

Percutaneous trans-ulnar artery approach for coronary angiography and angioplasty; A case series study

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Case Series

Abstract

BACKGROUND: Coronary angiography is the gold standard method for diagnosis of coronary heart disease and usually performed by femoral approach that has several complications. To reduce these complications, upper extremity approach is increasingly used and is becoming preferred access site by many interventionists. Although radial approach is relatively well studied, safety, feasibility and risk of applying ulnar approach is not clearly known yet.

METHODS: We followed 97 patients (man = 56%, mean \pm standard deviation of age = 57 ± 18) who had undergone coronary angiography or angioplasty via ulnar approach for 6-10 months and recorded their outcomes.

RESULTS: In 97 patients out of 105 ones (92.38%), procedure through ulnar access were successfully done. Unsuccessful puncture (3 patients), wiring (2 patients), passing of sheath (2 patients), and anatomically unsuitable ulnar artery (1 patient) were the reasons of failure. In 94 patients (89.52%), the angiography and angioplasty was done without any complications. Five patients (5.1%) hematoma and 11 patients (11%) experienced low-grade pain that resolved with painkiller. No infection, amputation or need for surgery was reported.

CONCLUSION: This study demonstrated that ulnar access in our patients was a safe and practical approach for coronary angiography or angioplasty, without any major complication. Bearing in mind its high success rate, it can be utilized when a radial artery is not useful for the catheterization and in cases such as prior harvesting of the radial artery (in prior coronary artery bypass grafting).

Keywords: Outcome of Arterial Access, Coronary Angiography, Coronary Angioplasty

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Introduction

Coronary angiography (CAG) is the gold standard for detection of arterial narrowing related to atherosclerotic coronary artery disease (CAD). This procedure provides the most reliable information for determining the effectiveness of medical therapy as well as interventional procedures such as percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG) in patients with CAD.¹

Coronary angiography is performed through percutaneous approach to arteries; therefore, selecting the best vascular access is one of the first decisions for any percutaneous cardiovascular procedure. For the first time this approach was applied in 1953,² and brachial artery was the first

access to use.³ Then cardiovascular interventionists began to use of femoral access for CAG and PCI due to some complications of brachial access in 1967.⁴ However, this new access site has shown to have several complications as well.⁵⁻⁹ During 1989 till 1999 percutaneous radial artery approach started to be applied by cardiology interventionists.¹⁰ There is already a considerable amount of articles that discuss about the conversion to predominantly radial access and its results.¹¹ Moreover recently, an interest for upper limb approach has been emerged in some patients as it has been shown to result in significantly less clinical complications.¹²

Trashima and his colleagues were the first who reported the feasibility of trans-ulnar approach for diagnostic catheterization of coronary arteries more

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than one decade ago¹³ and their study was followed by limited numbers of investigations later.¹⁴ A number of studies has revealed that this method is safe and feasible and has some advantages over trans-radial approach.¹⁵ However, while the transradial approach has been proven to be useful and is established as an accepted alternative to femoral approach,^{16,17} trans-ulnar artery approach, and its potential risks need to be more investigated. In this article, we will discuss this approach based on 6-10 months follow-up of 97 patients undergone CAG or PCI through ulnar access.

Materials and Methods

We examined 97 patients that have been under CAG or PCI through ulnar approach from June 2013 till February 2014. We followed all of the patients that were under ulnar approach.

The patients were from two hospitals of Isfahan University of Medical Sciences, Iran, (Chamran Heart Center and Noor Hospital).

Clinical diagnosis of 78 patients was chronic CAD, while acute coronary syndrome (ACS) and acute myocardial infarction (AMI) were the indications of the intervention in 15 and 4 patients respectively (risk factors for need to intervention is presented in table 1).

CAG was performed in 81 patients and 16 patients underwent PCI. We used right hand ulnar artery in 86 patients and left one in 11 cases.

Assessment of the deep palmar arch (Allen's test) was done for all of the patients.

For the procedure, after injection of 1.5 cc lidocaine (2%) by 2 cc syringe at the puncture site (usually about 2 cm from the head of ulnar bone) the ulnar artery was punctured with fine needle. A short guide wire was inserted and then a 5-6 French radial hydrophilic sheath was placed over the wire.

After injecting 5 cc of cocktail (consist of nitroglycerine 250 µg, verapamil 2.5 mg and normal saline diluted heparin 2500 units), 0.035" wire was

passed through ulnar artery into brachial artery and entered coronary arteries via ascending artery.

6" tiger, right judkins and left judkins catheters were used for CAG and 6" Icaris, extra back-up and right judkins guiding catheters for PCI. Using ulnar approach was canceled in four cases due to the severe tortuosity of their ulnar arteries.

The patients were followed by observation and examination at the post catheters laboratory (right after procedure), at coronary care unit (CCU) or ward and every other month for at least 6 months and up to 10 months at the clinical office.

We used a data gathering form to record patients' related information including demographic data, diagnosis, complications (major complications such as pulselessness, site ischemia, ulnar nerve damage, surgery or need to consult with surgeon, need to blood transfusion or hand amputation, myocardial infarction or pseudoaneurysm, AV fistula and ulnar artery occlusion), (minor complications such as low grade hematoma (Grade 1 hematoma: under 5 cm subcutaneous hematoma or Grade 2: under 10 cm), pain, irritation of ulnar nerve, and methods for resolving the complications and patients outcomes. Risk factors of complications in ulnar approach were emergent procedure, severe tortuosity of ulnar artery, narrowing of ulnar artery and lack of good and new wire.

Results

Totally, 54 patients (55.67%) were males and the age range of patients was from 37 to 84 years (mean ± standard deviation: 57 ± 18). Table 1 showed the frequency of major cardiovascular risk factors in both sexes. In total, 78 (80%), 15 (16%), and 4 (4%) suffer from CAD, ACS, and AMI, respectively. among the patient 81 (83%) and 16 (17%) underwent CABG and PCI, respectively. Angiography procedures performed 86 (88%) by the right hand and 11 (12%) by the left hand.

Table 1. Frequency of major cardiovascular risk factors based on sex

| Risk factor | Men n (%) | Women n (%) |
|---|--------------|----------------|
| Smoking (ever smoked) | 20 (37) | 1 (2) |
| Diabetes (FBS ≥ 26 mg/dl) | 15 (33) | 19 (44) |
| Hypertension (SBP ≥ 140, DBP ≥ 90 mmHg) | 17 (31) | 15 (35) |
| History of myocardial infarction | 11 (20) | 4 (9) |
| Hyperlipidemia (Chol ≥ 200 mg/dl) | 23 (42) | 25 (58) |
| Family history of coronary artery disease | 11 (20) | 13 (30) |

FBS: Fasting blood sugar; SBP: Systolic blood pressure; DBP: Diastolic blood pressure

Frequency of complications

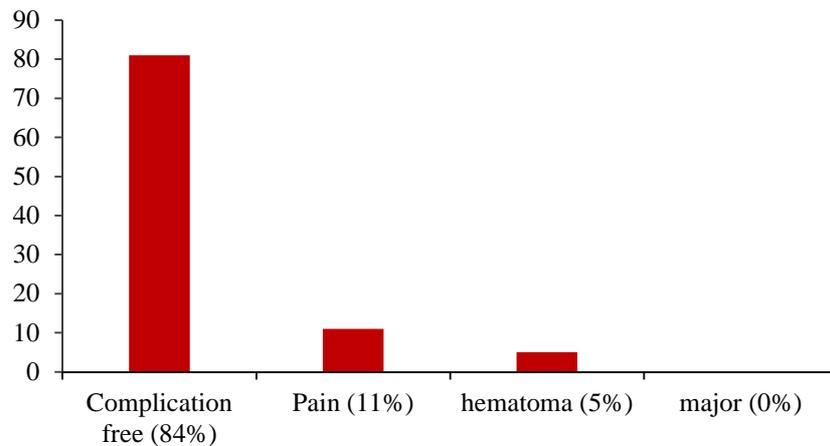


Figure 1. Frequency of trans-ulnar approach complications

Considering major complications, none of our patients showed any of them. Regarding minor complications, 5 patients in PCI group experienced Grade 1 hematoma in ulnar region (5.1%), which was healed by local compression, bandage and oral analgesics. All of these 5 patients discharged one day after the procedure. Furthermore, 11 patients (11.3%) had a low grade pain in their hand and irritation of ulnar nerve that were resolved by administration of dexamethasone (0/5 mg) + non-steroidal anti-inflammatory drugs (200 mg ibuprofen) + gabapentin (100 mg) (oral). In 8 cases of 105 patients, this approach was not successful. Unsuccessful puncture (3 patients), unsuccessful wiring (2 patients), unsuccessful passing of sheet (2 patients) and anatomically unsuitable ulnar artery (1 patient) were the reasons of failures. Figure 1 shows the frequency of trans-ulnar approach complications among our study population.

Discussion

This study showed that ulnar approach for CAG or PCI in our patients could be consider as a safe and practical method with only minor and easily resolvable complications. Our patients showed very limited minor complications that relieved easily and quickly. In line with this, two studies had been designed to evaluate safety and feasibility of this approach. In the first study 13 patients had been followed for 30 days and in the second study 28 patients were followed for 1 week.^{15,18} In both studies they didn't find any major complication due to this access and have concluded that ulnar artery is a safe and feasible approach for cardiac CABG

and PCI. Furthermore in a recent study on 410 patients, access site related complications were reported only in 3.9% of patients without any incidence of major complications.¹⁹ De Andrade et al.¹⁹ have listed their reasons for using ulnar approach and a wider and easily palpable pulse of the ulnar artery compared to the radial, was reported as the first reason which accounts for 73.2% of the cases. According to this article, this approach results in decreasing the incidence of vasospasm and consequently procedure failure and leads to more patient satisfaction.

Success rate of using this approach in our study was 92%. The reported success rates in some other studies have been 100% (20), 98.5% (19) and 88%.¹³ Besides, results of an investigation done to compare two upper limb accesses for arterial cannulation, showed that arterial cannulation success rate is equivalent in radial and ulnar (with strong pulse) approach.²⁰

Ulnar artery is usually larger than radial which may make it less disposed to catheter-induced vasospasm compared to the radial artery. Furthermore, this can lead to taking advantage of larger arterial sheaths. Moreover, ulnar nerve trauma is a potential complication of this method, which has not been reported in some studies. It is believed that applying a proper size needle and careful placement of it would be helpful to avoid the occurrence of this complication.^{15,21-23}

Furthermore, we recommend performance of Doppler sonography of upper limb in patients with persistent signs or weak end pulses. Furthermore, coronary angiography via femoral artery access should be considered in the case of severe hand

ischemia, although we didn't need to use any of these procedures.

In summary, in our patients, trans-ulnar approach for PCI and CAG was safe an alternative to the trans-femoral and trans-radial approaches that can be safely applied when those accesses are at high risk of complications or failure and even potentially may be considered as the preferred primary access site.

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Conflict of Interests

Authors have no conflict of interests.

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