JACC: CLINICAL ELECTROPHYSIOLOGY VOL. 5, NO. 3, 2019

PUBLISHED BY ELSEVIER

Pregnancy in Catecholaminergic Polymorphic Ventricular Tachycardia

Christopher C. Cheung, MD,[a,*] Krystien V. Lieve, MD,[b,*] Thomas M. Roston, MD,[a] Martijn H. van der Ree, MD,[b] Marc W. Deyell, MD,[a] Jason G. Andrade, MD,[a] Zachary W. Laksman, MD,[a] Eline A. Nannenberg, MD, PhD,[b,c] Rafik Tadros, MD, PhD,[b] Benjamin Pang, PhD,[d] Julie Rutberg, MS,[d] Martin S. Green, MD,[d] Susan Conacher, MSc,[e] Colette M. Seifer, MD,[f] Jason D. Roberts, MD, MAS,[f] Christian Steinberg, MD,[g] Shubhayan Sanatani, MD,[h] Arthur A. Wilde, MD,[b] Andrew D. Krahn, MD[a]

ABSTRACT

OBJECTIVES This investigation was a retrospective study of catecholaminergic polymorphic ventricular tachycardia (CPVT) patients in Canada and the Netherlands to compare pregnancy, postpartum, and nonpregnant event rates.

BACKGROUND CPVT is characterized by life-threatening arrhythmias during exertion or emotional stress. The arrhythmic risk in CPVT patients during pregnancy is unknown.

METHODS Baseline demographics, genetics, treatment, and pregnancy complications were reviewed. Event rate calculations assumed a 40-week pregnancy and 24-week postpartum period.

RESULTS Ninety-six CPVT patients had 228 pregnancies (median 2 pregnancies per patient; range: 1 to 10; total: 175.4 pregnant patient-years). The median age of CPVT diagnosis was 40.7 years (range: 12 to 84 years), with a median follow-up of 2.9 years (range: 0 to 20 years; total 448.1 patient-years). Most patients had pregnancies before CPVT diagnosis (82%). Pregnancy and postpartum cardiac events included syncope (5%) and an aborted cardiac arrest (1%), which occurred in patients who were not taking beta-blockers. Other complications included miscarriages (13%) and intrauterine growth restriction (1 case). There were 6 cardiac events (6%) during the nonpregnant period. The pregnancy and postpartum event rates were 1.71 and 2.85 events per 100 patient-years, respectively, and the combined event rate during the pregnancy and postpartum period was 2.14 events per 100 patient-years. These rates were not different from the nonpregnant event rate (1.46 events per 100 patient-years).

CONCLUSIONS The combined pregnancy and postpartum arrhythmic risk in CPVT patients was not elevated compared with the nonpregnant period. Most patients had pregnancies before diagnosis, and all patients with events were not taking beta-blockers at the time of the event. (J Am Coll Cardiol EP 2019;5:387–94)

From the [a]Heart Rhythm Services, Division of Cardiology, University of British Columbia, Vancouver, British Columbia, Canada; [b]Department of Clinical and Experimental Cardiology, Amsterdam UMC, University of Amsterdam, Heart Center, Amsterdam, the Netherlands; [c]Department of Clinical Genetics, Amsterdam UMC, University of Amsterdam, Amsterdam, the Netherlands; [d]Division of Cardiology, University of Ottawa Heart Institute, Ottawa, Ontario, Canada; [e]Division of Cardiology, Western University, London Health Sciences Centre, London, Ontario, Canada; [f]Division of Cardiology, University of Manitoba, St. Boniface Hospital, Winnipeg, Manitoba, Canada; [g]Institut Universitaire de Cardiologie et Pneumologie de Québec, Université Laval, Québec City, Québec, Canada; and the [h]Division of Cardiology, Department of Pediatrics, BC Children's Hospital, Vancouver, British Columbia, Canada. *Drs. Cheung and Lieve contributed equally to this paper and are joint first authors. The study was supported by the Heart and Stroke Foundation of Canada (G-13-0002775 and G-14-0005732), and the Canadian Institute of Health Research (MOP-142218 and SRG-15-P09-001). Dr. Krahn is supported by the Heart and Stroke Foundation of Canada, the Sauder Family, Heart and Stroke Foundation Chair in Cardiology, the Paul Brunes Chair in Heart Rhythm Disorders, and The Paul Albrechtson Foundation. Drs. Wilde, Lieve, and Santani were supported by E-rare Improve CPVT. Drs. Wilde and Lieve were supported by CVON 2012-10 PREDICT. Dr. Roston has been a consultant for Audentes Therapeutics. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

All authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the *JACC: Clinical Electrophysiology* author instructions page.

Manuscript received September 10, 2018; revised manuscript received October 31, 2018, accepted October 31, 2018.

ISSN 2405-500X/$36.00 https://doi.org/10.1016/j.jacep.2018.10.019

JACC: CLINICAL ELECTROPHYSIOLOGY VOL. 5, NO. 3, 2019
MARCH 2019:387–94

ABBREVIATIONS AND ACRONYMS

ACA = aborted cardiac arrest

CI = confidence interval

CPVT = catecholaminergic polymorphic ventricular tachycardia

ICD = implantable cardioverter-defibrillator

LQTS = long QT syndrome

RR = rate ratio

RyR2 = Ryanodine receptor 2

SADS = sudden arrhythmic death syndrome

Catecholaminergic polymorphic ventricular tachycardia (CPVT) is a rare inherited heart rhythm disorder characterized by adrenergically driven polymorphic ventricular arrhythmias, which can precipitate syncope and sudden cardiac death (1). Patients with CPVT typically present with a normal resting electrocardiogram and a structurally normal heart. Arrhythmic events are triggered by exertion or emotional stress, with most patients manifesting disease within the first or second decade of life (1). Beta-blockers are the mainstay of treatment, with flecainide, left cardiac sympathetic denervation, and implantable cardioverter-defibrillators (ICDs) typically used in refractory cases (2,3).

Pregnancy is associated with various cardiovascular changes that may influence the frequency of arrhythmic events in CPVT. Hormonal changes may affect the sensitivity of adrenergic receptors, and stress during pregnancy and labor and/or delivery may produce a hyperadrenergic state and transiently increase the risk of ventricular arrhythmias (4,5). Furthermore, general arrhythmia burden typically increases during pregnancy (6). In a recent study of 4,678 cases of maternal sudden death due to cardiovascular causes, most deaths (60%) were due to sudden arrhythmic death with a structurally normal heart (sudden arrhythmic death syndrome [SADS]) and underlying cardiomyopathies (7). Among those with SADS, patients with long QT syndrome (LQTS) have a reduced risk of cardiac events during pregnancy but a paradoxically increased risk of events in the postpartum period, particularly in patients with LQTS type 2 (8,9). This may be due to rapid changes in cardiac output and adrenergic activity in postpartum patients, including changes in hormonal status, emotional status, and sleep patterns (9).

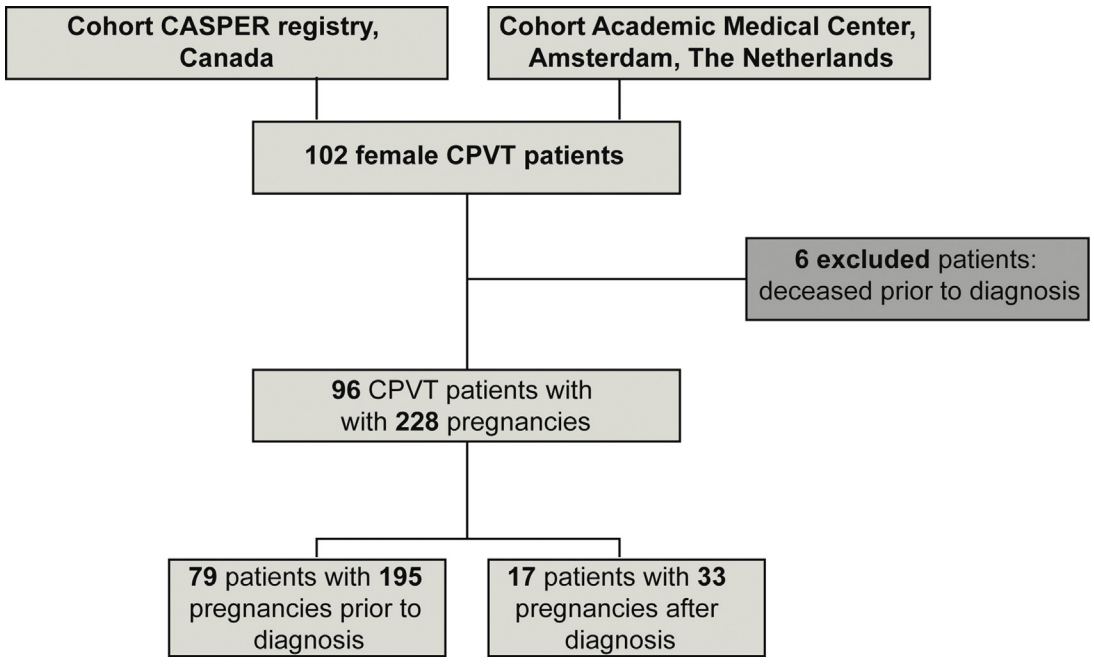
The risk of arrhythmic events during pregnancy in patients with CPVT remains largely unknown, with only 2 case reports of ventricular arrhythmias and ICD discharges in pregnant patients (10,11). Establishing the risk of such events during pregnancy is important because it may affect the clinical management of these patients in the setting of delivery. The aim of the present study was to evaluate the effect of pregnancy on the incidence of arrhythmic events in women with CPVT and to investigate the standard management of patients with CPVT during the pregnancy and postpartum periods.

METHODS

STUDY DESIGN, SETTING, AND POPULATION. We performed a retrospective cohort study of patients from Canada and the Netherlands. Cases were identified from 5 sites across Canada that participated in a national database of Cardiac Arrest Survivors with Preserved Ejection Fraction Registry (CASPER) or local inherited arrhythmia registries (12). In the Netherlands, patients with CPVT who presented to the Departments of Cardiogenetics or Cardiology at the Academic Medical Center, Amsterdam, were eligible for inclusion. All subjects met consensus diagnostic criteria for CPVT and had ≥1 pregnancies (including completed pregnancies, miscarriages, and spontaneous abortions) (1). The data analyzed in this study were of patients who had a pregnancy between 1948 and 2017. The study was approved by the local ethics boards at the contributing centers.

DATA COLLECTION AND MANAGEMENT. Baseline demographics, including date of birth, reason for presentation, age at CPVT diagnosis, (arrhythmic) events before CPVT diagnosis and at follow-up, treatments, and pregnancy data (i.e., age at pregnancy, number of pregnancies, date of delivery for each pregnancy, therapies during pregnancy) were collected retrospectively from clinical records, pedigrees, and mortality records (Netherlands National Death Index). The pregnancy interval was defined as the 40-week interval before the date of delivery. The postpartum interval was defined as the 24-week interval after the birth. The combined pregnancy and postpartum periods were calculated as the total pregnancy interval plus the postpartum interval. The nonpregnant follow-up period was defined as the interval between the date of CPVT diagnosis and date of last follow-up. Arrhythmic events included (probable) arrhythmic syncope, polymorphic ventricular tachycardia (VT), ICD therapy, aborted cardiac arrest (ACA), and sudden cardiac death. All arrhythmic events that occurred during the pregnancy and postpartum period were adjudicated by a syncope expert using the European Society of Cardiology 2009 syncope guidelines (13). Patients who died before CPVT diagnosis were excluded from analysis due to the absence of a follow-up period (defined as diagnosis date to last follow-up date).

FIGURE 1 Flowchart of Patients in Analysis



Flowchart of patients in analysis. CASPER = Cardiac Arrest Survivors with Preserved Ejection Fraction Registry; CPVT = catecholaminergic polymorphic ventricular tachycardia.

STATISTICAL ANALYSIS. Continuous data are presented as median (range), and categorical variables are presented as number (percentage). Associations between categorical variables and pregnancy complications were evaluated using the chi-square test. Event rates per patient-years during the pregnancy and postpartum periods were based on an assumption of a 40-week gestation and 24-week postpartum period. Rate ratios (RRs) were compared using both mid-p exact and Fisher exact test. A p value <0.05 was considered statistically significant. Statistical analyses were performed using SPSS 22.0 statistical software (IBM, Armonk, New York).

RESULTS

Ninety-six CPVT patients had 228 pregnancies (median 2 pregnancies per patient; range 1 to 10). Six patients were excluded from analysis due to death before their CPVT diagnosis (Figure 1). The study population demographics are reported in Table 1. The median age of diagnosis was 40.7 years (range: 12 to 84 years), with a median follow-up of 2.9 years (range: 0 to 20 years; total 448.1 patient-years). CPVT diagnoses were suspected in the context of ≥1 of the following: positive family history (83%), arrhythmic syncope or seizure (20%), and/or ACA (3%). Genetic testing confirmed pathogenic variants in ryanodine receptor 2 (*RyR2*) in 80%, with the most common being *RyR2* R420W (29%). A list of all *RyR2* variants is summarized in Online Table 1. Therapy at last follow-up included beta-blockers (76%), flecainide (32%), calcium channel blockers (5%), and ICDs (13%). Beta-blockers included bisoprolol (23%), metoprolol (22%), atenolol (9%), propranolol (8%), nadolol (7%), sotalol (3%), and other (3%). Only 13 patients (14%) were taking beta-blockers during pregnancy.

EVENTS DURING PREGNANCY. There were 228 pregnancies (median: 2; range: 1 to 10). Seventy-nine patients had 195 pregnancies (86%) before CPVT diagnosis. Most pregnancies occurred before CPVT diagnosis and thus were untreated (77 patients [80%]). Two patients received a CPVT diagnosis within 64 weeks of their first pregnancy (within the pregnancy and postpartum window). The median age of first pregnancy was 24.9 years (range: 15 to 40 years). Miscarriages were reported in 12 patients (13%). These data are further described in Table 2.

There were 6 pregnancy and postpartum cardiac events in 6 patients (6%) (Table 3), including 5 syncopal events (5%) and 1 ACA (1%). Events occurred

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TABLE 1 Characteristics of the Study Population (N = 96)

Age at diagnosis, yrs	40.7 (12-84)
Duration of follow-up, yrs	2.9 (0-24)
History of arrhythmic syncope or seizure	19 (20)
History of aborted cardiac arrest	3 (3)
Proband diagnosis	19 (20)
Family history of CPVT diagnosis	80 (83)
Genetics	
Variant of *RyR2*	77 (80)
RyR2 R420W mutation	28 (29)
Therapy in follow-up	
Beta-blocker	73 (76)
Beta-blocker during pregnancy	13 (14)
Flecainide	31 (32)
Calcium channel blocker	5 (5)
Implantable cardioverter-defibrillator	12 (13)

Values are median (range) or n (%).

CRVT = catecholaminergic polymorphic ventricular tachycardia; *RyR2* = Ryanodine receptor 2.

TABLE 2 Pregnancy Outcomes and Cardiac Events in Patients With CPVT

Total no. of pregnancies	228
No. of pregnancies	2 (1-10)
Patients with pregnancy before CPVT diagnosis	79 (82)
Pregnancies before CPVT diagnosis	195 (86)
Age of first pregnancy, yrs	24.9 (15-40)
Pregnancy and postpartum events	
Events during pregnancy	3 (3)
Events during pregnancy, patient-years	1 in 58.5
Postpartum events*	3 (3)
Events during postpartum period, patient-years*	1 in 35.1
Total events during combined pregnancy and postpartum period	6 (6)
Events during combined pregnancy and post-partum period, patient-years*	1/46.8
Syncope	5 (5)
Aborted cardiac arrest	1 (1)
Fetal complications†	1 (0)
Patients with miscarriages	12 (13)
Nonpregnant events	
Events during nonpregnant period	6 (6)
Aborted cardiac arrest	1 (1)
ICD shock	2 (2)
Syncope or polymorphic VT	3 (3)
Events during nonpregnant period, patient-years	1/68.6
Total events (pregnant and nonpregnant)	12

Values are median (range) or n (%), unless otherwise indicated. *Pregnancy period based on assumption of 40-week gestation. Postpartum period defined as first 24 weeks after delivery. Combined pregnancy and postpartum periods defined as the total pregnancy plus postpartum period. †Fetal complications, including 1 case of intrauterine growth restriction, occurred with beta-blocker use. Aborted cardiac arrest includes implantable cardioverter-defibrillator (ICD) shocks.

VT = ventricular tachycardia; other abbreviation as in Table 1.

both during the pregnancy (3 events; 3%) and postpartum (3 events; 3%) periods, with no events occurring during labor and delivery. Among the 6 patients with events during the pregnancy or postpartum period, none were taking beta-blockers (5 patients did not start beta-blockers until after pregnancy). One patient taking nadolol for exertional syncope before CPVT diagnosis had discontinued the medication during pregnancy and had a syncopal event. Reported fetal complications included 1 case of intrauterine growth restriction while the mother was on bisoprolol 10 mg daily. A complete list of maternal and fetal events is reported in **Table 3** (cardiac events) and Online Table 2 (miscarriages and fetal events). There were no significant predictors of cardiac events on univariate analysis (Online Figure 1, Online Table 3).

EVENT RATES DURING PREGNANCY, POSTPARTUM, AND NONPREGNANT PERIODS. During a cumulative nonpregnant follow-up of 411.4 patient-years, 5 patients (5%) experienced 6 events, including ACA (n = 1), ICD shock (n = 1, 2 events), syncope (n = 2), or polymorphic ventricular tachycardia (n = 1) with no deaths (1 event per 68.6 non-pregnant patient-years). The total pregnant period was 177.4 patient-years and the total postpartum period was 105.2 patient-years. The event rates were 1.71 events per 100 patient-years during pregnancy, 2.85 events per 100 patient-years while postpartum, and 2.14 events per 100 patient-years during the combined pregnancy and postpartum periods. There was no significant difference in event rates among the pregnancy, postpartum, and combined periods compared with the nonpregnant period (**Table 4**). The RR for events during the combined pregnancy and postpartum period was 1.47 (95% CI: 0.45 to 4.81; p = 0.518) (**Figure 2**) compared with the nonpregnant period.

PREGNANCY AFTER CPVT DIAGNOSIS. Most patients had pregnancies before CPVT diagnosis (82%). Baseline characteristics, treatment, and follow-up events among patients with pregnancies after CPVT diagnosis (n = 17 [18%]; 33 pregnancies) are listed in **Table 5**. Twelve of the 17 patients (71%) were taking beta-blockers during follow-up. There were 2 cardiac events during the postpartum period (both syncope), and neither patient took beta-blockers. The event rate during the combined pregnancy and postpartum periods in this subgroup (4.92 events per 100 patient-years) was similar compared with that of the overall cohort (RR: 1.70; 95% CI: 0.20 to 11.4; p = 0.575).

TABLE 3 Maternal Cardiac Events During Pregnancy and the Postpartum Period

Patient #	Age at First Pregnancy (yrs)	Mutation(s)	Total Pregnancies	Event(s)	Timing	Beta-Blocker During Pregnancy	Nonpregnant Events
1	27	*RyR2* p.E189D	1	Syncope	Pregnancy	No*	None
2	21	*RyR2* p.R420W	3	Syncope	Pregnancy	No	None
3	29	*RyR2* p.R420W	4	Palpitations and pre-term	Pregnancy	No	None
4	24	*RyR2* p.R420W	3	Syncope	Postpartum	No	None
5	26	*RyR2* p.E4076K	3	Syncope	Pregnancy	No	None
6	32	*RyR2* p.S4124G	3	Syncope	Postpartum	No	None
7	33	Mutation negative	3	Aborted cardiac arrest	Postpartum	Unknown	None

*Nadolol stopped while pregnant.
Pt = patients; other abbreviation as in Table 1.

SENSITIVITY ANALYSES. We performed additional sensitivity analyses to assess the rigor of our findings. There was only 1 patient with >5 pregnancies (10 pregnancies; all pregnancies were remote and prior to CPVT diagnosis). This patient might represent an outlier with an exceptionally low risk and was excluded in the sensitivity analysis (Online Table 4). After exclusion, repeat analysis demonstrated no significant difference in event RRs among the pregnant, postpartum, and nonpregnant periods (Online Table 4). We also performed a sensitivity analysis on probands only (n = 19) (Online Table 5). There was no significant difference in event rates among the pregnant, postpartum, and nonpregnant periods, although the risk appeared numerically greater in the postpartum period (RR: 3.14; 95% CI: 0.40 to 17.7; p = 0.232). Similarly, we performed a sensitivity analysis on nonprobands only (n = 77) (Online Table 6). There was no significant difference in event rates among the various time periods. When we compared event rates between probands and nonprobands, there was a nonsignificant trend toward greater event rates among probands, especially during the post-partum (RR: 8.86; 95% CI: 0.67 to 261; p = 0.096) and nonpregnant periods (RR: 4.76; 95% CI: 0.84 to 37.1; p = 0.078). This is shown in Online Table 7.

We also performed a sensitivity analysis, comparing event rates among patients with and without nonpregnant events (Online Table 8). Similarly, we performed a sensitivity analysis comparing event rates among patients diagnosed with CPVT within or after the first 4 decades of life (Online Table 9). Although patients with earlier diagnoses appeared to have more events, there was no significant difference in event rates during the peri-partum (RR: 2.39; 95% CI: 0.42 to 18.6; p = 0.339) and nonpregnant periods (RR: 3.83; 95% CI: 0.53 to 91.2; p = 0.217). We also performed a sensitivity analysis, comparing event rates among patients diagnosed with CPVT before and after pregnancy (Online Table 10). There was a nonsignificant trend toward increasing event rates in patients diagnosed with CPVT before pregnancy, particularly during the postpartum period (RR: 11.8; 95% CI: 0.90 to 349; p = 0.060).

DISCUSSION

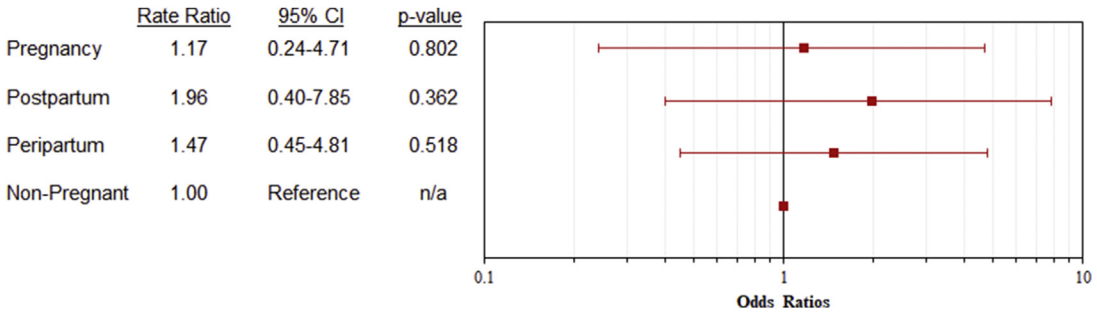
This Canadian and Dutch series of 96 CPVT mothers did not find evidence that the pregnant or postpartum period posed an incremental risk of cardiac events. In 228 pregnancies, we observed a low incidence of life-threatening cardiac events. For pregnancies following a diagnosis of CPVT, the event rate was similarly low, and fetal and maternal outcomes were generally favorable. Our data supported the safety of pregnancy in well-controlled or minimally symptomatic women with CPVT. Beta-blockers were used infrequently during pregnancy in this series, due to the remote pregnancies and the absence of a CPVT diagnosis. However, with the exception of atenolol (U.S. Food and Drug Administration

TABLE 4 Event Rates During Pregnant, Postpartum, and Nonpregnant Periods

Time Period	Duration (patient-years)	Event Rate (per 100-patient-years)	Rate Ratio (95% CI)*	p Value
Pregnancy	177.4	1.71	1.17 (0.24–4.71)	0.802
Postpartum	105.2	2.85	1.96 (0.40–7.85)	0.362
Combined pregnancy and postpartum	280.6	2.14	1.47 (0.45–4.81)	0.518
Nonpregnant†	411.4	1.46	1.00	N/A (reference)

*Rate ratio compared with nonpregnant period event rate. †Nonpregnant period defined as total follow-up minus pregnancy and postpartum periods. Combined pregnancy and postpartum period includes pregnancy (assuming 40-week gestation) and postpartum period (assuming 24 weeks).
CI = confidence interval.

FIGURE 2 Forest Plot of Event Rate Ratios



Forest plot of event rate ratios during pregnancy, postpartum, and nonpregnant periods. CI = confidence interval.

pregnancy class D for teratogenicity), beta-blockers are indicated in all symptomatic patients with a diagnosis of CPVT (Class I recommendation; discussed subsequently) and should likely be continued during the pregnancy and postpartum period (1).

Among patients with cardiovascular disease, pregnancy can pose a considerable challenge to the cardiologist caring for a woman of child-bearing age. The risk of maternal and fetal complications differs across the spectrum of inherited cardiovascular disease. A multidisciplinary team with expertise in cardiology, inherited arrhythmias, and obstetric medicine must balance the risks of cardiac events with the risks of treatment and the psychosocial consequences with delaying or avoiding pregnancy. In a previous study of cardiovascular causes of sudden unexpected death during the pregnant and post-partum period, SADS and underlying cardiomyopathies were the leading causes of death in 54% and 14% of patients, respectively (7). Among patients with LQTS, there might be a reduced risk during pregnancy, but there is an increased risk in the postpartum period, with almost one-quarter of probands experiencing cardiac events postpartum (odds ratio: 40.8) (8). Most cardiac events occur among patients with type 2 LQTS, with beta-blocker use significantly reducing the risk of events across multiple studies (8,14). Furthermore, in a large retrospective study of 379,238 pregnancies, beta-blockers did not appear to be associated with fetal anomalies after adjustment for age, body mass index, and maternal comorbidities (15). Among inherited cardiomyopathies, there were also several reports of cardiac events that occurred during pregnancy in patients with arrhythmogenic right ventricular cardiomyopathy (16,17).

The limited number of reported cases of pregnancy in CPVT focuses on adverse outcomes. Friday et al. (10) reported a case of a 19-year-old woman who had multiple events during gestation, including multiple ICD shocks, before premature delivery at 30 weeks' gestation. Ahmed et al. (11) reported a 17-year-old woman who also experienced multiple events during the first trimester of pregnancy (potentially related to poor compliance), followed by an uncomplicated delivery by caesarian section at 38 weeks. In the present study, we reported on the largest retrospective cohort of CPVT patients with at least 1 previous pregnancy, with no significant difference in cardiac event rates in the pregnancy, postpartum, and nonpregnant periods. ACAs occurred in 2% in our cohort, with an overall pregnancy and postpartum event rate of 2.14 events per 100 patient-years. There was no significant difference between the pregnancy and postpartum event rates compared with the nonpregnant period, with a nonpregnant event rate of 1.46 events per 100 patient-years. These findings persisted across multiple sensitivity analyses, albeit with a signal toward increased events among patients diagnosed with CPVT within the first 4 decades of life and those diagnosed with CPVT before pregnancy. Overall, these results suggested that pregnancy in CPVT patients is well tolerated, with a relatively low event rate. Importantly, our patients were typically mothers identified through family screening after a CPVT diagnosis was made in their family members (i.e., children). This might reflect a survival bias in a lower risk cohort in the context of maternally inherited disease with a male predominance for arrhythmic events (18,19). Furthermore, the arrhythmic risk in CPVT mothers in our cohort might be further attenuated with increased beta-blocker use, because most

TABLE 5 Subgroup Characteristics of Patients With Pregnancy After CPVT Diagnosis (N = 17)

Age at diagnosis, yrs	21.7 (13–31)
Duration of follow-up, yrs	7.4 (0–20)
History of arrhythmic syncope or seizure	6 (35)
History of aborted cardiac arrest	1 (6)
Family history of CPVT diagnosis	12 (71)
Genetics	
Variant of *RyR2*	14 (82)
p.Arg420Trp (R420W) mutation	5 (29)
p.Lys4650Glu mutation	3 (18)
Other *RyR2* mutation	6 (35)
Events during pregnancy and postpartum period	
Arrhythmic syncope	2 (12)
Aborted cardiac arrest	0 (0)
Miscarriages	2 (12)
Intrauterine growth restriction	1 (6)
Total pregnancy and postpartum period, patient-years	40.6
Event rate during pregnancy and postpartum period, per 100 patient-years	4.92 events
Nonpregnant follow-up	
Total events during nonpregnant period	3 (18)
Total nonpregnant period, patient-years	103.4
Event rate during nonpregnant period, per 100 patient-years	2.90 events
Therapy in follow-up	
Beta-blocker	12 (71)
Beta-blocker during pregnancy	10 (59)
Bisoprolol	4 (24)
Metoprolol	4 (24)
Atenolol	3 (18)
Sotalol	1 (6)
Flecainide	8 (47)
Calcium channel blocker	1 (6)
Implantable cardioverter defibrillator	3 (18)

Values are median (range) or n (%) unless otherwise indicated.
Abbreviations as in Table 1.

patients had a remote pregnancy before CPVT diagnosis (and thus were not taking beta-blockers).

We also presented the characteristics, treatment, and follow-up events among the subgroup of patients with pregnancies after their CPVT diagnosis. Compared with the overall cohort, these patients were younger and had longer follow-up, with a trend toward an increased event rate during the postpartum and nonpregnant periods. Notably, 2 patients experienced cardiac events in the pregnancy and postpartum periods, and neither were taking beta-blockers (1 event per 20.3 patient-years). Event rates might have been further reduced if these 2 patients did take beta-blockers during the pregnancy and postpartum periods. In the overall cohort and subgroup, the rate of miscarriage was similar to the population-reported incidence rate (20). Together, these results supported the use of beta-blockers (except for atenolol) in the CPVT mothers, by reducing cardiac events (ACA and syncope) with no increased risk of fetal complications. A systematic review of literature suggested that metoprolol and propranolol are likely to be most appropriate during pregnancy and lactation (American College of Cardiology/American Heart Association /European Society of Cardiology Class IIa, Level of Evidence: C, U.S. Food and Drug Administration category C) (21).

STUDY LIMITATIONS. Limitations of our study include its retrospective nature, as most patients had their pregnancies before CPVT diagnosis. As such, our data may be incomplete and have recall bias. We also reported few cardiac events during the pregnancy, postpartum, and nonpregnant periods, which limited our power to identify statistically significant differences. Furthermore, most patients had a family history of CPVT and were identified through family screening, with these mothers likely manifesting a milder phenotype with less arrhythmic risk compared with their children. Similarly, patients who died before CPVT diagnosis were excluded from this analysis because most deaths occurred before the first pregnancy. However, our population likely represented the general CPVT population because disease severity might have been overestimated in early cohorts (22). Finally, most mothers were likely untreated during their pregnancy, and no comparison of pregnancy and postpartum events with and without beta-blocker use could be performed.

CONCLUSIONS

In this retrospective cohort of 96 CPVT patients with 228 pregnancies, we report a low event rate of cardiac events during the pregnant and postpartum period. Rare events occurred during both the pregnant and postpartum periods, with an overall event rate of 2.14 events per 100 patient-years. There was no significant difference in cardiac events in the pregnant and postpartum periods compared with the nonpregnant period. The rate of miscarriages was consistent with the population reported incidence rate.

ACKNOWLEDGMENTS The authors thank the site coordinators and research staff for assisting with data collection. They also thank F.J. de Lange for adjudication of the arrhythmic events.

ADDRESS FOR CORRESPONDENCE: Dr. Andrew Krahn, Heart Rhythm Vancouver, 211-1033 Davie Street, Vancouver, BC V6E 1M7, Canada. E-mail: akrahn@mail.ubc.ca.

PERSPECTIVES

COMPETENCY IN MEDICAL KNOWLEDGE: Among patients with CPVT, cardiac events, including ACAs and arrhythmic syncope, can occur during the pregnant, postpartum, and nonpregnant periods. Among patients with CPVT, beta-blockers should be considered in the pregnancy and postpartum periods due to their overall safety (metoprolol and propranolol) and risk–benefit profile.

TRANSLATIONAL OUTLOOK 1: Among patients with CPVT, there was no increased risk of cardiac events during the pregnant and postpartum periods compared with the nonpregnant period.

TRANSLATIONAL OUTLOOK 2: Beta-blockers remain the foundation of treatment for patients with CPVT, and should be considered in the pregnant, postpartum, and nonpregnant periods.

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KEY WORDS arrhythmia, cardiac arrest, catecholaminergic polymorphic ventricular tachycardia, pregnancy, sudden death, syncope

APPENDIX For supplemental tables and figures, please see the online version of this paper.