Does site matter?

ARAVIND RENGARAJAN, KRISHNA ADLURI, GRAHAM PERKS, INDERPAUL BIRDI

Introduction

Cardiac catheterisation access site complications are common. Their incidence depends on various risk factors such as female gender, nadir platelet count, diagnostic versus therapeutic intervention, excessive anticoagulation and so on. Thrombotic complications are common at the brachial site and haemorrhagic complications are more common at the femoral site. In spite of new devices for securing haemostasis, the incidence of these complications has not decreased. We report the case of a 71-year-old, obese woman who died secondary to femoral access site haemorrhage despite all surgical attempts. This case emphasises the need for a tailor-made approach for deciding the site of access.

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Case report

A 71-year-old woman with a history of *Staphylococcus aureus* endocarditis developed severe mitral regurgitation and was referred for urgent mitral valve surgery. Her co-morbid risk factor was morbid obesity and she had a body mass index (BMI) of 40. She had a significant past history that included a history of recurrent pulmonary embolism for which she was being treated with warfarin; bilateral nephrostomies for lower urinary tract obstruction and left below-knee amputation for squamous cell carcinoma. At the time of cardiac catheterisation she also had a Marjolin's ulcer on the right lower leg, which was infected with *Pseudomonas aeuroginosa.*

She underwent cardiac catheterisation through the right femoral approach. The procedure was uneventful and she recovered well. On the second day following her catheterisation she had mitral valve replacement with a mechanical prosthesis. Unfortunately, she developed a large haematoma at the catheterisation site following her surgery whilst she was on the intensive care unit. She was returned to the theatre on three different occasions during the next 48 hours to control the bleeding from her right groin wound. No active bleeding site was identified and the wound was therefore packed; the packs were removed a day later after haemostasis was ensured. She made a good recovery, was extubated and returned to the ward.

On the ninth post-operative day she showed clinical signs of infection in her groin wound. She was returned to theatre and the wound was promptly debrided (figure 1a). A Vacuum Assisted Closure (VAC) pump was applied to promote healing. Despite antibiotics and the VAC pump, she became increasingly septic over the next few days; cultures from the wound grew *vancomycin-resistant enterococci* (VRE).

She was returned to the theatre on several occasions for extensive wound debridement (figure 1b). Despite aggressive management, she developed progressive sepsis and died of multi-organ failure.

The Departments of Cardiac Surgery and Plastic Surgery, Nottingham City Hospital, Hucknall Road, Nottingham, NG5 1PB.
Aravind Rengarajan, Specialist Registrar
Krishna Adluri, Specialist Registrar in Cardiac Surgery
Graham Perks, Consultant Plastic Surgeon
Inderpaul Birdi, Consultant Cardiac Surgeon
Correspondence to: Mr K Adluri
(email: arkrishnap@yahoo.com)

Discussion

The incidence of vascular complications at the arterial site after cardiac catheterisation has been variously reported as being between 0.5% and 7.4%.[1-4] Common access sites are via the femoral artery, brachial artery or radial artery, each with its own advantages and disadvantages.

Femoral and brachial artery approaches

Femoral arterial catheterisation has been the traditional approach and it is still one of the most common.[5] The femoral artery is a big calibre vessel and is useful for interventional cardiology requiring large catheters to be inserted. There has been no statistical difference in early mobilisation and duration of hospital stay when compared to the other approaches.[3]

The next most common approach is via the brachial artery, which has the advantage of being more easily accessible, with fewer reported haemorrhagic complications and early mobilisation.[4] The most frequent complications are thrombotic and these are more common in women.[1,4,6,7]

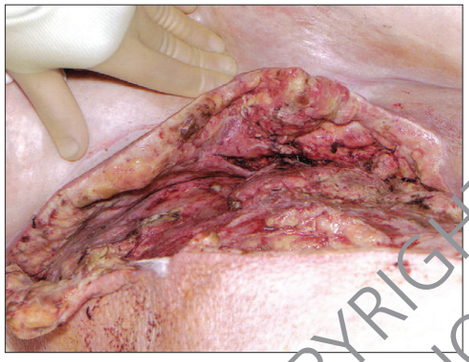
In some studies it has been shown that the incidence of complications is more common with the brachial than with the femoral approach.[1,6] This is particularly true in women.[4]

Of the complications requiring surgical intervention, the distribution of the lesions is as follows: pseudoaneurysms (61.2%), groin haematomas (11.2%), arteriovenous fistulae (10.2%), external bleeding (6.1%), retroperitoneal haematomas (5.1%), arterial thrombosis (3.1%), groin abscesses (2.0%) and mycotic pseudoaneurysm (1%).[8] The incidence of complications is more common with therapeutic rather than diagnostic procedures.[9]

Figure 1. Debridement of an infected groin wound on two separate occasions following cardiac catheterisation via the femoral arterial approach. **a**: shows the infection on the ninth post-operative day and **b**: shows the infection shortly before the patient's death

a

b



Since brachial complications are primarily thrombotic, they can be easily diagnosed and treated, whereas femoral artery complications can be more complicated, difficult to identify, and associated with significant morbidity.[1,6] Risk factors for groin complications following percutaneous cardiac procedures include female gender, increasing age, the type of procedure, the number of arterial punctures to initiate the procedure, and peri-procedure anticoagulation and pre-procedure treatment with corticosteroids.[2,8]

Retroperitoneal haematoma is a particularly serious complication occurring following the femoral approach, with an incidence of 0.5–3%. Predisposing factors include female gender, the protocol for sheath removal, the nadir platelet count, and excessive anticoagulation. Signs and symptoms are supra-inguinal tenderness and fullness, severe back and lower quadrant pain and femoral neuropathy. In most cases, early identification can lead to conservative management but surgical exploration may be needed in others.[10]

Depending on the site of actual puncture on the femoral artery it can sometimes become difficult to compress on the proper site. Femoral access haemostasis is a blind technique.[11]

Key messages

- Vascular complications are common with catheterisation
- Thrombotic complications are common with the brachial artery approach
- Haemorrhagic complications are common with the femoral artery approach
- The radial artery approach has a lower complication rate and should be used where possible
- The catheter site should be individualised depending on the co-morbid risk factors for each patient
- Complications can be fatal

Earlier research has reported that puncture sites not located in the common femoral artery are associated with a higher rate of post-catheterisation vascular complications.[11]

Septic complications can be life threatening and are commonly due to repeated punctures at the same site or leaving the sheath in for one to five days.[12]

Radial artery approach

The radial artery approach is another site that is gaining in popularity. Compared to the brachial and femoral arterial approaches, the radial artery is more superficial, with no important veins or nerves in proximity, hence avoiding neuropathy or the incidence of atrioventricular fistulae. Compression of the vessel is easy and this leads to a reduced rate of haematoma formation and earlier ambulation, which can reduce the hospital stay and the cost of procedure.[13] The radial approach offers a better site for catheterisation in patients who require intensive anticoagulant and antithrombotic therapy, in those who are obese and also in those with hypertension.[14] Occlusion of the radial artery is more common than via the other two arterial approaches (3–5%),[15] although the presence of the palmar arch reduces the clinical significance of any complications related to the occlusion. Arterial size (3 mm internal diameter on average) makes it prone to spasm during and following the procedure; related discomfort can be severe. On average, the procedural length is longer due to difficulties in catheter manipulation and the initial learning curve. Despite these limitations, stent implantations, arterectomy and primary angioplasty have all been performed through the radial approach.[16]

Retrospectively, the current case emphasises the need for a carefully planned approach when choosing a catheter site. As this patient was morbidly obese, choosing the groin as a catheter site made the approach difficult, with resulting issues of poor hygiene. The fact that she was already suffering bacterial endocarditis predisposed her to infective complications should a haematoma develop. Her clinical condition required surgical intervention on an urgent basis and the anticoagulation around

the time of surgery aggravated the chances of her bleed. Retrospectively in the present case, a brachial approach would have been more appropriate. A brachial/radial approach would have allowed early identification of the problems, early ambulation and discharge. Even if the femoral site had been chosen, the side of the amputated leg would have been a better choice in case of thrombotic problems.

Conflict of interest

None declared.

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