

## STEMI after replacement of a CRT-D electrode

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## SÚHRN

**Úvod:** Koronárna embolizácia je raritnou príčinou akútneho infarktu myokardu. V práci popisujeme prípad koronárnej embolizácie, ktorá spôsobila extenzívny anterolaterálny infarkt myokardu s eleváciami segmentu ST (STEMI) u pacienta podstupujúceho elektívnu výmenu elektródy srdcovej resynchronizačnej liečby/defibrilátora (CRT-D).

**Popis prípadu:** 72-ročný pacient s fibriláciou predsiení bol prijatý za účelom realizácie elektívnej repozície/výmeny elektródy CRT-D. Pred výkonom bola pozastavená antikoagulačná liečba. Po výkone u pacienta vznikla náhla bolesť na hrudníku, dýchavica a zhoršenie vitálnych funkcií. Tieto príznaky sprevádzal nález rozsiahlych ischemických zmien na EKG v anterolaterálnej oblasti a korešpondujúcich lokálnych porúch kinetiky. Urgentná koronarografia odhalila embolický uzáver distálnej časti ramus interventricularis anterior ľavej koronárnej artérie.

**Záver:** Prezentujeme prípad raritnej, dobre dokumentovanej koronárnej embolizácie komplikujúcej výmenu elektródy CRT-D.

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## ABSTRACT

**Introduction:** Coronary artery embolism is a rare cause of acute myocardial infarction. We present a case of coronary embolism causing extensive anterolateral ST elevation myocardial infarction (STEMI) after an elective replacement of a cardiac resynchronization therapy/defibrillator (CRT-D) electrode.

**Case presentation:** A 72-year-old male with atrial fibrillation was admitted for an elective reposition/replacement of CRT-D electrode. Anticoagulation was stopped before the procedure. After the procedure the patient developed sudden chest pain, dyspnea, and worsening of vital signs. These were accompanied by extensive ischemic anterolateral ECG changes and corresponding regional wall motion abnormalities. The urgent coronary angiography showed embolic distal occlusion of left anterior descending coronary artery.

**Conclusion:** We present a rare, well-documented case report of coronary embolism complicating CRT-D electrode replacement.

## Keywords:

Atrial fibrillation

Coronary embolism

CRT-D

STEMI

## Introduction

Myocardial infarction (MI) with non-obstructive atherosclerosis (MINOCA) represents a small proportion of diagnosed patients with STEMI. Approximately 3–4% of MINOCA are caused by coronary embolism (CE) which is mostly associated with atrial fibrillation (AF). The obstructing emboli can be lysed before the diagnostic angiography and the resultant coronary finding could show

no obstruction.<sup>1</sup> Earlier studies have shown that AF is the most common cause of CE.<sup>2</sup> We present a well-documented case report of a patient developing sudden chest pain, dyspnea, and a worsening of vital signs due to extensive anterolateral ST segment myocardial infarction after replacement of cardiac resynchronization therapy/defibrillator (CRT-D) electrode. In this patient an obstruction of the stem of left coronary artery (LCA) by CE was indirectly hypothesized as the most probable cause of STEMI.

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## Case presentation

72-year-old non-smoking male patient with a complex cardiovascular history including coronary microvascular disease with recurrent angina episodes and reduction of ejection fraction (35%) with the resulting chronic heart failure, permanent AF with slow conduction to ventricles and previously implanted CRT-D was hospitalized for elective reposition of a dysfunctional right ventricular electrode. The patient received a long-term anticoagulation for AF with apixaban dosed 5 mg b.i.d, which was discontinued 24 hours before the procedure (without heparin bridging). The repositioning of the dysfunc-

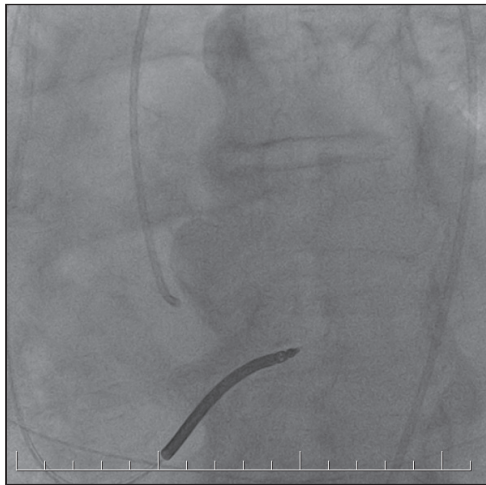


Fig. 1 – Final position of replaced electrode (image obtained during urgent coronary angiography, right and caudal angulation view).

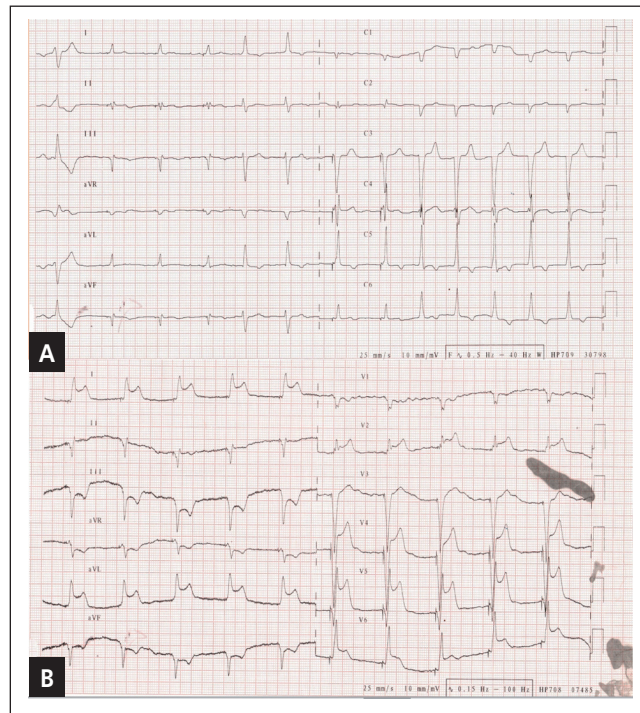


Fig. 2 – Diagnostic electrocardiogram showing (A) status of the patient at admission and (B) extensive anterolateral STEMI pattern during chest pain.

nal electrode was unsuccessful; therefore a replacement procedure was performed. The procedure itself was uncomplicated. Figure 1 shows the final position of replaced electrode. Eight hours after the replacement the patient developed sudden chest pain, dyspnea and worsening of vital functions – hypotension and low blood oxygen saturation. To keep the patient stable, vasopressors and oxygen supplementation were required. Auxiliary examinations showed an extensive anterolateral STEMI (Fig. 2) on ECG. Bedside echocardiography showed progressive left ventricular dysfunction with regional wall motion abnormalities of anterolateral wall. There was neither a relevant pericardial effusion nor a right ventricular enlargement or dysfunction. His high-sensitivity cardiac troponin I levels were elevated – 183.5 ng/mL (baseline value was 15 ng/mL). Based on these findings we suspected an acute obstruction of the left main chain of LCA, antithrombotic therapy with aspirin, ticagrelor and weight-adjusted heparin was administrated and an urgent coronary angiography was performed within the first hour after symptoms onset. During the procedure the patient's vitals and ECG finding improved. A distal obstruction of the left anterior descending (LAD) coronary artery was found (Fig. 3), left main disease was excluded. The revascularization was unsuccessful; there was no flow after the wire placement and balloon dilation (Fig. 4). After the coro-

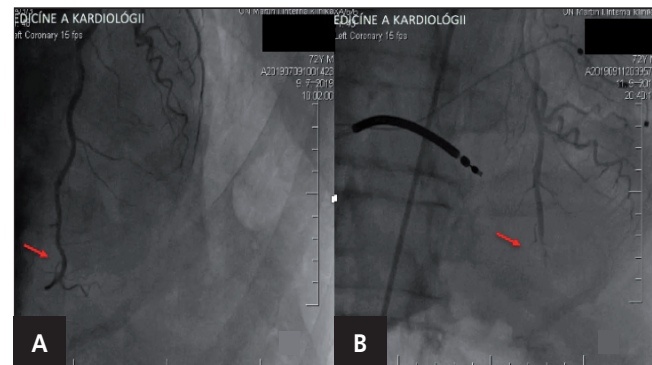


Fig. 3 – Coronarography showing (A) LAD without obstruction from a coronarography before the index hospitalization and (B) LAD with distal obstruction during urgent coronarography.

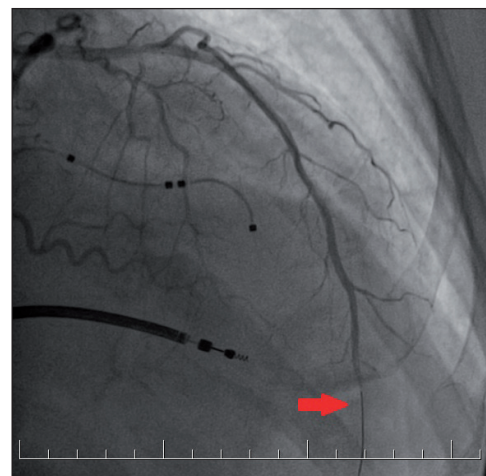


Fig. 4 – Last scene from coronarography showing persistent distal LAD no-flow after coronary guide-wire placement and balloon dilation.

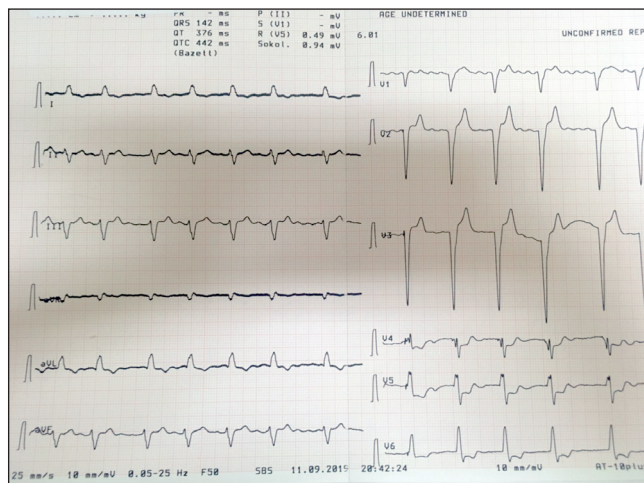


Fig. 5 – Final electrocardiogram prior to hospital discharge.

nary angiography the patient's condition improved and his vitals stabilized. The control levels of cardiac troponin I measured next day morning after coronary angiography were immeasurably high ( $> 26\,501.0$  ng/mL). The CRT-D function was checked and no signs of electrode dysfunction were found. Figure 5 shows last ECG prior the patient's discharge from hospital. His global left ventricular systolic function remained decreased. No other embolic events occurred after the re-starting of chronic anticoagulation.

## Discussion

Looking more closely at relevant scientific literature, there are several cases of MI in a paced rhythm, or in biventricular paced rhythm, but no other case report of coronary artery embolism related to CRT-D electrode replacement which highlights the uniqueness of this case.<sup>3</sup> In our case only indirect signs of CE were found so we can only hypothesize a thrombotic embolism in the left main chain at the time of symptoms onset. The ECG changes and echocardiography support this theory strongly. Now, it is possible that antithrombotic therapy (including weight-adjusted heparin injection) could lead to thrombus resolution, leading to a fact that only small residual peripheral coronary embolism was found during coronary angiography, resulting in our final diagnosis of MINOCA. The risk of CE in patients with AF who discontinue anticoagulation is well known.<sup>1</sup> A previous study showed that AF was the cause of CE leading to MI in 24% of the cases.<sup>4</sup> Our case opens a question of whether there is a need for anticoagulation discontinuation in patients with AF and high risk of stroke or systemic embolism undergoing CRT-D implantation, as this procedure is a minor surgery, with a relatively low bleeding risk,<sup>5</sup> and might be probably safely performed in those who have therapeutic anticoagulation with vitamin K antagonists (VKA).<sup>6</sup> According to current European Heart Rhythm Association (EHRA) recommendations on optimal implantable cardioverter-defibrillator (ICD) implantation technique,<sup>7</sup> the anticoagulation strategy in patients undergoing ICD (as well as CRT-D) implan-

tation requires individual considerations, and should be based on operator preference and/or thromboembolic risk assessment. In the patients with non-valvular AF and a lower risk for embolic events (CHA<sub>2</sub>DS<sub>2</sub>-VASC score  $< 3$ ), perioperative interruption of anticoagulation could be an option, as performing the procedure on anticoagulation increases the risk of pocket hematoma, and pocket hematoma increases the risk of infection. In all other patients, the procedure should be performed using uninterrupted oral anticoagulation (interruption of oral anticoagulation with heparin bridging is not recommended). In fact, in the BRUISE-CONTROL 2 (Bridge or Continue Coumadin for Device Surgery Randomized Controlled Trial) study,<sup>8</sup> patients on a direct oral anticoagulant with a CHA<sub>2</sub>DS<sub>2</sub>-VASC score of  $\geq 2$  had no difference in hematoma with or without interruption of anticoagulation. In our case, apixaban was discontinued and heparin bridging therapy was not established according to up-to-date relevant guidelines. Nevertheless, the data about the harmful effect of heparin bridging therapy are derived only from studies on patients using VKA.<sup>9</sup> Therefore more research on this matter should be advocated.

The ECG during the acute period was diagnostic for an extensive anterolateral STEMI even in the setting of paced rhythm and also one of the modified Sgarbossa criteria was fulfilled<sup>10</sup> which corresponds with a similar case report published recently.<sup>11</sup> On the contrary, another study has shown that the ECG findings do not always need to fulfill the criteria in case of a MI and recommends diagnosis performed by comparison with older ECGs, as was also done in our case.<sup>12</sup> Accordingly, there is a question about specific ECG criteria for MI in the setting of biventricular paced rhythm. This question needs to be answered in future studies.

## Conclusion

We present a rare, well-documented case of coronary artery embolism in a specific patient with CRT-D during withdrawal of apixaban anticoagulation due to replacement of the CRT-D electrode. We emphasize the need for further research in periprocedural management of direct oral anticoagulants in patients undergoing CRT-D (re)implantation procedures.

## Conflict of interest

Jakub Benko, Christer Böhler, Michael Audne Thu, Tomáš Bolek, Peter Galajda, Matej Samoř and Marián Mokáň declare that they have no conflicts of interest that might be relevant to the contents of this manuscript.

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## Ethical statement and informed consent

This research was done according to ethical standards. The patient agreed to participate in the research and signed informed consent for research participation.



### Data availability statement

All data are available at corresponding author upon reasonable request.

### Authors' contributions

J.B., C.B., and M.A.T. interpreted the data and drafted the manuscript, T.B., P.G., M.S., and M.M. revised the manuscript critically. All authors read and approved the final version of the manuscript.

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