



# The incidence of vascular complications after coronary angiography: evaluation of results and risk factors

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## ABSTRACT

**Introduction:** The aim of this study was to present the incidence of the vascular complications that had to be surgically treated during the two-year period of transfemoral cardiac catheterization procedure and to identify the risk factors associated with the complications.

**Methods:** A retrospective two-year study of post-catheterization complications with the six-month post-operative follow-up and analysis of risk factors was done. Patients with cardiovascular diseases who underwent therapeutic or diagnostic coronary angiography in the period of 2012-2013 were included in the study. A total of 1320 patients were subjected to catheterization for coronary angiography, of which 24 had vascular complications that had to be surgically treated. Indications for operative treatment included rapid growth of pseudoaneurysm, hemorrhage, large hematoma, hemodynamic instability, failure of the targeted compression therapy.

**Results:** Twenty-four patients experienced some kind of post-operative complication. Infection and dehiscence of surgical wound were the two most common complications. There were no fatalities. The average length of a hospitalization was 4 days. The important risk factors are gender (women more than man), obesity, concomitant use of anticoagulation therapy and antiplatelet therapy after catheterization.

**Conclusion:** Insufficient length of the compression of the punctured place and increased risks of a pseudoaneurysm formation, such as female gender, obesity, and use of a combined anticoagulant therapy are the main causes of these complications. Late vascular complications are not uncommon.

**Keywords:** pseudoaneurysm; cardiac catheterization; postoperative complications, risk factors

## INTRODUCTION

Pseudoaneurysm represents a constant rupture of all layers of the arterial wall wherein arterial blood

is constantly pouring out into the environment by creating a pseudo bag which is a result of a defense mechanism of the surrounding tissue. Pseudoaneurysm usually occur after catheterization, at the site of anastomosis native arteries and synthetic graft, after trauma, and very rarely, after an infection (e.g. fungal PSA) (1). The resulting punctured lesions of femoral artery after intervention do not close, but rather, extravasation of blood into the surrounding

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perivascular space occurs, resulting in hematoma and pseudoaneurysm wall.

Post-catheterizational pseudoaneurism is one of the most common vascular complications after this diagnostic examination. Its incidence on diagnostic catheterization ranges from 0.05% to 2%, but after coronary or peripheral interventions, this percentage is growing from 2% up to 6% (2). The pseudoaneurysm formed on such way often undergoes thrombosis, spontaneously within a few weeks, however, those larger than 1.8 cm in diameter or pseudoaneurysm occurring in patients treated with anticoagulation therapy usually has to be surgically treated (3). The smaller caliber of arteries which is specific for the female gender, as well as difficult catheterization and insufficient post-procedural compression of the arteries in obese patients are the main cause of frequent complication (4).

The aim of this study was to present the incidence of the vascular complications that had to be surgically treated during the two-year period of transfemoral cardiac catheterization procedure and to identify the risk factors associated with the complications.

## METHODS

A retrospective study included patients with vascular complications of pseudoaneurysm after transfemoral coronary angiography performed at the Clinical Center of Sarajevo, Institute for heart diseases, during the period from 2012 to 2013. All the patients underwent retrograde percutaneous transfemoral catheterization of heart for diagnostic or therapeutic purposes. The study included only patients with post-catheterizational complications of femoral artery. For each patient age, sex, BMI, type of catheterization, duration of catheterization, types of complications (thrombosis, infection, hemorrhage, pseudoaneurysm, etc.), length of compression, time period when complications occurred, the length of stay in hospital and clinical outcome was documented.

After catheterization digital compression was performed during 15 minutes. Size of the sheath was 5F for diagnostic catheterization, and 6F or 7F for therapeutic catheterization. All patients were hospitalized for at least one day after the procedure. In all patients a clinical examination of the local status

was done every hour until complete removal of local compression (bags with 750 grams of sand), and the next day the examination was carried out every three hours. Diagnosis was usually conducted easily, and it was a combination of a physical examination and ultrasound findings.

The ultrasound diagnostic criteria were: the presence of cavity on B-mode of a ultrasound, pulsating expansion and contraction of area and two-way flow of blood to the neck of the pseudoaneurysm in systole and diastole. CT angiography was indicated in patients with acute ischemia of the lower limbs.

Indications for surgical treatment of vascular complications were: rapidly increasing of the pseudoaneurysm, very large hematoma, a drop in blood counts, acute ischemia of a leg caused by local blood flow interruption due to dissection or due to compressive action of the pseudoaneurysm on the femoral artery, neuropathy caused by local pressure on the femoral nerve, threatened viability of the soft tissue (skin necrosis), the failure of digital compression.

All patients, who were included in the study, had the control of the local status after 3 months, and all surgically treated patients had control after 3 and 6 months of intervention.

## Statistical analysis

Statistical analysis was performed by using SPSS 14.0 (Chicago, IL, USA). The level of significance was set to  $P < 0.05$ .

## RESULTS

Of the 24 patients treated, 19 were women and 5 were men. The median age was 72 years (range 42-82 years). Femoral pseudoaneurysm after cardiac catheterization, which was diagnosed on ultrasound, was observed in 59.8% of cases. CT angiography was performed in 11.4%. Physical findings were significant in 13.2% of the patients.

It was observed that the complications were more associated with the patients with hypertension and high BMI, but the differences were not statistically significant (Table 1).

Pseudoaneurysms of femoral artery were present in 60% of cases. Hematoma was found in 26%, arterial dissection was found in 8% of cases, bleeding

**TABLE 1.** Risk factors associated with complications

Variable	Control group (n=1296)	With complications (n=24)	P value
Age	71.3 ± 9.9	70.11 ± 2.8	0.378
Hypertension	712 (54.0%)	19 (77.3%)	0.102
BMI (kg/m <sup>2</sup> )	24.85 ± 3.12	28.69 ± 3.33	0.692

BMI, body mass index

and foreign body in 3% of cases. Postoperative complications were found in 8 cases: dehiscence of a wound in 3 cases, or 39%, deep vein thrombosis in one case or 11%, and infection in 50% of cases (Table 2).

**TABLE 2.** Cumulative results of detected vascular complications

Patient	Age and gender	Symptom	Time of onset*	Diagnostic	Diagnosis
1	58 M	pulsating mass	1	US	PSA
2	61 F	pulsating mass	2	US	PSA
3	67 M	Hematoma	1	None	Hematoma
4	71 M	pulsating mass	2	US	PSA
5	59 F	bleeding	1	CTA	bleeding
6	60 F	pulsating mass	3	US	PSA
7	65 F	pulsating mass	2	US	PSA
8	70 F	Leg ischemia	1	CTA	Artery dissection
9	78 F	pulsating mass	3	US	PSA
10	54 M	Hematoma	4	None	Hematoma
11	62 F	pulsating mass	2	US	PSA
12	84 F	pulsating mass	12	US	PSA
13	59 M	Hematoma	4	None	Hematoma
14	60 M	pulsating mass	2	US	PSA
15	68 F	pulsating mass	2	US	PSA
16	67 F	Hematoma	5	None	Hematoma
17	52 M	Leg ischemia	1	CTA	Artery dissection
18	58 F	pulsating mass	3	US	PSA
19	84 F	Hematoma	3	None	Hematoma
20	59 M	pulsating mass	2	US	PSA
21	72 M	Leg ischemia	1	CTA	Foreign body
22	68 F	Hematoma	4	None	Hematoma
23	48 F	pulsating mass	3	US	PSA
24	47 F	pulsating mass	62	US	PSA

\*Days after catheterization procedure; US, ultrasound; CTA, Computed tomography angiography; PSA, Pseudoaneurism; M, male; F, female

The patients with vascular complications and subsequent surgery were in 64.2% subjected to diagnostic and 35.8% to therapeutic procedure. Distribution of complications during the year was interesting as most of them occurred in the summer months, and less in the spring and autumn, while in winter almost no cases of complication were found.

**DISCUSSION**

Large studies that have dealt with the incidence of post-catheterizational vascular complications have come up with results that complications occur in the range of 0.3% to 1.0%. In our study, such incidence was 1%. Kresowik et al, in the study of 144 patients with control ultrasound after the therapeutic catheterization, came to the incidence of vascular complications of 9% of patients (5).

Similar results have been reported by Messina et al. in a four-year study in which there were 106 surgically treated patient for vascular post-catheterizational complication, observed that prolonged local hemorrhage leads to the occurrence of a large number of pseudoaneurysm (6). In our study, the size of sheath lead was between 6 and 7 F, but we could not prove any connection between the size of lead and occurrence of complications. Although post-catheterizational complications are previously treated only via surgery, now in modern practice more conservative treatment are administered by an application of a thrombin or a target compression under ultrasound (7, 8).

Pseudoaneurism is the most common complication in our study. Clinical diagnosis of the pseudoaneurysms of the femoral artery in most cases was obvious and easy to diagnose. However, for all patients we have also performed the Duplex ultrasound, which is the method of choice for the assessment of its size, the thrombotic material inside the bag, and for clearly specifying the size and speed of communication with the

artery (9). In our study, the use of targeted compression at pseudoaneurysm under the control of the ultrasound was effective in all cases with smaller neck pseudoaneurysm (up to 3 mm), but those with larger necks and rapid flow through it, there was no effect. Similar results were received by Fellmeth and Eisenberg in their studies conducted in over 1500 subjects in which they are all treated with targeted ultrasound compression of the femoral artery bleeding. (10). From our experience, and the obtained results, we have achieved good results with extended digital compression with minimal lowering of blood pressure and strict bed rest which is consistent with research completed by Dangasa and colleagues (11). The incidence of deep vein thrombosis in our study was 0.5% which is in line with research conducted by Davis and others (12). However, the incidence of asymptomatic venous thrombosis is unknown and must be determined in a future, of a targeted prospective study.

Acute ischemia is in all cases treated surgically. There are estimated two different types of acute ischemia: in the two cases there was an acute thrombosis of the femoral artery at the site of catheterization due to dissection of atheromatous plaque. In one case, the reconstruction of arteries was performed with resection of the profunda femoris artery, and another patient underwent femoropopliteal reconstruction. In both cases the Dacron prosthesis was used. The third case was a dissection of iliac artery with Terumo guide where iliac-femoral reconstruction was used. Similar complications mentions Schneinert in his retrospective study (13). Fortunately, we had no loss of limbs in surgical patients, although amputations after these complications are not that rare (14). Mechanisms of complications after catheterization depend on the proper technique of catheterization, especially in atherosclerotic changed arteries, on the manner and duration of compression, controlling hypertension, and concomitant use of various anti-thrombotic medications.

However, our results show that complications can occur after a long period, even after several months (62 days) (15). We have also come to the results that indicate that complications are more common in women, especially those who are obese, with a high BMI which was confirmed by Applegate et al. (16).

## CONCLUSION

Vascular complications after cardiac catheterization are rare, but if undetected they can become compromising for limbs and life-threatening. Early clinical detection and timely consultation with a vascular surgeon are of paramount importance.

## COMPETING INTERESTS

The authors declare no conflict of interest.

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