Congenital Glucose Galactose Malabsorption complicated with Rickets and Nephrogenic Diabetes Insipidus

Tawfiq Al-Lawati, Thomas Vargees

Abstract

Congenital Glucose Galactose malabsorption (CGGM) is a rare disorder with limited data from the Arab world. We report the first case of CGGM in Oman.

B.S.A two years old female who presented with chronic osmotic diarrhea since birth with hypernatraemic dehydration. B.S was found to have Glucose Galactose Malabsorption based on clinical trial of ORS and elemental formula. Symptoms resolved on introduction of Carbohydrate free formula. The patient developed many complications while on TPN including rickets and nephrogenic diabetes insipidus. These complications have not been reported earlier in CGGM.

Submitted: 07Jan 2008
Reviewed: 20 Feb 2008
Accepted: 31 Mar 2008
From the Division of Paediatric Gastroenterology, Department of Child Health, Royal Hospital
Address correspondence and reprint requests to: Dr Tawfiq Al-Lawati, Division of Paediatric Gastroenterology, Department of Child Health, Royal Hospital, Muscat, Sultanate of Oman.
E-mail: tawfiqtaki@hotmail.com

Introduction

Congenital Glucose Galactose (CGGM) malabsorption is a rare disorder of carbohydrate malabsorption affecting selectively Glucose and Galactose monosaccharides.[1]

In general there are two means by which glucose is absorbed in different cells. The first method is through an active process against an energy gradient and the other one is a passive process. The active process is medicated by a group of genes called Na/glucose co-transporter (SGLT) which are present in the small intestine and renal tubules. The other family is GLUT group which is responsible of passive glucose absorption in the erythrocyte, brain and neurons.[2]

Studies identified Na/glucose co transporter SGLT1 to be defective in patients with CGGM.[3] Many homozygous and heterozygous genetic mutations were identified as the underlying etiology of SGLT defect.[4]

In the Arab world where consanguineous marriage is quite common, CGGM appears to be a rare problem. There are is no data about the incidence or the prevalence of this problem in the Arab world. Lebenthal E et al.[5] have reported an Iraqi adult with GGM and subsequently Abdullah et. al. reported 8 Arab children with a similar problem.[6]

We here present the first identified case of Congenital Glucose Galactose in Oman and its long term management complications.

Case report

B.S, a two year old Omani female referred to Royal Hospital from a local health center with history of diarrheal illness since the age of 2 days. The diarrhea was watery in character with no blood or mucous. The Child was the fourth sibling to first cousin parents with history of 2 abortions in the mother during the first trimester. No family history of chronic diarrhea or neonatal deaths. She was born by SVD with a birth weight of 2.3kg. There were no antenatal concerns and no polyhydramnious. She has 2 sisters and one brother who were well. Developmentally, she was delayed in gross and fine motor with normal speech. This was attributed to prolonged hospitalization as she was home for only 1 week after delivery. On initial examination at the age of 23 days, weighing 2 kg, was severely dehydrated, her blood pressure was 74/41 and hear rate of 80/min. She was emaciated with normal temperature. She had no dysmorphic features and systemic examination was unremarkable. Blood investigations showed serum sodium of 156 mmol/l, potassium of 2.8 mmol/l, urea of 18 umol/l, creatinine of 208 umol/l and pH of 7.22 with base excess of (-18) . Stools were acidic and showed no ova or cyst. Reducing substances were positive initially. No stool sugar chromatography was available.

She was tried on many formulae including lactose free, semi-elemental and elemental formula with no change in diarrhea. She subsequently was put on TPN with good weight gain. The TPN however was not on regular basis as She developed central line infection approximately once every month and require central line removal. Because of the repeated insertion and infections almost all major veins in the neck, upper and lower limbs were thrombosed. She spent 2 years in hospital receiving TPN intermittently with limited diet. BS could only tolerate some chicken based feeds.

During her stay in hospital, The child developed rickets and sustained right femur fracture. Serum 25 (OH) D2 was low. The fracture was fixed surgically and rickets responded to one alpha calcidol and calcium supplementation.

She continued to have diarrhea on and off while in hospital and would frequently have hyper-natraemic dehydration; moderate to severe at times when there was no peripheral vascular access.

A tunneled femoral central line was inserted and hypernatraemic dehydration was corrected. The child regained

weight on TPN. An upper endoscopy performed at that stage and showed normal duodenal mucosa both on light and electron microscopy. Disaccharidase assessment was not available.

The diagnosis of CGGM was contemplated based on normal duodenal histology with a history of early onset of acidic osmotic diarrhea causing hypernatraemic dehydration that did not improve with elemental diet. While nil orally the child had no diarrhea. The patient was put on WHO Orally Rehydration Solution (ORS) only for 1 day and developed acidic watery diarrhea again. Recurrence of diarrhea on ORS *clinically* confirmed the diagnosis of GGM.

Patient was started on Carbohydrate Free Formula (Abbott) and the stool consistency became normal for the first time in the child's life. Unfortunately CFF was not available on the long term and patient remained on TPN.

On TPN patient was found to have polyuria and polydypsia at times when all her daily blood glucose measures and serum electrolytes were normal. Renal ultrasound did not show nephrocalcinosis and urine analysis was negative for glocosuria or infection. Water deprivation test was performed and showed a serum osmolality of 332 mosmol/l with urinary osmolality of 222 mosmol/l. This was not normalized by the administration of DDAVP confirming the diagnosis of Nephrogenic Diabetes Insipidus (NDI). Patient was allowed free access to water with monitoring of TPN.

Two months after insertion of the central line the patient developed high spiking temperature and went into septic shock. Blood culture grew Candid albicans. At that time the patient had a single central line for the TPN and fluids with no other patent central vessels for reinsertion. The child was put on Ambisome 8 mg/kg daily but went into multi organ failure and died shortly after that at the age of 2 years.

Discussion

Glucose Galactose malabsorption is an aggressive disease which usually presents in the first 4 days of life and typically cause hypernatremic dehydration.[1] In the Arab world there have been very few reports of GGM. The diagnosis of CGGM is made by in vitro studies of glucose absorption by measuring intra luminal and intracellular glucose of enterocytes and looking at the changes of action potential across the cell membrane as indication of absorption.

This method is only available in research labs and is not part of routine clinical facilities. Recently gene identification has added a further confirmatory evidence of CGGM.

Another method of diagnosing carbohydrate malabsorption is hydrogen breath test after introduction of 2 gm/kg of glucose. Many authors however use the clinical observation of occurrence of diarrhea on ORS as indication of CGGM especially if elemental diet has failed to control diarrhea.[7]

This patient developed rickets while on TPN. This is a known complication of prolonged TPN in cholestatic patients. In our patient's case, development of rickets was most likely due to inadequate vitamin D in TPN as serum 25 (OH) D2 was low.

The other complication this child developed is nephrogenic diabetes inspidus (NDI). Acquired NDI is usually related to drugs or toxins particularly lithium and amphoteracin B. None of these medications was given to this child prior to the onset of NDI.

Although the long term outlook of patients with CGCM is thought to be good there are no prospective studies clearly demonstrating this claim.

In this case the prognosis was greatly limited by the unavailability of the formula.

Conclusion

Glucose-Galactose Malabsorption is rare in Oman. The diagnosis can be made clinically on introduction on ORS in a child who has osmotic diarrhea that improves on carbohydrate free formula. Rickets and Nephrogenic Diabetes Insipidus might be associated with GGM in patients dependent on TPN with recurrent sepsis. It is important to monitor fat soluble vitamin levels in in-patients with prolonged TPN.

CGGM should be considered and managed early before the complication of prolonged TPN sets in.

References

1. Desjeux JF. Congenital intestinal transport defects. Chapter 44 In eds. Walker A. Durie P, Hamilton J, Walker-Smith J, Watkins J. Pediatric Gastrointestinal diseases. Canada, B. C. Decker. 2000.
2. Pascual JM, Wang D, Lecumberri B, Yang H, Mao X, Yang R, et al. GLUT1 deficiency and other glucose transporter diseases. European Journal of Endocrinology, 2004; 150:627-633.
3. Wright EM. Genetic Disorders of Membrane Transport I. Glucose Galactose Malabsorption. America Journal of Physiology, 1998; 275:G879-G882.
4. Martin MG, Turk E, Lostao MP, Kerner C, Wright EM. Defects in Na+/glucose cotransporter (SGLT1) trafficking and function cause glucose-galactose malabsorption. Nat Genet, 1996; 12:216-220.
5. Lebenthal E, Garti R, Mathoth Y, Cohen BE, Katzenelson D. Glucose-galactose malabsorption in an Oriental-Iraqui Jewish Family. Journal of Pediatrics, 1971; 78:844-850.
6. Abdullah AM, el-Mouzan MI, el Shiekh OK, al Mazyad A. Congenital glucose-galactose malabsorption in Arab children. Journal of Pediatric Gastroenterology and Nutrition, 1996; 23:561-564.
7. Abad-Sinden A, Borowitz S, Meyers R, Sutphen J. Nutrition management of congenital glucose-galactose malabsorption: a case study. Journal of American Diet Association, 1997; 97:1417-1421.