Clinical Applications of Carbamylated Hemoglobin in Renal Diseases

Thesis
Submitted for partial fulfillment of MD degree in internal medicine

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Summary

Renal impairment is a common presentation in outpatient clinic and emergency room. Early detection and identification of type, severity and duration have great impact on outcome, and help reservation of effort and resources. Great effort is directed toward developing novel biomarkers of renal impairment helping in diagnosis and management **(Murray et al., 2014)**. This study aimed to describe the clinical importance of carbamylated hemoglobin (CarHb) in detection and differentiation of renal disorders. Our study included 88 persons distributed in the 3 groups according to type of renal impairment guided by KDIGO definitions and staging of AKI **(KDIGO; AKI Work Group, 2012)** and CKD **(KDIGO; CKD Work Group, 2013)** as following:

- Group 1: the control group with normal KFTs (26 Persons)
- Group 2: Patients with AKI (29 patient).
- Group 3: Patients with CKD (33 Patient).

Late presentation is obvious in both AKI and CKD. In group 2; 75.9% of patients presented in stage 3, 20.7% in stage 2, and 3.4% in stage 1. **Folefack et al., 2015** published that all AKI patients were RIFLE-F on presentation; 53.6% of AKI patients presented in stage 3 as reported by **Antonioet al, 2009** and 43.1% by **Legrand et al., 2013**. In group 3; no patient presented in stages 1 or 2, 42.4% in stage 5, 42.4% in stage 4, and 15.2% in stage 3. This is a worldwide issue and is associated worse outcome **(Hommel K et al., 2012),** increased costs and complications **(Ibrahim et al., 2016)**. The importance of early detection pushed Egyptian authorities to launch a screening program for renal impairment**.**

Carbamylated haemoglobin (CarHb) results from modification of haemoglobin chains by isocyanate that is derived from dissociation of urea.

Two decades ago, CarHb was investigated as a marker of uremia **(Jonathan et al., 1992).** In the current study, the mean CarHb differed significantly between the study groups. CarHb ranged from 2 to 4.8 U/ml. The mean of CarHb was 3, 3.5 & 3.8 in groups 1, 2 & 3 respectively.

Our study concluded that CarHb level is significantly higher in patient with renal impairment when compared to normal population, regardless the type of renal impairment. It was discovered that CKD patients had statistically significant higher CarHb level than AKI; So, CarHb level indicates long term exposure to uremic toxins; and may be used to differentiate between AKI and CKD in patient presented with renal impairment.

In our study; a cutoff point of CarHb ≥3.35 U/ml can predict CKD with sensetivity 90%, specificity 54%, negative predictive value 89%, and positive predictive value 56%. Regardless renal condition; CarHb was found to have positive correlation with urea and creatinine levels.

Further studies are needed to establish the ability of CarHb to differentiate AKI from CKD, early detection of renal impairment, prediction of renal outcomes and assess adequacy of RRT.