EMS Timely Tips: Endocrine Emergencies in the Pre-Hospital Setting

Endocrine disorders, specifically for pediatric patients, pose complex considerations in care based on the type of disorder and an individual's course of therapy. For this reason, Children's Mercy manages programs across the region, providing endocrinology care from western Kansas to south central Missouri. When a pediatric patient with an endocrine disorder requires emergency assistance in the pre-hospital setting, rapid intervention is necessary. In this segment, Children's Mercy Endocrinologist, Dr. Ryan McDonough, will offer life-saving guidance on treating this population of pediatric patients.

Featured Speaker:

Ryan McDonough, DO, FAAP

Dr. McDonough is a Pediatric Endocrinologist and Co-Medical Director of the Diabetes Center at Children's Mercy Kansas City. He is also an Associate Professor of Pediatrics at the University of Missouri – Kansas City School of Medicine, and a Clinical Assistant Professor of Pediatrics for the University of Kansas School of Medicine. Dr. McDonough earned his medical degree from the Des Moines University College of Osteopathic Medicine in 2010. He then completed residency in General Pediatrics and fellowship in Pediatric Endocrinology and Diabetes at Children's Mercy. His clinical work focuses on thyroid diseases, growth disorders, and most notably, type 1 and type 2 diabetes. Dr. McDonough works closely with his team at the Children's Mercy Diabetes Center to assess, educate, and care for families and patients living with diabetes.

Learn more about Ryan McDonough, DO, FAAP (https://www.childrensmercy.org/profiles/ryan-j-mcdonough/)

Transcription:

Melanie: Endocrine disorders specifically for pediatric patients pose complex considerations in care. When a pediatric patient with an endocrine disorder requires emergency assistance in the prehospital setting, rapid intervention is necessary. Welcome to Pediatrics in Practice with Children's Mercy Kansas City.

I'm Melanie Cole. And today, we're discussing endocrinology and diabetes, EMS timely tips, endocrine emergencies in the prehospital setting. Joining me is Dr. Ryan McDonough. He's a pediatric endocrinologist and Co-medical Director of the Diabetes Center at Children's Mercy Kansas City.

Dr. McDonough, it's a pleasure to have you join us today. So what are the most common pediatric endocrine disorders that you see and how common are these types of disorders in the pediatric population?

Dr Ryan McDonough: Thanks. It's a pleasure to be here today. Endocrinology and associated disorders are still relatively uncommon in kids. But the things that we see the most frequently and the one that we're most likely to encounter, it's going to be type 1 diabetes, which comes with both complications of

acute hyperglycemia, leading to diabetic ketoacidosis, or hypoglycemia, those episodes of low blood sugars that can result in seizures or other comorbidities.

Melanie: Tell us a little bit about the age they present themselves most commonly and how do they present and who notices.

Dr Ryan McDonough: So type 1 diabetes has a bi-modal incidence pattern. We typically see it around the age of preschoolers into that kindergarten age, and then right it again around the time of puberty. About one in 500, one to 600 kids in the United States are diagnosed with type 1 diabetes. It's out in the community, but it's not something you're going to see every day. When someone is newly diagnosed, what will typically be the presenting signs are going to be polyuria, polydipsia, polyphagia, weight loss, and then eventually what can lead into abdominal pain, nausea, vomiting, difficulty breathing, that can all be presenting signs of diabetic ketoacidosis.

Melanie: Yeah. Before we get into the EMS tips, unlike adults, growth and development can really be affected with kids with endocrine disorders. Tell us a little bit about that and how these are diagnosed.

Dr Ryan McDonough: So diabetes in particular is often found either on some sort of routine screening that's done by the pediatrician's office or, more commonly, they're going to present with really florid symptoms of the polyuria, polydipsia. Growth and development are definitely key players in there. In endocrinology, we like to say that the growth chart is another vital sign that is absolutely essential to picking up a lot of endocrine disorders. So taking a look at that and knowing how your kids are growing, how they're developing are definitely integral pieces to that diagnosis.

Melanie: It's really important. So now, let's get into diabetes management for EMS. When you and your colleagues offer education on this type of management for prehospital providers, what are the most important tips you offer?

Dr Ryan McDonough: I think it really is kind of sorted into two different categories. One being that acute hyperglycemia, those episodes where patients are going to show up with diabetic ketoacidosis. These are going to be circumstances where their blood sugar has been above 200 milligrams per deciliter for some duration of time. And as their body is starving for another source of energy that it isn't getting from glucose, it starts to break down fat cells, so when we start to break down the fat cells to make ketone bodies, which are another source of energy for our brain in particular, but then subsequently can develop into creating acid into the bloodstream and can make our patients really sick.

Those kids are generally going to have signs of dehydration. They're going to be feeling really ill, likely vomiting or with abdominal pain. And some of the important things are early recognition of that. Prevention is of course key, but when we do escalate to the point of diabetic ketoacidosis, early and rapid intervention is what's going to definitely help these kids recover quickly.

Melanie: Do you have some specific pitfalls to avoid in the care of kids with diabetes in this type of setting?

Dr Ryan McDonough: Yeah. Especially when we're talking about diabetic ketoacidosis, there's a couple of things that are out in the community, especially in the adult population that are commonly applied to

children, but probably ought not to be. One of the most common things that we see is a desire for rapid correction of the glucose level. We really don't want the glucose level itself to drop more than about 100 milligrams per deciliter per hour. Any rapider than that, you start to increase the risk for cerebral edema.

There's a couple of other things that can also increase that risk of cerebral edema, things like giving IV boluses of insulin. In general, we don't recommend that in kids. It's commonly done in the adult population. But in kids, a slow steady infusion of a continuous insulin drip is much more preferred. It allows again that titrating and that ability to slow the rapid drop of glucose if it does occur.

Other things to avoid include the use of bicarbonate that is often associated with increased risks of cerebral edema. And while rehydration from being dehydrated is really important in kids with type 1 in DK, actually, you have to be really careful, because once you start getting to above 40 milliliters per kilogram of body weight in IV fluid bolus, is when we start to also see an increased risk for cerebral edema.

Melanie: Do you have some risk factors that you can point to that would make a child more susceptible to these diabetic ketoacidosis risks and complications?

Dr Ryan McDonough: Yeah, absolutely. Some of the more common things are the younger the child's inability to communicate their symptomatology is associated with a higher DK risk. Kids who are from a lower socioeconomic status or those who are of a racial or ethnic minority tend to have higher rates of diabetic ketoacidosis.

And then, a common misconception is that the patients who are on insulin pumps or the technologies that support diabetes are extra protected from DK, but we know that's not the case. As it turns out, since those pumps contain only rapid-acting insulin, it is not uncommon for those kids to have a site issue, have a pump failure issue, a technology issue that can rapidly result in the development of ketones and diabetic ketoacidosis.

Melanie: So assessing signs of hyperglycemia and hypoglycemia in very small children or babies, as you said, can be difficult when not regularly caring for those pediatric patients. Do you have any reminders or take-home messages regarding some of those symptoms in kids for other providers or caregivers? And you can also speak about the complex metabolic state of hyperglycemia, ketosis and acidosis altogether.

Dr Ryan McDonough: Yeah, it's really important. Acidosis, it's got a very wide differential diagnosis in kids and the symptomatologies can be very different depending on the cause. In diabetes, the things that you're going to see again with those acute hyperglycemic moments, there's going to be a lot of urination, a lot of excessive thirst. Irritability, fussiness are going to be signs of things that you might see.

Hypoglycemia is a little different. You know, hypoglycemia in kids on insulin kids with type 1 diabetes is generally considered a blood glucose less than 70 milligrams per deciliter. And in those circumstances, you're going to get a big catecholamine response, a big epinephrine response as your body's attempt to prevent or to fix the hypoglycemia. And those kids, you're going to see shakiness, jitteriness,

sweatiness, irritability, fussy. Older kids might tell you they're dizzy, hungry, they feel shaky. And then, the outcome that is most worried about in hypoglycemia is going to be hypoglycemic seizure.

Melanie: So, as we're talking about these emergent conditions, speak about any others that you would like to mention such as hyperglycemic hyperosmolar syndrome or HHS, things that are similar to diabetic ketoacidosis, anything you'd like EMS and other providers to take note of.

Dr Ryan McDonough: I'm glad you brought up HHS or hyperglycemia hyperosmolar state. It is very similar to DK. The patients will present very similarly, though they may have a little bit more of an altered mental status than they would in DK. They're not acidotic, so they're unlikely to have that Kussmaul respirations and their blood glucoses are generally quite a bit higher. Most point-of-care machines that measured glucose are only going to be able to read a level in that 500, 550 or 600, and then they start just reading HI. But when you start seeing those values that are in that HI range, that's when we really want to at least broaden that differential.

The initial management, the initial stabilization for kids with HHS is very similar to DK. But it is the more in hospital setting and in hospital management that's going to vary. Hypoglycemia, depending on its severity, our ultimate goal is that we can try and treat hypoglycemia with non-injectable options. If a kid is able to drink, is able to swallow, then oral glucose is absolutely our preference. Fifteen grams of a rapid-acting carbohydrate, like four ounces of juice or four glucose tablets and then repeating the blood sugar and checking in 15 minutes is great.

One of the pitfalls that people often fall into though is after that initial treatment, getting the blood sugar up is not giving something that will sustain the blood sugar over a longer period of time. So that's where you want a protein-containing snack. Crackers and peanut butter or jerky or something like that that helps sustain blood sugar for a longer period of time.

Once you get into that severe hypoglycemia, once you start to see our patients, that are having the need for external assistance with hypoglycemia, meaning that they're having a seizure or they're not able to get that food into their mouth on their own, then that's when we start talking about using glucagon or using dextrose boluses if they happened to have an IV that's already in place.

Melanie: It's really important information. Dr. McDonough, as we wrap up, let other providers and EMS know what you'd like them to take away from this episode and how they need to be prepared to make adjustments. Because as we all know, not all children are the same as not all adults are the same, but children really can vary. So give us your best advice.

Dr Ryan McDonough: I think the most important takeaway messages just like any pediatrician would tell you, kids are not little adults and that their treatment needs to be tailored to their age, their size, their weight. And the other most important piece when you're talking about diabetes in kids, parents are experts. They live with this disease day in and day out, and it is okay to ask for their assistance in those moments. Make sure you ask what they've done. Make sure you ask about those technologies. And it's okay not to know exactly what the technology is that they have attached to their body. The most important thing is to assess the patient in front of you. If they're high, figure it out, how to get them down. If they're low, treat that low and get their blood sugar up.

Melanie: Thank you so much for sharing your expertise. Great information. To refer your patient or for more information, please visit ChildrensMercy.org/ems to get connected with one of our providers. This has been Pediatrics in Practice with Children's Mercy Kansas City. Please remember to subscribe, rate and review this podcast and all the other Children's Mercy podcasts. I'm Melanie Cole.