Case Report

Brachioradial Arteries with Anastomotic Arteries Connecting to Brachial Arteries Bilaterally

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We present a patient with a failed radial coronary angioplasty as a result of bilateral brachioradial arteries, the radial arteries anomalously originating from the axillary arteries. We review the literature concerning abnormal origins of the radial artery and propose the left ulnar artery as optimal access of choice in cases with a right brachioradial artery of relatively small size in its proximal part.

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The feasibility of performing coronary angiography or percutaneous coronary intervention (PCI) through the radial artery has been widely evaluated and documented by numerous studies. The major advantages of this approach compared to the standard femoral one are the reduction of local vascular complications and faster patient mobilisation. The present case reports a failure in performing PCI through the radial arteries bilaterally, due to their abnormal origin and small vessel diameter in their proximal parts.

Case presentation

A 72-year-old man was admitted with a history of exertion angina for 1 month and underwent routine coronary angiography in our catheterisation laboratory. He had no signs or symptoms of peripheral vascular disease. The radial approach was taken in order to allow the patient immediate ambulation after the procedure.

An Allen test performed before the catheterisation procedure was positive (normal). The right radial artery was punctured successfully and a commercially available 6 F radial artery sheath (Terumo Corp.) was inserted; then 5000 IU of unfractionated heparin, and 200 μg nitroglycerine were infused through the radial artery sheath. A Jackson R 4.0 catheter containing a guidewire (M-type hydrophilic, 150 cm long, 0.035" diameter guidewire, Terumo Corp.) was introduced, but it was difficult to reach the right axillary artery under fluoroscopic guidance. Both the catheter and guidewire were withdrawn so that contrast injections could be performed through the radial artery sheath; these demonstrated an unusual origin of the radial artery from the axillary artery. Such an anomalous radial artery has been called a brachioradial artery.[1,2] The initial part of the brachioradial artery was hypoplastic and small. In order to eliminate arterial spasm, another 200 μg nitroglycerine were infused without there being any change in the diameter of the initial part of the right brachioradial artery. The brachial artery ran along the arm and joined the ulnar artery at the elbow joint. At the antecubital *fossa*, the brachioradial artery anastomosed with the brachial artery through a vessel with a sling-like loop (Figures 1 & 2).

We then tried to gain access via the left radial artery and passed a Jackson R4.0

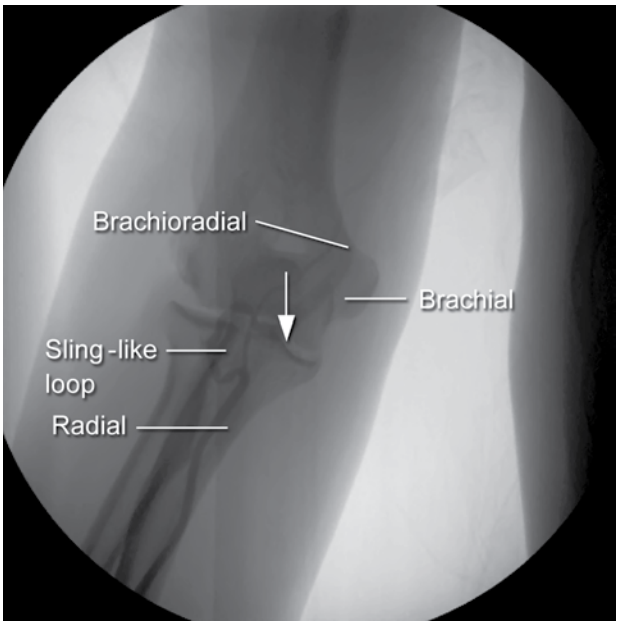

Figure 1. Contrast injected through the right radial artery sheath showed the proximal part of the right brachioradial artery, with the sling-like loop vessel connecting to the distal part of the right brachial artery.

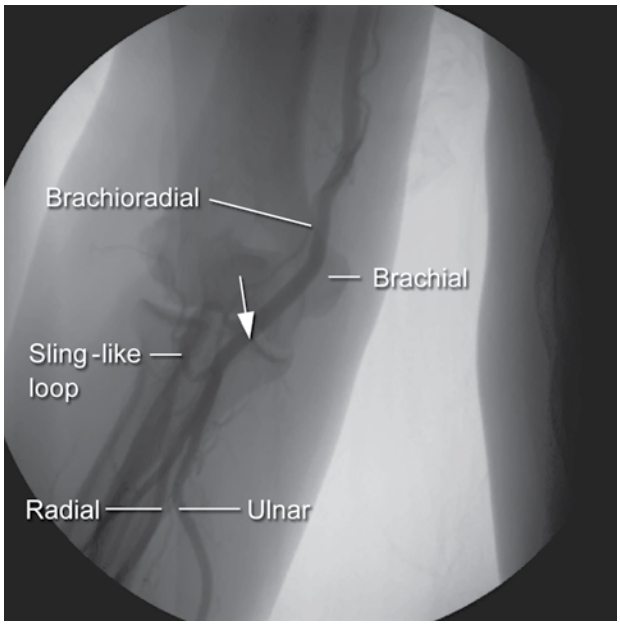

Figure 2. Contrast injected through the right radial artery sheath showed the entire brachial artery and the ulnar artery directly extending from the brachial artery.

catheter and a Jackson L4.0 catheter in turn to the right and left coronary ostium with some resistance, finally completing the angiography. After confirming a serious stenosis in the second segment of the right coronary artery, we decided to perform PCI. As the angiography catheter was withdrawn, a 6F guiding catheter with 2.3 mm external diameter was introduced along the guidewire left in the approach route. However, we encountered difficulty in advancing the guiding catheter to the left axillary artery, so we withdrew the catheter and injected contrast through the radial sheath. To our astonishment, the left radial artery also arose from the axillary artery, was relatively small in its proximal part, and anastomosed to the brachial artery through a vessel with a sling-like loop at the antecubital *fossa*, just as on the right side (Figures 3-5). The left brachial artery extended to the left ulnar artery, with a relatively large size, as did the right.

Finally, we gave up the radial artery approach and completed the PCI through a right femoral approach.

Discussion

The transradial approach for coronary procedures has gained progressive acceptance since its first introduction by Campeau[3] for diagnostic coronary angiography and its improvement by Kiemeneij and Laarman[4] for percutaneous transluminal coronary angioplasty and stenting.

Transradial access has several advantages over the transfemoral approach. The radial artery is easily

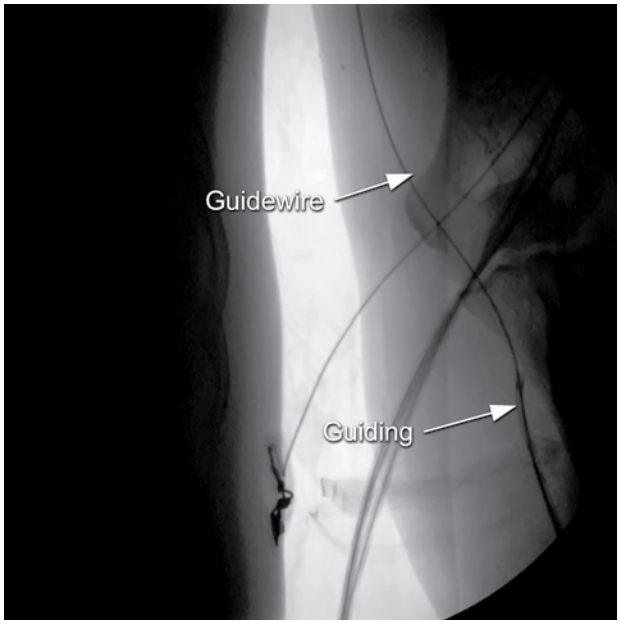

Figure 3. The guiding catheter could not be passed over the guidewire in the left brachioradial artery.

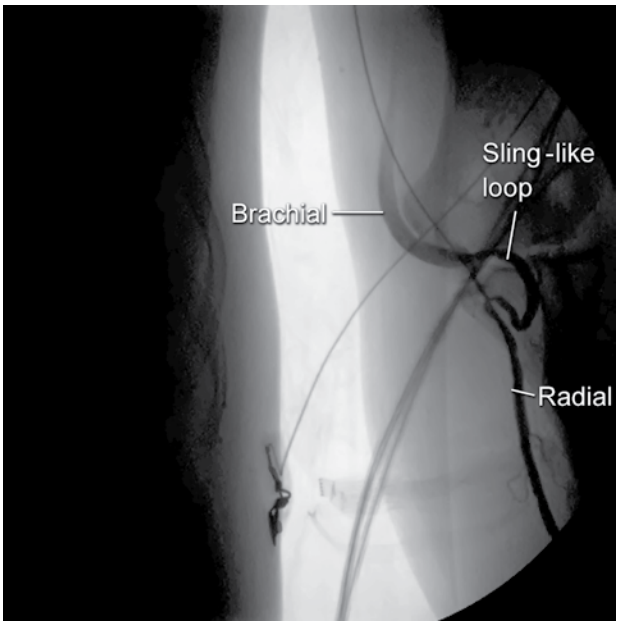

Figure 4. Contrast injected through the left radial artery sheath showed the distal part of the left brachial artery, with the sling-like loop vessel connecting to its distal part, and confirmed that the guidewire was in a left brachioradial artery.

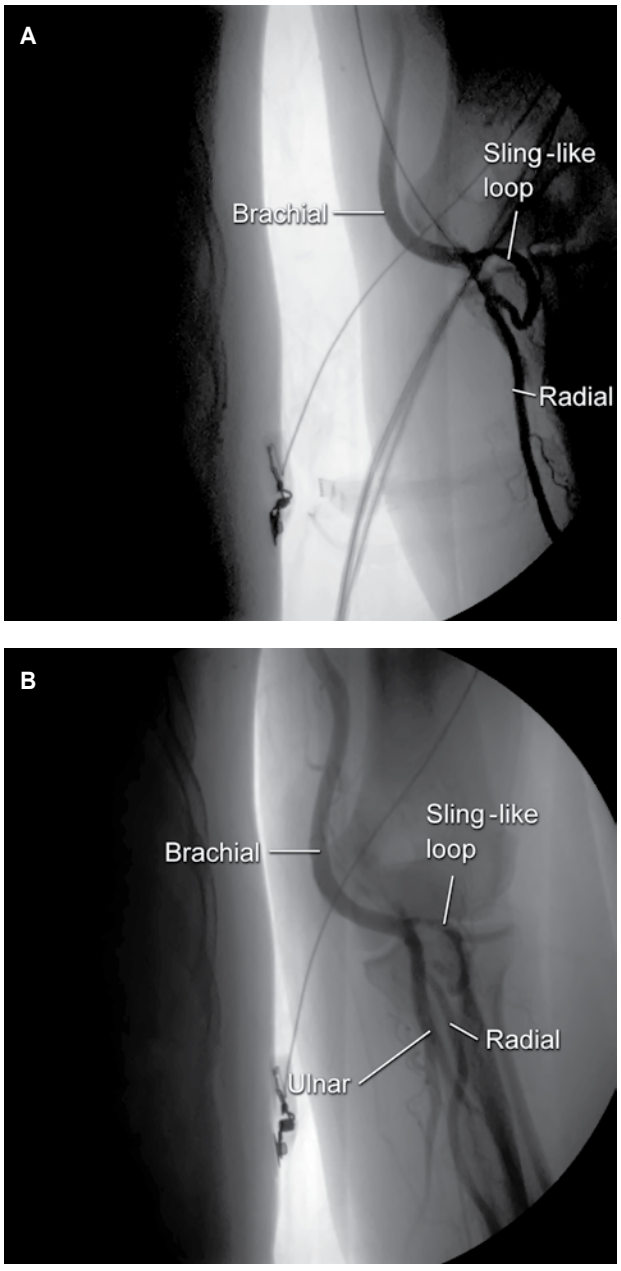

Figure 5. Contrast injected through the left radial artery sheath showed the entire brachial artery (A) and the left ulnar artery directly extending from the brachial artery (B).

compressible, thus bleeding is controllable and haemorrhagic complications are significantly reduced. Moreover, no major nerves or veins are located near the artery, minimising the risk of injury of these structures. Finally, post-procedural bed rest is not required, permitting immediate ambulation, more comfort, and early discharge.

Despite all these benefits, the transradial approach is more demanding than transfemoral access and requires a longer learning curve for the operator. Furthermore, it does not allow the use of other devices, such as a temporary pacemaker or intra-aortic balloon pump, or the performance of coronary interventions requiring 8 F catheters. Moreover, although the success rate of the transradial access approach is higher, 3.9-7.2% of procedures are unsuccessful.[5] The main reason for the failure of catheterisation using the transradial access approach is abnormal anatomic variation, such as radial hypoplasia, and radial-ulnar torque.[6] The high origin radial artery was the most common arterial variation observed in the upper limb, showing an incidence of 14.27% in dissection material[7] and 9.75% in angiographic exploration.[8] The brachioradial artery, one of the varieties of radial artery with anomalous origin, was the commonest arterial variation of the upper limb.[9] The total incidence of the brachioradial artery was 39 out of 192 cadavers (20.3%) or 53 out of 384 upper limbs (13.8%).[1] Of these, 35.9% were bilateral.[1]

The case we reported here had brachioradial arteries bilaterally, which originated directly from the axillary arteries and were hypoplastic in their proximal portions, making it difficult to advance the angiography or guiding catheter into the axillary arteries. On both sides, the brachial arteries led directly to the

ulnar arteries, which were large enough to advance an angiography or guiding catheter to complete PCI. In our case, the left radial artery was also chosen for angiography after failure in the right radial artery, but the procedure failed again for the same reason as on the right side. If we had chosen the left ulnar artery as an approach for introducing the catheter after the failure in the right radial artery, we might have been successful in performing PCI without the need for right femoral access.

As an alternative to transradial access, ulnar artery access is gradually becoming accepted by many authors. Therashima et al first reported 7/9[10] successful transulnar artery access approaches for coronary angiography, and Dashkoff et al had 5/5 successful transulnar artery access approaches, including two angioplasty cases.[11] In the relatively larger cohort of a clinical study, the success rate for transulnar artery access reached 85.2% (104/122 cases).[12] During the last two years, we have performed coronary angiography or intervention using transulnar artery access in more than 10 cases, with no failures.

In conclusion, the radial approach for PCI has been proved feasible. Success rates are high and almost all failures encountered are due to different anatomical patterns. An anomalous origin of the radial artery is often encountered in the general population and usually poses no problem to angiography, but manipulation may fail because of the relatively small artery size of a brachioradial artery. When a brachioradial artery with relatively small size in its proximal portion is encountered in angiography, the left ulnar artery should be selected as second access to perform the coronary angiography procedure or PCI, instead of the left radial artery, to allow for the possibility of the brachioradial artery existing bilaterally.

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