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A Twist in the Transradial Coronary Catheterisation

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Abstract

The transradial approach for coronary angiography was first described in 1989. With the advent of modern equipment and improved technology it has recently gained significant interest amongst interventional cardiologists. As compared to femoral access, the radial approach has the major advantages of lower access site complication rates, cost-effectiveness, and shorter hospital stays. Further clinical benefits of lower morbidity and cardiac mortality in patients with ST-elevation myocardial infarction have been shown recently. Rare vascular complications may include radial artery spasm, dissection, occlusion, perforation or compartment syndrome. Here we present two unusual cases of an entrapped catheter in the radial artery and their outcomes.

Keywords:

Myocardial infarction; coronary angiography; acute coronary syndrome; transradial catheterisation; entrapment;

Introduction

Transradial approach for coronary angiography and percutaneous intervention is currently popular amongst interventional cardiologists given the advantages of lower access site complication rates, cost-effectiveness, and shorter hospital course as compared to the femoral approach. Radial access in patients with ST-elevation myocardial infarction (STEMI) is associated with significant clinical benefits of lower morbidity and cardiac mortality (1-3). Catheter kinking is not uncommon in femoral artery cases where it usually occurs in the iliofemoral vessels. In radial cases, kinking can occur in the subclavian and axillary arteries but is very rare in the radial artery itself due to the small calibre of the vessel. We describe two unusual cases with this rare complication of coiling of the catheter over itself and entrapment in the radial artery, and their successful removal.

Case 1:

An 82 year-old lady presented for elective left heart catheterisation in the setting of exertional angina and a positive sestamibi myocardial perfusion scan. She was hypertensive, dyslipidaemic and had a permanent pacemaker (PPM) in situ. A 5-Fr sheath was inserted into the right radial artery and a cocktail containing 250 mcg verapamil and 250 mcg GTN was injected through the sheath with 5000 units of heparin administered intravenously. Using a 5-Fr Tig (Terumo Corporation, Tokyo) catheter the left coronary artery system was imaged showing no significant coronary artery disease. There was however a greater

difficulty encountered engaging the right coronary artery (RCA). Repeated attempts were made to cannulate the RCA ostium. At this point a sudden loss of aortic pressure tracing was noticed and it was not possible to aspirate blood through the catheter lumen. Fluoroscopy of the right forearm demonstrated a kinked loop in the catheter in the proximal radial artery.

Attempts were made to open the loop by rotating in the opposite direction, however with no success. The exchange wire as well as balloon support while untwisting was tried but was limited since the wire could not be advanced in the coiled loop (Figure 1). Attempts to advance or withdraw the catheter caused severe pain in the forearm. In view of the small calibre of the vessel as well as symptoms of pain in the forearm, the location of the loops was marked on the skin under fluoroscopy and the patient was transferred to the operating theatre for open exploration. The catheter was cut just under the loop and removed successfully from the radial artery. The postoperative course was uncomplicated and the patient was discharged the following day, and remains well on follow up at six months.

Case 2:

A 67 year-old gentleman was admitted for elective coronary angiography to investigate exertional dyspnoea and angina. He was hypertensive, dyslipidaemic and a smoker, and had known coronary artery disease with prior percutaneous intervention to his diagonal branch of left anterior descending artery two years prior.

The procedure was performed via right radial approach after standard preparation. Left coronary artery images were taken using a Tig catheter (Terumo Corporation, Tokyo) which revealed a left dominant system with moderate atheroma only. During attempts to torque the catheter into RCA, there was disappearance of the pressure trace. Fluoroscopy of the arm showed the catheter was kinked in the radial artery (Figure 2a). The catheter was supported using a standard 0.035" J wire and the kink was undone by untwisting it after a lot of gentle manipulation (Video 1). An exchange wire was then used to engage the RCA with a JR4 diagnostic catheter which showed a small non-dominant vessel. An angiogram of the radial artery showed significant spasm (Figure 2b) which resolved with further doses of GTN and verapamil (Figure 2c). The artery remained patent on discharge.

Discussion

Transradial access is becoming the most popular vascular access and is considered the future of cardiac catheterisation. With the advent of modern equipment and improved technology it has become a very safe approach, with a significantly lower incidence of major access-related complications compared to the transfemoral approach (1-5). The nature of these complications is essentially similar between the two approaches. Rare complications unique to the radial access involve trauma to the radial artery and in extreme situations compartment syndrome. Some of the definitive advantages include simple haemostasis by compression given the anatomy of the radial artery and forearm, which in turn reduces the incidence of haematoma and pseudoaneurysm. Early ambulation of patient and discharge from hospital increases patients' comfort

and satisfaction as well as has impact on length of hospital stay and costs. There is a significant learning curve associated with the successful performance given the complexity of transradial procedures. Length of the procedure, radiation exposure, as well as success rates improve with the level of expertise (6, 7). It has been suggested that a case volume of ≥ 50 is required to achieve outcomes comparable to experienced operators for transradial PCI (8). RIVAL trial showed that operators with >146 transradial PCI a year had benefits over femoral comparators for access site crossover, major vascular complications, and the composite of death, myocardial infarction, or stroke (3).

Catheter kinking and entrapment mostly secondary to radial artery spasm and tortuous vessels is extremely rare in experienced hands. A 0.35 wire may be used to manipulate the catheter on the slightest indication of tortuosity to reduce the risk of kinking. Severe tortuosity of the right subclavian artery is known to be present in approximately 10% of patients undergoing transradial angiography (9), where the catheter can get trapped with a build up of torque in the proximal part of the catheter. Rarely, a looped catheter may actually represent an underlying anatomic variation like a brachial loop (10). Anomalous accessory vessels are extremely rare and are reported to be $<1.4\%$ in the transradial angiogram population (11). Within these arteries, there may be a need to manipulate catheters that stress the limits of our present catheter technology. However, the overall incidence of crossover due to vessel tortuosity is rare (less than 1%) in several studies (9, 12, 13).

Catheter kinking may occur, especially in a catheter softened by time and stress of use. However most can be untwisted gently without causing major issues. A

loss of pressure waveform, torqueability, or enhanced resistance to injection are all signs of catheter failure from kinking. The kink should be immediately undone by countering the last movement, and the catheter should be removed and replaced with a fresh device.

In a recent large registry analysis from USA (14), the greatest benefit of radial access for percutaneous intervention (PCI) in terms of the absolute reduction of bleeding and vascular complications was seen in high-risk groups of patients aged ≥ 75 years, women, and patients with ACS, where paradoxically the use and growth of radial approach were shown to be the lowest. The overall incidence of bleeding and vascular complications was consistently lower with radial access among all subgroups as compared to femoral. Our first case is an example of patients at high-risk for procedure related adverse outcomes, where a smaller calibre vessels can result in difficult coronary engagement and spasm can be a prominent issue. The kinked catheter entrapped in a small radial artery in this patient that could not be manipulated any further due to spasm was in contrast to the second case where it was successfully unwound given a larger size of the vessel. In the second case antispasmodics were given due to severe spasm of the vessel after retrieving catheter to ensure no perforation had been concealed at the site of vessel spasm. There is a previously reported case of retrieval of an entrapped catheter using a snare kit via the right femoral approach in which the kinked catheter was pulled up into the brachial artery, successfully unraveled, and then removed through the radial sheath (15). On another occasion when the loop was trapped in the brachial artery, the operators cut the proximal part of the catheter, exchanged the sheath with a long sheath using the trapped catheter

as a guidewire, advanced this long sheath up to the kink, and then gently pulled the trapped catheter which unfolded its loop while slipping into the sheath, hence freeing the catheter (16).

Conclusion

Transradial approach is safe and has advantages over femoral access.

Entrapment of a kinked catheter is well appreciated from the femoral approach but has only rarely been described from the radial approach. Several different techniques may be used to manage this complication however care should be taken to avoid over manipulation in cases of anomalous vessels or if there is significant vessel spasm.

Legend

Figure 1 - Looped catheter in proximal radial artery showing exchange wire in the proximal segment

Figure 2 - Looped catheter in the radial artery (2a), severe spasm over the exchange wire (2b), spasm relieved with GTN and verapamil (2c)

Video 1 - Untwisting of the kinked catheter

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