Blood glucose as a predictor of diarrheal dehydration in children

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ABSTRACT

Background: Diarrhea remains the second leading cause of death globally among under 5 children. Historical clinical characteristics may not correlate to dehydration severity. **Objectives:** This study was done to evaluate the glycemic status of children having acute diarrhea with dehydration, at presentation, and to analyze the blood glucose as a predictor of the severity of diarrheal dehydration. **Materials and Methods:** Blood glucose levels were assessed in 150 children with acute diarrhea with dehydration, on admission. **Results:** Blood glucose levels showed statistically significant association with the degree of dehydration ($p<0.05$). Receiver operating characteristic curve analysis showed that blood glucose was a poor predictor of the severity of dehydration (area under curve [AUC] 0.240, 95% confidence interval [CI] = 0.050-0.429, standard error [SE] = 0.097) for some dehydration; and (AUC = 0.760, 95% CI = 0.571-0.950, SE = 0.097) for severe dehydration. **Conclusion:** Blood glucose is a poor predictor of the severity of diarrheal dehydration.

Key words: *Blood glucose, Dehydration, Diarrhea*

Diarrhea remains the second leading cause of death globally among under 5 children [1]. Introduction of oral rehydration therapy has revolutionized the management of diarrhea with significant reduction in diarrhea related mortality, but the morbidity has not decreased substantially [1]. Historical clinical characteristics may not correlate to dehydration severity [2].

The present study was done to evaluate the glycemic status of children having acute diarrhea with dehydration, at presentation, and to analyze blood glucose as a predictor of the severity of diarrheal dehydration, in an aim to improve its treatment.

MATERIALS AND METHODS

It was a time bound, prospective, observational study done in a tertiary care hospital over the duration of 10 months (March - December 2015). Ethical clearance was obtained from the Institutional Ethics Committee. Children <5 years of age, admitted with acute diarrhea with dehydration were enrolled. Neonates, patients with any co-morbidity and whose parents did not give consent, were excluded from the study. Acute diarrhea was defined as a recent change in the consistency of stools [1] and the degree of dehydration (no, some, and severe) was assessed using the World Health Organization criteria [3]. Blood glucose levels were recorded on admission. Values were measured bedside with a glucometer ("Pura X™" 2015-02). All patients were managed as per the Management of Neonatal and Childhood Illness guidelines.

A preformed standardized pro-forma was used to record the data, which was later transferred to an MS-excel worksheet 2007. Statistical analysis was done using the Epi-info software version 7.1.5. Receiver operating characteristic (ROC) curve was used to determine blood glucose values as a predictor of severity of dehydration and was drawn using SPSS version 22.0.0.0.

RESULTS

Total 150 patients with some or severe dehydration, hospitalized during study period were enrolled. Majority (141/150, 94%) of the patients had some dehydration. Mean age on admission was 15.90 ± 16.06 months (range - 1-96 months). Male to female ratio was 1.41:1 and 90 children belonged to rural areas (61.86%). About 94 patients (62.6%) had already taken either oral rehydration solution (ORS) or some homemade solution, prior to admission.

Mean blood glucose levels were 106.36 ± 29.76 mg/dl (range - 36-268 mg/dl). Blood glucose levels showed statistically significant association with the degree of dehydration ($p<0.05$). ROC curve analysis showed that blood glucose was a poor predictor of the severity of dehydration (area under curve [AUC] = 0.240, 95% confidence interval [CI] = 0.050-0.429, standard error [SE] = 0.097) for some dehydration (Fig. 1); and (AUC = 0.760, 95% CI = 0.571-0.950, SE = 0.097) for severe dehydration (Fig. 2).

DISCUSSION

Blood glucose levels were found to be in the normal range in all the patients. Mean blood glucose level was significantly
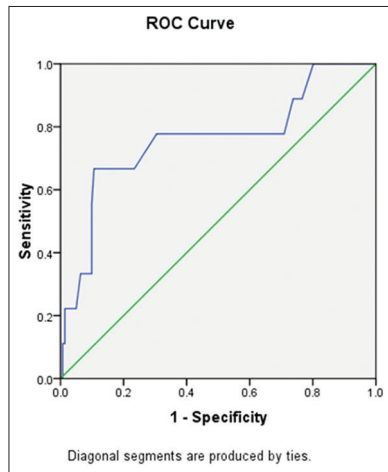
Figure 1: Receiver operating characteristic curve for some dehydration
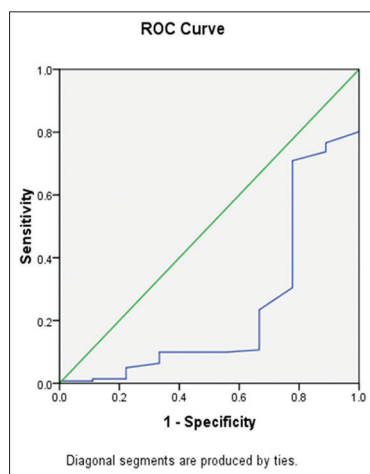
Figure 2: Receiver operating characteristic curve for severe dehydration

associated with the presence of dehydration, but it remained a poor predictor of the severity of dehydration. A previous study done in children <5 years of age, found pre-treatment hypoglycemia in 9.2% children with acute gastroenteritis [4]. Another study done in 2-10-year-old children with diarrhea found hyperglycemia in 9.4% patients [5]. A study on infantile gastroenteritis reported blood glucose levels between 0 and 50 mg/dl in 7.9% and over 200 mg/dl in 10.2% patients.

Hyperglycemia (including transient glucose intolerance) is due to stress response to hypovolemia and production of counter regulatory hormones [6,7]. Hypoglycemia, on the other hand, is due to diminished oral intake and associated vomiting. All the above studies were done a minimum of decade back. However, all children

in our study had normal blood glucose levels on presentation. This may likely due to be the increased awareness amongst the people and increased use of pre-admission ORS and home remedies.

Mean blood glucose levels were significantly associated with the presence of dehydration, but not with the degree of dehydration. To the best of our knowledge, ours is only the second study in children, to have evaluated that. In the other study, done on 251 children with acute gastroenteritis, children with severe dehydration had significantly low mean glucose levels (p<0.005) [2]. AUC was 0.684 (95% CI = 0.574-0.795) for glucose. The results of our study may be because of normal blood glucose levels on admission, in all children.

Our study is limited by lack of a pre-calculated sample size, the relatively small numbers and non-assessment of other biochemical parameters which might as well be implicated in predicting the severity of diarrheal dehydration.

CONCLUSIONS

As in current perspective, blood glucose levels are normal in children with acute diarrhea with some or severe dehydration. Blood glucose is a poor predictor of the severity of diarrheal dehydration.

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