Adults Are Not Just Enormous Children: Type 2 Diabetes Mellitus in Adults With Congenital Heart Disease

Jason F. Deen, MD; Eric V. Krieger, MD

It has often been said that “children are not just tiny adults” to highlight the unique medical needs of children and to set the expectation that physicians who care for children should be trained and educated in pediatric medicine. Presumably controversial in the past, this sentiment has risen to the level of axiom. Dedicated pediatric care is now available for nearly every medical subspecialty, and there has been a rapid expansion of dedicated children’s hospitals.

A consequence of the successes of pediatric cardiology and pediatric cardiac surgery is an aging population of patients born with congenital heart defects. It has been more than a decade since the number of adults with congenital heart disease (CHD) surpassed the number of children with CHD in the United States, and the proportion of adults continues to grow. The average age of patients seen in our CHD program in 2015, for example, was 35 years, and 26% were aged >40 years.

Adults with CHD experience premature morbidity and mortality, often from cardiovascular events and acquired comorbidities. These chronic medical problems are similar to those seen in an adult population. Chronic kidney disease is a strong predictor of death in adult CHD patients, and dementia, gastrointestinal bleeding, and chronic pulmonary disease also contribute to mortality in older patients with CHD. A recent report from a German national registry detailed non-CHD–related deaths in a cohort of patients (mean age at death 57.6±20.5 years) and showed that adults with CHD die of malignancies, infections, neurological events, and liver disease. Furthermore, traditional risk factors for atherosclerotic disease such as obesity, hypertension, glucose intolerance, dyslipidemia, metabolic syndrome, and sedentary lifestyle are pervasive in the adult CHD population. We previously reported a 2-fold increased risk of metabolic syndrome in adults with CHD.

Madsen and colleagues’ study of type 2 diabetes mellitus (T2DM) in CHD in this issue of the Journal of the American Heart Association adds to the growing body of literature highlighting traditional cardiovascular risk factors in survivors of pediatric heart disease. The authors use population-based cohort study of Denmark to determine whether those with CHD are at increased risk for the development of T2DM. The Danish National Registry of Patients uses unique personal registration numbers to provide patient-level information regarding diagnoses, inpatient and outpatient contacts, and medication usage. The authors use this database to identify 5149 Danish patients born between 1963 and 1980 with a diagnosis of CHD who were alive at age 30. They compare these participants with 49 968 age- and sex-matched Danish persons without CHD. The risk of developing T2DM is 1.35 (95% CI 1.14–1.61) higher in those with CHD compared with the control population.

The authors also report that the association between CHD and T2DM is strongest among those with cyanotic forms of CHD (hazard ratio 2.85, 95% CI 1.77–4.57) compared with controls. The authors propose that cyanotic patients have higher rates of T2DM because hypoxemia leads to impaired insulin secretion and insulin sensitivity; however, this explanation should be viewed with caution because the authors did not have information regarding the duration or severity of the cyanosis, and it can be assumed that the vast majority were repaired to normoxemia in infancy or early childhood. Although it is plausible that this relatively brief period of cyanosis could lead to impaired glucose metabolism decades later, such a novel hypothesis requires confirmation. The authors appropriately acknowledge alternative explanations.
for the increased prevalence of T2DM in cyanotic patients: a common genetic predisposition, exercise restriction leading to obesity and metabolic syndrome, or a type I error.

The primary finding of the report by Madsen et al, that those with CHD are at risk for T2DM, is important. Using a similar national database, researchers in Sweden explored the outcomes of adults with coexisting CHD and T2DM. Patients with CHD and T2DM had higher morbidity and mortality rates than those with T2DM alone. It remains unknown, however, how the diagnosis of T2DM affects the outcomes of patients with CHD. The Danish data set used by Madsen et al seems well suited to determine whether the presence of T2DM increases morbidity, mortality, or health care utilization in the adult CHD population.

T2DM is strongly linked to obesity and metabolic syndrome, and it is unfortunate that the Danish registry does not contain anthropomorphic data. Consequently, it is unknown whether differential obesity rates explain the high prevalence of T2DM in patients with CHD. Similarly, data were insufficient to determine whether exercise restriction, which is common in children with CHD, contributes to a sedentary lifestyle, central obesity, and the development of T2DM. Although some studies have found that the prevalence of obesity in CHD patients likely matches that of the general population, others reported that patients with complex forms of CHD have an increased higher rates of obesity.

Are these data the proverbial canaries in the coal mine? Do they portend an accumulation of traditional cardiovascular risk in adult CHD patients? Because adults with CHD are becoming obese, with increased rates of metabolic syndrome and T2DM, professional societies are making an effort to combat these risks. It is now widely known that activity restriction contributes to obesity, so recent policy statements have encouraged (rather than discouraged) increased physical activity in patients with virtually all forms of CHD.

Just as children are not simply tiny adults, adult survivors of pediatric heart disease are not just enormous children; they have acquired cardiovascular disease that increasingly mirrors that of the general adult population. For that reason, those who care for adults with CHD should have expertise in both CHD care and adult cardiovascular medicine. Directed subspecialty training must ensure qualified medical providers. In recognition of this, the American Board of Internal Medicine, the American Board of Pediatrics, and the Accreditation Council for Graduate Medical Education established training guidelines and board certification for adult CHD specialists, emphasizing that cardiologists with a background in adult cardiology must have expertise in CHD and those with a background in pediatric cardiology must expertise in acquired cardiovascular disease in order to provide comprehensive care to the adult population with CHD.

Disclosures

None.

References


**Key Words:** Editorial • adult congenital heart disease • diabetes mellitus
Adults Are Not Just Enormous Children: Type 2 Diabetes Mellitus in Adults With Congenital Heart Disease

Jason F. Deen and Eric V. Krieger

*J Am Heart Assoc.* 2016;5:e003960; originally published July 8, 2016; doi: 10.1161/JAHA.116.003960

The online version of this article, along with updated information and services, is located on the World Wide Web at:

http://jaha.ahajournals.org/content/5/7/e003960