Anesthetic Management of a Boy with Congenital Disorder of Glycosylation (CDG) I-x

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ABSTRACT

Congenital disorders of glycosylation (CDGs) are group genetic defects in the assembly and processing pathway of protein glycosylation, which cause a wide range of multi system dysfunction. This paper describes the anesthetic management of a six years old boy with CDG type I-x for upper airway surgery. We used a sevoflurane-nitrous oxide-remifentanil regime with no complications and good results. As for now, the literature lacks reports of anesthetic management of children with CDG I-x, and this report may provide clinicians an option for safe anesthetic management.

Keywords: Anesthesia, Pediatric, Metabolic Disorders, Congenital Disorders of Glycosylation, CDG

1. Introduction

Congenital disorders of glycosylation (CDGs) are group genetic defects in the assembly and processing pathway of protein glycosylation. This causes a phenotype of which growth, cardiac, neurological, hematological, gastrointestinal, renal, and dermatological and ophthalmological systems are affected in various penetration. The literature concerning information on the anesthetic management of CDG patients is very limited. The purpose of our report is to raise the awareness of anesthesiologists to this group of disorders, with emphasis on the CDG I-x subtype, because specific diagnosis of any entity is important for preventive measures. We describe the anesthetic management of a six years old boy suffering from CDG Type I-x, which was referred for an upper airway surgery under general anesthesia.

2. Case Presentation

DS is a 6 years old boy, whose parents are second degree cousins of Druze origin. He was considered as a healthy and normally developing boy until his brother was found to have hypertransaminasemia and dilated cardiomyopathy. These findings led to the screening of all family members including DS who was found to have the same symptoms as his brother including hypertransaminasemia and dilated cardiomyopathy at the age of 5 years. The boy, weighing 16.2 kg (second percentile), had no cognitive impairment, and physical examination did not reveal any abnormal findings. He was put on oral captopril 2.5 mg twice daily. Retrospectively, his medical chart showed a constant finding of hypertransaminasemia since the age of 6 months with alanine aminotransferase, (ALT) up to 387 U/L (normal values: 5 - 45 U/L) and aspartate aminotransferase (AST) rising to 302 U/L (normal values: 15 - 55 U/L). Serum bilirubin, alkaline phosphatase and gamma-glutamyltransferase (GGT) were normal, as were total protein, albumin, cholesterol, iron, ferritin, blood count, creatine phosphokinase, electrolytes, urea and creatinine. Further metabolic studies including serum lactate, aminoacids and urinary organic acids were normal. Isoelectric focusing of transferrin was performed because CDGs are considered in the differential diagnosis of hypertransaminasemia and dilated cardiomyopathy. Serum isoelectrofocusing (IEF) of transferrin revealed a type I profile suggesting a glycan assembly defect (CDG-I). However, analysis of the patient’s fibroblasts eliminated the possibility of CDG I-a and CDG I-b; lipid-linked oligosaccharide analysis did not show any abnormal accumulation of glycan intermediates. To date, the primary genetic defect of the glycosylation pathway remains unknown, thus we designated the siblings’ disorder as CDG I-x.
As for now, the literature lacks reports of anesthetic management of children with CDG I-x, and this report may provide clinicians an option for safe anesthetic management. The use of propofol based anesthesia, as well as the use of longer acting muscle relaxants and opioids may result in prolonged eduction and undesirable adverse reactions.

CDGs, formerly known as carbohydrate-deficient glycoprotein syndromes, consist of at least 18 genetic defects in the glycosylation of proteins. The CDGs comprise two groups. The first group, CDG I, includes defects in the N-glycan assembly localized in the cytosol and the endoplasmic reticulum (ER) including type I-a to I-I; CDG II comprises disorders in the processing of glycoproteins in the ER and Golgi apparatus accounting for types II-a to II-f [1]. Untyped cases are labeled CDG-x until the gene and its protein will be identified [2]. IEF of serum transferrin remains the most powerful screening test for CDG, although not all types can be detected by this assay. A type I IEF pattern (observed in CDG I) is characterized by a decrease of tetrasialotransferrin and an increase of di- and asialotransferrin bands, whereas a type 2 pattern (observed in CDG II) shows in addition and increase of tri- and monosialotransferrin [3].

The reports of various types have emphasized marked phenotypical variability of this multisystemic group of disorders [4]. The clinical presentation of CDG may include growth retardation, short limbs, delayed puberty and hypogonadism; hypertrophic or dilated cardiomyopathy and pericarditis [5] ataxia, psychomotor retardation, epilepsy, hypotonia, cerebral and cerebellar atrophy; bleeding tendency due to a decrease in Factors VII levels, and/or thrombosis due to decreased clotting factor XI, protein S and protein C; liver fibrosis and cirrhosis, chronic diarrhea, vomiting and protein-losing enteropathy; nephrotic syndrome; ichthyosis, abnormal fat pads and inverted nipples; and strabismus, abnormal eye movements, optic nerve atrophy, coloboma and retinitis pigmentosa.

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This case report presents a possible anesthesia regimen to be used in patients with CDG Ix scheduled for surgery. Previous report [6] regarding anesthetic management of CDG I patient described a sevoflurane-propofol-sufentanil based regimen. Since propofol tends to lower systolic blood pressure and cardiac output, it possesses a potentially negative effect in hemodynamically unstable patients and in patients with severe structural
heart disease or congestive heart failure. Cardiac involvement contributes significantly to morbidity and mortality and probably to sudden death in CDG patients, thus propofol may better be circumvented in these patients.

The use of remifentanil is proven to reduce postoperative nausea and vomiting [7] and to provide faster recovery and shorter time to tracheal extubation compared with fentanyl or sufentanil in tonsillectomy and adenoidectomy in the pediatric population [8]. Since remifentanil is metabolized by non specific esterases [9], its metabolism could be less affected by hepatic dysfunction resulting from CDG. We believe the use of a nitrous oxide-remifentanil based anesthesia regimen may be preferred for CDG I-x patients requiring general anesthesia.

REFERENCES


