

## Hypocalcemia in Acute Gastroenteritis (A Case-Control Study at Department of Internal Medicine)

<sup>1</sup>Bikha Ram Devrajani, <sup>1</sup>Syed Zulfiquar Ali Shah,  
<sup>1</sup>Samiullah Shaikh, <sup>1</sup>Shamsuddin Shaikh and <sup>2</sup>Salman Essa

<sup>1</sup>Department of Medicine, Liaquat University of Medical and  
Health Sciences Jamshoro / Hyderabad (LUMHS), Sindh, Pakistan  
<sup>2</sup>Essa Laboratory, Saddar, Hyderabad, Sindh, Pakistan

**Abstract:** Objective: To determine the serum calcium level in adult patients with acute gastroenteritis Patients and Methods: This descriptive type cross sectional study was conducted at Liaquat University Hospital Hyderabad Sindh, Pakistan. All patients above 12 years of age, of either gender present with history of acute diarrhea were further evaluated for their serum calcium status. The control group was selected for statistical comparative purpose; the data was recorded in pre-design proforma and analyzed in SPSS version 11.00. Result: Sixty six (66) subjects in each group were studied, of which 72(55%) were males and 60 (45%) were females, the mean age was 36.76±13.40. The hypocalcemia was observed in 75 (57%) patients while the serum calcium was normal in 57(43%) patients. Majority of subjects 92 (70%) belonged to urban areas. The mean±SD of serum calcium level in patients with acute gastroenteritis was 6.8455 ± 1.8266 mg/dL while the mean±SD of serum calcium in control group was 9.2167 ± 0.4534 mg/dL respectively (P<0.001). Conclusion: The low serum calcium level (hypocalcemia) was identified in patients with acute gastroenteritis.

**Key words:** Hypocalcemia % Serum calcium % Acute gastroenteritis % Diarrhea

### INTRODUCTION

Gastroenteritis is an infection of the gut and is a leading cause of morbidity and mortality worldwide [1]. The patients with acute gastroenteritis commonly present to emergency departments (EDs) and primary care centers, the etiological agents can be viral, bacterial, or protozoan; and bacterial agents can be either enteropathogenic, toxigenic, or both. The peak incidence of infectious gastroenteritis is found in younger age groups (< 5 years), while severe disease leading to hospitalization and resulting in death is most frequently observed in elderly patients (> 60 years) [2]. The study was conducted at Houston shown 12.4 prevalence of diarrhea [3]. Most cases of acute diarrhea caused by bacterial enteric pathogens are self limiting. The main goals in management are symptomatic treatment, rehydration or prevention of dehydration, prevention of spread of infection and empiric antibiotic treatment in selected cases [4,5]. The acute gastroenteritis was 7% in the study by Usman *et al.* [6].

Calcium regulation is critical for normal cell function, neural transmission, membrane stability, bone structure, blood coagulation and intracellular signaling. Depending on the cause, unrecognized or poorly treated hypocalcemic emergencies can lead to significant morbidity or death. The causes of hypocalcemia include hypoalbuminemia, hypomagnesemia, hyperphosphatemia, multifactorial enhanced protein binding and anion chelation, medication effects, surgical effects, Parathyroid hormone (PTH) deficiency or resistance and vitamin D deficiency or resistance [7]. The decrease level of serum calcium in acute gastroenteritis is reported in different studies [8,9]. The epidemiology of hospitalizations associated with gastroenteritis in adults, however, has not been well investigated so far, even though it imposes a major burden on the patient and the health care system [10]. The present study was conducted at the Liaquat university hospital Hyderabad Pakistan, the 1500 bedded tertiary care teaching hospital which provide all emergency and elective facilities and covers both urban and rural population. This hospital is located centrally in

the Hyderabad city of Pakistan, the second biggest city of province Sindh and fifth biggest city of country; the unhygienic drinking water causes various water-related health disorders in Hyderabad, Sindh, Pakistan and It has been reported that majority of citizens have suffered from acute gastroenteritis due to use of the hazardous drinking water.

The objective of the present study was to investigate the disturbance in serum calcium level in patients presented with acute gastroenteritis; our intention was also to provide data for recommendations concerning routine testing panels in these patients to guide clinicians and health care worker in the complete assessment and evaluation protocol for the patients with acute gastroenteritis. The findings of this study will lead to better interpretation of current information and will be used to inform policy on public health, leading to creation of appropriate planning in the management of patients with acute gastroenteritis.

## MATERIALS AND METHODS

This case control study was conducted in the department of Medicine at Liaquat University Hospital (a tertiary care 1500 bedded teaching hospital) Hyderabad from February 2009 to July 2009. The study population was divided in two groups (1) The patients of acute gastroenteritis (cases) (2) Normal / healthy individuals (control). The acute gastroenteritis group contains the patients presented with nausea, vomiting and diarrhea (loose motion) while control group consists of healthy population. The inclusion criteria for cases were (a) the subjects above 12 years of age, (b) of either gender, were came through outpatient department (OPD), inpatients and casualty outdoor department (COD) with history of acute gastroenteritis i.e. nausea, vomiting and diarrhea (loose motions) were admitted, evaluated and enrolled in the study while the inclusion criteria for control group was (i) the subjects above 12 years of age, (ii) of either gender. The exclusion criteria for the cases group were, (i) The patients had Hypoalbuminemia due to any cause e.g. cirrhosis, nephrosis, malnutrition, burns, chronic illness and sepsis. (ii) The patients with hypomagnesemia due to any cause e.g. pancreatitis, aminoglycoside treatment, amphotericin B, loop diuretics, alcoholism and malnutrition. (iii) The patients with Hyperphosphatemia, high calcitonin level and had Rhabdomyolysis. (iv) The

patients with malignancy e.g. Osteoblastic metastases (e.g. breast cancer, prostate cancer) and tumor lysis syndrome may cause hypocalcemia. (v) The patients had hypoparathyroidism and pseudohypoparathyroidism and (vi) The patients with Vitamin D deficiency or resistance. While the non cooperative patients who refused to give written consent or didn't have interest to participate in study were in the exclusion criteria in both groups (i.e. cases as well as control). The subjects of both groups consist of 66 individuals i.e. 66 patients with acute gastroenteritis (cases group) and 66 healthy individuals (control group). The data was collected through a pre-formed proforma by taking consent from the subjects and all such maneuvers were under medical ethics. The detail history of all such patients was taken; complete clinical relevant examination and routine investigation were performed. After that all the subjects of both groups (cases and control) were then evaluated for serum calcium level by taking 3cc venous blood sample and send to laboratory for analysis. The normal range of serum calcium is: 9-10.5 mg/ dL [11] and the value <9mg/dL was considered as hypocalcemia / low while the reading >10.5mg/dL was taken as raised / high. The collected data of both groups were analyzed in SPSS version 11.0. The frequency and percentage of hypocalcemia in patients with acute gastroenteritis (cases) and healthy individual (control) was calculated. Mean  $\pm$  SD of age was computed between the numerical parameters. The ANOVA and independent samples T-test was applied at 95% confidence interval among the categorical variables. The p-value =0.05 was considered as statistically significant.

## RESULTS

Sixty six (66) subjects in each group were studied, of which 72(55%) were males and 60(45%) were females, the mean age was  $36.76 \pm 13.40$  and their age distribution is mentioned in Table 1. The mean serum calcium in both groups is shown in Table 2. The hypocalcemia was observed in 75(57%) patients while the serum calcium was normal in 57(43%) patients. In gastroenteritis (cases) group the hypocalcemia was observed in 62(94%) patients while 04(6%) patients had normal serum calcium level. In control group, the serum calcium was normal in 53(80%) subjects while 13(%) subjects had hypocalcemia / low serum calcium level. Majority of subjects 92(70%) belonged to urban areas.

Table 1: Age Distribution of Participants

AGE (years)	Cases		Control	
	Male	Female	Male	Female
12 - 20	00	08	00	08
21- 30	12	06	12	06
31 - 40	08	08	08	08
41 - 50	10	06	10	06
> 50	06	02	06	02

P = 1.000 (non significant)

Table2: Mean Serum Calcium Level of Both Groups

Serum Calcium (n = 132)	Mean $\pm$ SD (mg/dL)	P-value
Cases (66)	6.8455 $\pm$ 1.8266	<0.001*
Control (66)	9.2167 $\pm$ 0.5534	

\*P value is statistically significant

## DISCUSSION

Acute gastroenteritis is a common cause of morbidity and mortality worldwide. Conservative estimates put diarrhea in the top 5 causes of deaths worldwide and diarrheal diseases are a significant cause for morbidity across all age groups in industrialized countries. Beside dehydration, there are also various biochemical markers that disturbed during acute gastroenteritis and by concentrating on such theme, the current study focused on disturbance in serum calcium level during acute gastroenteritis. At the end of study we identified hypocalcemia in 62(94%) gastroenteritis patients and it is similar to the study published in the Journal of Gastroenterology during 2003. [12] However our hypothesis is also consistent by the Westblom *et al.* [13] The People suffering from infectious diarrhea (Travelers' diarrhea) may get relief by consuming high-calcium milk products in a study by Bovee-Oudenhoven [12] in all participants developed diarrhea shortly after being infected with *E. coli*. The men drinking the regular milk had complete resolution of symptoms after the second day of treatment, while the men drinking the low-calcium milk continued to have diarrhea. The results of this study show that calcium in milk accelerates recovery from infectious diarrhea. Although there are limited studies in humans, however preliminary animal research also showed that calcium was effective in preventing diarrhea. One animal study found that oral calcium phosphate helped prevent *E. coli* infection and protects against salmonella infection. [14] More human research is still necessary to determine if calcium might be effective against other organisms that cause diarrhea.

Although it has not been determined whether calcium from other food sources or from supplements would provide the same benefit, individuals with milk allergy or lactose intolerance might consider alternative sources for calcium. Foods high in calcium include calcium-fortified soy products; nuts; green, leafy vegetables (kale, collard greens, mustard greens); and seaweed. The Calcium is best-known as a supplement to support bone health, but it also has a long history of use to control diarrhea and also has identified role in protease inhibitor-related diarrhea, in people with HIV [15]. There are different former studies conducted on children that identified hypocalcemia during diarrheal illness [16-17] but there are limited studies that focused on hypocalcemia in adult subjects with acute gastroenteritis. The present study will fill such vacant space of limited data and open a new forum of discussion because beside the various advance books, printed and electronic media there is yet shortage of exact, related and specific data on present theme. The study should need an advance continuous and extended phase during different time periods and episodes at various health care centers, clinics and hospitals. Such strategy will lead to providence of updated data which will be helpful in the management protocol of adult subjects with acute gastroenteritis.

## ACKNOWLEDGEMENT

The valuable and unforgettable help from SEARLE pharmaceutical during study period is gratefully acknowledged.

## REFERENCES

1. Musher, D.M. and B.L. Musher, 2004. Contagious acute gastrointestinal infections. *N. Engl. J. Med.*, 351: 2417-27.
2. Gangarosa, R.E., R.I. Glass, J.F. Lew and J.R. Boring, 1992. Hospitalizations involving gastroenteritis in the United States, 1985: the special burden of the disease among the elderly. *Am. J. Epidemiol.*, 135: 281-90.
3. Garey, K.W. and D. Pharm, 2006. Prevalence of Diarrhea at a University Hospital and Association with Modifiable Risk Factors. *The Annals of Pharmacotherapy*, 40(6): 1030-34.
4. Sadosty, A.T. and B.J. Browne, 2000. Vomiting, diarrhea and constipation. In: J.E. Tintinalli, G.D. Kelen, J.S. Stapczynski, eds. *Emergency medicine. A comprehensive guide*. 5th edn. New York: McGraw-Hill, pp: 567-7.

5. Bitterman, RA., 1998. Acute gastroenteritis and constipation. In: P. Rosen, ed. Emergency medicine: concepts and clinical practice. 4th edn. St Louis, MO: Mosby-Year Books, pp: 1917-58.
6. Usman, M., S. Tabassum and I. Khan, 2006. Pattern of medical disorders in adults in district Lakki Marwat, Pakistan. Gomal Journal of Medical Sci., 4(1): 19-23.
7. Guise, T.A., G.R. Mundy, 1995. Clinical review 69: Evaluation of hypocalcemia in children and adults. J. Clin Endocrinol Metab, 80(5): 1473-8.
8. Murtaza, Khan, S.R., K.S. Butt, B.S. Lindblad and A. Aperia, 2008. Hypocalcemia and Hyperphosphatemia in Severely Dehydrated Children with and without Convulsions. Acta Pædiatrica, 77(2): 251-56.
9. Dickerson, D. and R.N. Pharm, 2006. Hospital Pharmacy, 41(10): 993-94, 996-99.
10. Svenungsson, B., A. Lagergren, E. Ekwall, B. Evengård, K.O. Hedlund, A Kärnell, *et al.*, 2000. Enteropathogens in adult patients with diarrhea and healthy control subjects: a 1-year prospective study in a Swedish clinic for infectious diseases. Clin Infect Dis., 30: 770-8.
11. Bhakti Desai, Anand Gokani, Alpana Shukla, PS Tampi, 2008. Hypercalcaemic Crisis - A Case Study of Three Unusual Cases of Iatrogenic Vitamin D. and Calcium Intoxication. Bombay Hospital Journal, 50(2): 322-24.
12. Bovee-Oudenhoven, I.M., M.L. Lettink-Wissink, Van W. Doesburg, B.J. Witteman and R. Van Der Meer, 2003. Diarrhea caused by enterotoxigenic Escherichia coli infection of humans is inhibited by dietary calcium. Gastroenterol., 125: 469-76.
13. Westblom, T.U. and TW. Milligan, 1992. Acute Bacterial Gastroenteritis Caused by Hafnia alvei. Clinical Infectious Diseases, 14(6): 1271-72.
14. Beyer, M.J., J.F. Freestone, J.M. Reimer, W.V. Bernard and E.R. Rueve, 1997. Idiopathic hypocalcemia in foals. J. Vet. Intern. Med., 11(6): 356-60.
15. Turner, M.J., J.B. Angel, K. Woodend and P. Giguère, 2004. The efficacy of calcium carbonate in the treatment of protease inhibitor-induced persistent diarrhea in HIV-infected patients. HIV Clin Trials, 5(1): 19-24.
16. Heubil, J.E., J.C. Partin and W.K. Schubert, 1983. Hypocalcemia and steatorrhea - Clues to etiology. Digestive Diseases and Sci., 28(2): 124-128.
17. Hirschhorn, N., 1980. The treatment of acute diarrhea in children An historical and physiological perspective. The American J. Clinical Nutrition, 33: 637-63.