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Can Point-of-Care Betahydroxybutyrate Testing Be Used to Predict Diabetic Ketoacidosis in the Pediatric Emergency Department?

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Describe role of Submitting/Presenting Trainee in this project (limit 150 words):
I participated in the data analysis and synthesis of the project, creation of the poster, and will be presenting the poster at a national conference (ENDO 2019).

Background, Objectives/Goal, Methods/Design, Results, Conclusions limited to 500 words

Background
Diabetic ketoacidosis (DKA) is a potentially life-threatening complication of insulin-dependent diabetes. Unfortunately, delayed resulting of serum and/or urine studies may hinder timely diagnosis and intervention, thus contributing to negative outcomes. With the recent availability of immediate results from capillary BOHB testing, there is the potential for POC BOHB testing to expedite the diagnosis, and therefore, management of DKA in the emergency department (ED).

Objective
Guidelines released 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 POC *capillary* BOHB testing to predict DKA among pediatric patients presenting to the ED with hyperglycemia.

Methods
We reviewed pediatric ED encounters from January 2015 through June 2018 for patients with known or newly-diagnosed diabetes mellitus, where the triage POC glucose was > 200 mg/dL and POC BOHB and serum bicarbonate data were available. The outcome variable of interest was DKA, defined as a serum bicarbonate level less than 15 mmol/L per ISPAD criteria. Test characteristics of POC BOHB >/= 3.0 mmol/L, including sensitivity, specificity, positive-predictive value, and negative-predictive value were calculated. A receiver operating characteristics (ROC) curve was developed to describe the accuracy of POC BOHB to predict DKA. Sub-analyses were performed for newly-diagnosed vs. known diabetes patients.

Results
A total of 463 ED encounters were reviewed, 34% were newly-diagnosed diabetes patients, and 77% of encounters were in DKA based on serum bicarbonate < 15 mmol/L. Only 13 patients (3%) had a POC BOHB < 3.0 mmol/L. The sensitivity, specificity, positive-predictive value, and negative-predictive value of a POC BOHB level =/> 3.0 mmol/L to predict DKA were 98%, 4%, 77%, and 31%, respectively. The ROC curve

demonstrated an area under the curve (AUC) of 0.721 (0.670-0.773). The optimal cut off value of POC BOHB was 4.8 mmol/L with a sensitivity of 74% and specificity of 61% for predicting DKA. The AUC for known diabetes patients was 0.742 (0.677-0.807) compared to 0.724 (0.641-0.807) for newly-diagnosed patients.

Conclusion

Serum BOHB levels indicative of DKA cannot be extrapolated to POC BOHB testing in children with diabetes presenting to the ED. Overall, for both known and newly-diagnosed children with diabetes, POC BOHB testing is poor-to-fair predictor of DKA in the ED setting.