Burden of Arrhythmia in Pregnancy

Maternal morbidity and mortality in the United States continues to rise.\(^1\) Although supraventricular tachycardia (SVT) is considered the most frequent sustained arrhythmia in pregnancy, atrial fibrillation (AF) and ventricular arrhythmias are described with varying frequencies.\(^2,3\) A paucity of data exist regarding temporal trends of frequency and outcomes of arrhythmias in pregnancy-related hospitalizations. In this descriptive observational analysis of pregnancy-related hospitalizations from a large nationwide sample, we describe temporal trends in frequency of arrhythmias, comorbidities associated with arrhythmias, and the frequency of adverse maternal and fetal outcomes.

The Agency for Healthcare Research and Quality created the nationwide inpatient sample, which includes discharge data from >1200 hospitals. Each entry comprises hospitalization for a single patient and is associated with a primary discharge diagnosis and up to 24 secondary diagnoses. Multiple prior studies have utilized the nationwide inpatient sample to study various conditions.\(^3,4\) The study population comprised all hospital discharges in pregnant women 18 to 50 years of age from January 1, 2000, to December 31, 2012. Discharge codes with pregnancy-related codes (International Classification of Diseases-9 codes 630–648) and delivery-related codes (International Classification of Diseases-9 codes 72–75, v27 and 650–659) were used. According to a previous publication,\(^4\) arrhythmias were identified with the following International Classification of Diseases-9 codes: AF 427.31, atrial flutter 427.32, SVT 427.0, ventricular fibrillation 427.41, ventricular flutter 427.42, and VT 427.1. Patients with any of these diagnoses were defined as any arrhythmia.

Maternal and fetal adverse outcomes were identified with the following International Classification of Diseases-9 codes: preterm labor 644; antepartum hemorrhage 640.9, 641.1, 641.2, 641.3, 641.8, 641.9; preeclampsia, eclampsia, and gestational hypertension 642; postpartum hemorrhage 666, 667, 669.1; transfusion current procedural terminology codes 9900, 9902, 9904, 9907; postpartum infection 670, 672; and fluid and electrolyte imbalance 276. Stata IC 11.0 (Stata Corp) and SAS 9.4 (SAS Institute Inc) were used for the analyses, which accounted for the complex survey design and clustering. A multivariate model for mortality was adjusted for demographics (age, race), comorbidities (diabetes, congestive heart failure), and other variables (income, region, and admission day and type). This study involved deidentified data and therefore was determined to be exempt from Institutional Review Board review.

We identified 57315593 pregnancy-related hospitalizations from January 1, 2000, through December 31, 2012. Frequencies are reported per 100,000 pregnancy-related hospitalizations. The overall frequency of arrhythmias was any arrhythmia (68 per 100,000), AF (27 per 100,000), atrial flutter (4 per 100,000), SVT (22 per 100,000), ventricular fibrillation (2 per 100,000) and VT (16 per 100,000) (Figure). The number of pregnancy-related hospitalizations with arrhythmias increased

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by 58% (P < 0.001 for trend), from 55 per 100,000 in 2000 to 83 per 100,000 in 2012. Increase in arrhythmia was primarily caused by more AF (111% increase; from 18 per 100,000 to 35 per 100,000; P < 0.001 for trend) and VT (127% increase; from 10 per 100,000 to 21 per 100,000; P < 0.001 for trend), whereas SVT remained stable over time (12% increase; P < 0.001 for trend).

Women 41 to 50 years of age had overall greater frequency of any arrhythmia and greater increase in any arrhythmia over time (199 per 100,000 and 162% increase) compared with women 18 to 30 years of age (55 per 100,000 and 58% increase). Any arrhythmias were more frequent in black compared with white women (116 vs 73 per 100,000, P < 0.001) and women with lowest versus highest income quartile (72 vs 66 per 100,000, P = 0.001). Arrhythmias in pregnancy were associated with elevated odds ratio for mortality (AF: odds ratio 13.13, 95% confidence interval 7.77–22.21, P < 0.0001; SVT: odds ratio 6.32, 95% confidence interval 2.41–16.61, P < 0.001; VT: odds ratio 40.89, 95% confidence interval 26.08–64.1, P < 0.0001).

Pregnancy-related hospitalizations with any arrhythmia had overall greater frequencies of in-hospital death (5.9%) and maternal or fetal complications (36.5%) compared with all women (0% and 21.8%, respectively). Overall mortality associated with any arrhythmia decreased over time, from 5.7% in 2000 to 3.7% in 2012 (decrease of 24%; P < 0.001 for trend).

In this analysis of pregnancy-related hospitalizations from 2000 through 2012, we report an increase in the frequency of arrhythmias by 58%. Our findings of increase in frequency of arrhythmias in pregnancy are consistent with a previous report from the nationwide inpatient sample from 1995 to 2006.5 Between 1992 and 2000, Li et al² reported SVT in 33 of 100,000 and AF in 3 of 100,000 pregnancies. In women without congenital heart disease, Opotowsky et al³ reported SVT in 16.4 of 100,000 and AF in 14.5 of 100,000 pregnancies. Contrary to these previous studies, AF has emerged as the most frequent arrhythmia in pregnancy. Contributors to the increased frequency of AF could be the increase in maternal age (the increase in pregnancy rates in women in their 30s and 40s and continuing decline in women in 20s) and the increase in risk factors such as hypertension, diabetes mellitus, obesity, and congenital heart disease in pregnancy. The presence of any arrhythmia is associated with adverse maternal and fetal outcomes, including death.

Studies based on administrative databases are susceptible to errors in coding. Validation of arrhythmias by ECG

Figure. Frequency of arrhythmia in pregnancy and associated mortality and complications. A, Frequency of any arrhythmia per 100,000 pregnancy-related hospitalizations for the entire study period, stratified by age. B, Frequency of arrhythmias per 100,000 pregnancy-related hospitalizations by arrhythmia type for the entire study period. C, All-cause mortality in percentage for the entire study period. D, Maternal/fetal complications (including preterm labor, ante- or postpartum hemorrhage, preeclampsia, eclampsia, gestational hypertension, transfusion, postpartum infection, and fluid and electrolyte imbalance) in percentage for the entire study period.
analysis, cause of death, long-term follow-up of patients, data on anticoagulation and other medications, management strategies, changes in billing practices, and arrhythmia monitoring practices are unavailable through the nationwide inpatient sample. The unit of analysis is pregnancy-related hospitalization, and multiple admissions for the same patient could increase hospitalization rates over time.

In summary, we report an increase in the frequency of arrhythmia in pregnancy over time. AF is now the most frequent arrhythmia in pregnancy. Further studies are required to explore the link between arrhythmias and pregnancy outcomes and to improve outcomes.

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FOOTNOTES
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