# Anomalous Origin of Right Radial Artery as a Cause of Radial Approach Failure of Coronary Angiography

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We are presenting a case-report of a patient with a failed radial coronary angiography approach, due to the anomalous origin of the radial artery from the brachial artery. The radial artery was hypoplastic and exhibited a severe spasm resistant to vasodilators. We review the literature concerning the abnormal origin of radial artery and discuss the possible reasons of a failed radial coronary angiography approach.

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The feasibility of performing coronary angiography or percutaneous coronary intervention through the radial artery has been broadly evaluated and documented by numerous studies in recent literature. Major advantages of this approach compared to the classic femoral one, mainly include reduction of local vascular complications and patient's short ambulation[1]. The present case, reports a failure in conducting a coronary angiography through the radial artery, due to its abnormal origin and the relative short vessel diameter.

## Case description

A 72 year old patient with a history of stable angina underwent routine coronary angiography in our Catheterisation Laboratory. He had no signs or symptoms of peripheral vascular disease. We favoured the radial approach in order to allow the patient the opportunity for immediate ambulation.

An Allen test performed before the catheterization procedure was positive (normal), reflecting ulnar artery patency. The right radial artery was punctured successfully using a 20G needle and 300 μg nitroglycerin, 2.5 mg verapamil and 5000 IU of unfractioned heparine were infused through the needle sheath. A commercially available Radiofocus II 6F sheath, 25 cm long, with a 2.52 mm external diameter was inserted into place, using an hydrophilic 180 cm long, 0.25 inch thick guidewire (Figure 1).

We advanced an AL2 catheter all the way up to the right axillary artery first, with no fluoroscopic guidance. Left coronary ostium catheterization was troublesome, due to aortic arch dilation so we replaced the catheter with an AL3. Manipulation of the catheter met some resistance after the first introduction manoeuvres. Both catheter and guidewire were withdrawn so that contrast injections through the radial sheath were performed, demonstrating an unusually high radial origin from the most proximal part of the right brachial artery and a severe spasm (Figure 2). Both arteries had a parallel direction down the brachium and deviated at the elbow joint forming the radial and ulnar artery respectively (Figure 3).

In order to dissolve the severe spasm, 1.2 mg nitroglycerin and 5 mg verapamil were injected forcefully through the sheath; the sheath's tip lay proximally to the elbow joint. The spasm began to dissolve ten minutes later and radial artery

**Figure 1.** The 6F sheath inserted into the radial artery.

**Figure 2.** Radial artery with anomalous origin and severe spasm.

diameter was restored to normal. The guidewire was then again introduced in place, but AL3 catheter manipulation faced significant resistance. We then tried to replace the guidewire with a common 0.35 inch wire, which produced an even more severe spasm. Due to the presenting danger of radial disection we abandoned the procedure and continued using the femoral approach. Inverse Allen test performed at the end of the examination was evaluated as positive-normal, reflecting normal radial patency.

## Discussion

Femoral approach is by far the commonest interventional coronary artery access route, with the cost of local vascular complications such as pseudoaneurysms, arteriovenous fistulas and haematomas[2]. Advances in interventional Cardiology technology did not offer serious improvement over these complications especially after the implementation of thrombolysis and IIb/IIIa inhibitors in the everyday routine practice[3]. Additionally, the need for a surgical or interventional therapeutic "complication repair" might have serious implications in the patient's general health status[4].

The use of the radial artery as a route for interventional procedures gained much of attention due to the relative lack of local vascular complications, which are associated with the standard method (femoral approach)[5]. Radial artery shares some special anatomic features. It disposes the minimum size needed for a 6F sheath to be easily introduced. Additionally 6F catheters are thought to have the minimum diameter necessary for qualitative coronary artery visualization and for easily performed angioplasty interventions. Radial artery runs superficially being easily accessible and effectively compressed for haemostasis induction. Finally, in the case of radial artery thrombosis, the hand almost never becomes ischemic due to its dual perfusion by both radial and ulnar arteries[1]. Another significant point concerning this method is the immediate patient ambulation and the significant reduction of examination and hospitalization cost.

**Figure 3.** The radial and ulnar artery continue their course separately above the elbow.

Success rates are fairly high and failure is associated with the interventional Cardiologist's experience. It is reported in general, that during the learning curve, arterial spasm at the site of puncture is usually the cause of failure[7]. When interventional cardiologists become familiar with the method, failure rates fall dramatically to 1.4%[8]. The main reasons for these failures are abnormal anatomic features such as radial hypoplasia and radial-ulnar torque[6].

Anomalous origin of radial artery is encountered in 11.3% of the general population[9] and does not usually constitute a problem for performing a coronary angiography; due to the relatively large diameter of the artery, which enables catheter manipulation. We report another case where angiography was performed successfully through the radial artery, which was of a relatively larger diameter (Figure 4).

The probable explanation of the severe artery spasm we encountered might be the forceful and continuous catheter manipulation in order to cannulate the ostium. Additionally artery's relatively small size at the proximity of the brachial artery might have influence the severity of the spasm. We must also emphasize the fact that radial artery's histological structure is thought to promote vasomotor tone augmentation. Finally we have to state that there are no available data in the literature implicating anomalous origin of radial artery with spasm induction.

The use of long wires has been proposed at least during the first stages of the method's learning curve. Their use enables catheter introduction to the aortic root especially in the case of severe subclavian curves. In our case, a hydrophilic, thinner than normal, 180cm long guidewire was used. Using these special wires, catheter exchange becomes easier and less time consuming. We feel that in our case, the use of a longer wire would not offer any serious advantage in catheter manipulation and in spasm prevention.

Longer sheaths are no commercially available, which might have prevented artery spasm, sharing the same characteristics such as the one we used. Additionally, current, interventional practice favours the use of shorter sheaths. We feel that it would be of great value if interventional cardiologists using the radial approach, would perform small contrast injections in order to diagnose this anatomic pattern in time. In this case spasm prevention would have been feasible if vasodilatory drugs were infused into the brachial artery before catheter pull back.

Finally, it should be stated that the presence of anomalous origin of the radial artery, could produce serious problems, if intervention through the brachial artery is chosen. In this case the ulnar or radial artery would be catheterized instead of the brachial demonstrating significant catheter manipulation problems[10].

In conclusion, radial approach for percutaneous coronary interventions has been proved feasible. Success rates stand high and all failures encountered are due to different anatomic patterns. Anomalous origin of radial artery is often encountered in the general population and usually presents no problem in angiography conduction. Failures could be the result of a relative small artery size promoting spasm after catheter manipulation. Immediate recognition of this pattern and prophylactic injection of vasodilators into the brachial artery, have the potential of becoming a promising every day routine practice in transradial coronary angiography procedures.

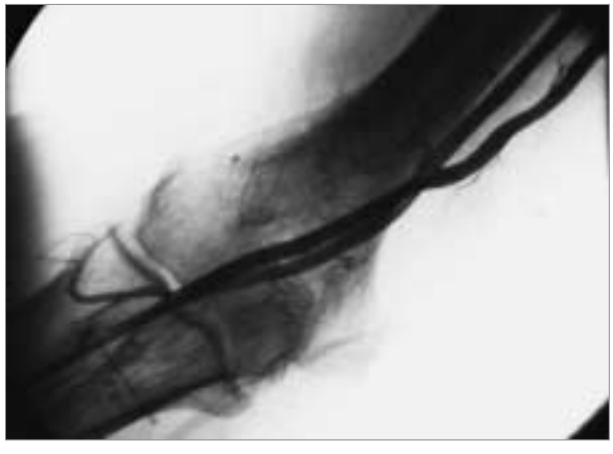

**Figure 4.** The same pattern of radial artery anomalous origin in a different patient with successful radial approach coronary angiography.

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