

Pathology and Laboratory Medicine Memorandum

To: NSHA Physicians, Nurse Practitioners, Health Service Directors and Laboratories
From: Program of Pathology and Laboratory Medicine
Date: April 23, 2019
Subject: Implementation of Point of Care Beta-hydroxybutyrate Ketone Assay

Commencing May 1, 2019, a quantitative beta-hydroxybutyrate (BHB) assay for blood ketone testing on the Point of Care (POC) Nova StatStrip device will be offered. This will replace blood ketone assays performed in the laboratory. Urine ketone testing will still be available as part of the urinalysis assay.

What is Beta-hydroxybutyrate (BHB) and why is testing BHB superior to acetoacetate?

BHB, acetone and acetoacetate are the main sources of ketone bodies, and in a normal state, the BHB to acetoacetate ratio is usually 1:1. However, in diabetic ketoacidosis (DKA) the main ketone produced is BHB, and the ratio of BHB to acetoacetate can range from 3:1 in milder cases up to 10:1 in more severe cases. The blood ketone nitroprusside assay performed in the laboratory, which primarily detects non-BHB ketones, can be misleading and underestimate the true ketone load.

Clinical Implications

1. **For assisting in diagnosis of DKA:** The test should be considered in patients presenting to the emergency room with hyperglycemia, acidosis, suspected alcohol ingestion, and/or an unexplained increase in the anion gap. For patients with acidosis and an elevated blood glucose, a BHB level >1.5 mmol/L warrants further investigation for DKA, and a BHB level ≥ 3 mmol/L is typically diagnostic of DKA. Increased BHB can however, occur in patients with normal blood glucose (such as in patients taking SGLT2 inhibitors).
2. **For monitoring DKA therapy:** In DKA, a suggested treatment target is the reduction of BHB levels by 0.5 mmol/L/hour. Evidence of resolution of DKA would include a blood ketone <0.6 mmol/L and pH >7.3 ; other clinical parameters such as glucose, potassium, etc. should also be used to guide management.
3. **In pediatric patients:** The presence or absence of ketonemia is an essential component in the differential diagnosis of certain inborn errors of metabolism.

Specimen Requirements

Nova StatStrip meters with blood ketone testing capability will be available in certain acute care locations across NSHA, mainly emergency rooms and ICUs. Capillary blood will be required for the POC BHB testing. The collection technique and procedure is the same as Nova StatStrip glucose testing, therefore no additional training is required.

Reference Ranges for both POC and In-Lab Testing:

- ≥ 18 years: ≤ 0.6 mmol/L
- < 18 years: ≤ 0.4 mmol/L
- Note: Levels that are > 7 mmol/L will be reported as “HI”

Note: The following clinical comments will be added to laboratory reports:

- In patients with acidosis and an elevated blood glucose, a ketone (Beta-hydroxybutyrate or BHB) level > 1.5 mmol/L warrants further investigation for diabetic ketoacidosis (DKA), while a level ≥ 3 mmol/L is typically diagnostic of DKA. Increased BHB can occur in patients with normal blood glucose (such as in patients taking SGLT2 inhibitors).
- During treatment of DKA, reduction of ketones by approximately 0.5 mmol/L/hour is the suggested goal. Resolution of DKA is signified by POC ketones < 0.6 mmol/L and $\text{pH} > 7.3$.

If you have any queries on the above, please contact Dr. Manal Elnenaei at 902-473-5194 or Dr. Tugwell at 902-473-2952.