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Incidence, diagnosis and treatment of femoral pseudoaneurysm

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Abstract

Background: *The aim of the study was to assess the risk of iatrogenic damage to the femoral artery after cardiac catheterisation and to analyse the efficacy of therapeutic procedures applied in the treatment of femoral pseudoaneurysm.*

Methods: *4916 cases of coronary angiography and 3263 cases of PTCA performed using femoral artery access were analysed. Ultrasound examination confirmed the presence of pseudoaneurysm in 60 patients. In all cases mechanical compression was applied at the site of arterial puncture, resulting in successful obliteration of the pseudoaneurysm in 19 cases. The remaining 25 patients were referred by a vascular surgeon to either surgical procedure or thrombin injection directly into the cavity of the pseudoaneurysm.*

Results: *Femoral artery pseudoaneurysm complicated 0.6% of coronary angiographies and 0.9% of angioplasty procedures. No correlation was observed between the frequency of this complication and sex, age or the intensity of the antiplatelet and antithrombotic treatment. The high degree of efficacy of the non-invasive approach resulted in little need for surgical intervention, which was applicable only in the case of one patient.*

Conclusions: *The compression of a pseudoaneurysm with an elastic band combined with ultrasound-guided compression is efficient in 60% of cases. Thrombin injection into the lumen of the pseudoaneurysm is a safe procedure and appears to be the most effective method of treatment.* (Folia Cardiol. 2006; 13: 419–422)

Key words: femoral artery iatrogenic pseudoaneurysm, ultrasound-guided artery compression, ultrasound-guided thrombin injection

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Introduction

The dynamic development of invasive cardiology and the growing number of diagnostic and therapeutic interventions performed is associated with the occurrence of complications, mainly local, as a consequence of peripheral artery cannulation. Apart from ecchymoses of various sizes, a pseudoaneurysm (PA) represents an important local complication resulting from arterial cannulation. According to the literature, the incidence of pseudoaneurysms varies from 0.1% to 5.5%. There are several factors predisposing to PA formation: female gender, the co-existence of arterial hypertension, diabetes mellitus or peripheral arteriosclerosis, the use of vascular sheaths of greater size and intensive antiplatelet or antithrombotic treatment [1–4]. The universally accepted and widely implemented therapeutic method in cases of PA is compression with the use of a compressive band [3, 5]. Even

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better results are yielded by a modification of this method, consisting in compression with the use of an ultrasonographic probe under direct vision. Investigators estimate that the efficacy of the first method ranges from 32% to 56% and that the efficacy of the second strategy ranges from 61% to 81%, depending on the duration of compression [4–9]. Another very effective method of PA treatment is the injection of thrombin solution to the aneurysmal cavity. Larger PAs with diameters exceeding 8 cm are commonly associated with severe clinical symptoms and require surgical intervention [5].

The aims of this paper are to describe the iatrogenic damage to the femoral artery associated with coronary angiography and angioplasty interventions and to analyse the efficacy of different therapeutic procedures used for the treatment of a PA.

Methods

In the period from 1st September 2002 to 30th September 2004 at the 3rd Department of Cardiology 4975 coronary angiography interventions and 3267 coronary angioplasty procedures were conducted, of which 4916 and 3263 cases respectively were performed via femoral artery access. All patients received 75–150 mg of ASA prior to intervention. Patients in whom a percutaneous transluminal coronary angioplasty (PTCA) procedure was performed received additionally a second antiplatelet agent, ticlopidine or clopidogrel, and a single dose of 100 IU/kg body weight unfractionated heparin. In 401 patients a IIb/IIIa receptor blocking agent was administered during PTCA procedure (12.3%). Coronary angiography and PTCA procedures were performed with the use of 6 F vascular sheaths, larger sheaths of 7 F and 8 F only being used occasionally for PTCA.

In patients with symptoms suggesting the formation of a PA after the invasive procedure an ultrasonographic examination of the cannulated vessel was performed. The most frequent indications for ultrasonography were: pain at the site of cannulation, haematoma and the presence of hard round pathological resistance and/or murmur at the site of cannulation.

For vascular imaging we used the ultrasound devices Hewlett-Packard Sonos 2500 and Philips--Agilent 5500 with broad band linear probes 5–11 MHz. Two-dimensional images with colour blood flow imaging and Doppler frequency spectra at the puncture site and distal to the puncture site were assessed for all the patients.

When a PA was diagnosed by ultrasound examination, mechanical compression of this region was applied by means of an elastic bandage. Compression was maintained for 8 hours. If this procedure became ineffective, ultrasonographically guided PA compression was performed the following day. Compression of the femoral artery ensured the closure of the PA cavity without limitation of the blood flow distally through the artery. Compression was maintained for 10–20 minutes, at an average of 12 minutes. Mechanical compression with an elastic bandage was applied for the following 6 hours. Control ultrasonography was performed after 24 hours. If the procedures implemented proved ineffective, the patient was qualified by a vascular surgeon either to surgical intervention or thrombin administration to PA cavity.

Results

On the basis of ultrasonographic examination of the femoral arteries in patients after coronary angiography or PTCA procedure the presence of a PA was confirmed in 60 patients.

The study group consisted of 31 women and 29 men with a mean age of 69.3 ± 7.9 and 63.8 ± ± 9.5 years respectively, the mean for the group as a whole being 66.6 ± 10.2. After coronary angiography the presence of a PA was revealed in 31 patients (0.6%), of whom 16 were women and 15 men. The incidence of pseudoaneurysm after PTCA was 0.9% and it was confirmed in 29 patients (15 women and 14 men). None of these patients received an IIb/IIIa receptor blocking agent during PTCA intervention.

In 56 patients (93.3%) a single-cavity PA was observed. In the remaining cases, four patients (6.7%), a multi-cavity PA was revealed. In 54 patients (90.0%) a PA was located anteriorly to the femoral artery, while in the remaining cases (6 patients) the location was lateral or medial.

The size of PA was established by measuring its width, depth and surface area. Mean surface area was $4.87 \pm 4.52\ cm^2$. There was a statistically significant difference between women and men in the size of PA (women $6.22 \pm 5.5\ cm^2$, men $3.43 \pm 2.54\ cm^2$, $p < 0.01$).

Beside the presence of PA no other complications of arterial cannulation were observed, such as acute peripheral ischaemia, arteriovenous fistula or femoral nerve damage.

One patient from the study group (1.7%) required urgent surgical intervention because of the large size of PA, considerable blood loss to PA cavity and intensive pain.

In the remaining 59 patients mechanical compression with an elastic bandage was applied and, in the event of failure, ultrasonographically guided compression was performed.

After the removal of the 8-hour bandage compression control ultrasonography was performed and a total closure of PA was observed in 19 patients, 7 women and 12 men. This compression method was effective in 32.2% of cases.

In the remaining group of 40 patients with a PA compression was re-applied with the use of an ultrasonographically guided method. Closure of PA sac was obtained in 16 patients (11 women and 5 men), which confirmed the 40% efficacy of this method.

Overall the elastic bandage and ultrasonographic probe compression caused effective PA closure in 35 patients (59.3%).

Gender, age and PA size had no influence on the efficacy of either compression method.

No recanalisations of a PA closed with the use of compression were observed. In three patients a significant increase in PA size occurred after compression with the ultrasonographic probe (7.5%). No complications associated with the use of compression methods were observed.

Overall 25 (41.7%) PAs required surgical intervention. In one case PA was surgically removed (1.6%), while the remaining 24 (40%) patients received a thrombin solution injection to the PA sac. This method was effective in all patients. In two patients with a double-cavity PA a two-stage procedure was performed. A standard approach consisted in the injection of one or two ampules of thrombin, depending on the size of PA. No complications of this treatment method were observed. After intervention mechanical compression with an elastic bandage was applied for 6 hours. No recanalisation was observed in control ultrasonography.

Discussion

Colour Doppler ultrasound imaging enables each case of prolonged pain in the inguinal region, inguinal haematoma or vascular murmur at the femoral artery puncture site to be reliably verified. Additionally, this method makes it possible to locate arterial damage precisely, to assess the size of PA and the communication canal between the femoral artery and PA and, finally, to visualise PA structure, showing, for example, mural thrombus.

In our group of patients the incidence of femoral artery PA was 0.6% after coronary angiography and 0.9% after PTCA, amounting to 0.73% overall. These results are consistent with the findings of other authors. No confirmation was obtained of an increased incidence of PA amongst women. In our study group PA was equally frequent in men and in women, although female gender was associated with a greater size of PA. The significantly greater PA size in women did not influence the efficacy of further treatment. There was no statistical significance of PA incidence in relation to type of invasive procedure.

The difference between the incidence of PA after coronary angiography and PTCA (0.6% vs. 0.9%) was not statistically significant. In patients undergoing a PTCA procedure, which is usually associated with larger vascular sheaths and more aggressive antiplatelet and antithrombotic treatment, PAs were equally as frequent as in those undergoing standard invasive diagnostic procedures. Our findings differ, therefore, from results obtained in other investigations, which report a 1.0% incidence of PA after diagnostic procedures and 3.5–5.5% after therapeutic interventions [2, 3, 5].

In studies assessing ultrasonographically guided compression as a method of PA treatment its efficacy has been estimated at between 61% and 87% [2, 4, 6–9]. In our group of patients this method proved to be effective in 39% of cases. This lower success rate may be due to the shorter mean compression time of 12 minutes, whereas those authors who achieved an efficacy of 87% applied compression for a mean of 37 minutes, with a maximum of 70 minutes.

Our experience indicates that the formation of PA is caused by the several factors. The first may be too short a period of vessel compression or insufficiently precise compression after removal of the vascular sheath. The recommended compression time should be at least 10 min. Also crucial is the continuation of compression with the use of an elastic bandage. Obesity is the second factor contributing to PA formation, particularly hip obesity, where a thick layer of adipose tissue constitutes a mechanical barrier for effective compression. The third factor is the cannulation of the femoral artery with atheromatic lesions. The puncture site in the case of a normal femoral artery is quickly closed thanks to arterial wall smooth muscle cell contraction and the formation of a platelet clot. Puncture at a site where atheromatic lesions have replaced the muscular tissue with simultaneous administration of antiplatelet agents may contribute to the formation of a PA.

Until recently the only method of PA treatment-intervention. Now, however, several non-surgical methods of PA treatment can be used, such as ultrasonographically guided compression or injection of thrombin.

The first successful thrombin administration to the PA cavity was described by Liau et al. [10] in 1997. Such intervention consists in a guided aneurysm

puncture and injection of an adequate volume of thrombin solution, which would cause thrombosis inside the aneurysmal sac. The efficacy of this strategy as reported by various authors ranges from 96% to 98% and does not decrease in patients undergoing intensive antithrombotic treatment [11–16].

In our group of patients this procedure was effective in all patients, even though it had to be repeated in two cases of double-cavity PA.

Conclusions

1. Femoral artery pseudoaneurysm following diagnostic and therapeutic procedures in invasive cardiology occurs in 0.7% of cases.
2. Gender and the intensity of antiplatelet and antithrombotic treatment are factors that have no impact on the incidence of pseudoaneurysms.
3. PA compression with the use of an elastic bandage followed by ultrasonographically guided compression is effective in almost 60% of cases.
4. Thrombin injection to PA cavity is a safe and highly effective therapeutic procedure.
5. In our series only one patient with PA of the femoral artery required surgical intervention.

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