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Transient symptomatic ST-segment elevation following transseptal puncture for pulmonary vein isolation

Przejściowe objawowe uniesienie odcinka ST po nakłuciu transseptalnym podczas zabiegu izolacji żył płucnych

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INTRODUCTION

The transseptal puncture for left atrial (LA) access is a fundamental method of catheter ablation of LA-originating arrhythmias, including atrial fibrillation (AF) (1-3). ST-segment elevation associated with transseptal puncture has been recognized as a rare complication of this procedure (4-12). We describe a case of ST-segment elevation with concomitant stenocardia that appeared soon after the transseptal puncture. Additionally, we review the literature on ST-segment elevation associated with transseptal puncture and discuss the potential underlying mechanisms.

S u m m a r y

Pulmonary vein isolation (PVI) become a standard procedure in atrial fibrillation (AF) treatment, proved to be more effective than antiarrhythmic medication alone. The procedure of PVI requires access to the left atrium, provided by the transseptal puncture (TSP), which carries potential risk of complication. We describe a case of transient, symptomatic ST-segment elevation in 57 year old male following TSP during PVI procedure. The symptoms resolved completely within next 5 minutes, however, concerning the potential risk factors we decided to discontinue the procedure and perform coronary angiography, which revealed no significant changes in the coronary arteries. Successful pulmonary vein isolation procedure was performed the next day without complications. We review the literature and discuss the possible causes of this phenomenon. The data suggest that transient ST-segment elevation is a rare incident associated with transseptal puncture, yet it should not impede continuation of the ablation procedure after thorough evaluation of the patient.

S t r e s z c z e n i e

Zabieg izolacji żył płucnych (PVI) jest standardowym postępowaniem w przypadku nawracającego, lekoopornego migotania przedsionków. Dostęp do miejsca aplikacji uzyskiwany jest poprzez wykonanie punkcji transseptalnej, niosącej ze sobą ryzyko potencjalnych powikłań. Przedstawiamy opis przypadku przejściowego, objawowego uniesienia odcinka ST, które wystąpiło u 57-letniego mężczyzny poddanego zabiegowi izolacji żył płucnych bezpośrednio po wykonaniu nakłucia transseptalnego. Zmiany odcinka ST oraz objawy kliniczne ustąpiły w ciągu kolejnych 5 minut, niemniej z uwagi na obecne czynniki ryzyka zdecydowano o przerwaniu zabiegu oraz wykonaniu pilnej angiografii naczyń wieńcowych, która nie wykazała obecności istotnych zmian mogących odpowiadać za stwierdzone przejściowe zmiany odcinka ST. Zabieg skutecznej izolacji żył płucnych wykonano następnego dnia bez powikłań. Poniżej dokonujemy przeglądu literatury opisującej podobne przypadki oraz omawiamy możliwe przyczyny tego zjawiska. Przedstawione dane sugerują, że wystąpienie przejściowego uniesienia odcinka ST podczas nakłucia transseptalnego jest rzadko obserwowanym powikłaniem, jednak nie powinno być ono przeciwwskazaniem do wykonania zabiegu izolacji żył płucnych po wnikliwej ocenie stanu pacjenta.

CASE REPORT

A 57-year old male with symptomatic (EHRA III) paroxysmal atrial fibrillation was referred to our center for AF ablation. The patient had the history arterial hypertension and smoking (10 cigarettes per day for 30 years). Physical examination, ECG, transthoracic and transesophageal echocardiography revealed no abnormalities. CT scan performed before hospitalization presented normal anatomical configuration of 4 pulmonary veins. The procedure was performed in fasting state, with interrupted oral anticoagulation (rivaroxaban). Fluoroscopy-guided transseptal punc-

ture was performed with 8.5 F transseptal sheath and Brockenborough's needle applying standard technique. Once the sheath was introduced to left atrium, the bolus of heparine (10 000 u) was given to avoid thromboembolic complication. Approximately 2 min after the transseptal puncture the patient reported increasing heart pain, with the drop of blood pressure from 135/75 to 85/50. The 12-lead ECG revealed ST-segment elevation in leads II, III and aVF with "mirror" depression in leads I and aVL (fig. 1). The ECG abnormalities resolved spontaneously in the following 5 minutes and normal blood pressure was restored, however, considering the risk factors of potentially co-existing coronary artery disease we decided to stop the ablation procedure. Coronary angiography performed afterwards revealed no significant abnormalities (fig. 2). Successful AF ablation was performed on the following day with no complications.

DISCUSSION

There are several possible patomechanisms underlying the described phenomenon of ST-segment elevation following the interatrial septum puncture. Acute air or thrombus embolism might be an obvious cause of transient ST-segment elevation with concomitant symp-

oms of angina. However, the strict anticoagulation regimen (to maintain ACT value above 300-350 s) and very careful manipulation with the transseptal sheaths make this mechanism very unlikely, and, in fact, it was ruled out by performed immediately coronary angiogram. In the analyzed literature only one case of thromboembolism and ST-elevation following transseptal puncture was described by Michael et al. (10). In this case coronary angiography revealed subtotal occlusion of 1st diagonal branch, and the ST elevation in leads I and aVL persisted for more than 1 hour. Interestingly, there is a predominant pattern of ST-segment elevation in leads II, III and aVL, present in 14 of 17 (tab. 1) described cases (82.3%), which usually correspond with the injury to the myocardium that is supplied by the right coronary artery (RCA) and sometimes by the left circumflex artery (LCx). If the air embolism was the mechanism, the incidence of myocardial injury should be similar in the right or left coronary artery system. This uneven distribution of ECG symptoms makes this patomechanism very unlikely. Moreover, the predominant inferior lead location of the ST-segment injury pattern may suggest that manipulation on the interatrial septum evokes selective right cardiac parasympathetic nerve stimulation to the inferior or posterior myocardial region that is supplied by the RCA and/or LCx.

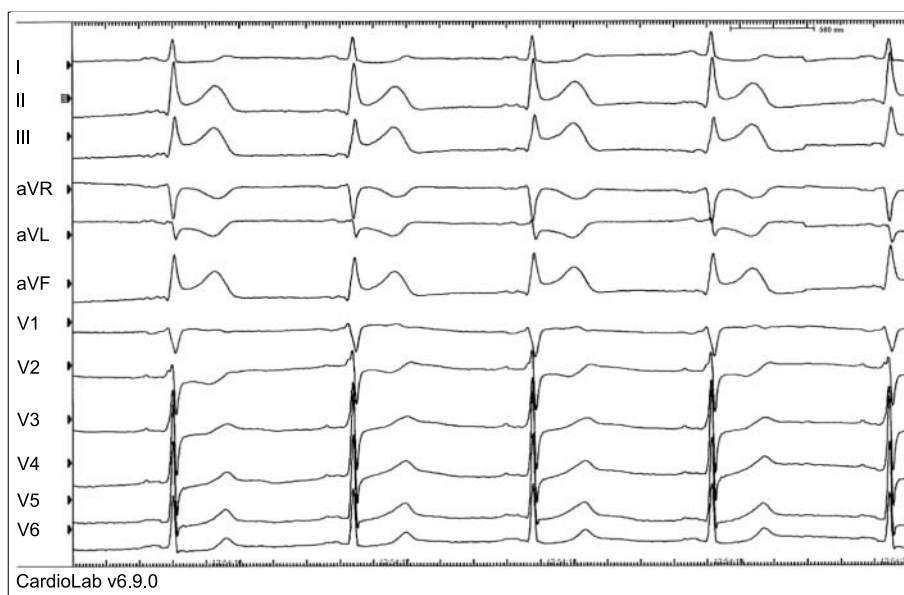


Fig. 1. ECG recorded 1 min after transseptal puncture, presenting ST-segment elevation in leads II, III and aVF.



Fig. 2. Coronary angiography showing the LAO 30° projection of the right coronary artery (left panel) and RAO 30° projection of the left coronary artery (right panel).

Table 1. Review of case reports of ST-segment elevation following transseptal puncture.

Authors	No	Age	Gender	ST-elevation in leads	Duration of episode (min)	Coronary angiography	Concomitant symptoms	Possible underlying mechanism
Simon and Gill (4)	1	50	M	II, III, aVF	several minutes	–	–	vasospasm
	2	56	M	I, aVL, V3-V6	several minutes	slow flow	–	vasospasm
	3	57	M	II, III, aVF, V1-V5	several minutes	–	–	vasospasm
Arita et al. (5)	4	40	M	II, III, aVF	several minutes	–	bradycardia	hypoperfusion
	5	54	M	II, III, aVF	several minutes	–	bradycardia	hypoperfusion
Schwab et al. (6)	6	42	F	II, III, aVF	5-10 min	–	complete AV block	vasospasm
	7	45	M	II, III, aVF	5-10 min	–	–	vasospasm
Tada et al. (7)	8	63	M	II, aVF, V5-V6	several minutes	–	–	vasospasm
Risius et al. (8)	9	44	M	II, III, aVF	5	–	sinus arrest	vasospasm
	10	59	M	II, III, aVF, V2-V4	22	–	–	vasospasm
	11	62	F	II, III, aVF	4	–	sinus bradycardia	vasospasm
	12	65	M	II, III, aVF	4	–	–	vasospasm
Efremidis et al. (9)	13	65	M	II, III, aVF, V1	30	–	complete AV block	vasospasm
Michael et al. (10)	14	59	M	I, aVL	several hours	subtotal occlusion of 1 st diag. branch	–	thromboembolism
Le et al. (11)	15	71	M	II, III, aVF	4	–	sinus bradycardia	vasospasm
Ishigaki et al. (12)	16	47	M	II, III, aVF, V5-V6	6	–	ventricular fibrillation	vasospasm
Described case	17	57	M	II, III, aVF	5	normal	hypotension	vasospasm

This hypothesis can be additionally supported by concomitant symptoms of parasympathetic stimulation, such as hypotension, sinus bradycardia, sinus arrest or complete A-V block, present in 8 of 17 (47%) of described cases. Arita et al. (5) suggested that the pathomechanism of ST-segment elevation in inferior leads might be right coronary artery hypoperfusion in the course of Bezold-Jarisch-like reflex, provoked by stimulation of the ganglia in the intraatrial septum during transseptal puncture. Considering the results of immediately performed coronary angiography in the described cases, most authors (4, 6, 7-9, 11, 12) propose the vasospasm as the underlying mechanism of this rare phenomenon.

CONCLUSIONS

The reported phenomenon of transient, symptomatic ST-elevation following the transseptal puncture is a rare complication of AF ablation procedure. There are several cases described so far, and the most likely mechanism suggested in the literature is the spasm of the coronary artery, however air embolism and thromboembolism cannot be ruled out completely and should always be considered in the differential diagnosis. Discussed literature, as well as our case, suggest that the transient ST-segment elevation should not impede continuation of the ablation procedure after thorough evaluation of the patient.

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