

Introduction

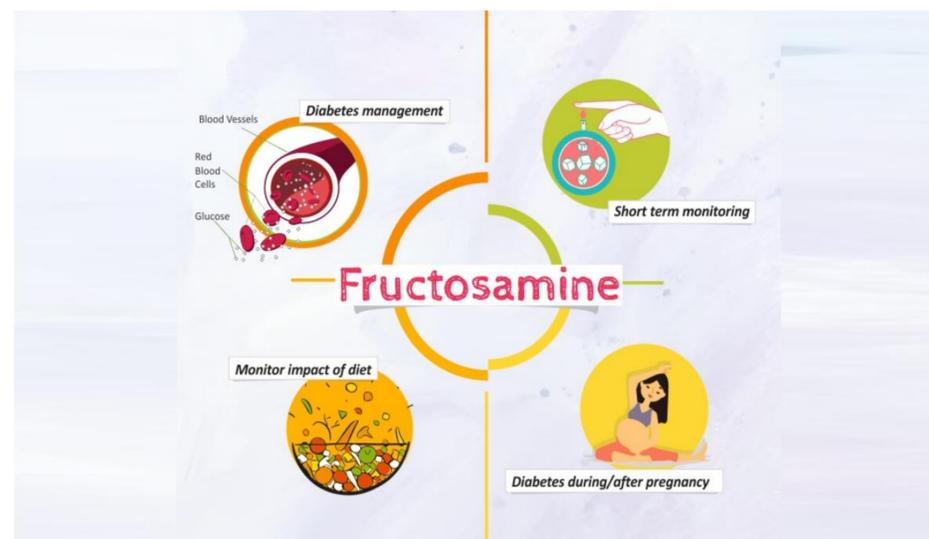
- Diabetes Mellitus is a widespread problem, increasing at alarming rates and is associated with increased morbidity and mortality
- HbA1C is an accepted as a reliable tool for the diagnosis of DM, and help monitor glycemic control
- However, in some clinical cases, A1C can be an inaccurate representation of control
- Several alternative methods have been proposed, including Fructosamine, Glycated Albumin, and continuous glucose monitoring to evaluate recent glycemic control
- We present a case of a patient with Sickle Cell Anemia who had a severe discrepancy between HbA1C and Fructosamine Assay.

Case Description

- 59-year-old Female presents with Altered Mental Status
- PMH: Sickle Cell Anemia, HTN, Hyperlipidemia
- Vitals: BP 158/60, HR 75, Afebrile, 6L NC
- Labs: Glucose 696, Bicarb 10, AG 31, K 3.8, Na 138, Lactate 19.5, Cr 1.52 (Baseline 1.2), Beta-hydroxy 1.3, WBC 19300/uL
- Developed generalized tonic-clonic seizures, treated with IV Lorazepam, started on Levitriacetam
- Placed on BiPAP for respiratory failure, and uncompensated metabolic acidosis
- Started on IV Insulin, IV fluids for HHS
- HbA1C and Fructosamine were sent
- HbA1c resulted 7.3
- Fructosamine resulted 428 umol/L
- Utilizing formula created by Kang and colleagues:
 $HbA1C = 0.17 \times \text{Fructosamine umol/L} + 1.6$, his A1C correlated with an estimate of 8.9%
- Transitioned to subcutaneous Insulin regimen: Lantus 18 units HS + Lispro 20 units breakfast, Lispro 10 units Lunch and Dinner.
- Follows up Endocrinology as out-patient

Fructosamine test

- Fructosamine, is a ketoamine, formed by reaction between glucose and amino group of proteins, including Albumin, Globulins, and lipoproteins
- Glycated Albumin, (GA) is the result of non-enzymatic glycation of albumin with higher blood glucose levels being associated with higher glycated albumin levels.
- Since serum proteins have a much lower half life, 14 – 21 days, measurement of fructosamine provides overview of blood glucose control within the previous 2-3 weeks
- Fasting specimen are not require
- Assays are widely available, and fairly inexpensive
- Reference range of Fructosamine in non-diabetic individuals is 200-285
- Glycated albumin – 14% in normal, can be up to 17% or higher in diabetics
- However, there is lack of standardization across assays
- Affected by changes in temperature, presence of substances e.g., Bilirubin, and conditions that influence serum albumin levels (e.g., Cirrhosis, Nephrotic syndrome)
- GA less affected by albumin concentrations as expressed as a percentage of total albumin
- Fructosamine unreliable when serum Albumin < 3.0 g/dl
- Can be affected by condition that raise serum protein e.g., MM



Discussion

- HbA1C, a key tool in diagnosis and monitoring Diabetes Mellitus, can often underestimate blood glucose control in patients with sickle cell disease, other RBC Disorders and Renal Disease.
- Fructosamine assay may be used as a short-term marker to assess glycemic control and prediction of both microvascular and macrovascular complications
- Can have additional utility in monitoring people with fluctuating or poorly controlled diabetes, monitoring control in diabetes, as well as monitor recent medication change.
- Although conversion formulas have been developed to approximate A1C levels, no definitive guideline exist to correlate fructosamine to blood glucose control or A1C levels.

Conclusion

- We propose greater awareness be made regarding alternative monitoring in such patients at high risk for inaccurate readings
- Additionally, guidelines should be developed to help clinicians interpret these alternative methods for better control of blood sugar levels and to help prevent adverse events of uncontrolled Diabetes.

References

1. Ji-Eun Lee, "Alternative biomarkers for assessing glycemic control in diabetes: fructosamine, glycated albumin, and 1,5-anhydroglucitol", *Annals of Pediatric Endocrinology & Metabolism* 2015;20(2): 74-78.
2. Selvin Em Rawlings A M, Grams M, Klein R, Sharret R, Et al., "Fructosamine and glycated albumin for risk stratification and prediction of incident diabetes and microvascular complications: a prospective cohort analysis of the Atherosclerosis Risk in Communities (ARIC) study", *The Lancet, Diabetes and Endocrinology*; Volume 2 Issue 4, April 2014, Pages 279-288
3. Selvin E, Warren B, He X, Sacks D, Saenger A, "Establishment of Community-Based Reference Intervals for Fructosamine, Glycated Albumin, and 1,5-Anhydroglucitol" *Clinical Chemistry*, Volume 64, Issue 5, 1 May 2018, Pages 843-850
4. Lamb E.^a · Venton T.R.^b · Cattell W.R.^c · Dawnay A, "Serum Glycated Albumin and Fructosamine in Renal Dialysis Patients"; *Nephron* 1993;64:82-88
5. Ciaccio, M. (2019). Introduction of glycated albumin in clinical practice. *J. Lab. Precis. Med.*, 4, 28.