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Case Report / Приказ болесника

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

Ретка компликација примарне перкутане коронарне интервенције –
перфорација артерије *axillaris*

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

Ретка компликација примарне перкутане коронарне интервенције – перфорација артерије *axillaris*

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 the rare complications of transradial approach such as perforation of the axillary artery.

Case outline The patient was admitted because of 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 LAD. One hour after the intervention, hematoma in the right upper arm was registered with the hemodynamic collapse. Angiography of the left axillary artery shows an extravasation of contrast. A graft stent was implanted in the area of extravasation. After the intervention, the regression of 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, there can be considered a stent implantation as in our case.

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

САЖЕТАК

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

Приказ болесника Болесница је примљена због STEMI. Ургентном коронарографијом је регистровано 90% сужење проксималног сегмента предње силазне гране леве коронарне артерије (LAD). У истом акту је урађена pPCI са имплантацијом металног стента у проксимални сегмент LAD. Након интервенције долази до развоја хематома десне надлактице и хемодинамског колапса. Индикувана је ангиографија артерија десне руке којом се у нивоу исходишта артерије *axillaris* региструје екстравазација контраста. Имплантиран је графт стент у подручје екстравазације контраста. Након интервенције региструје се регресија хематома. Десет година након примоинтервенције урађене су CT коронарографија и ангиографија којим се не региструју сужења у пределу имплантираног стента у LAD, као и у аксиларној артерији.

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

Кључне речи: компликација; перфорација артерије *axillaris*; примарна перкутана коронарна интервенција; имплантација графт стента

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 (ESC), 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) [2,3,4], which showed the advantages of the transradial approach. Complications of the transradial approach, such as spasm, asymptomatic 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 at the Clinic of Cardiology of the Institute of Cardiovascular Diseases of Vojvodina because of the STEMI. Dual anti-platelet 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 transradial approach. As a diagnostic catheter, Tiger 5F (Terumo, Japan) was used with the 0.035 inches and 180 cm SIMPLEX J type hydrophilic guidewire (St. Jude Medical, USA). During the pPCI, one metal stent of 18x3.5 mm (Tsunami Gold, Terumo, Japan) was implanted into the proximal segment of 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 upper arm. Growing hematoma of the right upper 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 was 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 right arm arteries.

The diagnostic catheter JR 6F 4.0 (CORDIS, 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, USA). 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, USA) and the 0.014-inch guidewire (Balance Middle Weight Universal, ABBOTT, Japan) were placed. The graft stent of 2.75x26mm (Jostent Coronary Stent Graft, ABBOTT, Japan) was implanted in the area of extravasation of contrast. A stent that was manually put on a balloon catheter was used. Since there was no balloon of adequate length, a short balloon Ultra-soft SV 5.0x20mm (Boston Scientific, USA) was used. The graft stent was positioned from its distal part (Figure 2). After the first dilatation 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 an extravasation of contrast (Figure 5). After the intervention, the regression of hematoma in the area of the right upper 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-hand arm. The neurocirculatory finding of the right arm was normal. Ten years after the primary intervention, CT coronarography and angiography were performed. There was no stenosis in the region of the implanted stents in the LAD (Figure 6) as well as 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 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 need for transfusion. Patients treated with the transradial approach had a significant reduction of mortality. Also, should not be forgotten 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.

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 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 with 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 performed urgent angiography of the right arm arteries.

Perforation of the artery represents a rare complication of transradial approach. A study that included 10,344 patients who underwent coronarography through the radial artery, in the period from February 2010 to December 2014, found a perforation of the artery in 8 patients (0.08%) [8]. Six patients with registered perforation of the radial artery were treated with the mechanical compression. Treatment of axillary artery perforation most often is conservative [9]. Exclusion of anticoagulant therapy and mechanical compression. Emergency surgery was described only in one case of brachial artery perforation leading to compartment syndrome [8]. In one case, right internal mammary artery perforation resulting in huge breast hematoma was treated endovascularly with the graft stent implantation [8,10].

The literature describe only individual cases where subclavian artery dissection is resolve 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. described stent implantation by an antegrade approach into the area spiral dissection subclavian artery. Angiography on the day after 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 [12]. Angiography performed two months after showed normal flow through the stent and stent graft. Spies and Fergusson describe the treatment of subclavian artery dissection placing two stents overlapping by retrograde approach [7]. 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.

Conflict of interest: None declared.

REFERENCES

1. Ibanez B, James S, Agewall S, Antunes JM, Bucciarelli-Ducci C, Bueno H, et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC). *Eur Heart J*. 2018; 39(2):119–77. DOI: 10.1093/eurheartj/ehx393 PMID:28886621
2. Jolly SS, Yusuf S, Cairns JJ, Niemelä K, Xavier D, Widimsky P, et al. RIVAL trial group: Radial versus femoral access for coronary angiography and intervention in patients with acute coronary syndromes (RIVAL): a randomised, parallel group, multicentre trial. *Lancet*. 2011;377(9775):1409–20. doi:10.1016/S0140-6736(11)60404-2 PMID 21470671
3. Romagnoli E, Biondi-Zoccai G, Sciahbasi A, Politi L, Rigattieri S, Pendenza G, et al. Radial Versus Femoral Randomized Investigation in ST-Segment Elevation Acute Coronary Syndrome: The RIFLE-STEACS (Radial Versus Femoral Randomized Investigation in ST-Elevation Acute Coronary Syndrome) Study. *J Am Coll Cardiol*. 2012;60(24):2481–9. PMID:22858390 DOI:10.1016/j.jacc.2012.06.017
4. Valgimigli M, Calabro P, Cortese B, Frigoli E, Garducci S, Rubartelli P, et al. For the MATRIX Investigators. Scientific foundation and possible implications for practice of the Minimizing Adverse Haemorrhagic Events by Transradial Access Site and Systemic Implementation of Angiox (MATRIX) trial. *J Cardiovasc Transl Res*. 2014;7(1):101–11. PMID: 24395497 DOI:10.1007/s12265-013-9537-1
5. López-Palop R, Carrillo P, Frutos A, Cordero A. Conservative management of Iatrogenic subclavian artery dissection during a percutaneous coronary interventional procedure. *Rev Esp Cardiol*. 2011;64(9):833–4. PMID: 21489675 DOI:10.1016/j.recesp.2010.11.017
6. Beleslin B. New developments, treatment options and possible complication in complex coronary artery disease, structural and congenital heart disease, and heart failure. *Srp Arh Celok Lek*. 2017;145(11-12):562–63. DOI:<https://doi.org/10.2298/SARH170717151B>
7. Spies C, Fergusson D. Treatment of an iatrogenic subclavian artery dissection. *Catheter Cardiovasc Interv*. 2010;76(1):35–8. DOI: <https://doi.org/10.1002/ccd.22432> PMID:20578187
8. Tatli E, Buturak A, Cakar A, Vatan BM, Degirmencioglu A, Agac TM, et al. Unusual vascular complications associated with transradial coronary procedures among 10,324 patients: case based experience and treatment options. *J Interv Cardiol*. 2015; 28(3):305–12. DOI: <https://doi.org/10.1111/joic.12206> PMID:25989895
9. Frohwein S, Ververis JJ, Marshall JJ. Subclavian artery dissection during diagnostic cardiac catheterization: the role of conservative management. *Cathet Cardiovasc Diagn*. 1995;34(4):313–7. DOI: <https://doi.org/10.1002/ccd.1810340208> PMID:7621540
10. Tatli E, Gunduz Y, Buturak A. Hematoma of the breast: A rare complication of transradial angiography and its treatment with hand made stent graft. *J Invasive Cardiol*. 2014; 26(2):24–6. PMID:24486674
11. Murphy TP, Dorfman GS, Segall M, Carney WI. Iatrogenic arterial dissection: treatment by percutaneous transluminal angioplasty. *Cardiovasc Intervent Radiol*. 1991;14(5):302–6. DOI 10.1007/BF02578455 PMID:1834338
12. Schmitter SP, Marx M, Bernstein R, Wack J, Semba CP, Dake MD. Angioplasty-induced subclavian artery dissection in a patient with internal mammary artery graft: Treatment with endovascular stent and stent-graft. *Am J Roentgenol*. 1995; 165:449–51. DOI [doi/pdf/10.2214/ajr.165.2.7618575](https://doi.org/10.2214/ajr.165.2.7618575) PMID:761857

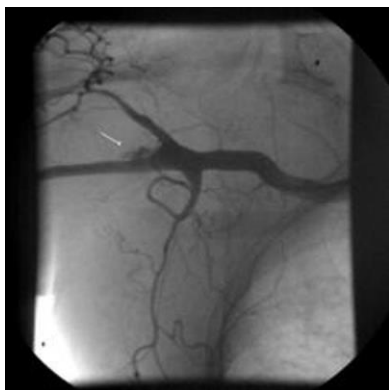


Figure 1. Angiogram of the left axillary artery with extra station of contrast

Paper accepted

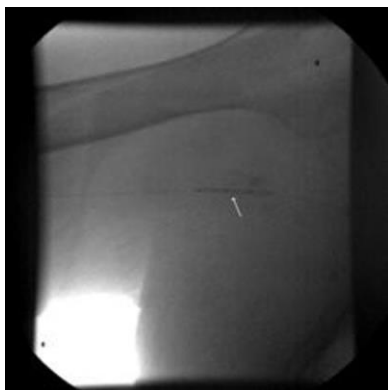


Figure 2. The angiogram shows that the graft stent is positioned from its distal part

Paper accepted

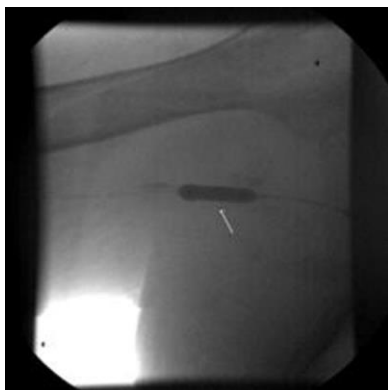


Figure 3. The angiogram shows expansion of the distal part of the graft stent

Paper accepted

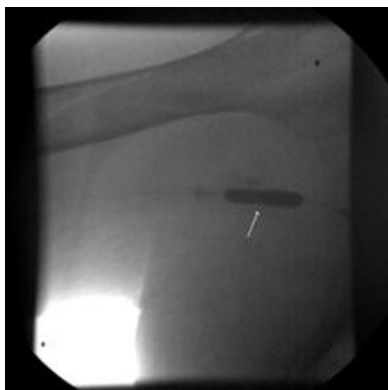


Figure 4. The angiogram shows expansion of the proximal part of the graft stent

Paper accepted

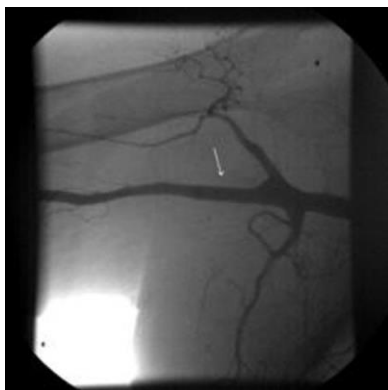


Figure 5. Angiography of the left axillary artery after the implantation of the graft stent was without extravasation of contrast

Paper accepted



Figure 6. CT coronary angiography, 10 years after the primary intervention shows no stenosis in the region of the implanted stent in the LAD

Paper accepted

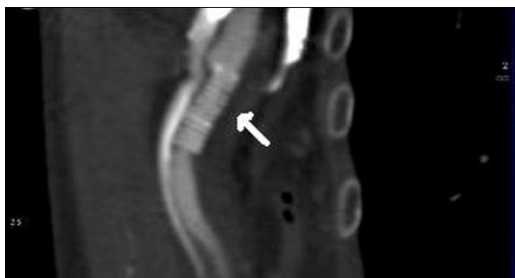


Figure 7. CT angiography, 10 years after the primary intervention, shows no stenosis in the region of the implanted stents in the axillary artery

Paper accepted