

## Original Article

# Ultrasound Guided Compression Repair of Post-catheterization Femoral Pseudo-aneurysm

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**ABSTRACT**

**Objective:** Iatrogenic pseudoaneurysm have traditionally been treated surgically. Recently, this problem has been successfully treated without operation by the ultrasound-guided compression (UGC). The purpose of this study is to describe the indications, technique and results for UGC of femoral pseudoaneurysms and to define the factors that predict its success.

**Methods:** One hundred and two (102) patients were referred to the vascular division with suspected pseudoaneurysm (PA) over a 36 months period. Data regarding the location and morphologic characteristics of the pseudoaneurysms, anticoagulation status and morbid diseases were documented. Each

pseudoaneurysm was compressed with a 4-7 MHz linear transducer for 10-minute intervals until the PA was completely occluded or the procedure was considered to be a failure.

**Results:** Out of 102 patients referred with suspected PA, 36 had a duplex confirmed PA (22 post cardiac catheterization, 10 post aortogram and four post femoral central line).

UGC was successful in 29 patients (81%), the rest were surgically treated.

**Conclusion:** UGC provides a reliable alternative to surgical treatment for post catheterization femoral pseudoaneurysm. Anticoagulants, large PA size (> 6 cm) and hypertension were main predictors for UGC failure.

**KEYWORDS:** femoral artery, post catheterization, pseudoaneurysm, ultrasound guided compression of pseudoaneurysm

**INTRODUCTION**

Percutaneous transfemoral catheterization is a common procedure performed for investigation and therapeutic purposes. The incidence of pseudoaneurysm (PA) varies from 0.1 - 0.7% after diagnostic to 3.2% after interventional procedures<sup>[1,2]</sup>. Pseudoaneurysm are most likely to occur when, the patient is anticoagulated or is receiving thrombolytic therapy, a large sheath has been used, inadequate compression has been applied post-procedures or the branches of the femoral artery have been punctured<sup>[2]</sup>. Most pseudoaneurysms are asymptomatic and undergo spontaneous thrombosis, especially if less than 2 cm in diameter<sup>[3]</sup>. The remainder requires therapy to avoid complications such as haemorrhage, rupture, and peripheral embolization<sup>[4]</sup>.

The detection of pseudoaneurysm is now facilitated by the wide availability of duplex scanning, which permits accurate, non-invasive assessment of arterial puncture site complications from interventional therapy<sup>[5,6]</sup>. Treatment options include ultrasound compression, surgery and more recently use of thrombin injection directly into the sac<sup>[7]</sup>. Ultrasound guided compression (UGC) is

simple to perform and has a high success rate between 70 to 100%<sup>[1,8-10]</sup>. The aim of this series is to record our experience with UGC and to study the factors that affect its success.

**SUBJECTS AND METHODS**

A prospective non-randomized study was started in February 1999 and ended in March 2002 at King Khalid University Hospital, Riyadh, Saudi Arabia. One hundred and two (102) patients were referred to the vascular division service for duplex scanning to assess the presence of a post catheterization femoral artery pseudoaneurysm.

The reasons for referral were: presence of a pulsatile mass, haematoma, bruit or significant pain after femoral artery puncture. With the patient supine, the symptomatic groin was imaged in transverse and longitudinal sections (using ATL, HDI 5000 USAcolor duplex scanner equipped with a 4-7 MHz probe). Extravascular masses were interrogated for the presence of flow and thrombus. If a flow was present, the pseudo-aneurysm neck and the anterior and posterior and lateral diameters of the aneurysm were measured. UGC was not performed for those who were found to have an

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Fig 1: Pre-ultrasound compression of left common femoral artery pseudoaneurysm

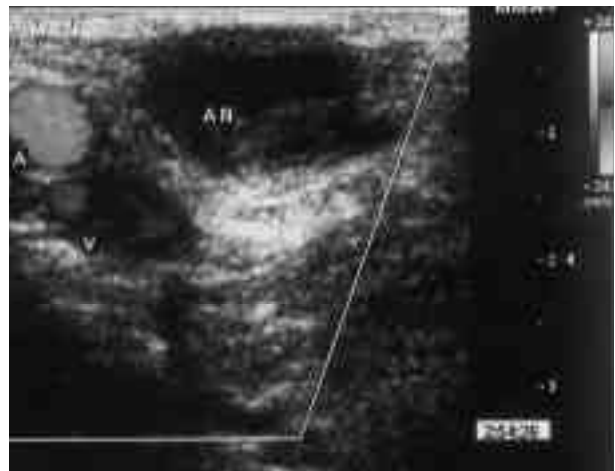


Fig 2: Post-ultrasound compression of left common femoral artery pseudoaneurysm, showing absence of arterial flow in the aneurysm

arteriovenous fistula (AVF) or a prosthetic graft PAs. Before compression, the venous and arterial Doppler signals from the ipsilateral ankle were examined. The PAs were compressed under duplex visualization for sequential 10 minutes intervals until they thrombosed. The native vessels were observed in real time to ensure that they were not compressed with the probe. After each 10 minute compression period, pressure was slowly released from the PA. If flow persisted, compression was quickly resumed. Attempts at compression were abandoned, if no thrombosis was evident after three attempts. If some thrombosis could be achieved, the patient was brought back the next day for additional compression. A single follow-up duplex scan was performed in all patients after 2-5 days, then repeat scans after 1, 3 and 6 months to determine the durability of the procedure.

Data regarding PA diameter, location, (common, profunda or superficial femoral artery), the sheath size that created the injury, the presence of anticoagulation at the time of compression, and associated morbid diseases were documented to study the predictor factors that affect the success of UCG. Fisher's exact test was used for statistical analysis.

## RESULTS

Out of 102 patients referred with suspected PA between February 1999 and March 2002, 36 had a duplex confirmed PA (22 post cardiac catheterization, 10 post aortogram and four post femoral central line). Twenty one were men and 15 women with a mean age of 44 years (range 32 to 65 years). Of the 36 PAs, 29 (81%) were thrombosed during UCG after 1-3 sessions (Fig. 1-2). The remaining seven were treated by surgery. No complications relating to compression were observed in any patient. Seven factors were analyzed to determine if they affected UCG

success; Diabetes Mellitus (DM), Hypertension (HTN), Ischemic Heart Disease (IHD), Peripheral Vascular Disease (PVD), artery punctured, sheath size and anti-coagulation. Of all the variables studied only anticoagulation, aneurysm size and hypertension significantly affected the outcome ( $P < 0.05$ ).

Data on anti-coagulation were available in all patients. Patients were not considered to be anticoagulated, if heparin was used at the time of the interventional procedures, but was discontinued prior to compression. Four patients were therapeutically anti-coagulated at the time of compression with heparin. In the latter, UGC failed ( $P = 0.00059$ ) and operative repair was necessary. Aneurysm size significantly affected overall success. PA diameter ranged from 2 cm to 10 cm with a mean of 4 cm. PA with a diameter of less than 6 cm were compressed successfully (88%) in 29 out of 33, while all 3 PA that measured 6 cm or more required surgical repair ( $P = 0.0049$ ).

Hypertension significantly decreased overall success ( $P = 0.00263$ ), in five out of eight patients with hypertension UGC failed. Other factors such as DM, IHD, PVD, artery punctured and sheath size were studied. Sheath size ranged from five to seven French. Sheath 5F caused 14 PA (39%) and 6 to 7 F caused 22 PAs (61%). The location of arterial injury was in the common femoral artery in 19 and 17 arose from, the profunda-femoris ( $n = 4$ ), and the superficial femoral artery ( $n = 13$ ). Associated infrainguinal PVD, DM and IHD were present in eight, 22 and 29 patients respectively. None of these factors significantly influenced the outcome of UCG ( $P > 0.05$ ).

## DISCUSSION

Pseudoaneurysm is a complication of arterial catheterization. Color-flow imaging systems have significantly simplified the diagnosis of PA and

allowed the examiner to rapidly locate and define the communicating tract between the artery and the aneurysm<sup>[11,12]</sup>.

The natural history of post catheterization PA is unclear<sup>[13]</sup>. Some aneurysms can rupture<sup>[13]</sup> and infection with skin ulceration can occur in a few cases<sup>[14]</sup>. Neuropathy and deep vein thrombosis may also result from femoral nerve and vein compression by the aneurysm<sup>[15]</sup>.

Despite the availability of multiple modalities like (surgery, UGC, and thrombin injection) by which PA may be treated, UGC seems to be the most attractive and effective method<sup>[16-18]</sup>. Most series document no complications with UGC and a success rate between 70 and 100%<sup>[1,8-10]</sup>. Our overall success rate of 81% was achieved after a maximum of 30 minutes of compression over one or two days. This is in accordance with other reports in which occlusion of the PA was noted after an average of 30 minutes<sup>[17,19]</sup>. Cox *et al* have also stated that the age of PA correlated negatively with the success of UGC in older aneurysms<sup>[17]</sup>.

Several variables have been reported to adversely affect outcome including large PA size, anti-coagulation, associated AV-fistula, large sheath and arterial injuries not located in the common femoral artery<sup>[16-18,20-24]</sup>. In our series, large PA size, anticoagulation and hypertension were the main predictors of UGC failure.

Schaub *et al* have stated that many femoral artery PA is thrombosed without specific therapy<sup>[15]</sup>. They concluded that operation should be reserved for progressive and complicated cases of PA. It is difficult to predict the likelihood of spontaneous PA closure on the basis of color doppler sonographic characteristics<sup>[15]</sup> except for certain obvious patho-anatomical features, like arteriovenous fistulae (AVF), multi-lobulated PA or rupture<sup>[26]</sup>.

Schaub *et al*<sup>[25]</sup> have described successful UGC in three out of nine AVFs, whilst Krumme *et al*<sup>[27]</sup> only succeeded in one out of five such cases. The latter concluded that AVFs should be repaired surgically. We did not attempt UGC in PA with AVF or PA at a prosthetic graft anastomosis.

The results in our series agrees with those of Kumins *et al*<sup>[16]</sup> with no late recurrence of PA on late scanning after six months, which further confirms the efficacy of UGC.

We had no peripheral thrombo-embolic complications after UGC which is similar to other series<sup>[16,24]</sup>. At present, thrombin injection may be more promising with success rate of 94% and less pain compared to UGC<sup>[7]</sup>. However, if thrombin is not available, then UGC appears to be the treatment of choice for managing patients with post catheterization femoral artery PA. Surgical repair will be required for those who fail UGC and has

progressive symptoms. We confirmed that anticoagulation, large PA size and hypertension were the main predictors of early UGC failure.

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