next episode.