

Ipsilateral radial and ulnar artery cannulation during the same coronary catheterization procedure

Koutouzis M¹, Ziakas A², Didagelos M², Maniotis C¹, Kyriakides Z¹

¹Cardiology Department, Red Cross General Hospital, Athens

²1st Cardiology Department, AHEPA Hospital, Aristotle University of Thessaloniki, Thessaloniki Greece

Abstract

Background: Switching to femoral after a failed radial approach carries an increased risk of bleeding complications since the femoral artery puncture is performed in patients already anticoagulated. Moreover, dedicated radial operators find it more and more difficult to use the femoral approach, and ulnar artery cannulation provides them with the opportunity to further reduce its use. Our objective was to evaluate the feasibility and safety of ipsilateral radial and ulnar artery cannulation during the same coronary catheterization procedure.

Methods: We performed a retrospective analysis of all cardiac catheterizations, from January 2015 until June 2016, with initial radial approach and conversion to ipsilateral ulnar approach. Patients with sheath insertion both in radial and ipsilateral ulnar arteries were further evaluated.

Results: Four thousand one hundred and two procedures were performed during the study period, and 3,876 (94.5 %) of them were performed initially through a radial approach. Radial and ipsilateral ulnar catheterization was accomplished in nine patients, resulting in successful catheterization and procedure completion, without any serious complications recorded.

Conclusions: Ipsilateral radial and ulnar artery catheterization proved to be feasible and safe, without any serious complications. Hippokratia 2016, 20(3): 249-251

Keywords: Transradial, transulnar, cardiac catheterization, radial artery catheterization, ipsilateral ulnar artery catheterization, coronary intervention

Corresponding author: Michael Koutouzis, MD, PhD, Red Cross General Hospital, 11526, Athens, Greece, tel: +302132068304, +306972321536, fax: +302132068084, e-mail: koutouzismike@yahoo.gr

Introduction

Transradial approach for cardiac catheterization is a world wide evolving technique since it results in less bleeding complications and less mortality in ST-segment elevation myocardial infarction (STEMI) patients treated with primary percutaneous coronary intervention (PCI)^{1,2}. Due to the possibility of radial artery occlusion after the procedure, a functional dual blood supply (from the radial and ulnar artery) of the hand was considered crucial before radial catheterization. However, recent evidence showed that even patients with a negative Allen's test could be successfully and safely catheterized through the radial artery³. Dual sheath insertion (in radial and ipsilateral ulnar artery) is not a recommended practice and data on this strategy are limited⁴. In the present study we evaluated the feasibility and safety of this strategy.

Methods

Study sample

We performed a retrospective analysis of all patients who underwent cardiac catheterization in the Red Cross General Hospital during an 18-month period (January 2015

- June 2016). The initial approach, conversion to another approach and the alternative approach were all at operating physician's discretion. All five operators were high volume operators (more than 300 cases per year) and experienced in transradial procedures (more than 80 % radial approach for all operators). Informed consent was obtained from all patients before the procedure. The study was approved by the institution's Ethics committee (Red Cross General Hospital Scientific Committee, 32-02/12/2014).

Radial and ulnar artery cannulation

All radial and ulnar arteries were cannulated with the cannula over the needle technique, with a 20G plastic cannula. When optimal arterial "back flow" was obtained, a 0.025" guidewire was inserted, and a 5Fr or 6Fr introducer (SCW Mediacath LTD, China or KDL, China) was inserted over the guidewire. The size of the introducer was at operating physician's discretion. Switching to a larger introducer was performed by leaving the 0.035" guidewire in place to secure access to the ascending aorta, and a femoral introducer was inserted over the guidewire in the forearm artery. Unfractionated heparin (50-100

IU/Kgr, maximum 5,000 IU) and verapamil 5 mg were administered intra-sheath to avoid artery occlusion and spasm. Cannulation of the radial and the ipsilateral ulnar artery is shown in Figure 1.



Figure 1: Radial and ipsilateral ulnar artery cannulation of the right forearm.

Coronary angiography and intervention

Diagnostic procedures were performed with 5Fr catheters (Boston Scientific, Marlborough, Massachusetts, USA), while percutaneous coronary interventions were performed with 6Fr or 7Fr guiding catheters (Boston Scientific, Marlborough, Massachusetts, USA). The type of the guiding catheter, coronary guidewires, balloons, and stents were at operating physician's discretion. Bivalirudin (0.75 mg/kg bolus and 1.75 mg/kg/h infusion until the end of the procedure) or unfractionated heparin intravenously (in order to achieve 100 IU/kg in total) was administered in PCI patients. Glycoprotein IIb/IIIa inhibitors were used as a bail-out therapy.

Hemostasis

Hemostasis was achieved using a tourniquet based closure device (KDL, China) and patent hemostasis or ULTRA method facilitated patent hemostasis was aimed in all patients⁵. In the case of ipsilateral radial and ulnar artery cannulation during the same procedure, two devices were placed on the same wrist. The devices were gradually released and in most cases were withdrawn after 3-4 hours. The patency of the radial and ulnar artery was evaluated before patient's discharge by radial artery palpation and Doppler or duplex ultrasonography.

Results

Four thousand one hundred two patients were included in the analysis. Three thousand eight hundred seventy-six (94.5 %) of the procedures were performed with the radial approach as the primary operator's choice. After sheath insertion, in 190 (4.9 %) patients successful completion of the procedure was not possible, and a conversion to another approach was necessary. The following approaches were chosen: femoral approach (56 patients, 29.5 %), contralateral radial (101, 53.2 %), contralateral ulnar (24, 12.6 %) and ipsilateral ulnar (9, 4.7 %).

Nine patients who had the radial and the ipsilateral ulnar artery cannulated during the same procedure were identified. None of them had a prior radial or ulnar artery catheterization. Patient characteristics, type of procedure, sheath size, cause of conversion, and procedure outcome

are presented in Table 1. All nine patients had palpable and patent by ultrasound radial and ulnar arteries after closure device removal and no local ischemic complications. One patient suffered a mild forearm hematoma graded as type II according to the Early Discharge After Transradial Stenting of Coronary Arteries (EASY) classification, which resolved conservatively.

Discussion

All radial and ipsilateral ulnar catheterizations were successfully accomplished, without the need to convert to a femoral approach. Switching to the femoral approach after a failed radial approach carries an increased risk of bleeding complications, since the femoral artery puncture is performed in patients already anticoagulated (after radial sheath insertion, heparin is always administered).

Agostoni et al have previously published the results of the SWITCH registry with six patients having a radial and ipsilateral ulnar artery simultaneous cannulation, without any reported ischemic complications⁴. Our data shed further light on this approach. It should be mentioned that the rate of radial approach in our cohort was much higher (94.5 % versus 66.5 %) and the rate of switching from the radial to another approach (4.9 % versus 6.9 %) was less.

Dedicated radial operators find it more and more difficult to use the femoral approach. This can be faced with two alternatives: either by increasing the transfemoral procedures in order to maintain their skills or by reducing it further in order to practically eliminate the possibility to use it. In our center, we apply the second alternative, as we maintain the femoral approach only as a final solution when all other forearm approaches are not feasible. We usually try this in the following order: right radial, left radial, right ulnar, left ulnar artery. In the aforementioned cases, we switched to the ipsilateral ulnar approach because there were contraindications for the contralateral forearm approach or this was considered not a good alternative. Furthermore, there were relative contraindications or patient's preference against the femoral approach (as explained in Table 1).

Radial approach is a worldwide expanding method and is continuously evolving compared with the traditional femoral approach. New strategies are developed in order to expand the transradial approach in populations formerly considered as a contraindication (patients with negative Allen's test, end-stage renal disease, previous coronary artery bypass grafting and implantation of two mammary arteries, need of catheters larger than 6Fr) and to improve the outcomes of patients treated transradially (minimize the conversion to femoral, reduce pain and spasm, reduce radial artery occlusion). Recently, we published the results of the transradial catheterization in patients with negative Allen's test and the feasibility and safety of this strategy, were manifested³. Kedev et al reported the results of the transulnar approach and the feasibility and safety of this approach even in patients with previously occluded radial artery⁶. This was also confirmed by our results when we used the transulnar approach in patients with a harvested ipsilateral radial artery⁷. It seems that the rich collateral

Table 1: Demographic and procedural characteristics of the nine patients with radial and ipsilateral ulnar artery cannulation.

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
Age (years)	85	57	64	75	68	58	68	73	74
Gender	Male	Male	Male	Male	Male	Female	Male	Male	Female
Indication	NSTEMI	NSTEMI	STEMI	HF	Chest pain	Chest pain	NSTEMI	HF	Chest pain
Medical history	CABG, PAD	Prior MI, PCI, PAD	ESRD	PAD	DM II	Prior PCI	DM II	Prior MI	HF
Type of procedure	Angio + PCI	Angio + PCI	Angio + PCI	Angio	Angio	Angio	Angio + PCI	Angio	Angio
Sheath size	6F for both	Radial 6F, ulnar 7F	7F for both	5F for both	5F for both	5F for both	6F for both	5F for both	5F for both
Cause of conversion	Radial dissection	Radial perforation	Radial 360° angulation	Radial 360° angulation	Radial dissection	Radial spasm	Accessory brachial artery	Radial dissection	Radial 360° angulation
Contrast volume (ml)	150	100	100	50	60	110	170	90	90
DAP (cGy cm ²)	5640	3520	2483	1350	960	1560	3490	1850	1500
Radiation time (min)	5.8	5.4	4.1	2.0	1.6	4.8	6.0	2.4	3.1

AF: atrial fibrillation, Angio: coronary angiography, AV: arterio-venous, CABG: coronary artery bypass grafting, DAP: dose area product, DM II: diabetes mellitus type II, EASY: EARly discharge after transradial Stenting of coronary arteries, ESRD: end stage renal disease, HF: heart failure, LAD: left anterior descending artery, LIMA: left internal mammary artery, MI: myocardial infarction, NSTEMI: non ST-segment elevation myocardial infarction, PAD: peripheral artery disease, PCI: percutaneous coronary intervention, STEMI: ST-segment elevation myocardial infarction.

circulation of the arm, with the crucial role of the anterior interosseous artery, can provide sufficient blood supply for the hand, even in circumstances of temporary ipsilateral radial and ulnar artery malfunction, as it is the case in occlusion or sheath insertion.

Regarding hemostasis in patients having ipsilateral radial and ulnar artery cannulation, two devices were placed on the same wrist, and all patients had patent radial and ulnar arteries after closure device removal and no local ischemic complications. Similar hemostatic conditions have been described during the previously published ULTRA method⁵ for radial artery hemostasis. In these patients simultaneous compression of both radial (preferably with patent hemostasis) and ulnar arteries is performed, without symptoms or signs of hand ischemia, in order to augment radial artery flow and reduce the rates of occlusion.

It is prudent to keep in mind that ipsilateral radial and ulnar artery cannulation during the same approach should be reserved for patients: i) where contralateral radial or ulnar approach are not available, ii) when the estimated bleeding risk of the femoral approach is high (obesity, recent use of anticoagulants), and iii) only when performed by experienced radial operators.

The limitations of our study include the retrospective method of data collection, the small absolute number of patients finally managed with radial and ipsilateral ulnar artery cannulation and that all interventional cardiologists were dedicated radial operators with great experience in forearm arteries cannulation.

Conclusion

Radial and ipsilateral ulnar arteries cannulation during

the same procedure is feasible and safe when applied in selected patients by experienced operators.

Conflict of interest

The authors declare that they have no conflict of interest.

References

- Agostoni P, Biondi-Zoccai GG, de Benedictis ML, Rigattieri S, Turri M, Anselmi M, et al. Radial versus femoral approach for percutaneous coronary diagnostic and interventional procedures; Systematic overview and meta-analysis of randomized trials. *J Am Coll Cardiol.* 2004; 44: 349-356.
- Jolly SS, Amlani S, Hamon M, Yusuf S, Mehta SR. Radial versus femoral access for coronary angiography or intervention and the impact on major bleeding and ischemic events: a systematic review and meta-analysis of randomized trials. *Am Heart J.* 2009; 157: 132-140.
- Maniotis C, Koutouzis M, Andreou C, Lazaris E, Tsiapoutis I, Zografos T, et al. Transradial Approach for Cardiac Catheterization in Patients With Negative Allen's Test. *J Invasive Cardiol.* 2015; 27: 416-420.
- Agostoni P, Zuffi A, Faurie B, Tosi P, Samim M, Belkacemi A, et al. Same wrist intervention via the cubital (ulnar) artery in case of radial puncture failure for percutaneous cardiac catheterization or intervention: the multicenter SWITCH registry. *Int J Cardiol.* 2013; 169: 52-56.
- Koutouzis MJ, Maniotis CD, Avdikos G, Tsoumeleas A, Andreou C, Kyriakides ZS. ULnar Artery Transient Compression Facilitating Radial Artery Patent Hemostasis (ULTRA). A Novel Technique to Reduce Radial Artery Occlusion After Transradial Coronary Catheterization. *J Invasive Cardiol.* 2016; 28: 451-454.
- Kedev S, Zafirovska B, Dharma S, Petkoska D. Safety and feasibility of transulnar catheterization when ipsilateral radial access is not available. *Catheter Cardiovasc Interv.* 2014; 83: E51-E60.
- Koutouzis M, Maniotis C, Agelaki M, Tzifos V, Matsoukis I, Lazaris E. Transulnar approach for coronary catheterization in patients with a harvested ipsilateral radial artery: A case series. *Cardiovasc Revasc Med.* 2016; pii: S1553-8389(16)30292-5.