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Transulnar versus transradial approach for coronary angiography and angioplasty: Considering their complications

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Original Article

Abstract

BACKGROUND: Transulnar approach was introduced as an alternative procedure for transradial coronary angiography (CAG) due to its safety and feasibility. The present study was accomplished with the aim to compare major and minor complications of these two upper extremity approaches in the population under study.

METHODS: In this prospective observational study, 216 patients who underwent CAG and/or angioplasty via radial (111 cases) or ulnar artery (105 cases) were observed and followed for 6 months and were evaluated for major adverse cardiac events (MACEs), minor and major neurovascular events (access related) of the arm including paresthesia/pain, pseudoaneurysm, artery spasm, arterial occlusion, large hematoma, and necessity for amputation or emergency surgery.

RESULTS: The majority of patients were men (62.1%) with a mean age of 59.98 ± 9.74 years old. No MACEs and major life threatening vascular complication like large hematoma, need for amputation or surgery, and hand ischemia were occurred. There was no significant difference in minor complications, except for arterial occlusion 9.0 % vs 1.0 % and artery spasm 12.6 % vs 1.9 % in transradial and transulnar approaches, respectively ($P < 0.05$).

CONCLUSION: This study suggested that both transradial and transulnar approaches were safe and feasible for CAG and/or angioplasty. However, regarding minor complications, arterial spasm and occlusion were significantly more common in transradial approach.

Keywords: Radial Artery, Ulnar Artery, Coronary Angiography, Complication

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Introduction

Coronary angiography (CAG) is known as a gold standard diagnostic approach for atherosclerotic coronary artery diseases (CADs).[1-3] Transfemoral artery approach is a common and routine method for CAG and percutaneous coronary intervention (PCI). Moreover, transradial approach is known as a safe alternative method with lesser access site bleeding, patient satisfaction, and preference and early ambulation.[4,5] Some limitations of transradial approach are small size artery, radial artery anatomic variations (radial loop, highly take off, tortuosity), radial artery harvesing for coronary artery bypass grafting (CABG), radial artery occlusion (RAO), and radial artery spasm.[6-8] Accordingly, transulnar approach was performed since more than a decade ago by Terashima et al.[9] Although several studies suggested that transulnar approach is a safe and feasible method for coronary angiography and angioplasty,[6-9] higher cross over rate, access failure, and possibility of ulnar nerve trauma are challenging.[10] However, the authors in the present study believe that the odds of these side effects are negligible when this method is performed by experienced operators. Therefore, the present study was carried out to assess the transradial versus transulnar access-related complications in our center, two hospitals of Isfahan University of Medical Sciences (Shahid Chamran Heart Center and Noor

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Materials and Methods

In this prospective observational study, 231 patients candidate for CAG or angioplasty were examined from July 2016 to Dec 2016. The patients were admitted to two hospitals of Isfahan University of Medical Sciences (Shahid Chamran Heart Center and Noor Hospital). Inclusion criteria were age > 18 years old, indication for CAG and angioplasty, and written informed consent to participate in the study. Patients with acute coronary syndrome (ACS), cardiogenic shock and/or hemodynamic instability, chronic hemodialysis, dermal myoskeletal forearm deformities, history of CABG, patients with planned elective femoral approach, and patients with abnormal Allen and reverse Allen Test were excluded from the study. The patients were randomly divided into two groups tolerating transradial and transulnar approaches with 118 and 113 cases, respectively. All procedures were performed by single interventional cardiologist expert in transradial and ulnar approaches.

Allen and the reverse Allen tests for assessment of deep palmar arch perfusion were performed for all of the patients. After prep and drep, 2 cc of lidocaine 2% was injected subcutaneously at the planned puncture site (3 cm above proximal wrist crease). Following puncture with fine needle, radial sheath (5-6 French) was inserted over hydrophilic guidewire. A cocktail which contained 20 cc of normal saline, 200 microgram nitrate and 2.5 mg verapamil, flushed through 5-6 French hydrophilic sheath. Unfractionated heparin (5000 units) was also injected systemically.[11] Over the 0.035-inch guide wire, the diagnostic catheter (Tiger 5-6 French) was inserted. EBU and Judkins catheters were used for angioplasty and TR band was used for final hemostasis.

In this study, the incidence of death, myocardial infarction (MI), stroke, and urgent target vessel revascularization (TVR) as major adverse cardiac events (MACEs) within the hospital and during the 6 months after the procedure were assessed.

Major and minor neurovascular events (access related) of the arm including pain/motor paralysis/paresthesia, large hematoma, pseudoaneurysm, artery spasm, arterial occlusion, and necessity for amputation or emergency surgery were also recorded. The hematoma grading was according to the classification proposed in the study by Bertrand et al.[12,13] This scale included a hematoma < 5 cm, 5-10 cm, > 10 cm, proximal to the elbow hematoma, and compartment syndrome as grade I, grade II, grade III (grade I to III were distal to the elbow, grade IV, and grade V, respectively.[12,13] The follow up data were obtained by an interventional cardiologist in two separate clinic visits in 3 and 6 months after the procedure. Demographic data included age, gender, and CAD risk factors like diabetes mellitus (DM), smoking, dyslipidemia, hypertension, and history of old MI. The data were collected through the data gathering forms.

Pearson's chi-square test and Fisher's exact test were considered for analyzing categorical data. Statistical analysis of data was carried out using the statistical program for social sciences (SPSS) software (version 15.0, SPSS Inc., Chicago, IL, USA). All differences were considered as statistically significant at a P value less than 0.050.

Results

Four patients excluded from the study because of uncooperation. Failure to puncture (3 and 5 cases in radial and ulnar approaches, respectively) and failure to wire cross (3 cases in radial approach) were the result of unsuccessful procedures. Finally, 216 patients including 111 and 105 cases respectively in transradial and transulnar approaches were analyzed. The majority of the subjects were men (62.1%) with a mean age of 59.98 ± 9.74 years old. There was no significant difference between the groups in terms of the demographic and clinical data (Table 1).

Table 1. Demographic and clinical characteristics of the study subjects

Demographic and clinical variables	Transradial approach (n = 111)	Transulnar approach (n = 105)	P
Age (mean ± SD)	59.55 ± 10.26	60.32 ± 9.20	0.622
Gender (men) [n (%)]	69 (62.1)	63 (60.0)	0.745
Hypertension [n (%)]	21 (18.9)	23 (21.9)	0.586
DM [n (%)]	16 (14.4)	22 (20.9)	0.207
Dyslipidemia [n (%)]	22 (19.8)	28 (26.6)	0.233
Previous MI [n (%)]	14 (12.6)	9 (8.5)	0.336
Current smoker [n (%)]	13 (11.7)	9 (8.5)	0.446
Angiography [n (%)]	69 (62.1)	83 (79.0)	0.007
Angioplasty [n (%)]	42 (37.8)	22 (20.9)	0.007

SD: Standard deviation; DM: Diabetes Mellitus; MI: Myocardial infarction

Table 2. Comparison of minor and major complications of transradial versus transulnar approach in coronary artery angiography and angioplasty

Complication	Transradial approach (n = 111)	Transulnar approach (n = 105)	P
MACEs	0 (0.0)	0 (0.0)	-
Hematoma	11 (9.9)	11 (10.4)	0.893
Paresthesia/pain	13 (11.7)	12 (11.4)	0.948
Artery spasm	14 (12.6)	2 (1.9)	0.002
Pseudoaneurysm	0 (0.0)	0 (0.0)	-
Arterial occlusion	10 (9.0)	1 (0.9)	0.006
Amputation/emergency surgery/large hematoma	0 (0.0)	0 (0.0)	-

MACEs: Major adverse cardiac events

No MACEs were occurred in both groups. In addition, no major access-related complications such as grade 5 hematoma, necessity for amputation or surgery were occurred (Table 2). Comparing the minor complications indicated that there was not significant differences in paresthesia/pain and hematoma (P = 0.948 and P = 0.893, respectively) (Table 2). Local pain and/or paresthesia was treated with analgesic (ibuprofen or steroid). Local hematoma was controlled with compression bandage and ice bag. All hematomas were grade 1-3, except 1 patient in transulnar group who developed to grade 4. All hematomas were controlled with the above-mentioned conservative management. In contrast to the above, differences in arterial occlusion and artery spasm were significant between the two groups (P < 0.050) (Table 2). Arterial occlusion was significantly higher in transradial approach (9.0% vs 1.0%, P = 0.006), which was diagnosed by physical examination and documented by Doppler sonography (absent pulses). As there was no significant ischemia associated with this complication, no further treatment was performed. Arterial spasm was also significantly higher in transradial group (12.6% vs 1.9%, P = 0.002) and was treated with systemic nitrate. No pseudoaneurysm was occurred in both groups.

Most of these complications were observed during the first week, while hematoma occurred in the first 24 hours.

Mean time of procedure (from arterial puncture till reaching to ascending aorta) was 20 ± 8 and 21 ± 11 minutes in transradial and transulnar approaches, respectively (P = 0.723).

Discussion

This study showed that both transradial and transulnar approaches are safe and feasible alternatives for femoral CAG and angioplasty regarding to the MACEs and access site complications. Regarding the difficulties with transradial approach including radial artery anatomic variations and complications including RAO and spasm, ulnar artery contained positive aspects like less anatomic variations and larger artery size, preventing arterial spasm, which were the purpose and necessity of this study. The transulnar CAG safety and feasibility was shown in few recent studies;[7-9] although Hahalis et al. questioned the feasibility of transulnar approach in comparison to transradial approach. They found higher cross-over rates in transulnar approach in comparison to transradial procedure.[10] No MACEs or necessity for amputation and emergency surgery were observed in the present study as shown previously in similar ones.[6-9] Considering minor complications (transulnar approach), pain and/or paresthesia was complained by 11.4% of the patients in the present study; this rate is close to the result of the study by Roghani-Dehkordi et al. as 11.0%,[7] or even lower than the rate reported by Sallam et al. as 15.5%.[14] This variation may be related to the sensitivity of the patient and/or population to the pain and also somehow to the accuracy of the observer to pick out this complication. However, it should be emphasized that puncturing by the skilled individuals and decreasing puncture time as low as possible will decrease pain/paresthesia. Hematoma (not life and limb threatening) was occurred in 10.5% of the patients participating in this study with transulnar approach, this is in agreement with other studies.[7-12] Spasm was significantly higher in transradial approach compared to transulnar approach with 12.6% and 1.9%, respectively as shown in other studies, for instance the studies carried out by Hahalis et al.[10] and Louvard and Lefevre.[15] This may be related to smaller size of radial artery and also its tortuosity causing prone it to spasm. Decreasing puncture time, flushing with cocktail (including nitrate and/or verapamil) and gentle handling of wire and catheter decrease arterial spasm.[16] In the present study, RAO was significantly more than ulnar artery occlusion with 9.0% and 1.0%, respectively. Several studies also showed similar values.[7,13,17] Lower rate of ulnar artery

occlusion most probably results from higher size of ulnar artery, and also deep location of ulnar artery which inhibited complete occlusion of artery during hemostasis in comparison to the radial approach.[10,14]

Conclusion

As shown in the present study, transulnar CAG was safe and feasible as transradial approach regarding to MACEs and vascular (access site) complications. However, minor complications like RAO and artery spasm were more common in transradial approach.

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Conflict of Interests

Authors have no conflict of interests.

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