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Nonsurgical Therapy of Femoral Artery Pseudoaneurysm with Color Doppler Ultrasound-guided Compression

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FEMORAL ARTER PSÖDOANEVRİZMALARININ ULTRASON REHBERLİĞİNDE KOMPRESYONLA TEDAVİSİ

Femoral arter psödoanevrizmaları, girişimsel kardiyoloji işlemleri esnasında hastaların %0.3-%0.7'sinde oluşan önemli komplikasyonlardan biridir. Doppler rehberliğinde psödoanevrizmanın kompresyonu, cerrahi dışında etkili olabilen yeni bir tekniktir. Biz 47-69 yaşları arasında (ortalama yaş: 60.1±9.0) olan, 6 erkek, 6 kadın psödoanevrizmalı hastada kompresyon metodunu uyguladık. Hastada hematom, üfürüm veya pulsatil kitle gibi bulgularla damarsal bir komplikasyon düşünüldüğünde Doppler ultrason çalışması, 3.75 konvex ve 7.5 Mhz linear prob ile yapıldı. Psödoanevrizmalı hastaların 11'ine, dışarıdan ultrason rehberliğinde kompresyon deneyimli bir radyolog tarafından uygulandı. Bir vakada ise aşırı hassasiyet ve kanama sebebiyle operasyon tercih edildi. Tüm hastaların, psödoanevrizma yerleri, boyutları, ponksiyon yerleri, kompresyon zamanı, yapılan işlem sayısı ve sonuçları kaydedildi.

Bulgular:

Doppler muayene zamanı	:	*1-15 gün*
Psödoanevrizma boyutu	:	*21.8±8.1mm*
Psödoanevrizma yeri	:	*Ana femoral arter: 10, yüzeyel :2*
Ponksiyon sayısı	:	*1-3 (1.4±0.6)*
Kompresyon zamanı	:	*40.3±18.5 dakika*
İşlem sayısı	:	*1.8 (4.4±1.8)*

Tedavi 12 hastanın 11'inde başarılıydı (%91.6). Bir aylık takip döneminde tekrarlama görülmedi. Sonuç olarak, Anjiyografi sonrası oluşan femoral arter psödoanevrizmalarının Doppler ultrasonografi rehberliğinde kompresyonla tedavisinin yeni ve başarılı bir teknik olduğu düşünüldü.

Anahtar kelimeler: *Anjiyografi, femoral psödoanevrima, kompresyon tedavisi*

A false aneurysm is caused by bleeding from an arterial lesion into the surrounding tissue [1]. Iatrogenic arterial puncture is the most common cause of false aneurysms, with an incidence reported in the literature ranging between 0.3 to 0.7 % [2]. Long-term sequelae of pseudoaneurysm include pain, infection, progressive enlargement, compression neuropathy, and rupture [3]. Accurate diagnosis of these injuries can now be made non-invasively with duplex sonography and color Doppler flow imaging [4]. Conventional therapy of femoral artery pseudoaneurysm (surgical repair) carries the risk of anesthesia, prolonged convalescence and also needs extra expenses [5]. Color Doppler-guided pseudoaneurysm compression is a new technique that may offer an effective nonsurgical treament [6]. Our study examines femoral artery pseudoaneurysm in patients with interventional cardiology procedures and assesses the safety and the efficiency of nonsurgical Color Doppler ultrasonography-guided pseudoaneurysm repair.

PATIENTS AND METHODS

All patients undergoing diagnostic or therapeutic cardiac catheterization at the University of Çukurova Medical School were prospectively evaluated in a 12-month study period. All patients were examined; if a vascular complication was suspected due to the presence of a hematoma, bruit or pulsatile mass, a Color Doppler ultrasonography was performed using a Sonochrome (GE Medical Systems) with 3.75 convex and 7.5 Mhz linear array probe. A pseudoaneurysm was diagnosed in the presence of extraluminal color flow within a cavity and a "to-and-fro" pulsed Doppler pattern at the pseudoaneurysm neck mouth indicating of bidirectional flow [7]. All patients who met this diagnostic criteria were considered candidates for external compression (Figure 1-2). Contraindications to compression included evidence of limb or skin ischemia, suspected underlying infection, compartment syndrome, prosthetic grafts or location above the inguinal segment. Data regarding the pseudoaneurysm size, location, puncture site and the patient's protrombin and activated partial protrombin times were obtained before attempting compression. If a patient's protrombin and activated partial prothrombin time were excessively elevated, compression

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was postponed until the protrombin time was <19 seconds or partial protrombin time between 50 and 70 seconds. All antitrombotic agents and therapeutic heparin or coumadin were continued during attempting compression. After locating the pseudoaneurysm cavity and communicating tract, the surface of the imaging probe was used under continuous color flow monitoring to apply downward pressure directly over the communicating tract at the propiate angle sufficient to obliterate inflow into the pseudoaneurysm cavity. Compression was performed by an experienced radiolog, at 10-minute intervals, pressure was slowely releassed and inflow into pseudoaneurysm cavity reassessed. Pressure was applied there for a minimum of 10-minute cycles or until inflow ceased, indicating hematoma formation within the cavity. If partial cavity obliteration was noted after 45 minutes of compression, the patient was called back the next day for repeat treament. Compression was considered successful if there was no evidence of hematoma formation within the cavity after 30-minutes of compression. After the procedure, the elastic bandage was performed for 24 hours in every patient. If compression was unsuccessful, the patients was maintained at bed rest for 24 hours and called back between 24 and 48 hours for repeat imaging to document the results of follow-up. A delayed follow-up color flow scan was also obtained at least 1 month after ultrasound-guided Doppler compression therapy in all patients.

RESULTS

Between January 1, 1995 and January 1, 1996, two thousand interventional cardiologic procedures were performed in our clinic. Color flow scans were obtained in 104 patients evaluated for enlarging hematomas and/or bruits 1-15 days after catheter removal. Color Doppler flow imaging diagnosed 12 pseudoaneurysm cavities in 12 patients (0.57 %). Interventional cardiology procedures preceding pseudoaneurysms included balloon angioplasty (2 cases), coronary angiography (10 cases). Effective USGC could be applied to 11 pseudoaneurysms. The 6 male and 5 female patients ranged in age from 47 to 69 years (mean, 60.1±7.0 years). Compression times in the cases ranged from 10 to 80 minutes, with a mean of 40.3±18.5 minutes. Five cases required 30-35 minutes, four cases 40-50 minutes and two cases 60-70 minutes. USGC was performed 1-16 days after removal. In 11 patients, the discomfort of US-guided compression was none to moderate. No patients required sedation and/or analgesic drug. All patients received heparin during the catheterization procedure. After 1 month, in 11 successfully treated patients were rescanned in 24-72 hours after USGC. No recurrences were encountered, and all patients were

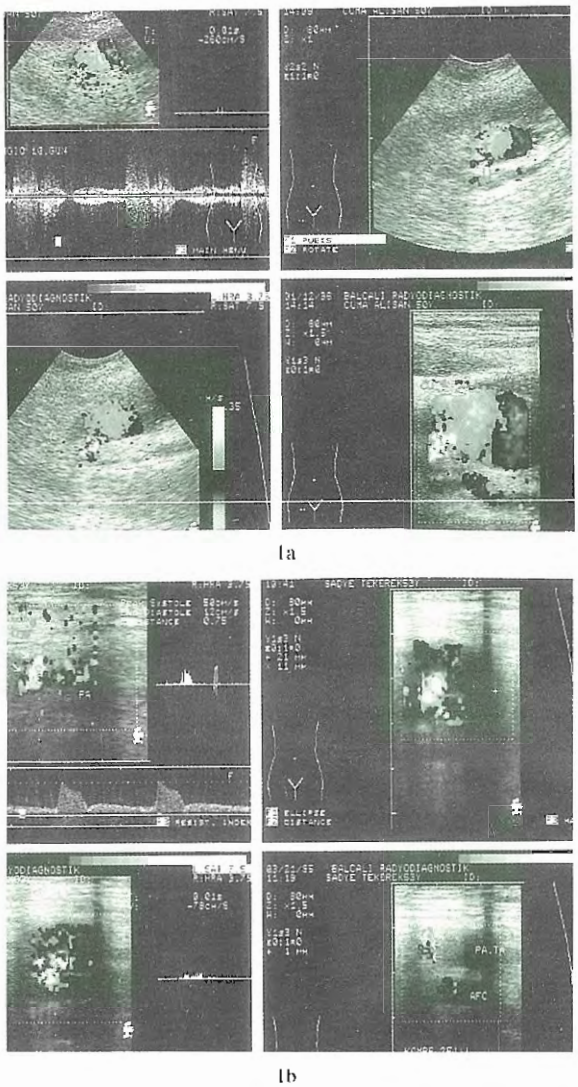

Fig 1. An illustration of femoral pseudoaneurysm (a) and its ultrasound-guided compression (b) in case 3.

asymptomatic. One pseudoaneurysm could not be compressed because the procedure had to be abandoned when the patient complained of severe groin discomfort, chest pain and increased mass (FAP size 100x120 mm). Surgical repair was required for this patient. Clinical characteristics of the 12 patients with pseudoaneurysms were shown in table 1.

Procedural characteristics (mean age, sex, femoral artery punction site, mean FAP size, femoral artery puncture no, mean FAP diagnosis day, FAP mean compression time and number of guiding compression) in patients with pseudoaneurysms were shown in table 2.

Table 1. Clinical characteristics in patients with pseudoaneurysms

Patients	Sex	Age	Risk factors	Clinical signs	Catheter size
E.Ş.	M	62	CAD, HT	Hematoma, pain	7F
M.K.	M	47	CAD, Smoker	Hematoma	7F
Ş.T.	F	65	CAD, HT	Hematoma	6F
Z.Y.	F	51	CAD, HT	Hematoma, pain	7F
K.H.	M	69	CAD, Smoker	Hematoma, pain	7F
M.Y.	M	67	CAD	Hematoma	7F
H.A.	M	54	CAD, Smoker, HT	Hematoma, pain	7F
S.O.	M	67	CAD	Hematoma	6F
U.B.	F	62	CAD	Hematoma	6F
A.Ş.	F	57	CAD, HT	Hematoma, pain	7F
M.K.	M	63	CAD,HT	Hematoma, pain	8F
S.Bt	F	65	CAT, HT	Hematoma	8F

M:Male, F:Female, CAD:Coronary artery disease, HT:Hypertension, F:French.

DISCUSSION

The reported incidence of femoral artery injury following cardiac catheterization, in a recent series of more than 83 000 transfemoral examinations, a puncture site complication rate of 0.47 percent was recorded [8]. In this study, we found the incidence of pseudoaneurysm 0.57 percent. Most femoral pseudoaneurysms result from vascular injury and involve the common femoral artery [9]. Pseudoaneurysm secondary to femoral artery puncture is well-documented, but the site from which the pseudoaneurysm arises is usually not reported [8]. In our patients, most of the pseudoaneurysms arose proximal to the bifurcation of the common femoral artery (10 cases), then the superficial femoral artery (2 cases). This finding is similar with Satiani et al [10]. Previous authors have attributed the etiology of pseudoaneurysms secondary to arterial puncture to be result of hypertension [11,12], wide pulse pressure, and poor hemostasis due to inadequate groin compression and anticoagulant therapy [13]. Our six patients had inadequate groin compression and six had hypertension.

Table 2. Procedural characteristics in patients with pseudoaneurysms

Age (year)	60.1±7	(47-69)
Sex	6 male	6 female
Femoral artery site	10 common	2 superficial
FAP size (mm)	21.8±8.1	(12-35)
FAP puncture no	9 Anteriorw	7 Lateral
FAP diagnosis (day)	4.6±5.7	(1-15)
FAP compression time (min)	40.3±18.5	(10-78)
Number of guiding compresion	4.4±1.8	(1-8)

FAP: Femoral Artery Pseudoaneurysm

Surgical repair of postcatheterization femoral artery injuries is safe, effective, but results in significant expense and prolonged hospitalization [3]. Potential surgical morbidity includes deyaled ambulation, wound infection, incision pain, and scarring that may make future groin procedures difficult [3]. Our study demonstrates the feasibilty of therapeutic USGC. After including one case who had excessive bleeding, the overall success rate of USGC was 91%. If USGC is technically feasible, the success rate will be higher.

Although we found them unnecessary in our cases, locally administered anesthetics, intravenously administered analgesics or both may be helpful for particularly tender groins. Compression discomfort ranged none moderate in 11 patients.

Leg ischemia due to compression can be avoided if femoral flow is maintained and monitored with real time color Doppler flow imaging during the procedure. In addition to complications of USGC; one case had deep venous thrombosis and one case had FAP rupture.

Although small pseudoaneurysms may close spontaneosly without any therapy [14,15], we believe that an attempt at USGC can be justified in all patients without contraindications, since it is non-invasive and also safe and also the cost and the morbidity rate are

so low. If USGC is unsuccessful, in any rate, surgical repair is always possible. In conclusion, we advocate USGC as the initial therapy in all the patients who have no contraidications.

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