

Novel Techniques

Percutaneous Ulnar Artery Approach for Coronary Angioplasty

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The transradial approach for coronary angioplasty has proven to be a useful technique in the era of modern interventional cardiology. Limitations of this novel method may be the small size of the vessel, some anatomic variations and the inadequate collateral palmar circulation circuit. We report on three patients in whom percutaneous coronary angioplasty was performed after ulnar artery cannulation. We favored the transulnar approach due to the adequate pulsation of the ulnar artery and after performing the relative Allen's tests. Transulnar coronary angioplasty is feasible and may turn out to be the favorable method in certain cases where the radial artery may serve as a free graft for surgical revascularization. Implications and possible complications are discussed.

Recently, the radial artery approach for diagnostic cardiac catheterization and interventional procedures has become more popular. The major advantages of this technique in comparison with the standard femoral approach are the relatively lower incidence of local access site complications and the immediate mobilization of the patient¹.

However, its utility may be limited by cannulation and catheter manipulation problems. The relatively small vessel size and vasospasm constitute the two main reasons for access failures^{1,2}. Additionally, the anatomic variations of the artery, such as the radial loop pattern that is encountered close to its junction with the brachial artery³, may render the method infeasible. In some of these circumstances transulnar artery cannulation may provide a reasonable alternative approach². We report on three patients in whom successful transulnar coronary angioplasty was performed.

Technique and case descriptions

Three patients, a man and two women, aged 55, 62 and 65 years, were admitted

to our Department for routine coronary angioplasty. The patients' clinical and angiographic characteristics are shown in table 1.

Before the procedure we tested both the radial and ulnar artery patency. We first looked for good ulnar pulsation at the wrist and then we performed the Allen's and inverse Allen's test.

The Allen's test was performed as follows: while the patient holds his arm flexed and elevated, both radial and ulnar arteries are compressed for about 10 seconds. Then the arm is extended, ulnar compression stops and the time for palmar skin discoloration to return to normal is recorded. If the time exceeds 8 seconds then the ulnar circulation support of the hand is considered inadequate.

Inverse Allen's test refers to the same test, but looking at radial artery patency, where compression of the radial artery is performed instead of the ulnar. If complete obstruction of the ulnar artery occurs during an angioplasty procedure, radial collateral circulation support of the

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Table 1. Clinical and interventional characteristics.

Variables	Patient 1	Patient 2	Patient 3
Age	55	62	65
Diagnosis	Stable angina	Infarction	Stable angina
Vessel	RCA	LAD	LAD
Allen (s)	3	4	2.5
Inverse Allen (s)	5	5	4
Access time (min)	4	3	6
Catheter	AR2	Kimny	Kimny
Procedure duration (min)	45	70	40
Radiation time (min)	18.3	16.3	8.7

hand is considered adequate when the time of the inverse Allen's test is under 8 seconds. Additionally, ulnar circulation is determined as dominant if Allen's test time is shorter than inverse Allen's⁴.

In all our cases, the times recorded for both tests were almost the same, demonstrating that both arteries were normal and could therefore offer adequate perfusion support of the hand if one of them was damaged during the procedure.

In all three patients we followed the same procedure protocol. The skin was infiltrated over the palpable ulnar artery with 2% lidocaine, the artery was entered with a 21-gauge needle and a soft-tipped wire was then introduced. A non-hydrophilic, short (11 cm) 6F sheath was inserted⁵ (Figure 1). The puncture site was 1.5-2 cm proximally to the pisiform bone. In order to prevent any arterial spasm 200 µg nitroglycerin and 2.5 mg verapamil were infused⁶. Then 70 IU/kg heparin were administered intravenously before catheter introduction. In the first patient we performed a right coronary artery angioplasty and in the other two left anterior descending artery angioplasty.

After completion of the angioplasty procedure, the arterial sheath was removed and the wrist was

compressed by a supportive bandage. The patients were mobilized 4 hours later and were discharged the next day. The in-hospital course was uneventful and before discharge the ulnar artery was successfully palpated distally to the puncture site in all patients. No sensory or kinetic finger defects were recorded.

Discussion

Radial artery cannulation has been established as an alternative approach in the performance of diagnostic and interventional coronary procedures^{7,8}. The main advantages of this method in comparison to the standard femoral technique are the lower incidence of local access complications, early patient mobilization and the relative lower cost of hospitalization^{1,8}.

However some limitations may be encountered. The main reason for failures consists of difficulties in vascular access and catheter manipulation (4-6%) owing to the small vessel size and vasospasm⁹ as well as to anatomic variations (10%) of the arterial circuit^{10,11}. Additionally, the use of the radial artery as a potential bypass graft for surgical revascularization and the possible media thickening after a transradial procedure constitute relative contraindications for the use of this method¹².

Recently, a small number of studies have suggested the feasibility of performing coronary angiography¹³ or angioplasty⁴ using the ulnar artery approach. Although the number of cases presented was rather small, success rates were fairly high (85%) and complications were absent.

In our three cases, the ulnar artery approach was used successfully and uneventfully for performing angioplasty. The ulnar artery was favored in order to

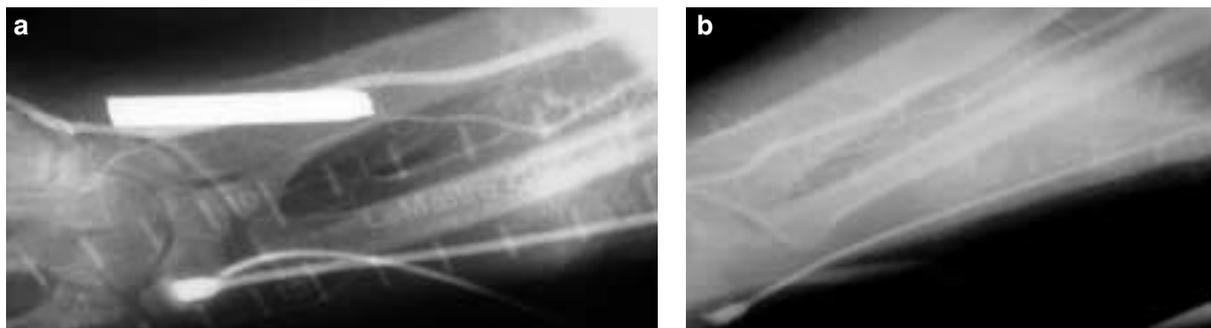


Figure 1. Selective angiography of the right arm in patients 1, (a) and 2, (b). The sheath is positioned in the ulnar artery. The radial artery demonstrates adequate size and no anatomic variations.

investigate the feasibility of the method. Additionally, Allen's and inverse Allen's test times were almost identical. A previous study⁴ has demonstrated consistently that these tests may be used for detecting the vessel with the largest diameter. The correctness of our choice in favoring ulnar artery cannulation was documented after performing an elective angiography of the arm, which revealed the approximately equal size of the two arteries (Figure 1).

The ulnar artery may exhibit a larger diameter (27%) than the radial artery^{4,14}, favoring the use of larger catheters and being less prone to spasm. This may result in fewer access failures and better catheter manipulation. In our reported cases, we did not encounter any difficulties in the manipulation of the angioplasty equipment and there was no need for any additional administration of vasodilators.

Ulnar artery anatomic variations are relatively less frequent than those of the radial artery (12.5 vs. 87.5%)¹⁵. For this reason, ulnar artery cannulation might be subject to fewer limitations. In our report, there were no anatomic variations concerning the artery anatomy of the right arm.

The ulnar nerve runs almost parallel and in immediate proximity to the ulnar artery. During the procedure, the nerve may be traumatized or compressed by a hematoma formation, resulting in neurological deficits^{2,16}. These defects may be frequent, intermittent or permanent. No such complications were documented in our patients. In order to evaluate their rate of appearance and their severity, larger scale trials are needed. We must emphasize that our report is just a feasibility study.

In conclusion, the use of the ulnar artery as an alternative approach in the era of modern interventional cardiology is feasible. However, the indications, complications and the special characteristics of the method are still not established. In addition, the method's learning curve remains unknown.

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