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Catheter Ablation of Cardiac Arrhythmias in Pregnancy with Limited Fluoroscopy

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Abstract

Objective: This study sought to evaluate the feasibility and safety of catheter ablation in pregnancy with limited fluoroscopy.

Method: A case-control retrospective study.

Results: Ten patients with tachycardia in pregnancy (age 26, 30 ± 4, 52 years; gestational age 26, 90 ± 2, 88 weeks) successfully underwent radiofrequency catheter ablation procedures with limited fluoroscopy. Type of tachycardia consisted of 2 patients with atrial tachycardia; 2 patients with ventricular tachycardia; 4 patients with atrioventricular reentrant tachycardia; 2 patients with atrioventricular nodal reentrant tachycardia. Procedure time, fluoroscopy time, total dose area product were 66, 50 ± 19, 86 minutes; 118, 80 ± 64, 38 seconds; 0, 73 ± 0, 64 Gy·cm² respectively. There were not any complications during and after procedures. All pregnancy normally delivered healthy babies.

Conclusion: Catheter ablation with limited fluoroscopy can be performed safely and with good outcomes in pregnancy.

Keywords: Tachycardia; Radiofrequency catheter ablation; Atrioventricular reentrant tachycardia; Fluoroscopy time; Catheter ablation

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Introduction

During pregnancy, the cardiovascular system is faced with significant changes which can precipitate the occurrence of arrhythmias. The hyperdynamic state and altered hormonal status is possibly predisposing pregnant women to arrhythmias. Cardiac arrhythmias during pregnancy pose a serious threat to the health of both mother and fetus. Tachyarrhythmia, including both supraventricular and ventricular tachycardia, is the most common cardiac complication observed during pregnancy. The paroxysmal supraventricular tachycardia during pregnancy is the most frequently observed arrhythmias with an incidence of 24 per 100,000 pregnancies [1]. The recurrence rates during pregnancy in women with a history of supraventricular tachycardia and ventricular tachycardia have been described in 50% and 27%, respectively [2]. Adverse fetal events occurred in 20% [2]. Catheter ablation is the first choice and safety for cardiac arrhythmias in patients without pregnancy. Some authors suggested that pregnant women should not undergo an ablation procedure because of the radiation risks to the fetus [3,4]. There are very limited data available for the effects and safety of catheter ablation in pregnancy. We investigate the feasibility and

safety of catheter ablation in pregnancy with limited fluoroscopy.

Patients and Methods

Patients

We studied 10 consecutive patients referred to Hanoi Heart Hospital, Hanoi, Vietnam from September 2015 to August 2019 for tachycardia in pregnancy. All patients underwent catheter ablation with limited fluoroscopy.

Study methods

A case-control retrospective study

Ablation Procedure

All patients were rolled around the abdomen with an X-ray protective apron. In general, three catheters (4–6F) were positioned at the right ventricular apex, His bundle region, and right atrium using the femoral vein approach and the coronary sinus using the left subclavian vein approach. In the

electrophysiological study, it was done using standard protocols. Heparin was used in all of the cases after the vein approach. During all of the procedures, we tried to reduce fluoroscopy as much as possible. X-ray was used only in the coronary sinus position and across the aortic valve. The fluoroscopy was set at a minimum of 3 frames/second. The non-fluoroscopic mapping system used Ensite Velocity (St Jude Medical) during the entire procedure. An ablation catheter (7F, 4-mm tip) was typically introduced using the right femoral vein or artery approach. Mapping and ablation were performed using established methods. The Radiofrequency (RF) energy delivered was 30–50 W, and the temperature limit was individually set to 50–70°C.

Follow up

The patients underwent follow-up by cardiologists in the hospital outpatient clinic at least from post-procedure to delivery.

All of the pregnant women gave their permission for ablation and accepted the possibility of using an X-ray if necessary. The study protocol was approved by the Ethics Committee of the Hanoi Heart Hospital.

Results

Ten patients with tachycardia in pregnancy underwent RF catheter ablation. The mean age was 26, 30 ± 4, 52 years of age (from 19 to 34 years old). The gestational age at the time of ablation procedure was 26, 90 ± 2, 88 weeks of age (from 21 to 31 weeks old). All patients had no history of heart failure and structural heart diseases. All patients had at least one tachycardia during their pregnancies. Two of 10 patients had a history of dysrhythmia before pregnancy. The characteristics of our studied group present in **Table 1**.

All patients were ablated successfully. In our studied group, there were 2 patients with AT, 2 patients with VT, 4 patients with AVRT, 2 patients with AVNRT. In 2 patients with AT, locations of ablation were one of under right atrial appendage (**Figure 1**) and one of the coronary sinus ostium. Both patients with VT, location of ablation were right ventricular outflow tract. In 4 patients of AVRT, locations of ablation were 2 of the left free wall accessory pathway, one of the left septal accessory pathways and one of the right posterior free wall accessory pathways. We ablated the

Table 1 Baseline characters of the studied patients.

No	Age	Type of Tachycardia	Gestational weeks	Parity	History of dysrhythmia	LVDd (mm)	LVEF (%)
Mean ± SD	26,30 ± 4,52		26,40 ± 2,71			44,70 ± 5,07	68,10 ± 7,43
1	27	AT	31	1	No	45	69
2	19	AT	28	1	No	49	52
3	34	VT	26	3	No	45	65
4	32	NSVT	28	2	No	43	76
5	21	WPW	24	1	No	51	68
6	25	AVRT	21	1	No	42	77
7	24	WPW	27	1	No	53	72
8	27	WPW	25	2	Yes	43	65
9	28	AVNRT	26	1	No	37	74
10	26	AVNRT	28	1	Yes	39	63

AT: Atrial Tachycardia; VT: Ventricular Tachycardia; NSVT: Non-Sustained Ventricular Tachycardia; WPW: Wolff-Parkinson-White Syndrome; AVRT: Atrioventricular Reentrant Tachycardia; AVNRT: Atrioventricular Nodal Reentrant Tachycardia; LVDD: Left Ventricular Diastolic Diameter; LVEF: Left Ventricular Ejection Fraction; SD: Standard Deviation

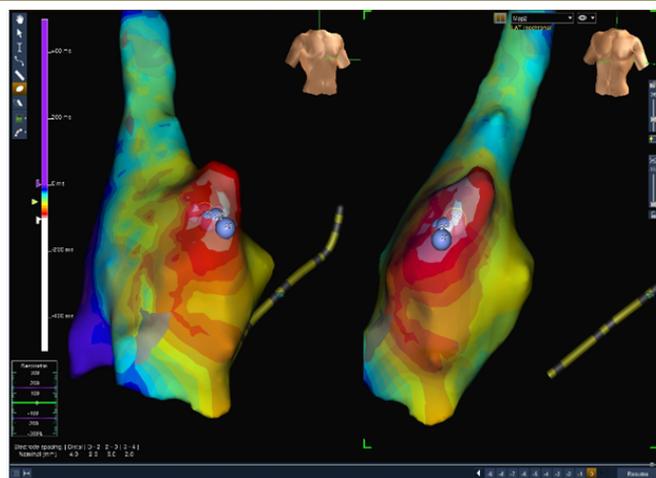


Figure 1 Case No 1 of AT. The gray dots represent where ablation was performed successfully in the right atrial appendage.

slow pathway in 2 patients with AVNRT (**Figure 2**). The timing of the procedure was 66, 50 ± 19, 86 minutes. The timing of fluoroscopy was 118, 80 ± 64, 38 seconds. The total dose area product was 0, 73 ± 0, 64 Gy-cm²). Data related to catheter ablation procedures is presented in **Table 2**.

Patient's outcome: There were not any complications during and after procedures. All pregnancy normally delivered healthy babies. Only one pregnancy needed cesarean surgery, but not due to cardiovascular problems.

Discussion

The use of anti-arrhythmic drugs during pregnancy is challenging due to potential fetal teratogenic effects. Moreover, many of the currently available anti-arrhythmic drugs have arrhythmogenic effects and could even increase mortality [5]. Although, the anti-arrhythmic drugs sometimes could not terminate the tachycardia episodes. It may cause hemodynamic deterioration in both the fetus and the mother [6]. Nowadays, there are no major studies guiding the selection of the safest and most effective anti-arrhythmic drugs for pregnancy. The most popular

anti-arrhythmic drugs use in practice to be beta-blockers and calcium channel blockers. However, it is not recommended because both of them are classified as category C by the US Food and Drug Administration [7]. In fact, anti-arrhythmic drugs are not warranted to assure during pregnancy and baby delivery. Catheter ablation may be definitive therapy for these patients. However, convention catheter ablation requires use fluoroscopy and we do not control the fluoroscopy time during procedures. Because of the potential risk for fetal, catheter ablation is not strongly recommended in previous guidelines with class II b (level of evidence C) for supraventricular tachycardia [8] and with class II a (level of evidence B) for ventricular tachycardia [9]. Our study showed that the X-ray exposure was very low in the non-fluoroscopic mapping age. Radiofrequency catheter ablation using a non-fluoroscopic mapping system is feasible and with limited radiation exposure in pregnancy. The more widespread use of non-fluoroscopic mapping system, the radiation risks for fetal may be reduced even further ionizing radiation will not be required at all with supplementary modalities such as intracardiac echocardiography to facilitate catheter navigation. Up to now, the radiation exposure is not a reason to eliminate

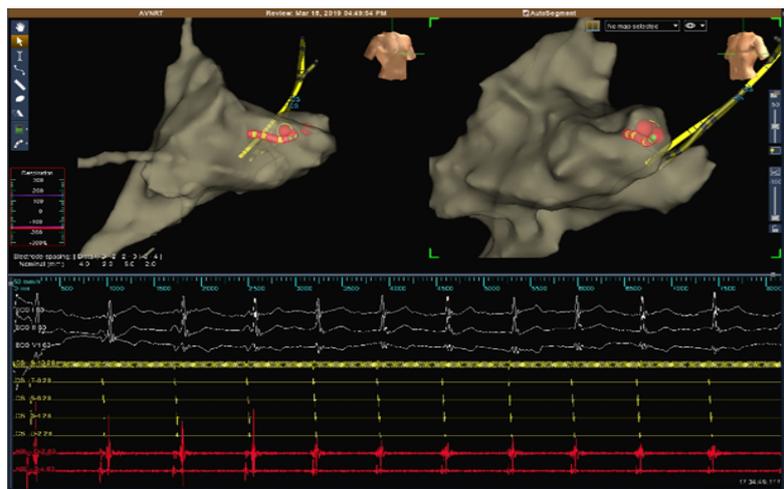


Figure 2 Case No 9 of AVNRT. The red dots were the position of 2 radiofrequency applications. The second one with catheter ablation was a successful ablation site.

Table 2 Data related to the catheter ablation procedure.

No	Age	Type of Tachycardia	Location	Procedure time (m)	RF application	fluoroscopy time (s)	Total dose area product (Gy-cm ²)
Mean ± SD	26,30 ± 4,52			66,50 ± 19,86		118,80 ± 64,38	0,73 ± 0,64
1	27	AT	RAA	100	8	144	1,05
2	19	AT	CSO	90	5	175	0,54
3	34	VT	RVOT	75	4	35	0,03
4	32	NSVT	RVOT	70	5	104	0,46
5	21	WPW	LFW	45	1	125	1,01
6	25	AVRT	LFW	40	1	204	1,93
7	24	WPW	LS	50	3	193	1,57
8	27	WPW	RPFW	80	12	132	0,54
9	28	AVNRT	SP	55	2	49	0,2
10	26	AVNRT	SP	60	3	27	0,02

RAP: Right Atrial Appendage; CSO: Coronary Sinus Ostium; RVOT: Right Ventricular Outflow Tract; LFW: Left Free Wall accessory pathway; LS: Left Septal accessory pathway; RPFW: Right Posterior Free Wall accessory pathway SP: Slow Pathway; M: minutes; S: seconds; SD: standard deviation

catheter ablation for pregnancy. Another reason to limit the catheter ablation for pregnancy may play a role of challenges performing pericardiocentesis and resuscitation in the event of a complication [10]. However, the complication of pericardial effusion and another complication in catheter ablation for tachycardia (not atrial fibrillation) are very rare [11]. In literature, mostly single cases of ablation during pregnancy [12-16]. In almost all cases, indication for catheter ablation is due to severe drug-resistant tachyarrhythmia. With an experienced operator, we could do ablation in almost common tachycardia for pregnancy with limited fluoroscopy. Our study also showed that catheter ablation procedures produced safe and good outcomes in pregnancy. The new ESC Guideline for supraventricular tachycardia recommended fluorless catheter ablation in cases of drug-refractory or poorly tolerated supraventricular tachycardia at the experienced centers with class II a [17].

In our daily practice, heparin was used in case of access to the left side of the heart and for procedures of longer duration. In

catheter ablation for pregnancy, we used prophylactic heparin for all cases. Pregnancy is associated with a hypercoagulable status and venous congestion [18]. During procedures, the patients underwent catheter ablation which is known to increase the thrombogenicity, and catheter movement through the femoral vein might embolize the venous thrombosis. Therefore, prophylactic heparin is strongly recommended to prevent thromboembolic events in pregnancy undergoing catheter ablation.

Conclusion

Catheter ablation with limited fluoroscopy can be performed in pregnancy with a high success rate. The catheter ablation procedures produced safe and good outcomes in pregnancy.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that be construed as a potential conflict of interest.

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