

MANAGEMENT PLAN OF POST-ANGIOGRAPHY FALSE ANEURYSMS OF THE GROIN

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Background: False aneurysm (FA) of the groin is a potentially serious complication of angiographic procedures. We developed a management plan at St. George's Hospital, and prospectively applied it to 14 consecutive cases over a period of one year.

Patients and Methods: This report is a prospective cohort study of post-angiography false aneurysms. Fourteen patients with groin FA presented to the vascular team between October 1995 and September 1996 (0.2% of 6926 angiographic procedures). Nine of the 14 patients were fully anticoagulated at the time of treatment. Ultrasound-guided compression (USGC) was tried in 11 patients and was considered inappropriate in three. Embolization was attempted in four patients and surgery was needed in seven patients.

Results: The initial angiographic procedure was therapeutic in nine and diagnostic in five patients. The median maximal dimension of the FA was 3 cm (range 2-5). USGC was successful in three patients and failed in eight, seven of them fully anticoagulated at the time of compression. Embolization of the FA was tried in four patients; all were anticoagulated, and embolization was successful. Surgery was required in seven patients, one with infected groin and bleeding, another with FA at the site of a groin graft anastomosis, three with concomitant evacuation of large groin hematomas, one who refused further angiographic procedures, and one who needed prolonged full anticoagulation before the availability of the embolization. The operation was successful in all the patients except one, who died of myocardial infarction 24 hours after successful surgical closure of a FA.

Conclusion: FA can be managed in a step-wise manner, starting with the noninvasive USGC, embolization and surgery. Surgery is indicated if evacuation of a large hematoma is required, or the presence of infection is suspected. Emergency surgery is indicated for bleeding or imminent rupture.

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Key Words: Aneurysm, angiography, complications, arteries.

False aneurysms are a recognizable complication of angiographic procedures. Their true incidence is unknown, for follow-up angiography is not routinely performed unless symptoms occur or persist. Color-flow duplex sonography has proved to be an excellent technique for the evaluation of groin complications following femoral artery catheterization.^{1,2} The reported incidence rates for vascular complications after groin puncture in some large series are 0.03%, 0.23%, and 0.1%.³⁻⁵

The natural history of these false aneurysms is largely unknown. Classically, repair is usually advised to avoid the complications of rupture, pressure neuropathy, distal ischemia and infection.^{1,6,7} Spontaneous thrombosis of femoral false aneurysms is well known, but only in patients not receiving anticoagulants.¹ The influence of anticoagulation, which is a common association especially in cardiac patients, on the incidence, outcome and the

response to different treatment modalities is significant.^{8,10} There is increased incidence of false aneurysms with therapeutic, as compared to diagnostic, procedures.^{5,8,10} These therapeutic procedures are usually associated with the use of large-sized sheaths and catheters, manipulations and post-procedure anticoagulation. However, sheath size failed to reach a statistical significance in one of the studies when correlated with the incidence of post-angiography FA.⁸

Anticoagulation is a prevalent feature in patients with post-angiography FA.^{9,10} On the whole, with the increasing use of interventional procedures, this complication is more likely to be seen now than it was in the past. The associated co-morbidities in these patients give increased risk to anesthesia and surgical repair. Most of these patients have an underlying cardiac disease.^{5,10} Increased age has also been shown to be correlated with greater incidence of vascular complications after percutaneous cardiac interventional procedures.^{5,10}

A protocol was established in our institute which involved the cooperation of the cardiologists, the vascular surgeons and the radiologists in the management of these

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TABLE 1. *The clinical details of the 14 patients with false aneurysms of the groin.*

Age/ sex	Procedure	Days until dx	Max. diameter/ volume cc	Anti- coagulation during ttt	ttt
61/M	Coronary stenting; infected groin/ bleeding	17	3/12	Yes	Successful surgery
63/M	Diagnostic coronary angiography	1	2.5/7.5	No	Failed USGC
				No	Successful surgery
79/M	Aortic stent; groin hematoma	0	4/8	No	Successful surgery; MI/died
62/M	Diagnostic coronary angiography	0	2/6.5	No	Successful USGC
66/F	Diagnostic coronary angiography	4	3/6.8	No	Successful USGC
61/F	Carotid angioplasty; groin hematoma	1	3/7.7	Yes	Failed USGC
				Yes	Successful surgery
58/M	Coronary stenting APTT >200	6	2.7/7.8	Yes	Failed USGC
				Yes	Successful embolizatio n
73/F	Coronary angioplasty	1	3.5/17.5	Yes	Failed USGC
				Yes	Successful embolizatio n
51/F	Coronary angioplasty	1	4/20	Yes	Failed USGC
				Yes	Successful embolizatio n
65/M	Coronary angioplasty	1	2/6	Yes	Failed USGC
				Yes	Successful surgery
67/F	Iliac stent; unable to tolerate compression	2	2.5/9	Yes	Failed USGC
				Yes	Successful embolizatio n
73/M	Coronary angiography	3	2.5/7.5	No	Successful USGC
71/M	Thrombolysis occl. graft; wide neck connected to previous graft	14	5/60	Yes	Successful surgery
57/M	Coronary angiography; groin hematoma	1	3/9	Yes	Failed USGC
				Yes	Successful surgery

Days until dx=interval between angio procedure and diagnosis of FA; ttt=treatment.

cases. This involved a policy designed to ensure early detection and a step-wise management for all patients, avoiding unnecessary interventional procedures and possible fatal results of negligence.

Patients and Methods

Between October 1995 and September 1996, there were 6926 angiographic procedures performed between the Cardiology Department (5832 procedures) and the Radiology Department (1094 procedures). Fourteen patients (0.2%) with false aneurysms of the groin (Table 1) were referred to the Vascular and Intervention Radiology Unit (Figure 1).

Diagnostic ultrasonography (obtained within 24 hours of referral) established the diagnosis, and provided information on the dimension of the aneurysm, its anatomy and any significant associated hematoma. Aneurysms measuring more than 2 cm were considered significant. An attempt to stop or reduce the level of anticoagulation was made in each case. However, this was not always possible, particularly in patients who had undergone a complicated angiography and stenting procedure. USGC was attempted in 11 patients, using a 5-Mhz linear array color probe. All patients received analgesia and sedation prior to the procedure. The site of the arterial jet (neck of the aneurysm) was localized and gradually compressed with the scanner head to obliterate the flow in the aneurysm sac without compromising parent artery patency. Compression was performed for 10 minutes and repeated up to a maximum of three compressions per session. After successful USGC, the patient was re-scanned within two weeks to confirm persistent cessation of flow within the aneurysm. Arterial embolization was attempted if USGC was unsuccessful, unless contraindicated.

The relative contraindications included the possibility of groin infection or marked thinning and stretching of the overlying skin with imminent necrosis because of massive hematoma. Embolization was performed using high-quality digital subtraction angiography, with the capability of rapid frame rate and multiple oblique projections. The parent vessel, sac size and communication were all accurately defined before intervention (Figure 2). An arterial access (brachial or opposite groin) was used to pass an angioplasty balloon and inflate it across the communication, stopping the flow into the aneurysm. In patients who had to remain anticoagulated because of their clinical conditions, the distal artery had almost no risk of thrombosis, otherwise, 3000 U heparin had to be given systemically. The balloon served to stop flow into the aneurysm, enhancing its thrombosis as well as protecting the parent artery from faulty deployment of the embolization material through the communication (Figure 3). The aneurysm sac was directly punctured and a 4F catheter was passed over a guide wire. We used “coils for embolization (E. Merck Pharmaceuticals, Hampshire, UK), which are tungsten coils available in 10 cm lengths. The aneurysm sac was packed as tightly as possible to ensure that the lumen was obliterated (Figure 4). The catheter was removed and manual compression was sustained for three minutes while the balloon catheter inflation was maintained. Subsequent ultrasonography

(within 24 hours) was obtained to confirm thrombosis following embolization.

A total of seven patients needed surgery. Three patients needed surgery for concomitant evacuation of large groin hematomas, and one patient for failure of attempted USGC and the need for prolonged full anticoagulation before the availability of embolization. Surgery was also used in a patient with a FA at the site of the distal anastomosis of an aortofemoral graft (wide neck of the aneurysm), and after failure of USGC in a patient who refused any further catheter procedures. Another patient had surgical closure of his false aneurysm because of an initial presentation with post-angiography groin infection, which was successfully treated with antibiotics, and who was only then noticed to have a false aneurysm. The possibility of an infected false aneurysm could not be reasonably excluded, and it was thought inadvisable to put any foreign material there. The arterial exposure was done under general anesthesia unless the patient was a high anesthetic risk, in which case local anesthesia was used. Proximal and distal control were always achieved, followed by exposure of the puncture site and application of one or two 4/0 prolene stitches. Skin incisions were placed vertically, or in a lazy S-shape to ensure adequate exposure.

Results

There were 13 right and one left groin false aneurysms. Nine occurred in male patients and five in female patients. Angiography was performed as part of a therapeutic procedure (angioplasty, stenting) in nine patients and was only diagnostic in five. Nine patients were anticoagulated at the time of therapeutic intervention for their false aneurysms (eight of them following angioplasty and/or stenting). Anticoagulation was judged to be necessary for their underlying clinical situation (e.g., difficult angioplasty, subintimal dissection). All 14 patients had a diagnostic color-flow Doppler ultrasonography within 24 hours of clinically suspecting a groin false aneurysm. The median duration between the arterial puncture and confirming the diagnosis on ultrasonography was two days (0-17 days). The median maximal dimension of the false aneurysm lumen was 3 cm (range 2-5 cm). The median size of the lumen of the false aneurysm (obtained by multiplying 3 dimensions) was 7.9 cm³ (range 6-60 cm³). The median interval between making the diagnosis and successfully treating the false aneurysm was one day (range 0-30 days).

USGC was attempted in 11 patients. The outcome was successful in three patients, none of whom was anticoagulated at the time of the intervention. It failed in eight patients, seven of whom were anticoagulated, and one who was unable to tolerate the compression, as his puncture site was above the inguinal ligament.

USGC was not attempted in three patients. One of them had a possible element of infection in his groin and a

pending rupture of his aneurysm with herald bleeding, and had to be taken to the theater as an emergency. Another had an anastomotic aneurysm at the suture line of a previous aorto-bifemoral graft, following thrombolysis of a blocked limb of this graft (this aneurysm had a relatively wide neck). The third had a large groin hematoma which needed evacuation (hemoglobin dropped from 15 to 7.6 g/dL). Embolization was attempted in four patients with false aneurysms of the groin, and all had a successful outcome, with clotting of their aneurysms being confirmed on subsequent US examination in the follow-up.

Discussion

The role of interventional radiology is continually expanding. The increased use of larger-sized sheaths and catheters, as well as lysing agents and anticoagulants in conjunction with the different procedures, is increasingly reported to be associated with a higher incidence of false aneurysms in the access arteries.^{6,12-15} Our incidence (0.2%) compares well with similar series in the literature. The incidence varies greatly in different reports, being as low as 0.8%, 0.09%, 0.1% and 0.3% in large retrospective series^{1,3,5,6} with predominantly diagnostic procedures. Prospective series which screen every post-angiography groin tend to report higher incidences (7.7%, 6%).^{12,13} Those patients who develop FA tend to be anticoagulated at the time of the development of the lesion (78%).¹³ Kent et al. tried to establish the natural history of 16 patients with clinically detected FAs and offered surgery only for symptoms doubling in size or persistent patency over a two-month period.¹ Fifty-six percent of the FAs clotted spontaneously, and all were no longer anticoagulated. Katzenschlager et al. reported a series of 581 procedures, including angiography, angioplasty and thrombolysis. It was interesting to note an incidence of 14% of pseudoaneurysms, which went down to 1.1% when a strict protocol of 5-minute minimal compression time after bleeding stops was rigorously observed. Again, anticoagulation was noted to be a statistically significant association with the formation of false aneurysms.¹²

Other risk factors for forming FAs include obesity, use of thrombolytic agents, antegrade puncture, heavily calcified arteries, repeated multiple punctures and high puncture site.¹⁵

The traditional approach of prompt, mainly surgical intervention^{5,6} originated from earlier experience with traumatic arterial injuries which rarely cure spontaneously.¹⁶ Graham et al. reported ruptured false aneurysms in 12 of their 50 false aneurysms within the first six days after the catheterization, arguing in favor of urgent operative correction of false aneurysms.⁶

Surgical repair was shown to be effective and could be done under local anesthesia.¹¹ However, patients with groin false aneurysms in whom cardiac interventions were frequently required have significant co-morbidities.

Graham et al. reported a 30% complication rate after surgery,⁶ and Lumsden et al. reported a 21% morbidity and 2.1% mortality for surgical repair in their series.¹⁰

The initial report of successful USGC by Fellmeth et al.¹⁷ started a wave of successful compression results. Overall success rates were 74%,¹⁷ 86%,¹⁸ 89%,²² 94%,²⁰ and 95%.¹⁴ Multiloculated aneurysms with possible high pressure inside require a longer time for successful compression.²¹ Compression therapy may be less successful in the long-standing aneurysms with possible endothelialization of the tract,¹⁷ large-sized aneurysms, and definitely in patients who receive high levels of anticoagulation.^{14,17,19-21} Fellmeth et al. had a 50% failure rate of USGC in patients who were fully anticoagulated at the time of compression therapy.¹⁷

USGC may be contraindicated in the presence of a large groin hematoma with overlying skin ischemia, signs of infection and in injuries at or above the inguinal ligament.^{17,21} The procedure itself carries particular risks of femoral artery thrombosis or distal embolization.^{14,17} Factors such as hand fatigue of the operator and patient intolerance of the compression (one patient in our series) may be important, and can cause failure.^{14,21} Adequate pressure at the puncture site after angiographic procedures, both in terms of amount and time, is a good prophylaxis against formation of false aneurysms.

Ultrasound-guided compression therapy should be applied as the first step for patients with false aneurysms. It is non-invasive, cost effective and generally well-tolerated by patients, although it can fail, particularly with anticoagulants. Radiological coiling of the pseudoaneurysm with balloon protection of the native artery is non-invasive and as effective as surgery in curing post-angiography false aneurysms even in anticoagulated patients. This was successful in all four of our patients with no complications on follow-up. Surgery, with its attendant morbidity and mortality, should be reserved for failures of USGC and embolization, or when their application is inappropriate. We find that this situation mainly applies in cases of possible infection or large groin hematomas.

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