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DKA in the Real World: Evidence and Cases that Matter

Announcer:

Welcome to CME on ReachMD. This activity is the third in the series titled, "In the Range: Real Talk on Diabetes Monitoring Best Practices." This is episode three focusing on DKA, titled "DKA in the Real World: Evidence and Cases that Matter." It is provided by Cornerstone Medical Education and AACME and supported by an educational grant from Abbott Diabetes Care. Before starting this activity, please be sure to review the faculty and commercial support disclosure statements as well as the learning objectives.

Dr. Wysham:

So, recently, new data was presented on the prevalence, risk, burden and management of DKA. Join worldwide experts as they discuss the practical application of all these advances into your clinical practice.

This is CME on ReachMD, and I'm Dr. Carol Wysham. Joining me to discuss the burden of DKA in our healthcare systems and data from the perspective of healthcare professionals and people with diabetes is one of my co-authors on the Continuous Ketone Monitor Consensus Recommendations, Professor Samuel Seidu.

Professor Seidu:

Thank you, Carol. It's good to be joining you on this program.

Dr. Wysham:

So before we dive in, let's start with a little background review on DKA and why it's such a challenge in diabetes management.

It's important to note that there is a significant burden of DKA in the healthcare system. Even though the incidence has decreased with the development and use of chronic glucose monitoring, it is still the most common hyperglycemic emergency in people living with diabetes. It is also the leading cause of death in children and adults who are under the age of 58 who have diabetes. Worldwide, there's a 1–13% annual prevalence of DKA in adults with type 1 diabetes. And even though we think of this as being a condition of type 1 diabetes, it is a significant burden in type 2 as well. It actually represents 1 in 5 of all the hospitalizations for DKA is attributed to type 2 diabetes. And their mortality is significantly higher when they're hospitalized with DKA than it is for patients with type 1 diabetes.

Professor Seidu:

And, and that is actually very interesting, Carol, because the prevalence of type 2 diabetes, as you know, is much higher. Ninety percent of people with diabetes will have type 2, and only about 5–10% will have type 1, so if you look at the absolute numbers of people with type 2 diabetes, given that 1 in 5 of hospitalizations for DKA will be in the type 2 population, that will be huge, will be a huge amount of people who will be suffering this. And given the higher mortality, not 0.5% that we have mentioned, that translates to higher absolute numbers of people with type 2 diabetes.

Dr. Wysham:

Sure. And, and actually, recent data suggests that the cost per hospitalization is significantly higher in patients with type 2 compared to type 1, so a very significant burden, just to put this into perspective. Now, knowing that we have this burden, that we have still frequent

admissions of patients with type 1 diabetes, what are the issues? And, and we know that there are issues in gaps, and one of them is in the patient unawareness. So this was focusing on an outpatient clinic population of endocrine patients with type 1 diabetes, so they presumably have better knowledge and education given to them in an endocrine setting, but still, these patients with type 1 diabetes who have had diabetes for an average of 22 years, they—32% of them were not familiar with the term DKA. And 46% of them were unable to name a single symptom of DKA. And furthermore, 64% of them failed to do any testing at all at any point as far as their ketones are concerned.

Furthermore, in another study, they found that fewer than 20% of patients checked their ketone levels when their glucose levels were 16.7 mM or higher for an hour. Thirty-eight percent of them never tested ketones when they're nauseated or vomiting, and 45% of them did no testing when they detected a fever, so again, really important issues of the patients not having important knowledge and acting on guidelines that we know—that we try to educate our patients on what to do when they have type 1 diabetes.

Now, Professor Seidu, can you walk through the new data that was just presented at ATTD on DKA burden?

Professor Seidu:

So yeah, this, this was new data that we presented at the ATTD conference in Barcelona a couple of weeks ago, and in the data we looked at the incidence, recurrence and predictors of DKA in people with type 1 and type 2 diabetes in the UK over the past two decades. From the analysis we noticed that annual incidence rose from 12 per 1,000 to 42 per 1,000 in type 1 population and 6 per 1,000 to 34 per 1,000 in the type 2 population. Of those who experienced DKA, recurrent DKA affected 31.5% of people with type 1 diabetes and 12.1% of people with type 2 diabetes. Recent DKA, that is within 28, the last 28 days, was the strongest predictor of recurrence in the population, and other factors that contributed to the recurrence were female gender, younger age, socio-economic deprivation and multimorbidity.

Dr. Wysham:

Yes, I think this is really important. It's actually increasing in some, in some studies; although, again, in looking at CGM studies, it appears that those patients using CGM have a lower risk, and so it looks like we've got issues of not only education but maybe even access to technology and, some healthcare system support for those patients who are at risk for recurrent DKA. I think that's an important, very important fact.

Professor Seidu:

And, Dr. Wysham, you were the co-author on some of the new data present at the ATTD. Can you tell me more about your findings on provider perspectives on the healthcare burden of DKA and ketone monitoring?

Dr. Wysham:

This is a first phase of a larger study that is being done with providers, diabetes educators, adults with diabetes, caregivers of pediatric diabetes and caregiver adolescent people with diabetes dyads.

These were endocrinologists, primary care physicians across the U.S. with these structured interviews, and we explored a range of ketone monitoring and management issues, and what we found was, number one, that guidance on ketone testing is often lacking in the case of the providers, and particularly in the primary care providers, and that ketone testing is very inconvenient. So they reported that they routinely emphasize ketone tests for type 1 but only do so in more selective cases in patients with type 2 diabetes. They said that management during illness is especially important and that there is a significant burden associated with trying to manage severe hyperglycemia in outpatients. So this is related to lack of equipment, so that the patients don't know whether or not they have high ketone levels, and really, an inability to understand how to safely manage these patients, so they frequently just send the patients to the ER without having the appropriate information and guidance on how to deal with it, and I think this was one of the most important things we learned from this study.

It was the perspective of the providers, and I'm not sure how true this is, but that they felt that patients generally favored urine ketone tests because of the discomfort of the finger pricks even though they know it's less accurate. Now, I think in this situation it's important, at least in the U.S., that we don't have any coverage for ketone strips, whether they be urine or blood, and the blood ones are much more expensive, and that may play a large role in why the patients are mostly using urine ketone tests.

For those of you just tuning in, you're listening to CME on ReachMD. I'm Dr. Carol Wysham, and today I'm speaking with Professor Samuel Seidu about new findings on DKA.

Professor Seidu, if we continue to review this new data, what key points would you like to share from the other DKA presentations at ATTD?

Professor Seidu:

So yeah, thank you, Carol. There were a few other studies that were presented at the ATTD, and here I select four of them to present. The first one is an online survey from the States, you know, a survey of 1,419 U.S. adults with type 1 diabetes who did ketone testing.

In that survey it was noted that 276% participants reported low confidence in understanding ketone levels. In that group of people who responded low confidence understanding ketone testing, they were less likely to test across every situation, including high glucose levels, nausea, illness, confusion, and more of them were likely to report being unsure of DKA events. They were more likely to be unsure of provider discussions regarding DKA and more likely to be extremely concerned about DKA. So the study concluded that there was a mismatch between understanding behavior and concerns, and that suggests a critical gap in both patient education and provider communication to improve ketone testing in people with DKA.

So the other study that I picked up from the ATTD was a cross-sectional study that surveyed adults from a French cohort with type 1 diabetes over 12 months using a 45-item questionnaire covering social demographic characteristics, diabetes management, DKA knowledge, ketone monitoring and the barriers. The leading barriers were poor symptom recognition, 56%; lack of equipment, 52%; and time constraints, 52%, particularly among insulin pump users and AID users or those with time in range less than 70%.

So the study concluded that despite a strong awareness in this well-controlled cohort, challenges remain around symptom recognition, equipment and time, so high interest in dual ketone monitor—ketone sensors highlights limitations of current methods and the need for accessible patient-centric solutions to support DKA prevention.

Dr. Wysham:

I think this is really important and really does register with what we talked about earlier in terms of the not having the equipment, not necessarily doing the testing even though these people know that they're supposed to do it.

Professor Seidu:

I did pick up on a third study from the ATTD, and this looked at the correlation between blood glucose and beta-hydroxybutyrate, a ketone body, and the study looked at the metabolic dynamics between blood glucose and ketone, ketones during insulin deficiency, especially when you are stopping your insulin pump or suspending insulin pump uses. Among the 27 visits, the baseline beta-hydroxybutyrate was 0.13, and peak level was 1.04. Eighty-nine percent exceeded beta-hydroxybutyrate levels of 0.6 mmol/L at five hours after insulin pump suspension, and 44% exceeded 1, 1 mmol/L at seven hours after suspension. Beta-hydroxybutyrate reached 1 mmol/L, while glucose was less than 13.9 mmol/L in five visits. During the visits, continuous ketone monitoring demonstrates strong concordance with blood beta-hydroxybutyrate trends. And so the study authors concluded that glucose may not rise significantly while beta-hydroxybutyrate levels were elevated, and that highlights the necessity of continuous glucose monitoring during insulin pump treatments for patient safety.

Yeah. So, the final case I want to present from the ATTD, Carol, is a clinical case study, and this was a case of a 55-year-old male with type 1 diabetes for 53 years and undetected C peptide. He had excellent glucose control with A1C of 6.9% or 51.9 mmol/mol. Continuous glucose monitoring time in range was 83%, and time above range was time above range of 10 mmol/L was 14%. Time below range less than 3.9 was 3% on automated insulin delivery system comprising of tubed insulin pump. His last episode of DKA was during childhood. As part of a clinical trial, he was on continuous glucose monitoring and received education in responding to ketone information. During a 2.5-hour gap in continuous glucose monitoring data to sensor warmup, he experienced a rapid rise in ketone levels from 0.6 mmol/L to 3.1 mmol/L due to insulin pump cannula dislodgement, so glucose levels peaked at 17.8 mmol/L.

The first indication of glucose insufficiency was a continuous ketone monitoring alarm notification of elevated ketones more than 1 mmol/L, which prompted recognition of the issue and treatment of ketonaemia by replacing the cannula and administering insulin. So ketonaemia resolved without any hospital attendance, and he was asymptomatic throughout.

Dr. Wysham:

So, finally, Sam, what key takeaways from this program would you like to share with clinicians treating these patients?

Professor Seidu:

So my key takeaway message from this program will be, let's start from this case study. The patient clearly has, very high risk of developing DKA, as you can see, an acutely unwell person on admission, and the person is on empagliflozin, so there is a high risk of getting DKA, so continuous glucose monitoring, continuous ketone monitoring will be very necessary for the team to be able to keep on top of their monitoring of ketosis, and indeed for the person, when they are discharged as an outpatient, to be able to follow up and detect very early signs of DKA and report to clinicians before at least for hospitalization. And from the presentation that I've done from the ATTD, the initial paper that we presented suggested an increase in treatment especially in the type 2 population of DKA incidence in the UK especially. And recurrent DKA is mostly predicted by various factors, including previous DKA and female, ethnicity and deprivation, and multimorbidity. And so these are some of the characteristics in patients that clinicians working with people with

diabetes have to be aware of and try to put in mitigating interventions to prevent any DKA episodes.

Dr. Wysham:

I think really this points out the importance of considering diabetes in general as a team sport, so to speak, so we really need to utilize all of the professionals that we have in our systems to be able to manage these patients. And I would just, just emphasize that the patients with DKA, particularly recurrent DKA, will require some form of not only intervention by the healthcare care professionals, the nurses and educators and providers, but also to utilize psychologists to better understand, what some of the other barriers that we're not getting from our patients when they are admitted repeatedly with DKA. I also really think this is a type of a patient with recurrent DKA who might benefit from some remote monitoring and continuous ketone monitoring, if the patient has access to it and uses it, will allow us to identify patients early. If they're ignoring their alarms, perhaps there's some kind of alarm that could go off so that we could be monitoring them and help to reach out to them prospectively.

So again, and one other another really important group that we don't think about very often, but for children, they are spending significant proportion of their days at school and that there are school nurses that are going to have to be involved with educating and knowing how to address the abnormal ketone level should they happen while the child's at school. Any other points you would like to clarify?

Professor Seidu:

No, except that some of the other data that you presented from the ATTD also highlighted the need for increasing awareness of DKA symptoms and implications in people living with diabetes.

Dr. Wysham:

Yeah, that's right. We've got to get our patients better educated. That's for sure. Well, that's a great way to round out our discussion on updates on DKA prevalence, risk burden, and trends. And I want to thank my guest, Professor Samuel Seidu, for joining me today in this conversation. Professor Seidu, it was great speaking with you today.

Professor Seidu:

Thank you very much. It was great speaking with you, Carol. Thank you.

Announcer:

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