

# Ablation of incessant supraventricular tachycardia in pregnancy (RCD code: VIII-V-3A.O)

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## Abstract

We present a case of a 40-year-old woman, 4-months pregnant (in vitro fertilization), admitted to a hospital due to incessant supraventricular tachycardia with a rate of 187 beats/min. Attempts to stop the arrhythmia (3 × cardioversion, verapamil IV) were unsuccessful; after electrical cardioversion, tachycardia recurred after a few sinus beats. In the view of poor arrhythmia tolerance (hypotonia, dyspnea) and the risks associated with incessant tachycardia (placental hypoperfusion, development of tachyarrhythmic cardiomyopathy), it was decided to perform an electrophysiology study and ablation. The procedure was carried out with the use of a computer 3D mapping system (Ensite NavX), aiming to minimize standard fluoroscopy use. The electrophysiology study indicated the presence of focal right-atrial tachycardia. In this situation, geometry reconstruction and activation mapping of the right atrium was carried out, localizing the arrhythmogenic focus in the inferolateral portion of the tricuspid ring. After several radiofrequency (RF) applications, arrhythmia subsided and sinus rhythm was restored. Total fluoroscopy time in the procedure was only 90 seconds; the total radiation exposure was 12mGy. In addition, the abdomen of the pregnant woman was shielded with lead gowns from both sides, thus nearly completely eliminating the fetal radiation exposure. Unfortunately, after 4 weeks, the arrhythmia returned. A repeated ablation was carried out in an identical fashion as the index procedure, again with only minimal fluoroscopy time (62 s, 10mGy). The rest of pregnancy and labour were uneventful, without recurrence of tachycardia and a *healthy baby* was delivered. Therapeutic options and literature are reviewed and discussed. JRC D 2013; 1 (4): 158–162

**Key words:** atrial tachycardia; pregnancy; fluoroscopy; long-RP tachycardia; ablation

## Introduction

Previous supraventricular arrhythmias may become exacerbated and new arrhythmias may occur in pregnancy. However, supraventricular tachycardia is observed only in approximately 0.024% of pregnancies. [1] It is usually a nodal reentrant tachycardia or atrioventricular tachycardia in the presence of a concealed accessory pathway; focal atrial tachycardia is less commonly observed. Treatment of arrhythmias in pregnancy constitutes a significant therapeutic challenge because the main treatment modalities, namely, pharmacotherapy and ablation, are burdened with significant risks for the fetal health.

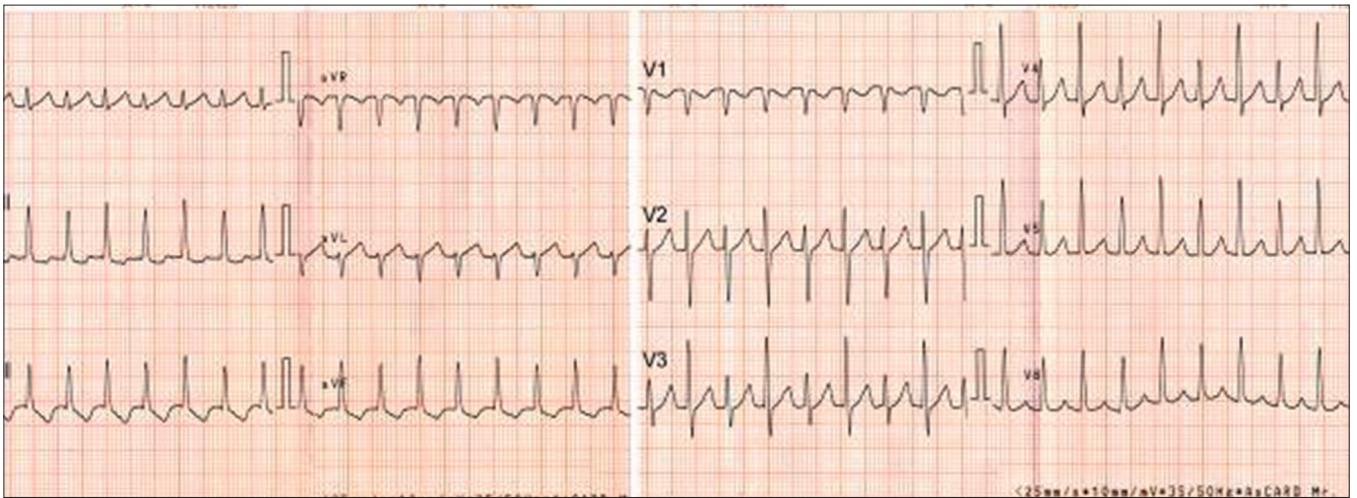
## Case report

A 40-year-old woman, 4-months pregnant (in vitro fertilization), was admitted to a district hospital due to incessant supraventricular tachycardia with a rate of 187 beats/min. (Figure 1). Attempts to stop the arrhythmia (3 × cardioversion, verapamil IV) were unsuccessful; after electrical cardioversion, tachycardia recurred after a few sinus beats. The patient was transferred to the university hospital for interventional management of arrhythmia. An electrocardiogram showed long RP-interval tachycardia. [2] The remaining tests (echocardiography, biochemical studies) showed no significant abnormalities. It was decided to attempt pharmacotherapy again (adenosine IV, metoprolol IV, metoprolol PO) – without success. In the view of poor arrhythmia tolerance (hypotonia, dyspnea) and the risks associated with incessant tachycardia (placental hypoperfusion, development of tachyarrhythmic cardiomyopathy), it was decided to perform an electrophysiology study

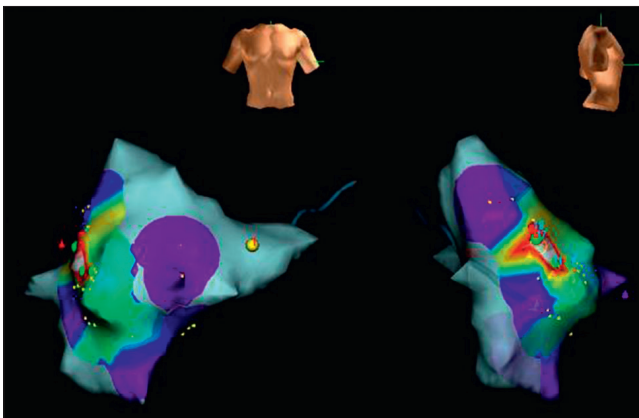
Conflict of interest: none declared.

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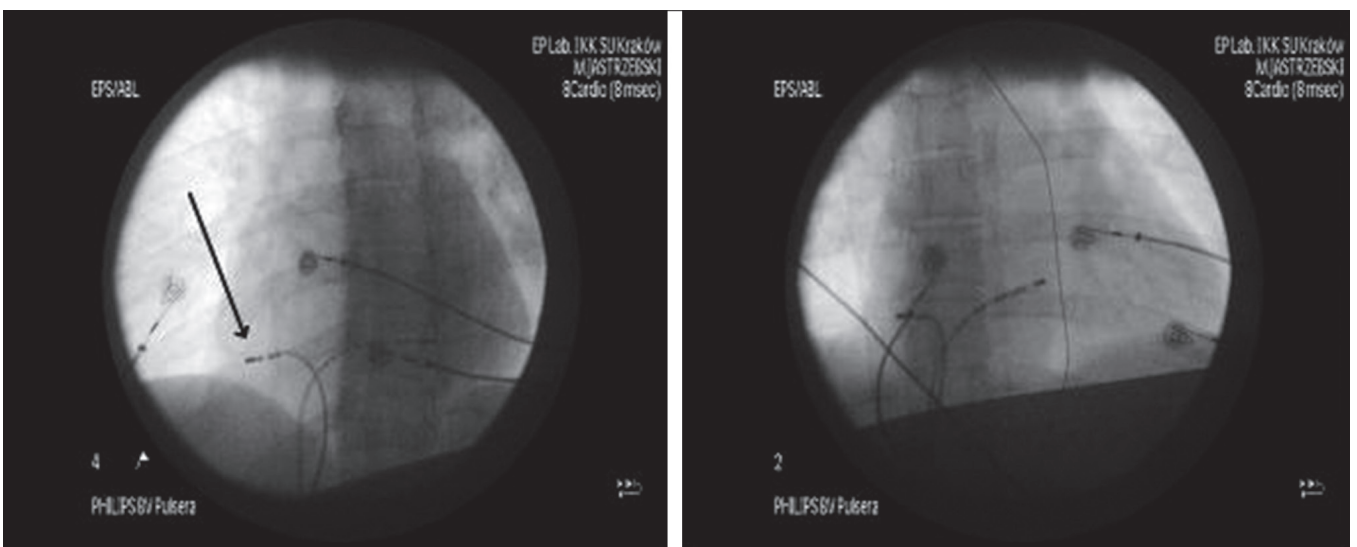


**Figure 1.** 12-lead electrocardiogram. Narrow QRS tachycardia; rate, 185 beats/min. P waves poorly visible overshadowed by the ST-T complex of the preceding evolutions; negative in leads II, III, aVF, and aVR; positive in leads I and aVL. QRS alternans present in precordial leads and ST depressions in leads II, III, and aVF

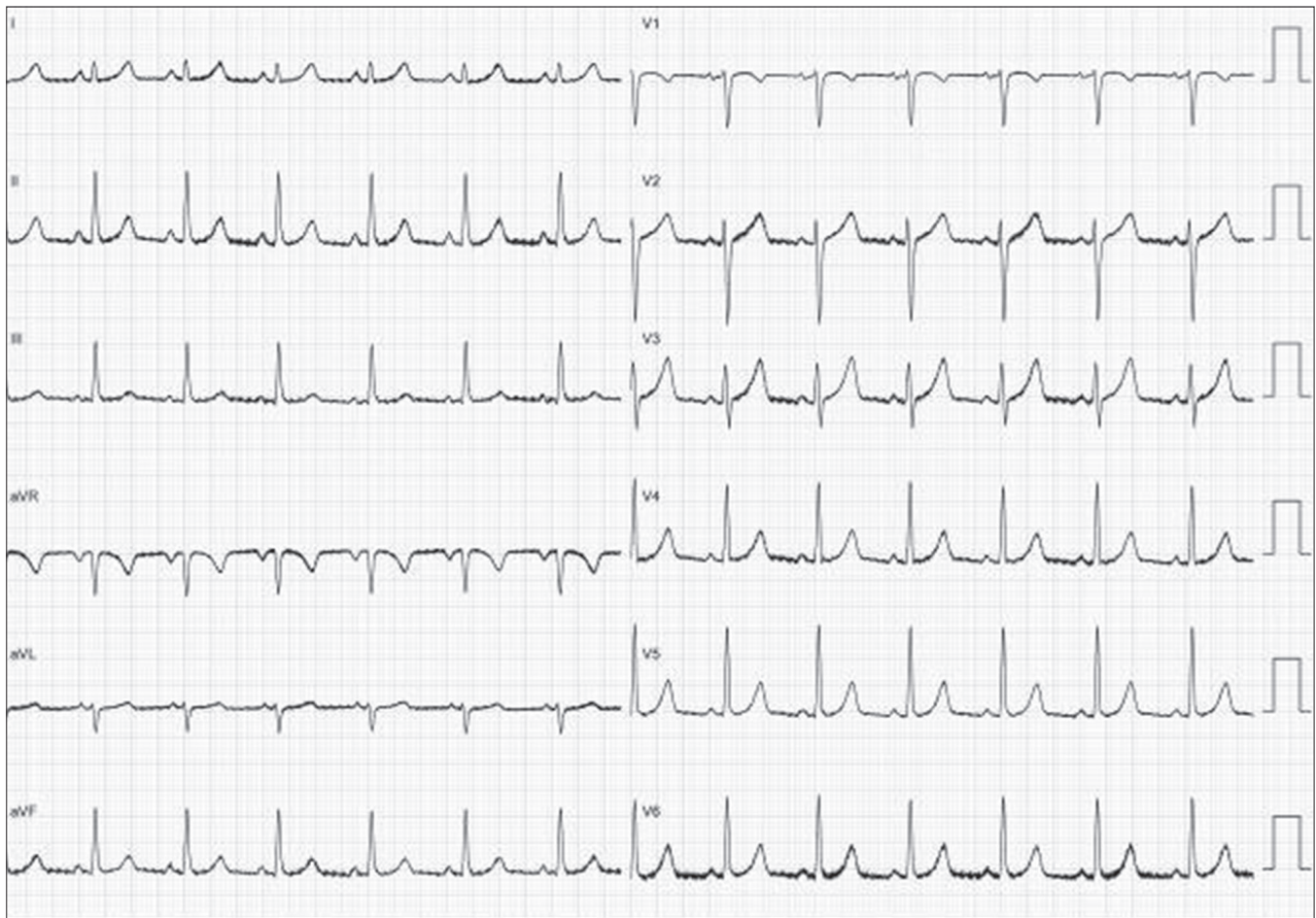


**Figure 2.** Electrophysiological study. Geometric and activation mapping of the right atrium in anteroposterior and lateral views. Red and white colors denote the sites of most early activation during tachycardia

and ablation. [3–5] The procedure was carried out with the use of a computer mapping system (Ensite NavX, St Jude Medical, USA), aiming to minimize standard fluoroscopy use. [6] The electrophysiology study indicated the presence of focal right-atrial tachycardia (Figure 2). In this situation, geometry reconstruction and activation mapping of the right atrium was carried out, visualizing the arrhythmogenic focus in the inferolateral portion of the tricuspid ring (Figure 3). After several radiofrequency (RF) applications, arrhythmia subsided and sinus rhythm was restored (Figure 4). After 30 minutes of observation and attempts to induce arrhythmia by stimulation and isoprenaline infusion, the procedure was terminated. Total fluoroscopy time in the procedure was only 90 seconds; the total radiation exposure was 12mGy. In addition, the abdomen of the pregnant woman was shielded with lead gowns from both sides, thus nearly completely eliminating the fetal radiation exposure. After 4 weeks, the arrhythmia returned (Figure 5), again in the form of incessant tachycardia with a rate of



**Figure 3.** Fluoroscopy image demonstrating the diagnostic catheter position in the coronary sinus and the ablation catheter (black arrow) in the inferolateral area at the tricuspid ring; this was the site of effective radiofrequency ablation. Left oblique (left panel) and right oblique (right panel) views



**Figure 4.** After ablation: 12-lead electrocardiogram demonstrating sinus rhythm; normal trace

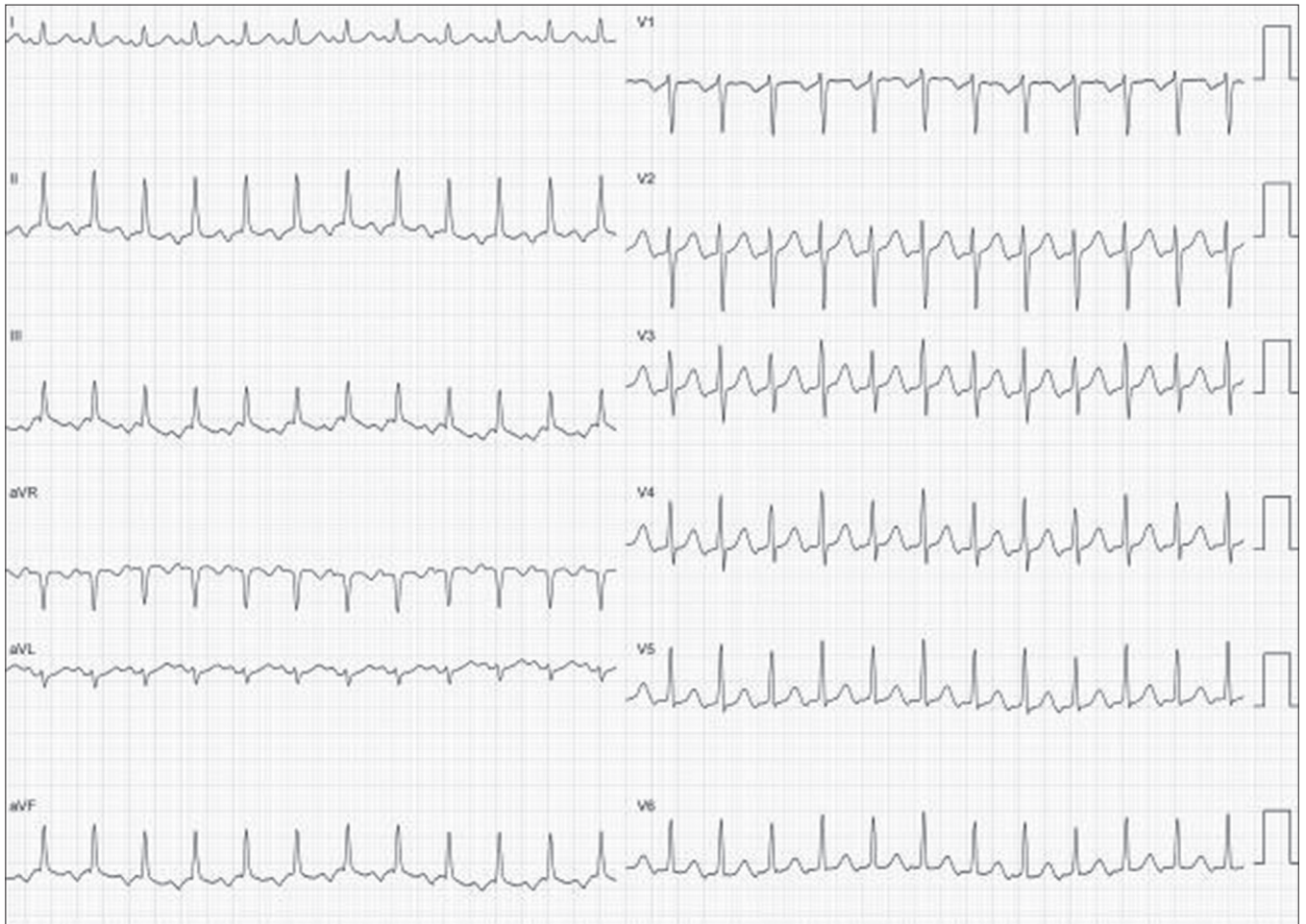
150–180 beats/min, which was found to be resistant to drugs (verapamil IV, metoprolol 3 × 50 mg PO). Recurrence of arrhythmia was thought to result from incomplete ablation of the ectopic focus due to mechanical instability of the ablation catheter during the initial procedure. A repeated ablation was carried out in an identical fashion as the index procedure, again with the use of spatial mapping and only minimal fluoroscopy time (62 s, 10mGy), this time successfully stopping the arrhythmia. The rest of pregnancy and labour were uneventful, without recurrence of tachycardia and a *healthy baby* was delivered.

## Review of literature

The causes for exacerbation of supraventricular arrhythmia in pregnancy have not been well studied; factors such as the effect of autonomic and endocrine systems, emotional status, and hemodynamic changes in pregnancy (increased cardiac output, hypervolemia, atrial distension/enlargement) have been proposed. Among pregnant women with supraventricular tachycardia present before pregnancy, approximately 22% to 44% will experience arrhythmia exacerbation in pregnancy; for 3.9% of the pregnant women, arrhythmia in pregnancy is the first manifestation of the disease. [7–9]

The use of antiarrhythmic drugs in pregnancy raises justified concerns about adverse effects on the fetus. It should be noted that despite general acceptance and a long tradition of the use of some drugs such as  $\beta$ -blockers (with the exception of atenolol), digoxin, verapamil, and, less commonly, flecainide and propafenone, these drugs have not been well studied in this clinical setting and, therefore, are classified as Food and Drug Administration, USA, (FDA) class C, i.e., “Animal reproduction studies have shown an adverse effect on the fetus and there are no adequate and well-controlled studies in humans, but potential benefits may warrant use of the drug in pregnant women despite potential risks”. [6,10] Therefore these drugs, although relatively safe for short-time use, are suboptimal for chronic prophylactic use, especially at higher doses and in the first trimester of pregnancy. Even the safe  $\beta$ -blockers are associated with reduced placental perfusion and preterm birth; therefore, they are hazardous for normal fetal development. Other drugs such as amiodarone have documented adverse effects and are classified as FDA class D.[11] Nevertheless, there are reports of the use of amiodarone in the management of supraventricular tachycardia in pregnancy [9]; we believe that this practice should be considered inappropriate in the age of ablation. In our case, the use of antiarrhythmic drugs was unsuccessful and we decided against amiodarone administration.





**Figure 5.** 12-lead electrocardiogram obtained after arrhythmia recurrence. Typical long RP-interval tachycardia. Negative P waves in leads II, III, and aVF; positive P waves in leads I and aVL – indicating that atrial depolarization starts within the inferior portion of the right atrium. Such image can be observed in nodal reentrant (atypical) tachycardia, atrioventricular reentrant tachycardia (including persistent junctional reciprocating tachycardia), or atrial focal tachycardia

Even less evidence is available regarding the RF ablation treatment of arrhythmia in pregnancy than regarding pharmacotherapy. The available literature only includes a few case reports and small patient series ( $n = 9$ ). [3,4,12–18] Most of the reported cases are reentrant tachycardias with well-defined substrate, often in standard location (the slow pathway of the atrioventricular node or accessory atrioventricular pathway); only a few case reports of pregnant women treated with ablation due to focal atrial tachycardia are available in the literature. [4,12,13,18] Computer-based three-dimensional mapping systems have facilitated the positioning of ablation catheters without the use of fluoroscopy and have become the standard of care. Thanks to this technology, it is possible to completely eliminate or minimize fluoroscopy exposure during ablation. The current guidelines for cardiology care of pregnant women support the RF ablation in cases where drug therapy has been ineffective and in cases of poor hemodynamic tolerance of arrhythmia; the proposed recommendation class is IIb (i.e., treatment to be considered in selected cases). [5] With no doubt, a thorough analysis of indications is mandatory in each case and the procedure should be reserved for experienced operators.

Incessant long RP-interval tachycardia (Figure 5) constitutes a diagnostic challenge. [2] This ECG picture (negative P waves in leads II, III, and aVF directly preceding the QRS complexes) can be a manifestation of persistent junctional reciprocating tachycardia, reentrant nodal tachycardia (atypical forms), or focal atrial tachycardia. In the presence of nondecisive electrocardiogram, the differential diagnosis should be based on electrophysiology maneuvers (response to entrainment and ventricular single-impulse stimulation in the His bundle refraction period). In our case, the atrioventricular dissociation during the entrainment attempts excluded accessory pathway tachycardia as a diagnosis and the activation mapping documenting eccentric atrial activation (earliest in the lateral portion of the tricuspid ring) excluded diagnosis of nodal reentrant tachycardia. The atrial ectopic focus can be located anywhere in the left or right atrium. The P-wave morphology is a certain hint. In the presented case, negative P waves in leads II, III, and aVF indicated a focus location in the inferior portion of the atria, whereas positive P waves in leads I and aVL and negative in lead aVR – a right-atrial focus, respectively; this was fully confirmed by endocavitary activation mapping. There are several areas

in the right atrium where ectopic foci are preferentially located, including the crista terminalis, mitral ring, coronary sinus ostium, His bundle area, and auricula. In our case, the ectopic focus was located in the ring area and therefore falls within this rule.

## Summary

The treatment of arrhythmia in pregnancy with RF ablation is the last resort; however, the available evidence indicates good efficacy and safety of the method. It enables to discontinue the potentially harmful drugs and facilitates further management of pregnancy and delivery. Further development/standardization of the radiation-free methods in the future will possibly make ablation a method of choice in pregnancy, thus rendering chronic antiarrhythmic pharmacological treatment superfluous. To minimize the need for ablation procedures in pregnancy, women with a history of arrhythmia should be referred for an electrophysiology consult before planned pregnancy.

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All the study have been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.