

Otterbein University

Digital Commons @ Otterbein

Nursing Student Class Projects (Formerly MSN)

Student Research & Creative Work

7-2018

Congenital Heart Disease (CHD) Adult Survivors and Type 2 Diabetes Mellitus

Olivia Sutter
sutter@otterbein.edu

Follow this and additional works at: https://digitalcommons.otterbein.edu/stu_msn



Part of the [Family Practice Nursing Commons](#)

Recommended Citation

Sutter, Olivia, "Congenital Heart Disease (CHD) Adult Survivors and Type 2 Diabetes Mellitus" (2018).
Nursing Student Class Projects (Formerly MSN). 278.
https://digitalcommons.otterbein.edu/stu_msn/278

This Project is brought to you for free and open access by the Student Research & Creative Work at Digital Commons @ Otterbein. It has been accepted for inclusion in Nursing Student Class Projects (Formerly MSN) by an authorized administrator of Digital Commons @ Otterbein. For more information, please contact digitalcommons07@otterbein.edu.

Congenital Heart Disease (CHD) Adult Survivors and Type 2 Diabetes Mellitus (T2DM)

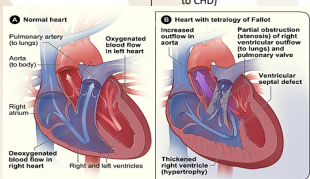
Olivia Sutter, RN, BSN
Otterbein University, Westerville, Ohio

Introduction and Significance of Pathology

- The risk of developing T2DM in CHD survivors is 1.35 times higher than the general population and are 2 times more likely to develop metabolic syndrome than the general population (Deen and Krieger, 2016)
- The risk for T2DM is higher in children with cyanotic heart defects (Deen and Krieger, 2016)
- In the last decade, adults with CHD now surpass the number of children with CHD (Deen and Krieger, 2016)
- Adults with CHD are still at risk for acquiring classic disease of aging such as atherosclerosis and metabolic syndrome (Deen and Krieger, 2016)
- CHD is the most common birth defect, comprising of 1% of all birth defects (CDC, 2018)
- About 20-30% of congenital heart disease patients have a physical or development comorbid condition (CDC, 2018)
- 9.4% of the American population has diabetes mellitus type 1 or 2 (CDC, 2018)

Reasoning Behind Topic Selection

Type 2 diabetes mellitus is one of many co-morbid diseases adults with CHD are at risk for. The purpose behind selecting this topic is to raise awareness of this growing population and the progress of interventions to improve quality of life. Healthcare providers in this specialty are in high demand because this population must be followed from infancy or discovery of heart defect into adulthood.



Normal Heart and Tetralogy of Fallot (TOF) anatomy (UCSF, 2018)

Congenital Heart Disease (CHD)

Wide spectrum of congenital heart disease/defects that develop in utero key point for pathophysiology (Mayo Clinic, 2018)

Heart defects can be classified as critical (cyanotic) or less critical (acyanotic) (Mayo Clinic, 2018)

Types of heart defects (Mayo Clinic, 2018):

- Holes in atrium or ventricles (Example: patent ductus arteriosus - less critical/acyanotic)
- Blood flow obstruction (Example: pulmonary stenosis - can be critical or less critical)
- Blood vessel abnormalities (Example: transposition of the great arteries (critical/cyanotic))
- Heart valve abnormalities (Example: Ebstein's anomaly (tricuspid valve abnormality) - less critical/acyanotic)
- Underdeveloped heart (Example: hypoplastic left heart syndrome - critical/cyanotic)
- Combination of defects (Example: Tetralogy of Fallot - can be critical (cyanotic) or less critical (non-cyanotic) *See picture below for example)

Risk Factors attributed to Acquiring Type 2 DM in Adults with CHD (Madsen et al., 2016)

- Activity restriction to preserve energy → sedentary lifestyle
- Gestational glycemic dysfunction (gestational diabetes of mother) while individual is in utero
- Hypoxia (risk factor not exclusive to CHD)

Pathophysiology

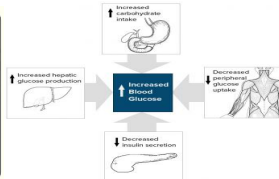
Type 2 Diabetes Mellitus (T2DM)

Type 2 DM is characterized by abnormal glucose metabolism from peripheral insulin resistance and decreased insulin secretion regulated by malfunctioning beta cells of the pancreas (See picture below) (Medscape, 2018)

- Insulin resistance: decreased response from tissues that use insulin (liver, muscle, and/or reorganization)
- Dysregulation of glucose metabolism caused by: (Medscape 2018)
- Beta cells - part of pancreas that make insulin; in type II DM, alpha cells less responsive to high glucose and secrete glucagon in excess → excess secretion of glucose from liver → hyperglycemia
- Proinflammatory cytokines and free fatty acids are high in type II DM and compromise glucose transport
- Combination of genetic and environmental factors that predispose individuals to beta cell dysfunction, over 40 genes identified (Medscape, 2018)

Risk Factors (Medscape, 2018)

- Obesity
- First-degree relative with type II DM
- Hispanic, Native American, African American, Asian American, or Pacific Islander descent
- Gestational DM
- Hypertension
- Dyslipidemia



Retrieved from Medscape, 2018

Signs and Symptoms

Congenital Heart Disease (Mayo Clinic, 2018)

Signs and symptoms determined by type of heart defect and subsequent blood flow through heart (i.e. R → L shunt, L → R shunt, degree of stenosis, and/or regurgitation)

Cyanotic/Critical

- Seen after birth or shortly after birth when patent foramen ovale closes
- Hypoxia key indicator
- Heart murmur
- Cyanosis
- Tachypnea
- Poor feeding and poor weight gain
- Swelling around eyes and abdomen

Acyanotic/Less Critical

- May not be diagnosed until later in childhood
- Exercise intolerance
- Unexplained fainting
- Swelling in hands, feet, or ankles
- Heart murmur

Type 2 DM (Medscape, 2018)

Classis symptoms

- Polyuria
- Polydipsia
- Polyphagia
- Weight loss

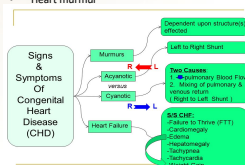
Other Symptoms

- Blurred vision
- Lower extremity paresthesia
- Yeast infection

Diagnostic Criteria (ADA, 2014)

- A1C ≥6.5%
- Random glucose test ≥200
- Fasting glucose of 100-125
- Oral glucose tolerance test of 140-199

**May have no classic symptoms but patient may have signs of prediabetes found in routine physical exams



Retrieved from Kondracki, n.d.

Diagnostic Testing for CHD (Mayo Clinic, 2018)

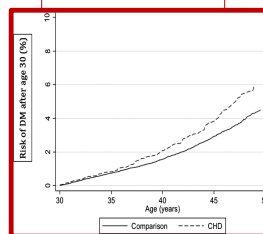
- Failed newborn pulse/ox test
- Abnormal fetal echocardiogram
- Cardiomegaly on chest x-ray
- Cardiac catheterization

Risk Factors for developing CHD in utero (Mayo Clinic, 2018)

- Mother with gestation DM
- German measles (rubella) while pregnant
- Medications (ex: isotretinoin and lithium)
- Heredity
- Smoking while pregnant

What is the significance of diabetes mellitus and the congenital heart disease adult survivor?

- The presence of hypoxemia determines degree of insulin resistance and impaired insulin sensitivity (although it is the minority of adults with CHD that maintain severe hypoxemia into adulthood) (Deen and Krieger, 2016)
- Genetics, sedentary lifestyle, and cyanosis in infancy also play a role in glucose dysfunction in this population (Deen and Krieger, 2016)
- Any of the disease of aging, including T2DM can increase mortality in this population (Deen and Krieger, 2016)
- More common complications seen in adults with congenital heart disease are chronic kidney disease, pulmonary disease, GI bleeds, and dementia, all of which can be severely complicated by T2DM (Deen and Krieger, 2016)
- In a recent study published by the Journal of the American Heart Association, after age 30, individuals with CHD are at increased risk for developing type II DM (See graph below) (Madsen et al., 2016)



Retrieved from Madsen et al, 2016

Nursing Implications

- Exercise restriction for individuals with CHD are now discouraged due to the prevalence of obesity in this population. Exercise restrictions during childhood may remain, however, to reduce strain on the heart (Deen and Krieger, 2016)
- Diet changes, along with exercise should be encouraged in this population to promote prevention of all diseases of aging, especially type II DM (ADA, 2015)
- Adult cardiologist are typically not trained to treat adults with CHD and pediatric facilities have assumed the care of these individuals (Stout et al., 2015)
- Unfortunately, pediatric facilities currently cannot care for all of the adult comorbidities seen in adults with CHD and patients with comorbid conditions, such as Type 2 DM, require additional care and collaboration (Stout et al., 2015)
- Healthcare facilities across the country are creating adult congenital heart disease fellowships to better serve this population and the comorbid conditions that may arise and if no fellowship is available at a facility, it is recommended to establish contact with an adult CHD facility to manage the care of these patients (Stout et al., 2015)

Conclusion

The complexity of the adult congenital heart disease population cannot be overlooked, especially those living with chronic hypoxia. These individuals are at a heightened risk for developing type 2 DM and require extra monitoring and care to minimize mortality. The advances in the field of adult congenital heart disease are incredible, considering this is the first time in a decade in which there are more adults than children living with CHD (Deen and Krieger, 2016). Further development of the adult congenital heart disease specialty, collaboration with other adult providers, and developing new recommendations for care will be key in maximizing the quality of life with this chronic disease.

References

- American Diabetes Association (ADA). (2014). Diagnosing Diabetes and Learning About Prediabetes. Retrieved from <http://www.diabetes.org/diabetes/basics/type-2/diagnosing-diabetes>
- American Diabetes Association (ADA). (2015). Facts about Type 2. Retrieved from <http://www.diabetes.org/diabetes/basics/type-2/facts-about-type-2.html>
- CDC. (2018). Congenital Heart Defects (CHDs). Retrieved from <https://www.cdc.gov/ncbddd/heartdefects/what.html>
- CDC. (2018). National Diabetes Statistics Report. Retrieved from <https://www.cdc.gov/diabetes/data/statistics/statistics-report.html>
- Deen, J. F., & Krieger, E. V. (2016). Adults Are Not Just Enormous Children: Type 2 Diabetes Mellitus in Adults With Congenital Heart Disease. *Journal of the American Heart Association*, 5(7), doi:10.1161/JAHA.116.003600
- Kondracki, M. (n.d.). Formation of the Heart and Heart Defects. Retrieved from <https://videopointer.com/video/7736024/>
- Madsen, M. L., Marino, B. S., Wood, L. G., Thomson, R. W., Vidotak, J., Laurien, H. A., & Olson, M. (2016, July). Congenital Heart Disease With and Without Cyanotic Potential and the Long-term Risk of Diabetes Mellitus: A Population-Based Follow-up Study. Retrieved from <https://www.ahajournals.org/doi/10.1161/JAHA.115.003076>
- Mayo Clinic. (2018). Congenital heart defects in children. Retrieved from <https://www.mayoclinic.org/diseases-conditions/congenital-heart-defects/symptoms-causes/syn-20026076>
- Medscape. (2018). Type II Diabetes Mellitus. Retrieved from <https://www.medscape.com/article/137653-overview>
- Stout, K., Valente, A. M., Bartz, J. J., Cook, E., Gorn, M., Sade, A., & Ross, E. D. (2015, March). Task Force 6: Pediatric Cardiology Fellowship Training in Adult Congenital Heart Disease. Retrieved from <https://www.ahajournals.org/doi/10.1161/CR.0000000000000197>
- UCSF. (2018). Congenital Heart Disease. Retrieved from <https://surge.ucsf.edu/fundamentals/procedures/congenital-heart-disease.aspx>



OTTERBEIN UNIVERSITY