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Michelle Knoll

Children's Mercy Hospital

Kelsee Halpin

Children's Mercy Hospital

Ryan McDonough

Children's Mercy Hospital

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Recommended Citation

Knoll, Michelle; Halpin, Kelsee; and McDonough, Ryan, "Utility of Point-of-Care Beta-hydroxybutyrate Testing for Predicting Diabetic Ketoacidosis in the Pediatric Emergency Department" (2019). *Posters*. 110.

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Utility of Point-of-Care Beta-hydroxybutyrate Testing for Predicting Diabetic Ketoacidosis in the Pediatric Emergency Department

SAT-144

Michelle Knoll, MD; Kelsee Halpin, MD, MPH; Ryan McDonough, DO
 Children's Mercy – Kansas City; Kansas City, MO

*No conflict of interests exist

Background

Diabetic ketoacidosis (DKA) is a potentially life-threatening complication of insulin-dependent diabetes. Delayed resulting of serum and/or urine studies may hinder timely diagnosis and intervention, contributing to negative outcomes. With the recent availability of capillary beta-hydroxybutyrate (BOHB) testing, immediate results are available and several studies have suggested the potential for the early diagnosis of DKA.

Guidelines from the International Society of Pediatric and Adolescent Diabetes (ISPAD) in 2018 define a serum BOHB level of ≥ 3.0 mmol/L as indicative of DKA. The objective of our investigation was to describe the diagnostic characteristics of point-of-care (POC) BOHB testing to predict DKA among pediatric patients presenting with hyperglycemia in the Pediatric Emergency Department (ED).

Methods

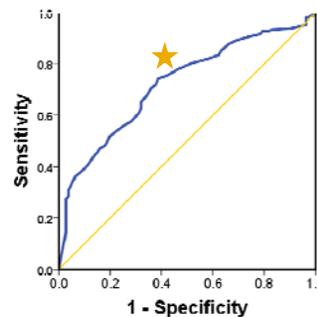
Diabetes-related encounters in our Pediatric ED between January 2015 and June 2018 were reviewed. Those with an initial POC glucose ≥ 200 mg/dL, as well as POC BOHB and serum bicarbonate data were included. Sensitivity, Specificity, Positive Predictive Value (PPV), and Negative Predictive Value (NPV) for BOHB values ≥ 3.0 mmol/L for the diagnosis of DKA, defined as serum bicarbonate < 15 mmol/L, were calculated.

Results

A total of 463 encounters were reviewed; 34% had newly diagnosed diabetes, and 77% were in DKA based on serum bicarbonate levels. Only 13 patients (3%) had a POC BOHB < 3.0 mmol/L.

All Subjects DKA ($\text{CO}_2 < 15$)				Subjects with Known Diabetes DKA ($\text{CO}_2 < 15$)			
BOHB ≥ 3	Yes	No	Total	BOHB ≥ 3	Yes	No	Total
Yes	348	102	450	Yes	248	49	297
No	9	4	13	No	6	2	8
Total	357	106	463	Total	254	51	305

ROC Curve for BOHB ≥ 3 to predict DKA ($\text{CO}_2 < 15$)



Subjects with New Onset Diabetes
DKA ($\text{CO}_2 < 15$)

BOHB ≥ 3	Yes	No	Total
Yes	100	53	153
No	3	2	5
Total	103	55	158

★ BOHB ≥ 4.75
 Sensitivity: 74%
 Specificity: 61%

Results

Test Characteristics of BOHB ≥ 3.0 to predict DKA ($\text{CO}_2 < 15$)

	All patients	Known Diabetes	New Onset Diabetes
Sensitivity	97%	98%	97%
Specificity	4%	4%	4%
PPV	77%	84%	65%
NPV	31%	25%	40%
ROC AUC (95% CI)	0.72 (0.67-0.77)	0.74 (0.68-0.81)	0.72 (0.64-0.81)

Conclusions

Based on ROC Curve data, POC BOHB testing is a poor-to-fair predictor of DKA in the ED setting, though its accuracy may be increased among patients with an established diagnosis of diabetes compared to newly diagnosed patients. While a POC BOHB ≥ 3.0 is an excellent screening test to rule out DKA in the ED (sensitivity of 97%), it should not be used to initiate therapy, particularly in new-onset diabetes where 35% of positive tests are false. Increasing the BOHB threshold to ≥ 4.75 increases the overall accuracy for predicting DKA.