Clinical Investigation

Characteristics and In-Hospital Outcomes of Peripartum Cardiomyopathy Diagnosed During Delivery in the United States From the Nationwide Inpatient Sample (NIS) Database

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ABSTRACT

Background: Peripartum cardiomyopathy (PPCM) is associated with advanced maternal age, African-American race, hypertensive disorders of pregnancy, and multiple-gestation pregnancies. Less is known regarding racial differences in risk factors and predictors of adverse in-hospital outcomes.

Methods and Results: A total of 1,337 women with PPCM were identified with the use of the Nationwide Inpatient Sample (2004–2011). Clinical profiles and maternal outcomes in delivering mothers with and without PPCM were compared and stratified by race. In multivariate analysis, established risk factors for PPCM were confirmed. Anemia (odds ratio [OR] 2.0, 95% confidence interval [CI] 1.6–2.5; $P < .0001$), asthma (OR 2.2, 95% CI 1.5–3.2; $P = .0002$), smoking (OR 33.6, 95% CI 9.3–159.4; $P < .0001$), and thyroid disease (OR 5.9; 95% CI 1.5–21.3; $P = .01$) were associated with PPCM. Risk factors significant in whites, African Americans, and Hispanics were hypertension during pregnancy and anemia. Patients with PPCM had higher rates of in-hospital adverse outcomes ($P < .0001$), but no differences in race or comorbidities predicted adverse events.

Conclusions: Hypertensive disorders during pregnancy and anemia were associated with PPCM in whites, African Americans, and Hispanics, providing further evidence that vascular stress may play a role in the pathogenesis of PPCM. Thyroid disorders may represent a novel risk factor for PPCM. (*J Cardiac Fail 2016;22:512–519*)

Key Words: Pregnancy, heart failure, risk factors, racial differences.

Peripartum cardiomyopathy (PPCM) is an idiopathic dilated cardiomyopathy that presents as heart failure secondary to left ventricular (LV) systolic dysfunction toward the end of pregnancy or in the months following delivery, where no other cause of heart failure is found. It is a diagnosis of exclusion, and the ejection fraction is nearly always <45%.[1]

Although most estimates of the incidence of PPCM in the United States are ~1 in 3,000–4,000 births, many recent studies have shown significant variability regarding these estimates, with rates from 1 in 968 to 1 in 5,555 live births.[2–6] Previously published risk factors for the development of PPCM include advanced maternal age, African-American race, preeclampsia, chronic hypertension, and multiple-gestation pregnancies.[4] However, the higher rate of PPCM among African American women suggests different pathophysiologic mechanisms or risk factors may contribute to the development of PPCM in different racial or ethnic groups. In addition, outcomes may vary by race or ethnicity, with some

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studies demonstrating worse outcomes among African Americans.[7,8] Nonetheless, current understanding of race-specific differences in PPCM risk factors and outcomes is limited. Only a few studies have performed analyses based on race to evaluate differences in demographics, comorbidities, and outcomes.[9,10] In addition, little is known regarding racial and comorbid predictors of poor outcomes at the time of delivery.[3,7,9]

Therefore, with the use of a large national database, we investigated established and novel risk factors for the development of PPCM by race and ethnicity group and assessed in-hospital outcomes and predictors of adverse outcomes.

Methods

Data Source

Data from the Nationwide Inpatient Sample (NIS) hospital discharge database for the period January 1, 2004, through December 31, 2011, acquired from the Healthcare Cost and Utilization Project (HCUP) of the Agency for Healthcare Research and Quality, Rockville, Maryland, were used for the present analyses.[11] The NIS is a hospital discharge database that represents 20% of all inpatient admissions to nonfederal hospitals in the United States. Diagnosis-related groups (DRGs) were used to select patients admitted with a delivery. International Classification of Diseases, 9th Edition, Clinical Modification (ICD-9-CM) diagnosis codes and Clinical Classification Software (CCS) codes provided by the NIS database were used to determine the proportion of patients in each group with various comorbidities and outcomes. CCS coding is a method used by the NIS to collapse multiple ICD-9-CM codes into a smaller number of categories to facilitate statistical analysis. This study was approved by the University of Michigan Institutional Review Board.

Patient Population

Patients with an ICD-9-CM code for PPCM (674.50–674.54) during the same hospitalization as a pregnancy delivery (see DRG codes in Supplemental Table 1) were included. Exclusion criteria included any case with ICD-9-CM codes for other cardiomyopathies and preexisting cardiac dysfunction (rheumatic and nonrheumatic heart valve disease, congenital heart disease, hypertensive congestive heart failure, pulmonary circulation disease, coronary atherosclerosis), ICD-9-CM codes for other ill-defined/unspecified heart disease, human immunodeficiency virus, and male sex (Supplemental Table 1). Patients with a diagnosis of PPCM without a concomitant delivery code from the same hospitalization were excluded from this analysis. The control group was made of randomly selected patients who were admitted for pregnancy deliveries but without a diagnosis of PPCM. From the entire delivery cohort (n = 7,156,393), 3 non-PPCM delivery control subjects were randomly included for every 1 PPCM patient, which provided a sufficient sample size for the control group, given the low prevalence of PPCM. DRG codes change on a periodic basis, and different delivery codes were used from 2004–2007 and 2008–2011 but represented the same diagnoses (Supplemental Table 1). From this, demographic and potential comorbid predictors for PPCM were compared with control patients (delivering mothers without PPCM). Although the NIS uses a weighting factor to obtain nationwide representative estimations, we used the unweighted numbers to reduce the risk of inaccuracies.

Covariates

Demographic variables included income tertiles (lowest: ≤$38,999; middle: $39,000–$62,999; highest: ≥$63,000), and insurance status [private including HMO, Medicaid, or uninsured (self/no payment)]. Age was dichotomized at 35 years and older according to the definition of advanced maternal age put forth by the Society for Maternal Fetal Medicine. Race and ethnicity are grouped together by the NIS and defined as white or Caucasian, black or African American, Hispanic, and Asian or Pacific Islander. Race and ethnic classifications were based on the HCUP classification methodology described elsewhere.[11] Comorbidities studied in patients with PPCM versus control subjects are listed in Table 1. Nutrient deficiencies were defined as vitamin A, B1, B3, B6, other B-complexes, C, D, and K deficiencies, unspecified/other vitamin or mineral deficiencies, or mild–severe protein-calorie malnutrition. Drug abuse included dependent or nondependent abuse of opiates, sedatives, hypnotics, anxiolytics, cocaine, cannabis, amphetamines or other psychostimulants, hallucinogens or other unspecified drug dependence, withdrawal or drug-induced psychiatric disorder, or poisoning. Thyroid disorders included toxic diffuse, uninodular or multinodular goiter, and thyrotoxicosis. Malignancy was defined as any major organ cancer, melanoma, leukemia, lymphoma, and secondary malignancies. Connective tissue disease included systemic lupus erythematosus, systemic sclerosis, sicca syndrome, dermatomyositis, polymyositis, or other unspecified diffuse connective tissue diseases. Chronic liver disease included alcohol-related liver disease, acute or chronic hepatitis, autoimmune hepatitis, and cirrhosis. Chronic kidney disease included stages I–V chronic kidney disease, end-stage renal disease, hemodialysis or peritoneal dialysis, renal transplant, or unspecified chronic kidney disease. Early labor included early onset of delivery or threatened premature labor. The specific ICD-9-CM codes and CCS codes included and excluded can be found in Supplemental Table 1. A reference list of all ICD-9-CM codes that have been collapsed within each CCS code is publicly available at http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp.

Outcomes

Maternal major adverse events that occurred during the hospitalization for delivery were assessed. The combined end point was defined as death, cardiac arrest, cardiogenic shock, or use of extracorporeal membrane oxygenation or intra-aortic balloon pump. Additional outcomes included the individual