PerkinElmer
For the Better

PerkinElmer GENOMICS

Glucose-6-Phosphate Dehydrogenase Deficiency

Background

Glucose-6-Phosphate Dehydrogenase (G6PD) functions throughout the body, but its deficiency is seen predominantly in its effects on the red blood cells. G6PD anchors the production of NADPH and glutathione to protect the body from oxidative insults. Erythrocytes are especially sensitive to oxidative damage. G6PD deficiency can result in neonatal jaundice and in life threatening reactions to several medications, foods and infections. G6PD deficiency affects 400 million people around the world and is the most common genetic enzyme deficiency in man. Population and epidemiology information point to G6PD deficiency as providing some resistance to malaria.

Clinical

Babies with G6PD deficiency appear normal at birth. They may experience neonatal jaundice and hemolysis that can be so serious as to cause neurologic damage or even death. Barring such severe complications in the newborn period, infants with G6PD deficiency generally experience normal growth and development. Exposure to certain antimalarial drugs and sulfonamides, infection stress (such as upper respiratory or GI infections), environmental agents (e.g. moth balls), and eating certain foods (e.g. fava beans), each of which impact the patient's ability to handle oxidative reactions, can cause acute hemolytic anemia. Conversely, uniform testing for several years by the United States military found no significant adverse affects in G6PD deficient males with their health or military performance under proper care and avoidance.

Testing

Newborn screening for G6PD deficiency can be done by enzyme analysis or primary DNA screening. DNA analysis of the four most common mutations in the U.S. popula-tion will identify approximately 90% of individuals with G6PD Deficiency. Confirmatory testing using a quantitative assay should be performed for diagnosis of G6PD deficiency.

Treatment

Infants with G6PD deficiency may be at increased risk for pathological newborn jaundice and may warrant close monitoring for associated complications during the newborn period. Otherwise, treatment of G6PD deficiency is avoidance. For the infant, this means avoid-ance of several medications routinely prescribed for infections and illness. Strict atten-tion to the ingredients of prepared foods and restaurant meals is required as fava beans are a frequent addition to prepared foodstuffs. Patients should not be exposed to moth balls containing naphthalene. The adverse affects of infection on patients with G6PD Deficiency can be acute and life threatening. Over exertion from exercise and work leading to dehydration and hypoglycemia can precipitate clinical symptoms. As men-tioned above, patients mindful of these limitations can lead a normal life of exercise and choice of vocation.

Because the diagnosis and therapy of this disorder is complex, the pediatrician is advised to manage the patient in close collaboration with a consulting pediatric hema-tology specialist. It is recommended that parents travel with a letter of treatment guide-lines from the patient's physician.

Inheritance

G6PD deficiency is inherited as an X-linked defect. Males with a G6PD deficiency mutation on their X chromosome are affected. Females with one G6PD deficiency mutation are carriers at a 50% risk to pass their G6PD deficiency X chromosome to a male child. As an X-linked disorder, G6PD deficiency would generally be thought to affect only males. However, females having a G6PD deficiency mutation on both of their X chromosomes also have clinical symptoms. Some carrier females have been reported to have symptoms. Therefore, all members of an identified family should have G6PD testing and genetic counseling. The risk for having an affected male pregnancy is one chance in two for a carrier female. G6PD deficiency is found in populations from areas of the world where malaria is prevalent.

References

Eshaghpour, E., Oski, F.A. and Williams, M. The relationship of erythrocyte glucose-6-phosphatae dehydrogenase deficiency to hyperbilirubineamia in Negro premature infants. J Pediatrics 70:595, 1967.

Kaplan, M., Rubaltelli, F.F., Hammerman, C., et al. Conjugated bilirubin in neonates with glucose-6-phosphatae dehydrogenase deficiency. J Pediatrics 128:695, 1996.

Luzzatto, L., Mehta, A. and Vulliamy, T. Glucose 6-Phosphate Dehydrogenase Deficiency. In, The Metabolic and Molecular Basis of Inherited Disease. 8th Edition, 2001. Scriver, Beaudet, et al. McGraw-Hill. Chapter 179, pg. 4517 - 4553.

Seidman, D.S., Shiloh, M., Stevenson, D.K., et al. Role of hemolysis in neonatal jaundice associated with glucose-6-phosphatae dehydrogenase deficiency. J Pediatr 127:804, 1995.

Valaes, T., Dokiadis, S. and Fessas, P.H. Acute hemolysis due to naphthalene inhalation. J Pediatrics 63:904, 1963