Crossover from transradial to ipsilateral transulnar access after sheath insertion into the radial artery

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Introduction The radial artery has been the preferred access site for percutaneous coronary procedures since it has some proven clinical benefits.[1-3] However, in some studies, the failure of transradial access (TRA) was reported in 1% to 7% of cases, mainly due to the inability of puncture, radial artery spasm or dissection, hypoplastic or small radial artery, and failure of catheter passage to the subclavian artery and ascending aorta.[1,4] In these situations, the ipsilateral transulnar access (TUA) has shown to be a safe and feasible alternative to contralateral TRA for coronary interventions.[5,6] In the present report, we describe 11 cases of successful crossover performed from the radial to ipsilateral ulnar artery after sheath insertion into the radial artery.

Methods This was a prospective, descriptive, observational study on 11 patients who were candidates for elective coronary angiography due to stable ischemic heart disease with unsuccessful TRA catheterization at 2 distinctive hospitals (Shahid Chamran [7 patients] and Khorshid [4 patients] hospitals, Isfahan, Iran) from January 2012 to September 2018. Our alternative planned approach was to perform a crossover from the radial to ipsilateral ulnar artery after sheath insertion into the radial artery. The crossover from the radial to femoral arteries was not possible due to severe obesity and/or peripheral vascular disease. All procedures were performed by 2 interventional cardiologists with expertise in TRA and ipsilateral TUA approaches.

The right radial access was used for all patients. After sheath insertion into the radial artery, the advancement of the catheter was unsuccessful due to complications; therefore, the procedure was incomplete. In 6 patients, a Tiger catheter (Terumo, Tokyo, Japan) could not be advanced due to tortuosity or loop of the radial artery (FIGURE 1A), which caused patient discomfort after several attempts to repeat the procedure. In 2 patients, the catheter could not be advanced due to a severe spasm of the radial artery (FIGURE 1B); in 2 other patients, dissection of the radial artery occurred; and in 1 patient, advancement failed because the patient had a high take-off radial artery (FIGURE 1C). Therefore, due to limitation of the femoral access, we performed the crossover from TRA to ipsilateral TUA. Local anesthesia (2 ml of 2% lidocaine) was infiltrated about 1 inch proximal to the flexor crease where the most powerful pulsation of the ulnar artery was sensed. Then the ulnar artery was accessed and the hydrophilic 5F or 6F sheath was introduced over the guide wire (FIGURE 1D and 1E). Intravenous unfractionated heparin was administered (50–70 U/kg, up to 5000 units),[7] and to reduce ulnar artery spasm, intra-arterial injection of diluted verapamil (2.5 mg) was used. Coronary angiography or angioplasty was successful in all patients without any further hindrance and complication.

All patients provided written informed consent to participate in the study. No ethics committee approval was required in this study.

Statistical analysis Continuous and categorical variables for the 11 analyzed cases were reported as mean (SD) and frequency, respectively.

Results and discussion The mean (SD) age of patients was 57.8 (5.7) years. There were 7 men and 4 women. The mean body mass index of the patients was 32.5 kg/m^2. Atherosclerotic

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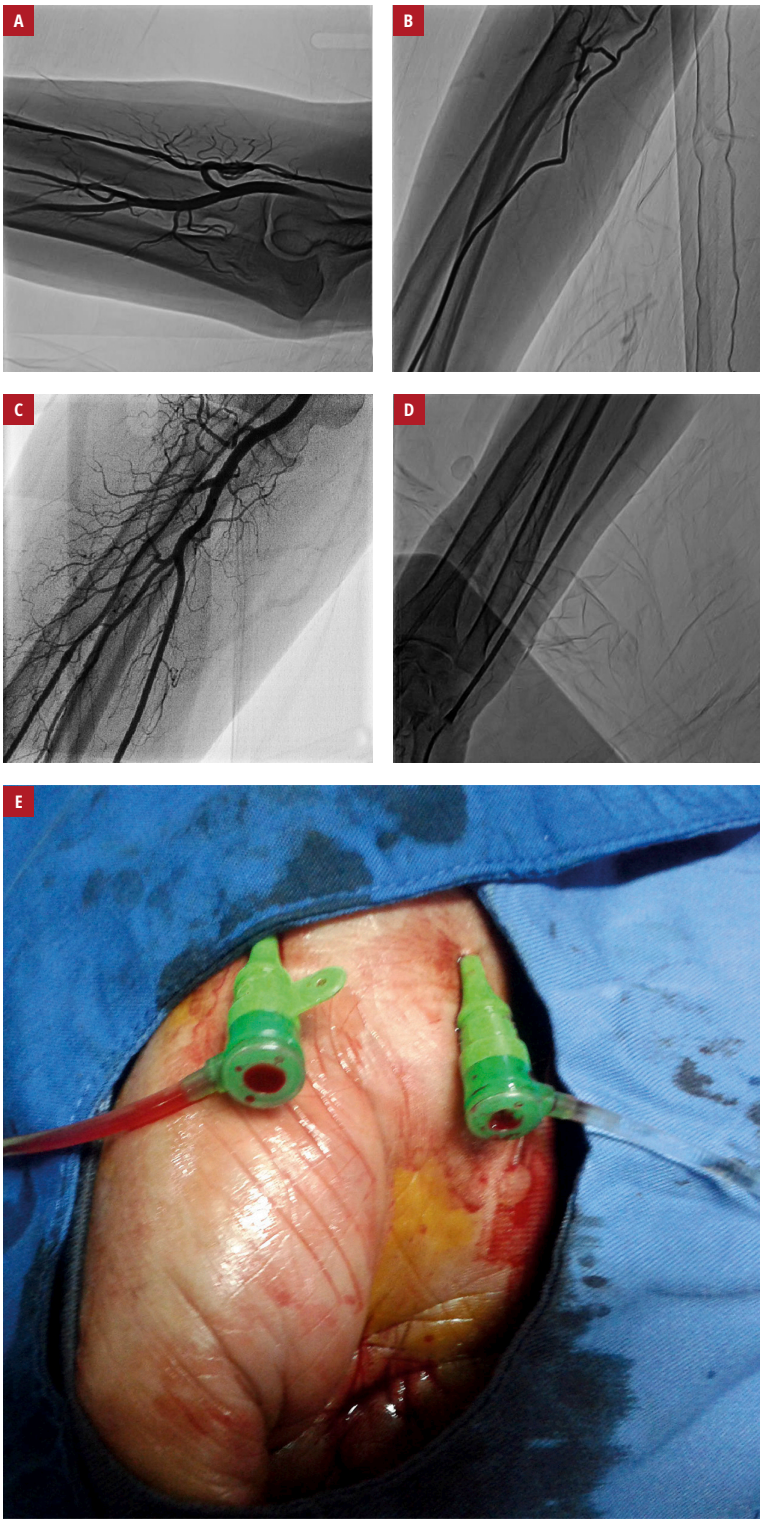

FIGURE 1 Angiographic images of the radial artery tortuosity (**A**), radial artery spasm (**B**), radial artery with high take-off (**C**), and radial and ipsilateral ulnar artery sheath insertion (**D**); **E** – cannulation of both radial and ulnar arteries

risk factors were as follows: diabetes in 7 patients; hypertension, in 8; dyslipidemia in 6; and current smoking, in 5. Five of the patients underwent percutaneous coronary intervention in addition to coronary angiography. All of the procedures were successful. In the first cases, we achieved hemostasis after sequential compression, ie, the radial artery compression via TR BAND (Lepu Medical Technology Co., Beijing, China) followed by the ulnar artery compression. In most cases, we used a simultaneous hemostasis method with 2 overlapping balloon-based compression devices on the radial and ulnar arteries. No complications such as hematoma, pain or paresthesia, pseudoaneurysm formation, arterial obstruction, or limb ischemia were recorded during hospitalization or the 1-year follow-up. Radial artery occlusion occurred in 1 and 3 cases in the early (first 24 hours) and late period, respectively.

It has been shown that TUA can be a safe and feasible alternative approach for cardiovascular interventions when the ipsilateral radial artery is inaccessible.[6] Recent studies have reported a high success rate and an extremely low incidence of puncture site complications for TUA, which was similar to data reported for TRA.[8,9] On the other hand, the cannulation of the ulnar artery is associated with longer procedural and fluoroscopy times and a higher crossover rate compared with TRA.[10] While the radial artery has a more superficial course, it is readily palpable and compressible, which makes TRA a more preferable approach than TUA.

After TRA failure, the most common alternative approach is transfemoral or contralateral TRA. Despite the limitations of the femoral access, when the mechanism of failure is the radial artery itself, ipsilateral TUA may be considered.[11] In our patients, tortuosity, dissection or perforation, severe spasm, and the radial artery with a high take-off were the reasons for discontinuation of the procedure and the crossover from TRA to TUA; however, recently, the use of distal radial artery access has been reported to be safe and helpful in these cases.[12]

There are 2 major concerns about simultaneous sheath insertion in both the radial and ulnar arteries. The first concern is hand ischemia due to obstruction of the 2 major arteries supplying the hand by 2 sheaths during the procedure. Kedev et al[6] reported no occurrence of hand ischemia in patients with radial artery occlusion undergoing ipsilateral transulnar catheterization procedures. This was most likely due to rapid recruitment of collateral flow from the interosseous arteries. The second concern is the simultaneous hemostasis of both arteries. Manual compression is feasible but using 2 overlapping balloon-based compression devices on the radial and ulnar arteries is also helpful. A Pulsera hemostatic device (Accumed Radial Systems LLC., Ann Arbor, Michigan, United States) also could be safe and practical for achieving simultaneous hemostasis in the radial and ulnar arteries.

Regarding complications, it should be noted that there are several causes of a relatively high incidence of radial artery occlusion (approximately 35%), including multiple radial artery

puncture and manipulation, prolonged sheath removal time, atretic or small-diameter radial artery, severe tortuosity and loop, high take-off, and limited experience in hemostatic strategies.

This report demonstrated that ipsilateral TUA could be a secure and viable alternative approach for cardiovascular interventions in case of inaccessible radial and femoral arteries.

ARTICLE INFORMATION

CONFLICT OF INTEREST None declared.

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