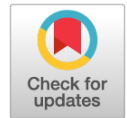


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Research article



Catheter ablation of sustained idiopathic right ventricular outflow tract tachycardia in a pregnant patient without fluoroscopy

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In 2020, our department has performed 739 operations on nonpregnant patients. Additionally, 545 highly successful nonfluoroscopic catheter ablation of cardiac arrhythmias were routinely performed using a three-dimensional navigation system, including 47 patients with idiopathic ventricular tachycardia (VT) from the right ventricular outflow tract (RVOT).

A 38-year-old female patient with a structurally normal heart was admitted to our hospital in 10–11 weeks of her third pregnancy because she sustained recurrent 166 regular heartbeats per minute, wide QRS-complex tachycardia with left bundle branch morphology, and frequent premature ventricular contractions on Holter monitoring with complaints of presyncope and dyspnea. Standard antiarrhythmic drugs failed to control tachycardia. This case report presents our initial successful experience of the rescue zero-fluoroscopy catheter ablation of sustained poorly tolerated idiopathic RVOT tachycardia in a pregnant patient. Our result suggests that this technique may be considered in the few rare cases in which drug-resistant, sustained frequent VT is accompanied by hemodynamic compromise with fluoroscopy contraindication.

AIM: Diagnostic algorithm of idiopathic sustained drug-resistant, poorly tolerated VT and the possibility of radiofrequency catheter ablation in the most vulnerable first trimester of pregnancy without fluoroscopy were presented in our case report.

Keywords: safety; catheter ablation of arrhythmia; pregnancy; electro-anatomical mapping; non-fluoroscopy imaging.

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УДК 61

Научная статья

Катетерная абляция устойчивой идиопатической желудочковой тахикардии из выходного тракта правого желудочка у беременной женщины без использования рентгеноскопии

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Цель. Представлен случай диагностического алгоритма у пациентки с пароксизмальной устойчивой идиопатической желудочковой тахикардией с гемодинамическим компромиссом, рефрактерной к антиаритмической терапии, и возможностей радиочастотной абляции (РЧА) без рентгеноскопии в наиболее уязвимом первом триместре беременности.

Материалы и методы. В 2020 году в нашем отделении выполнено 739 операций у небеременных пациентов. 545 весьма успешных нефлюороскопических РЧА по поводу аритмий проведены с использованием 3-х мерной навигационной системы, в их числе 47 пациентов с идиопатическими желудочковыми тахикардиям (ЖТ) из выходного отдела правого желудочка (ВТПЖ).

В нашу больницу госпитализирована 38-летняя женщина на 10-11-й неделе третьей беременности со структурно нормальным сердцем и устойчивой рецидивирующей тахикардией с широкими QRS-комплексами, частыми ЖЭ при холтеровском мониторинге, с жалобами на пресинкопе и одышку. Тахикардия была рефрактерна к антиаритмическим препаратам. Нами представлен наш первый, успешный опыт нефлюороскопической РЧА устойчивой идиопатической тахикардии с клиническими проявлениями из ВТПЖ у беременной пациентки.

Результаты. Наш случай говорит о том, что методика может быть применима в тех редких случаях, когда имеет место аритмия с гемодинамическим компромиссом, рефрактерная к антиаритмическим препаратам, и рентгеноскопия противопоказана.

Выводы. Представлен случай возможного диагностического алгоритма у пациентки с пароксизмальной устойчивой идиопатической желудочковой тахикардией с гемодинамическим компромиссом, рефрактерной к антиаритмической терапии, и возможностей радиочастотной абляции без рентгеноскопии в наиболее уязвимом первом триместре беременности.

Ключевые слова: безопасность; катетерная абляция аритмии; беременность; электро-анатомическое картирование; нефлюороскопическое картирование.

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INTRODUCTION

Physiological, hemodynamic, hormonal, and metabolic changes occur during pregnancy [1–2] and may induce maternal arrhythmia, regardless of any preexisting heart pathology. Usually, this has a benign prognosis. However, drug-resistant arrhythmia with hemodynamic compromise rarely occurs and may require precise management, considering that maternal and fetal safety should be paramount. The radiofrequency catheter ablation (RFCA) of arrhythmia with zero-fluoroscopy is a rescue approach in the severe tachyarrhythmia treatment in pregnant women, when it is without other existing alternatives [3].

CASE REPORT

Our department has performed 739 operations on nonpregnant patients in 2020. Additionally, 545 highly successful nonfluoroscopic catheter ablation of cardiac arrhythmias were routinely performed using a three-dimensional navigation system, including 47 patients with idiopathic ventricular tachycardia (VT) from the right ventricular outflow tract (RVOT).

A 38-year-old female patient in 10–11 weeks of her third pregnancy was admitted to our hospital, due to sustained recurrent 166 regular heartbeats per minute, wide QRS-complex tachycardia with left bundle branch block (LBBB) morphology, and frequent premature ventricular contractions (PVCs) on Holter monitoring (Fig. 1) with complaints of

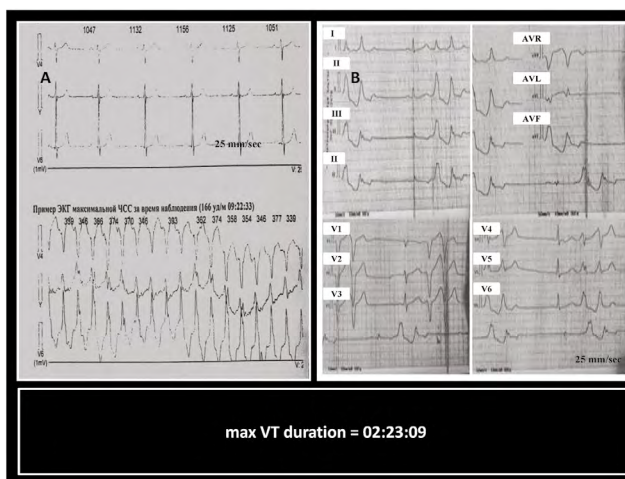


Fig. 1 (A). Holter monitoring: sustained 166 regular heartbeats per minute wide QRS-complex tachycardia with LBBB morphology was introduced (B). 12-lead ECG: coupled PVCs are shown in all leads

presyncope and dyspnea. She had two uncomplicated vaginal deliveries and two healthy children.

The patient had been suffering from irregular heartbeats for 5 years but had never been referred to a cardiologist. Her condition worsened 3 months ago due to recurrent presyncope. Her blood pressure was normal and there was no family history of sudden cardiac death.

A pregnancy termination was scheduled by the local outpatient obstetrician and physician due to arrhythmia.

A blood and urine analysis did not indicate thyroid and electrolyte disturbances and the myocardial injury markers

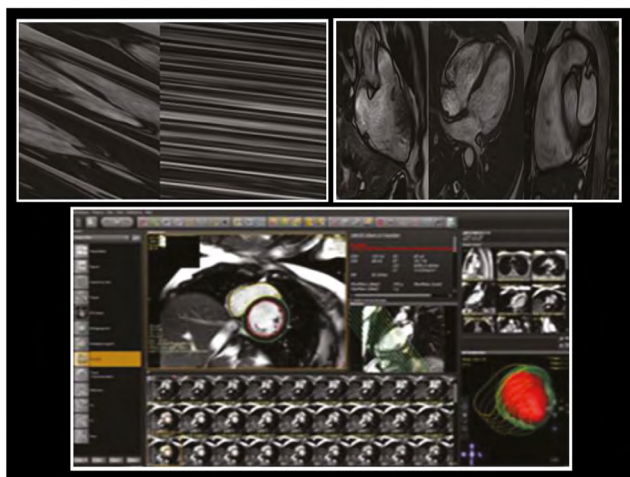


Fig. 2. MRI without gadolinium-based contrast: regional RV akinesia, dyskinesia, or dyssynchronous RV contraction were not determined. The RV was not dilated. The ratio of the RV end-diastolic volume to BSA was 75 mL/m². The RV ejection fraction was not reduced (51%). The results of the cardiac MRI did not concur with the Padua criteria for diagnostic arrhythmogenic cardiomyopathy 2020

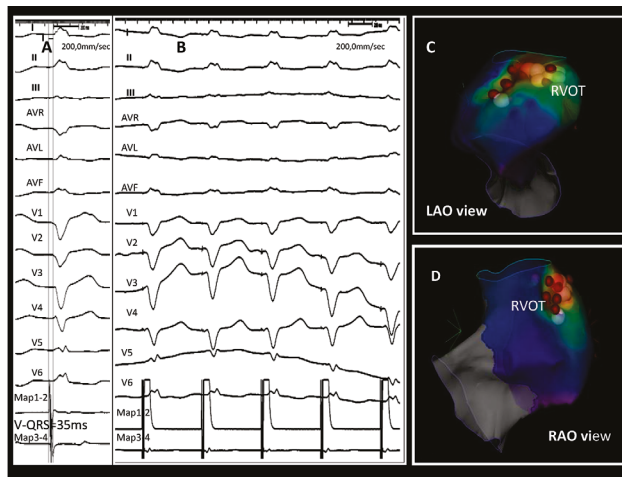


Fig. 3. Serial images of pace- and electroanatomical and activation mapping that guided successful RFCA recurrent VT, originating from the RVOT. (A) Only PVCs with a morphology similar to VT morphology were recorded during the procedure. Ventricular preexcitation recorded on Map 1–2 = 35 ms during spontaneous PVC. (B). Pace-mapping RV. A similar QRS-complex morphology both during pacing (Panel B) and spontaneous PVC (Panel A) is shown. Simultaneous intracardiac recordings are presented in Panels C and D, the earlier ventricular activation was recorded at the RVOT in the septal area, and a successful RF application at 35 W was conducted in the specific area of interest.

were not increased. RV morphological PVCs were registered on 12-lead electrocardiography (ECG) (Fig. 1). However, the ECG was normal, as well as the echocardiography and cardiac magnetic resonance imaging (MRI) without gadolinium-based contrast (Fig. 2).

Standard antiarrhythmic drugs failed to control tachycardia. Thus, propafenone is advised as a B category and β -blocker Sotalol as a C category by the United States Food and Drug Administration [3].

Echocardiogram and cardiac MRI without gadolinium contrast were notable for preserved left and right ventricular structure and function. The LBBB morphology with tall R waves in inferior leads of the wide complex tachycardia and frequent PVCs was highly suggestive of VT originating from the outflow tract region. The findings were suggestive of a benign prognosis; however, its presence during pregnancy significantly increased the risk of maternal mortality or severe morbidity following the World Health Organization classification of cardiovascular maternal risk [3].

A multidisciplinary team approach was used in patient management. However, not all cardiac arrhythmias can be conservatively treated in pregnancy. She suffered from sustained drug-resistant and poorly tolerated VT with a high risk of recurrence. Therefore, we recommended catheter ablation of the arrhythmia (RFCA) without fluoroscopic exposure during the procedure. Informed consent was obtained after a detailed discussion of procedure risks and benefits. Antiarrhythmic medications were discontinued for at least 5 half-lives before the procedure.

The procedure was guided by the nonfluoroscopy electroanatomical mapping system CARTO 3 SYSTEM VERSION 6 (Johnson & Johnson Medical Devices), and intracardiac echocardiography (ICE) imaging was performed using a Sequoia ultrasound system (Acuson Corporation, Siemens Medical Solutions USA, Inc.) with an AcuNav diagnostic ultrasound catheter. A transfemoral approach was used.

An electrophysiological study was conducted during the initial stage of the operation to exclude supraventricular tachycardia (SVT) with a bundle branch block and VT induction. The arrhythmogenic zone (RVOT, septal part) was determined by electroanatomical, activating- and pace-mapping RV (Fig. 3).

A single irrigated RF application at 35 W was conducted with a Thermocool Smarttouch catheter in the area of interest. The contact force was >5 g. The ectopy, similar to the clinical VT, was noted during ablation, and arrhythmia was suppressed after 60 s.

The operation time was 38 min, and it was performed with local anesthesia to avoid maternal hypotension and low placental perfusion. Fetal cardiocography was used for intraprocedural fetal monitoring.

Surveillance levels during delivery among women with arrhythmias were estimated and an action plan was formulated [3]. The woman in question gave birth to the

infant by vaginal delivery with epidural anesthesia to full term. The infant's condition was fair (bodyweight of 2.420 The patient was discharged in a stable condition 3 days later. The postoperative followup at 6 and 12 months did not indicate any pathological myocardial activity.

DISCUSSION

Herein, we examine the issues relating to pregnancy due to clinical situation underestimation, antiarrhythmic drug prescription limitations [3], which would lead to pregnancy termination, complicated by idiopathic, sustain, recurrent, drug-resistant, and poorly tolerated VT from the RVOT. Our initial successful experience of a rescue RFCA of arrhythmia with zero-fluoroscopy in pregnant women is presented.

The prognosis and treatment strategies of VT substantially differ, and a correct diagnosis was important. Similar to other clinicians, we were dealing with a situation of limited diagnostic capabilities in the first trimester of pregnancy, due to the potential fetal risk.

MRI without gadolinium-based contrast is advised as IIa (C), indicating whether other noninvasive, diagnostic measures are insufficient in providing a definitive diagnosis in the latest European Society of Cardiology (ESC) guidelines [3]. Novel MRI sequences, as well as endomyocardial biopsy, may assist in achieving a correct diagnosis [4]. The safety of MRI rendered it the only applicable method after echocardiography, as a means of excluding structural heart diseases, such as arrhythmogenic cardiomyopathy (ACM), sarcoidosis, and other common cardiomyopathies in this case.

In accordance with the Padua criteria for ACM diagnosis, our case showed only one minor ECG criterion (sustained VT of RV outflow configuration, LBBB with inferior axis [positive QRS in leads II, III, and aVF, and negative QRS in lead aVL]), which was insufficient for any diagnosis. Therefore, genotyping is indicated to identify a pathogenic or likely pathogenic mutation in a proband with consistent phenotypic disease features [5] according to the expert recommendations for genetic testing in ACM, and genetic testing was not recommended in patients with only a single minor criterion.

Idiopathic RVOT was determined as a likely diagnosis in the case of our patient [5-7]. Idiopathic RVOT is the most frequent VT type during pregnancy, and antiarrhythmic drug therapy is the first stage of treatment for acute and longterm management of this condition to avoid medication prescription, which could potentially be harmful to the fetus. Maternal arrhythmia can be transient, well-tolerated during delivery, and disappear after childbirth [3].

Managing idiopathic sustained VT, in this case, was a challenge due to its hemodynamic instability and drug resistance. We could follow the latest ESC guidelines [3] for the immediate electrical cardioversion for both sustained unstable and stable VT as I (C) indication if arrhythmia was not continuously recurrent in this case.

The ESC recognized catheter ablation with electroanatomical mapping systems in sustained drug-refractory and poorly tolerated VT as II b (C) level of indication in its latest guidelines. Potential risks to the mother and fetus from catheter ablation during pregnancy include anesthesia-related risk, pacing-induced maternal tachycardia, and radiation exposure [3]. However, this was determined as the only remaining fundamental solution, considering its ability to eliminate the arrhythmogenic zone in our event.

Meng-meng Li et al. have reported that ~28 pregnant patients without structural heart pathology underwent successful RFCA with zero-fluoroscopy, as their arrhythmia was drug-resistant and hemodynamically significant. SVT was determined in 15 cases, PVS in 10, and VT in 3 [8].

Chen et al. have demonstrated 2 cases of successful zero-fluoroscopy catheter ablation of severe drug-resistant arrhythmia guided by the Ensite NavX system during pregnancy, including one healthy woman with PVCs and VT in the third trimester of pregnancy. They also conducted a literature review of cases of pregnant women with SVT who underwent zero-fluoroscopy ablation. All women and fetuses were in good condition and had an uneventful postoperative

course after the procedure. Recurrence of arrhythmia and complications related to the procedure were not reported [9].

Herein, we demonstrated our initial, clinical experience of rescue RFCA of idiopathic, sustained, recurrent poorly tolerated VT from RVOT, with zero-fluoroscopy in the most vulnerable first trimester of pregnancy as a safe and effective procedure, resulting in the survival of the mother and fetus, when executed by an experienced operator.

Unfortunately, very few cases of RFCA with zero-fluoroscopy of sustained poorly tolerated VT in pregnant women without heart pathology are recorded in the database, which would enable clinicians to make a risk-benefit ratio reassessment of this procedure in cases of pregnancy, complicated by VT. Currently, this technique may be considered in the few rare cases in which drug-resistant sustained frequent VT is accompanied by hemodynamic compromise with fluoroscopy contraindication.

ADDITIONAL INFORMATION

Conflict of interest. The authors declare no conflict of interest.

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