The Frequency of Complications of Pseudo aneurysms After Cardiac Interventional Diagnostic and Therapeutic Interventions

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Pseudo aneurysms as complications are a major source of morbidity after cardiac catheterization. Their incidence varies in the literature due to different definitions, methods of interrogation and presence of certain complications. We found in the literature that post-catheterization lesions occur in approximately 0.05% of treated patients after diagnostic catheterization and up to 1.2% after more complex procedures. The aim of this retrospective study was to determine the incidence of pseudo aneurysm after cardiac catheterization using the physical findings and color Doppler ultrasound. In the study, which encompasses the period of 2009-2010, there were 400 coronary angiography with trans femoral catheterization. After compression hemostasis was carried out, each patient was checked after 24 hours and again after 48 hours. Diagnostic coronary angiography was made in 400 patients (100%), out of which, 110 patients (27.5%) had a percutaneous coronary intervention with stent placement (PCI), Color Doppler ultrasound of femoral artery was normal in 384 (96.3%), local hematoma was found in 360 (90%), pseudo aneurysm in 14 (3.7%), AV fistula in 1 (0.25%) and dissection of the femoral artery in 1 (0.25%) patient. Complications in 16 patients were treated surgically, in 7 patients they were treated conservatively and in 1 case thrombin was applied within pseudo aneurism. Patients with complications were more often present with concomitant use of anticoagulant and anti platelet tablets than patients without complications (P = 0.003). Prevention of post catheterization pseudo aneurysm can be achieved by proper puncture technique, choosing the right place and right post interventional hemostatic compression with or without external devices. Special attention should be paid to the use of anti platelet drugs and anticoagulant and combinations thereof. Keywords: color Doppler, complications, coronary angiography, pseudo aneurysm

1. INTRODUCTION

Pseudo aneurysms typically occurs as a result of local damage to the arterial wall after diagnostic or therapeutic catheterization, they are far less likely to occur in other arterial punctures, such as catheterization for arterial line, or post-traumatic or post-operative (1, 2, 3). Occurrence of organizing hematoma is caused by the blood coming through emphasis on FNA place on the wall of an artery in periartery soft tissue, with the resulting pseudo capsula and compression of surrounding structures. The differential diagnosis includes simple hematoma, tissue edema, lymphadenopathy, thrombosed pseudo aneurysms, dissections, acute arterial occlusion, retroperitoneal hemorrhage, embolism, cholesterol accumulation and infections (1.5 to 9%) (4). Post-catheterisation lesions occur in approximately 0.05% cases after diagnostic catheterization and up to 1.2% cases after more complex procedures (1, 2, 3). There is still no reliable data on the incidence of pseudo aneurysm formation during an increased and prolonged use of anticoagulants. Use of adequate and long enough compression technique, careful monitoring of the puncture place, and frequently controlling the place of puncture using color Doppler technique may be particularly successful for the prevention of complications.

Initially, vascular surgeons can handle any complications and until recently are able to handle any complications with the help of interventional radiologists (5). Not surprisingly, this data underestimates the real incidence of local complications. Diagnostic procedures and treatments have changed considerably in recent decades (6). Previously, the diagnosis is appointed solely on the
basis of the clinical picture, however, advances in medical technology and the introduction of diagnostic ultrasound in everyday practice, has changed this. Some prospective studies in selected patient groups have tried to diagnose the pseudo aneurysm on the basis of local signs, in relation to groups of patients in whom the diagnosis was made by using color Doppler scan, except for those who were asymptomatic (7).

2. OBJECTIVE
The aim of this retrospective study was to determine the incidence of complications of femoral artery pseudo aneurysms after cardiac catheterization, to determine the etiology, identify the differences in risk factors and to determine the percentage of diagnostic errors between the clinical findings and color Doppler findings.

3. MATERIALS AND METHODS
In this retrospective study we examined 400 patients hospitalized at the Heart Center, University Clinical Centre of Sarajevo, in the period 2009–2010, who had undergone coronary angiography. All patients were informed about the study and all gave their written consent. Catheterizations were performed in the same place, Cat Lab of the Heart Centre, using the same apparatus, by the same team of interventional radiologists and using the same material for angiography. All the patients who underwent coronary angiography via the trans femoral approach, achieved a hemostasis with manual compression technique without using an external push apparatus.

Manual compression was performed by doctors, with stronger pressure applied to the puncture area for the first 5 minutes, after which the pressure applied for the next 15 minutes was weaker. Control of hemostasis was for 20 minutes and if this proved insufficient, the compression was continued until hemostasis was completed. After achieving hemostasis, the pressure on the puncture site was continued with elastic bandages. Patients were rested during the night.

Basic data (age, sex, hypertension, diabetes, body mass index) were collected as well as common femoral artery diameter, arterial wall thickness and the presence of atherosclerotic plaques, anticoagulation therapy and anti thrombotic therapy. Catheterization procedure was uniform, a decrease in systolic blood pressure of more than 20 mmHg, and heart rate less than 40 beats per minute were recorded as a hemodynamic disorder.

Criteria for inclusion in the study were:
- Patients scheduled for cardiac catheterization
- Patients older than 18 years
- Patients are capable to undergo local anesthesia
- Patients who had not been operated in the femoral artery

Criteria for exclusion from the study:
- Patients younger than 18 years
- Patients undergoing reconstructive surgery performed on the femoral artery
- Patients who are not able to undergo local anesthesia
- Patients with hematological diseases
- Patients with renal insufficiency

Color Doppler diagnosis was made on the cardiovascular ultrasound OcuSon Siemens CV70, with a linear probe 7 MHz in B mode, 24 and 48 hours after the completion of manual hemostasis. Ultrasound examination included the common femoral artery diameter, the thickness of the artery wall, wall features, size of hematoma, possible presence of dissection, pseudo aneurysms, and determining the size of its characteristics and the possible presence of AV fistula.

Fresh hematoma has been characterized as hypoechogenic, irregular, predominantly without the formation of liquid flow. The existence of flow in the hematoma that communicates with the blood in the artery established characteristics of pseudoaneurismatic formation.

A large hematoma in our study, was characterized if it led to a decrease in hematocrit by 10%.

Dissection of the femoral artery was diagnosed as an intimal flap with blood flow in the tunica media. Pseudo aneurysm, was defined as the presence of extravascular cavity filled with blood, in direct communication with the artery in systole and in diastole partially empty. Arteriovenous fistulas were characterized as abnormal communication between arteries and veins. The clinical parameters of each group were compared by using independent groups t-test and $x^2$-test. The color Doppler studies showed that the flow was analyzed by using the Wilcoxon test.

4. RESULTS
In this study, out of 400 patients

![Chart 1. Type of Intervention](image)

<table>
<thead>
<tr>
<th>Patient with complication</th>
<th>without complication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>71.2 years</td>
</tr>
<tr>
<td>Sex</td>
<td>298 male</td>
</tr>
<tr>
<td>Smoking</td>
<td>314</td>
</tr>
<tr>
<td>Obesity</td>
<td>142</td>
</tr>
<tr>
<td>Diabetes</td>
<td>28</td>
</tr>
</tbody>
</table>

| Diameter (cm)            | 0.98                 | 0.96               |
| Wall thickness            | 3                    | 2.5                |
| The presence of plaques  | 4                    | 0                  |

which had coronary angiography, percutaneous coronary intervention was performed in 110 (27.5%) patients, and 290 (72.5%) patients had diagnostic coronary angiography (Chart 1).

Complications after coronary angiography as pseudo aneurysms were found in 14 (3.7%) patients, 360 (90%) patients had local hematoma, AV fistula in 1 (0.25%) patient and dissection
The Frequency of Complications of Pseudo aneurysms After Cardiac Interventional Diagnostic and Therapeutic Interventions

The incidence of complications of pseudo aneurysms after cardiac intervention is not rare. Local hematoma which caused hemodynamic disorder was found in 12 (3%) patients, while 1 (0.25%) patient needed blood transfusion therapy. Pseudo aneurysms were mostly treated by surgery in 16 (71%) patients, 7 (28.5%) patients were treated conservatively, while 1 (0.5%) patient had application of thrombin within aneurism [Chart 3].

The main parameters of patient risk factors are presented in Table 1. Based on the results, we were able to extract one of the factors that could suggest occurrences of complications. Ultrasonic characteristics of the femoral artery indicate that the diameter and wall thickness do not affect the occurrence of complications and in one case we consider, although not proven significant dissection of the femoral origin, significantly contributed to severe diffuse calcifying atherosclerotic changes in the artery wall.

In our study, color Doppler and short post-operative findings showed much better results of adequate diagnosis than the complications which were diagnosed without the use of sonography (p = 0.02). The results are listed in Table 3.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Conservative treatment (2) Mean ± SD</th>
<th>Median</th>
<th>Surgery treatment (14) Mean</th>
<th>Median</th>
<th>Wilcoxon p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume of pseudoaneurysm (mm)</td>
<td>9.0 ± 10.2</td>
<td>4.3</td>
<td>11.1 ± 9.7</td>
<td>10.6</td>
<td>0.53</td>
</tr>
<tr>
<td>Volume of flow in lumen of pseudoaneurysm (ml)</td>
<td>1.6 ± 2.7</td>
<td>26</td>
<td>3.0 ± 2.2</td>
<td>2.2</td>
<td>0.27</td>
</tr>
<tr>
<td>Length of pseudoaneurysm neck (cm)</td>
<td>1.30 ± 0.65</td>
<td>1.4</td>
<td>1.7 ± 0.74</td>
<td>0.7</td>
<td>0.37</td>
</tr>
</tbody>
</table>

Table 3. Color Doppler Findings of Patients with Pseudoaneurysm of the Femoral Artery after Cardiac Catheterisation

In our research we found correlation between wall thickness and appearance of complications, but no particular difference in patients who have already had a puncture of femoral artery, which coincides with the published references (11). Our results show a higher incidence of complications in patients with shorter manual compression and shorter immobilization. Also we noted that larger number of patients with complications were those who had a combination of aspirin and clopidogrel as their therapy (12).

Although we found that the increased number of patients who underwent PCI were with complications, we did not find the exact correlation between the recorded parameters and issues (13). This study clearly shown that early use of color Doppler sonography as routine, significantly contributed to more accurate diagnosis of complications such as pseudo aneurysms detected at an early stage, which gave us enough time to complete healing by conservative therapy (14).

6. CONCLUSION

The occurrence of complications in cardiac catheterization is not rare. Poor clinical diagnosis of the presence of the post-puncture pseudo aneurysms is one of the most common and important complications after coronary angiography. Relying only on clinical signs and the assessment of doctors who can be subjective and unreliable and with very little reliance on ultrasound, can often lead to failure in early diagnosis. So, in monitoring patients after catheterization, color Doppler control of the puncture site should be carried out.

5. DISCUSSION

Incidence of femoral pseudo aneurysms after coronary catheterization in our retrospective study of 400 patients was 3.7%, which correlates with published literature (1-14%) [8]. Clinically observed and diagnosed pseudo aneurysms, however, significantly exceed 0.06 to 0.7% pseudo aneurysm diagnosed by color Doppler [9].

The importance of risk factors is of little importance in the development of complications. Our results obtained are consistent with the published literature (10).

In our study, color Doppler and short post-operative findings showed much better results of accurate diagnosis than the complications which were diagnosed without the use of sonography (p = 0.02). The results are listed in Table 3.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Without complication</th>
<th>Complication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous puncture</td>
<td>394</td>
<td>3</td>
</tr>
<tr>
<td>Catheterisation time</td>
<td>26 (min)</td>
<td>38 (min)</td>
</tr>
<tr>
<td>Sheath time keeping</td>
<td>140 (min)</td>
<td>190 (min)</td>
</tr>
<tr>
<td>PCI</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Sheath thickness</td>
<td>6.75</td>
<td>6.85</td>
</tr>
<tr>
<td>Duration of immobilization</td>
<td>24 h</td>
<td>16 h</td>
</tr>
<tr>
<td>Duration of compressive hemostasis</td>
<td>20 min.</td>
<td>15 min.</td>
</tr>
</tbody>
</table>

Table 4. Characteristics of Coronary Angiography
which leads to a significant increase in early identification of phenomena pseudo aneurysms.

Particular attention should be paid to coagulation status of patients who use aggressive anticoagulant therapy, the careful implementation of emergency procedures as soon as the duration of catheterization ends, correct and sufficiently long digital compressive hemostasis, and monitoring of possible hemodynamic disturbances during the implementation of hemostasis.

REFERENCES