

## CASE REPORT / ПРИКАЗ БОЛЕСНИКА

# Rare complication of primary percutaneous coronary intervention – perforation of the axillary artery

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## SUMMARY

**Introduction** Several arteries can be used as the approach for coronarography or primary percutaneous coronary intervention (pPCI). In patients with acute ST-elevation myocardial infarction (STEMI), when performing pPCI according to the current recommendations, approach artery should be the radial artery. Complications of the transradial approach, such as spasm, asymptomatic occlusion, perforation, nerve damage, arteriovenous fistula, compartment syndrome, and radial artery pseudoaneurysm are described. However, only a few cases describe rare complications of transradial approach such as the perforation of the axillary artery.

**Case outline** The patient was admitted due to the STEMI. Urgent coronarography found 90% stenosis of the proximal segment of the left anterior descending branch of the left coronary artery (LAD). During the pPCI, a metal stent was implanted in the proximal segment of the LAD. One hour after the intervention, a hematoma in the right arm was registered with the hemodynamic collapse. Angiography of the left axillary artery showed an extravasation of the contrast. A graft stent was implanted in the area of extravasation. After the intervention, regression of the hematoma was registered. Ten years after the primary intervention, CT coronarography and angiography were performed. The stent in the LAD, as well as in the axillary artery, was without any stenosis.

**Conclusion** Advanced life expectancy, hypertension, atherosclerosis, anatomical variations, and blood vessel tortuosity contribute to the perforation of the axillary artery, a very rare complication of the radial approach. It is usually treated conservatively. In the case of hemodynamic instability, a stent implantation can be considered, as it was in our case.

**Keywords:** complication; perforation axillary artery; primary percutaneous coronary intervention; graft stent implantation

## INTRODUCTION

Several arteries can be used as the approach for coronarography or primary percutaneous coronary intervention (pPCI). Approach arteries on the arm can be axillary, brachial, ulnar, and the radial arteries, while on the leg it is the femoral artery. Today, the radial artery and femoral artery are most commonly used as the vascular approach in the interventional cardiology. Due to the low risk of acute bleeding, vascular complications, short hospital stay, as well as the greater comfort of the patient, radial artery is now a very popular vascular approach. In patients with the acute ST-elevation myocardial infarction (STEMI), when performing pPCI according to the current recommendations of the European Society of Cardiology, approach artery should be the radial artery if the procedure is carried out by an experienced operator (Class I, the level of evidence A) [1]. This recommendation of the European Society of Cardiology is the result of several studies (RIVAL, RIFLE-STEACS, and MATRICS), which showed the advantages of the transradial approach [2, 3, 4]. Complications of the transradial approach, such as spasm, asymp-

tomatic occlusion, perforation, nerve damage, arteriovenous fistula, compartment syndrome, and radial artery pseudoaneurysm are often described in the literature. However, only a few case reports describe the rare potentially fatal complications of the transradial approach such as the perforation of the axillary artery.

## CASE REPORT

A 65-year-old woman was admitted as an emergency case to the Clinic of Cardiology of the Institute of Cardiovascular Diseases of Vojvodina because of the STEMI. Dual anti-aggregation therapy (aspirin, clopidogrel) was administered with the analgesic therapy. Urgent coronarography registered a 90% stenosis of the proximal segment of the left anterior descending branch of the left coronary artery (LAD). Coronarography was performed with the transradial approach. As a diagnostic catheter, Tiger 5F (Terumo Corporation, Tokyo, Japan) was used with the 0.035 inches and 180 cm SIMPLEX J type hydrophilic guidewire (St. Jude Medical, Saint Paul, MN, USA). During the pPCI, one metal stent of 18 × 3.5 mm (Tsunami Gold,

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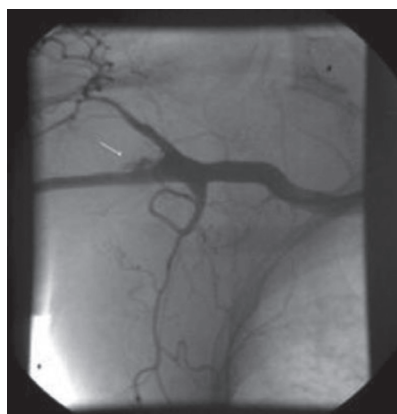
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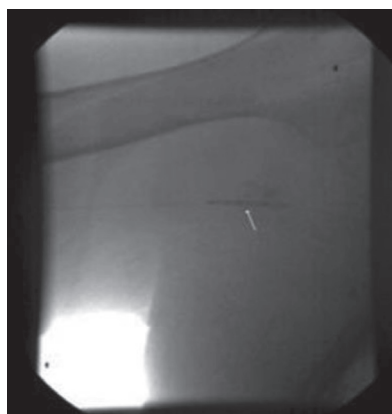
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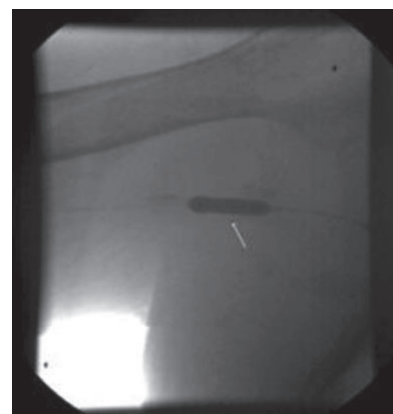
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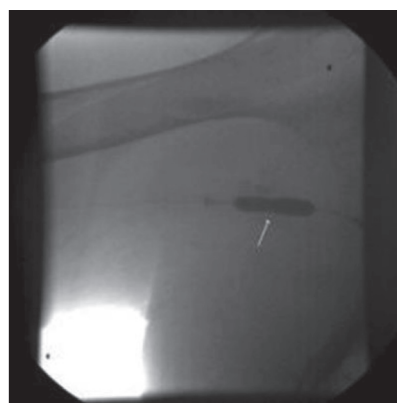
**Figure 1.** Angiogram of the left axillary artery with extra station of contrast



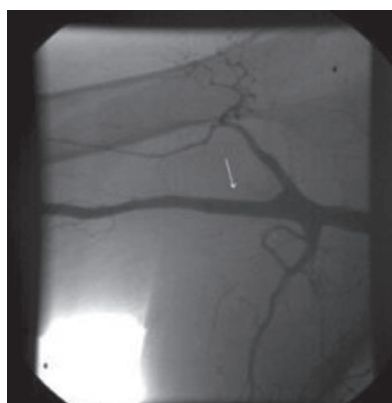
**Figure 2.** The angiogram shows that the graft stent is positioned distally



**Figure 3.** The angiogram shows expansion of the distal part of the graft stent



**Figure 4.** The angiogram shows expansion of the proximal part of the graft stent



**Figure 5.** Angiography of the left axillary artery after the implantation of the graft stent was without extravasation of contrast

Terumo Corporation, Tokyo, Japan) was implanted into the proximal segment of the LAD.

Due to the presence of thrombotic masses, inhibitors of the GpIIb/IIIa receptors were administered according to the protocol. About one hour after the intervention, the patient felt pain in the area of the right arm. A growing hematoma of the right arm was registered. The pulses of the radial and cubital artery are filiform. Shortly after that, the hemodynamic collapse developed and the patient became tachycardic and hypotensive. In the laboratory findings, a fall in the parameters of the red blood cells was registered (decrease in hemoglobin by 29%). Crystalloid, colloid, and deplasmated erythrocytes were administered. Inhibitors of the GP IIb/IIIa receptors were stopped. Doppler ultrasonography of the right arm was performed. From the beginning of the branchial artery, enlarged lumen with the suspected flapping intima was registered. The finding of other arm arteries was without any morphological and hemodynamic changes. The interventional cardiologist and cardiovascular surgeon decided to perform the angiography of the right arm arteries.

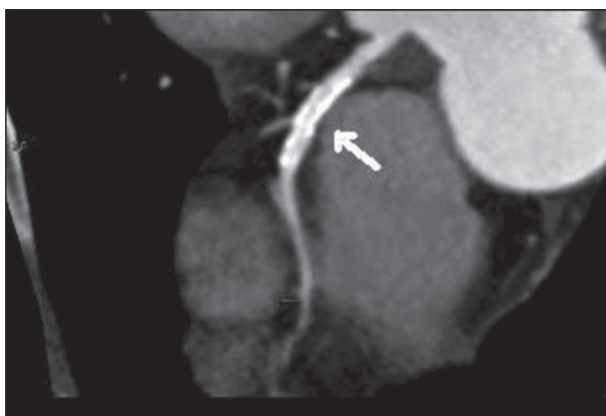
The diagnostic catheter JR 6F 4.0 (CORDIS, Baar, Switzerland) was used for the angiography, which was guided by the 0.035 inches and 180 cm long guidewire (SIMPLEX J type, St. Jude Medical). At the level of axillary artery, the extravasation of the contrast beyond the lumen of the

blood vessel was registered (Figure 1). The catheter AL 1 7F (Launcher, Medtronic, Dublin, Ireland) and the 0.014-inch guidewire (Balance Middle Weight Universal, Abbott Japan Co. Ltd., Tokyo, Japan) were placed. The graft stent of 2.75 × 26 mm (Jostent Coronary Stent Graft, Abbott) was implanted in the area of extravasation of contrast. A stent manually put on a balloon catheter was used. Since there was no balloon of adequate length, a short balloon Ultra-soft SV 5.0 × 20 mm (Boston Scientific, Marlborough, MA, USA) was used. The graft stent was positioned from its distal part (Figure 2). After the first dilata-

tion and the expansion of the distal part of the graft stent (Figure 3), the balloon was withdrawn and the proximal stent expansion was performed (Figure 4). Angiography of the left axillary artery after the implantation of the graft stent was without extravasation of the contrast medium (Figure 5). After the intervention, the regression of the hematoma in the area of the right arm was registered, and the patient was hemodynamically and rhythmically stable, with no subjective discomfort. Control Doppler ultrasonography of the right arm did not register morphological and hemodynamic changes on the upper blood vessels of the right arm. The neurocirculatory finding of the right arm was normal. Ten years after the primary intervention, CT coronarography and angiography were performed. There was stenosis neither in the region of the implanted stents in the LAD (Figure 6) nor in the axillary artery (Figure 7).

## DISCUSSION

Transradial approach is associated with a lower incidence of acute bleeding and vascular complications compared with the transfemoral approach. In the RIVAL study, it has been shown that radial approach reduces the incidence of acute bleeding in the acute coronary syndrome, as well as the mortality of STEMI patients [2]. It has also been shown



**Figure 6.** Computerized tomography coronarography performed 10 years after the primary intervention shows no stenosis in the region of the implanted stent in the left coronary artery

that the benefit of the radial approach compared with the femoral approach depends on the experience of the operator in the radial approach. The RIFLE-STEACS study has shown that the radial approach reduces the incidence of acute bleeding in the acute coronary syndrome, as well as the mortality of STEMI patients [3]. In the MATRIX study, the patients were randomized for the transradial or transfemoral approach [4]. Radial access is associated with minor bleeding, vascular complications, and the need for transfusion. Patients treated with the transradial approach had a significant reduction of mortality. Also, the disadvantages of radial access, such as the risk of spasm, difficult manipulation with a catheter in the tortoise brachiocephalic tree, movement of catheter during respiration of the patient which can affect the positioning of the stent, longer exposure to X-ray radiation, and the use of catheters of maximal 7F, should not be forgotten.

In the literature, only a few cases of iatrogenic dissection of the axillary artery are described. Advanced life expectancy, hypertension, atherosclerosis, anatomical variations and blood vessel tortuosity can contribute to this rare complication of the radial approach. Forced manipulation guidewire and catheter can also contribute to the perforation of the axillary artery [5]. However, in our case, the perforation most likely occurred during the manipulation of the guidewire. In most cases, perforation occurs when angiography of the mammary artery is performed by a femoral approach. Continuous technological developments including new dedicated guidewires enabling safer and easier interventions [6]. Left radial or brachial approach is the method of choice for angiography of the mammary artery to reduce the risk of subclavian artery damage [7].

The available literature does not describe the algorithm for diagnosis and treatment of subclavian artery dissection. The most common initial diagnosis was set by ultrasonography, and then confirmed by CT angiography. In our case, the patient was hemodynamically unstable and because of that there was no time for CT angiography. It was decided to perform urgent angiography of the right arm arteries.

Perforation of the artery represents a rare complication of the transradial approach. A study that included 10,344



**Figure 7.** Computerized tomography coronarography performed 10 years after the primary intervention shows no stenosis in the region of the implanted stents in the axillary artery

patients who underwent coronarography through the radial artery, in the period from February 2010 to December 2014, found a perforation of the artery in eight patients (0.08%) [8]. Six patients with registered perforation of the radial artery were treated with the mechanical compression. The treatment of the axillary artery perforation is most often conservative – exclusion of anticoagulant therapy and mechanical compression [9]. Emergency surgery was described in only one case of the brachial artery perforation leading to compartment syndrome [8]. In one case, the right internal mammary artery perforation resulting in huge breast hematoma was treated endovascularly with the graft stent implantation [8, 10].

The literature describes only individual cases where subclavian artery dissection is resolved by placing a stent as in our case. Traditionally, the therapeutic option is a prolonged balloon insufflation. In the case of failure with the prolonged balloon insufflation, surgical correction is indicated.

Some cases of iatrogenic dissection of the subclavian artery were successfully treated with a prolonged balloon insufflation [11]. This technique represents an attractive healthcare treatment due to its availability, simplicity, and the lower cost compared to other techniques [11]. Schmitter et al. [12] described stent implantation by an antegrade approach into the spiral dissection area of the subclavian artery. Angiography one day after the intervention registered an extension of the pseudoaneurysm in the middle area of a previously implanted stent, and the stent graft was implanted into this area. Angiography performed two months later showed normal flow through the stent and stent graft. Spies and Fergusson [7] describe the treatment of subclavian artery dissection by placing two overlapping stents using the retrograde approach. Namely, they consider that a retrograde approach is less likely to pass through a false lumen of the blood vessel causing the mechanical lumen extension and dissection extension.

**Informed consent statement:** Consent was obtained from the patients for publication of this report and any accompanying images.

**Conflict of interest:** None declared.

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## Ретка компликација примарне перкутане коронарне интервенције – перфорација аксиларне артерије

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### САЖЕТАК

**Увод** Већи број артерија се може користити за приступна места за коронарографију, односно примарну перкутану коронарну интервенцију. Код болесника са акутним инфарктом миокарда са *ST* елевацијом (*STEMI*) приликом извођења примарне перкутане коронарне интервенције, према актуелним препорукама, приступна артерија би требало да буде радијална артерија. Описују се компликације трансрадијалног приступа, као што су спазам, асимптоматска оклузија, перфорација, оштећење нерва, артериовенска фистула, компартмент-синдром и формирање псеудоанеуризме радијалне артерије. Међутим, само као појединачни случајеви се описују ретке компликације трансрадијалног приступа, као што је перфорација аксиларне артерије.

**Приказ болесника** Болесница је примљена због *STEMI*. Ургентном коронарографијом је регистровано 90% сужење проксималног дела предње силазне гране леве коронарне артерије. У истом акту је урађена примарна перкутана коронарна интервенција са имплантацијом металног стента у проксимални део леве коронарне артерије. После интер-

венције долази до развоја хематома десне надлактице и хемодинамског колапса. Индикувана је ангиографија артерија десне руке, којом се у нивоу исходишта аксиларне артерије региструје изливање контраста. Имплантиран је стент-графт у подручје изливања контраста. После интервенције региструје се регресија хематома. Десет година после примоинтервенције урађене су *CT* коронарографија и ангиографија, којима се не региструју сужења у пределу имплантираног стента у левој коронарној артерији, као и у аксиларној артерији.

**Закључак** Узнапредовало животно доба, хипертензија, атеросклероза, анатомске варијације и тортуозитет крвног суда доприносе перфорацији аксиларне артерије, врло реткој компликацији радијалног приступа. Најчешће се третира конзервативно, али у случају хемодинамске нестабилности болесника и пласирање стента долази у обзир, као у нашем случају.

**Кључне речи:** компликација; перфорација аксиларне артерије; примарна перкутана коронарна интервенција; имплантација стент-графта