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Iatrogenic femoral pseudoaneurysms - a simple solution of inconvenient problem?

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ABSTRACT

Purpose: A femoral artery pseudoaneurysm - is the most common complication associated with invasive coronary interventions. The aim of the study was to analyze the effectiveness of various methods used for femoral pseudoaneurysm treatment and to assess how routine use of radial approach leads to reduction of these site complications.

Methods: The study comprised 1854 consecutive patients who were hospitalized in years 2005-2008 and underwent coronary angiography (with or without angioplasty) via femoral artery access. Since 2009 routine radial approach has been introduced for both coronary angiography and angioplasty. In patients with symptoms suggesting entry site complications Doppler ultrasound was performed.

Results: Femoral access site complications requiring additional procedures were observed in 63 patients (3.4%): in 56 femoral pseudoaneurysms (88.8%) and in 7 arteriovenous fistulas (11.1%) were diagnosed (all appeared after coronary angioplasty). The patients were treated in following ways: standard compression with an elastic bandage prolonged to 12 hours - in 14 cases (25%), ultrasound guided compression - in 13 patients (23.2%), finger compression followed by standard compression with an elastic bandage prolonged to 12 hours or ice compress - in 10 patients (17.8%), surgical treatment - in 3 patients (5.3%). Only 2 patients required thrombin injection (3.6%). Since the time routine radial approach was introduced extreme reduction in the rate of local complications was registered.

Conclusion: Although iatrogenic femoral pseudoaneurysms following invasive percutaneous coronary interventions are still important complications, most of them can be treated conservatively. It seems that radial access completely eliminates the risk of this complication.

Key words: percutaneous coronary interventions, iatrogenic pseudoaneurysms

INTRODUCTION

The number of performed coronary angiographies or percutaneous coronary interventions (PCIs) is continuously increasing, which results in raising number of entry site complications associated with femoral artery cannulation. They delay discharge and require additional procedures.

Complications of femoral artery catheterization include: pseudoaneurysms (observed after 0.2-0.5% of coronary angiographies and after 1-8% of PCIs), arteriovenous fistulas, bleeding (in some cases associated with massive blood loss), thrombosis of cannulated artery and distal embolisation. The most frequent of the complications is the femoral pseudoaneurysm that is caused by inappropriate compression at entry site.

The risk factors for iatrogenic pseudoaneurysms are: large-diameter catheter (>6F), advanced age, arterial wall calcification, increased body mass index, female sex, anticoagulants, puncturing during the same procedure both femoral artery and vein, inappropriate compression at entry site [1].

Natural history of pseudoaneurysms depends on their diameter. Aneurysms up to 3 cm large thrombose spontaneously

within 4 weeks in 86-100% of cases. Arteriovenous fistulas usually close within 8 weeks [1]. Threatening complications of pseudoaneurysms are: rupture, limb ischemia, vein, artery or nerve compression, infection or cutaneous ischaemia over an aneurysm.

Purpose

The aim of the study was to evaluate efficiency of various non-invasive treatment methods of iatrogenic femoral pseudoaneurysms. Next, we tried to provide an appropriate treatment algorithm for these entry site complications and to assess how routine use of radial approach leads to reduction in number of pseudoaneurysms.

METHODS

The study comprised consecutive patients who were hospitalized at Department of Cardiology in years 2005-2008 and underwent invasive procedures (both for diagnostics and treatment) via femoral artery access. Total number of performed invasive procedures equaled 1854.

PCIs were performed mainly in the course of acute coronary syndromes (93%, n=1724). There were only few patients with stable coronary artery disease and scheduled interventions (it is a result of our Department`s specificity). During coronary angiography 6F catheter was used. In years 2005-2008 PCIs were routinely performed via femoral artery. Before the procedure, all the patients received standard antiplatelet treatment (acetylsalicylic acid and clopidogrel). During PCI unfractionated heparin (UFH) was given in dose of 100 U/kg. In patients, who received it before the procedure due to clinical indications, ACT was controlled and additional UFH was added, if needed. Platelet glycoprotein IIb/IIIa receptor antagonists were used according to operator`s decision. After the procedure and vascular sheath removal, as a rule, a 15-minute manual compression was applied followed by 12-hours compression with elastic bandage and immobilization in a supine position. Vascular closure devices (Angio-Seal, StarClose SE) were used seldom- only in non-compliant patients or the ones with essential obesity.

At our Department, since year 2009 almost 100% of catheterization procedures are routinely performed via radial approach. An exception is made for patients with negative Allen test (performed before planned procedures), in case of radial artery spasm not responding to intra-arterial agents (verapamil, nitroglycerin) or when large-diameter catheters are required for PCI. In such patients femoral access is used. As a rule, radial artery puncture and vascular sheath insertion are followed by injection of verapamil (2.5 mg diluted in 2 ml of 0.9% NaCl) and UFH (5000 U). After the procedure, a 10-minute manual compression is applied and, afterwards, radial artery compression device for 6 hours.

Table 1. **Patients characteristics.**

	(n=63)
Age (years)	50.5 ± 8.7
Smoking (n)	41 (65.1%)
BMI (kg/m2)	27.9 ± 4.0
Systolic BP (mmHg)	144.0 ± 19.8
Diastolic BP (mmHg)	92.6 ± 13.4
Total cholesterol (mmol/l)	4.6 ± 0.85
LDL – cholesterol (mmol/l)	2.84 ± 0.77
HDL – cholesterol (mmol/l)	0.99 ± 0.24
Triglycerides (mmol/l)	1.53 ± 0.97
Impaired glucose tolerance (n) *	19 (30.1%)
Diabetes (n)*	11 (17.5%)
Creatinine (μmol/l)	1.05 ± 0.16
Glomerular filtration rate (ml/min)	101.02 ± 24.8
Fibrynogen (g/l)	4.2 ± 0,99
Platelet count (G/l)	225.6 ± 88.1
Ejection fraction (%)	45.9 ± 7.9

Femoral artery ultrasound was performed only in patients with signs suggesting pseudoaneurysm. Philips Sonos 5500 system with a 3-11 MHz linear transducer was used. The indications for ultrasound were: haematoma, tenderness, thickening or continuous murmur at entry site. Blood flow was assessed with colour-coded Doppler sonography in 2D images.

In the case of recognized femoral artery pseudoaneurysms, therapeutic strategy was tailored based on both clinics (symptomatology) and ultrasound findings (pseudoaneurysm`s size, diameter and length of pseudoaneurysm`s neck, number of chambers, coexisting haematoma located subcutaneously or in surrounding tissues). The first choice methods were ultrasound guided compression or finger compression (4x10 minutes) with short breaks to evaluate the effect. Injured arteries were compressed in a way that did not reduce blood flow in distal parts of vessel. In case of incomplete closure of pseudoaneurysm sack, prolonged compression with elastic bandage or ice compress were used. Control ultrasound was performed after 24 hours. Then, as a last resort method, thrombin injection of pseudoaneurysm was applied, according to technique described by Kang *et al*. [2] or Liau *et al*. [3]. After obtaining informed written consent and local skin decontamination, the patients were administered bovine thrombin into aneurysm sack (800 IU in 4 ml of a solvent). The pseudoaneurysm neck was compressed with an ultrasound transducer. Then, with guidance of ultrasound, the cavity was slowly injected with thrombin. In both cases clotting and complete obliteration were obtained rapidly (within up to twenty seconds). After the procedure common femoral artery and superficial femoral artery were controlled with Doppler for blood velocity and spectrum of flow. The patients were recommended to remain supine for 4-6 hours after the