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Original Article

Distal Versus Proximal Radial Intervention; Is It Really Worth of It?

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Abstract

Objectives: Distal transradial approach (dTRA) is a promising technique with a decreased risk of radial artery occlusion and puncture-related injuries. There has been no data which compare dTRA and proximal transradial approach (pTRA) in Turkish population group, so far. Thus, researchers aimed to compare the efficacy and safety of the dTRA versus the conventional pTRA in coronary procedures in this study.

Methods: Between September 2021 and June 2022, patients scheduled for transradial angiography at a tertiary cardiac center were enrolled in this study. Patients were randomly selected to undergo coronary imaging using either the distal dTRA or the conventional pTRA in equal numbers. A total of 79 patients were randomized to the proximal approach, and 77 patients were randomized to the dTRA. The primary endpoint was defined as procedural failure.

Results: The success rate of cannulation of the dTRA was significantly lower compared to proximal pTRA (pTRA [89.6%] and pTRA [79%] p=0.002). The rate of radial artery thrombotic complications was not different between groups (proxymal %10.6 vs. distal %5.8, p=0.288). The time of cannulation and total procedural time were longer in the dTRA group (20–40 min, median 25 min) compared to the proximal radial group (15–30 min, median 20 min) p = 0.005. However, this did not affect the total scope time duration 3.3 min. (1.6–6.4) versus 2.4 min (1.6–3.7).

Conclusion: dTRA has a relatively long access time with no advantages in terms of thrombotic complications in the radial artery.

Keywords: Distal radial access; proximal transradial access; radial artery occlusion.

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Distal veya Proksimal Radyal Arter Girişimi: Hangi Yolu Tercih Edelim?

Özet

Amaç: Distal transradial (dTR) yaklaşım, radial arterin oklüzyon riskinin ve girişim ile ilgili zedelenme riskinin azaldığı umut verici bir tekniktir. Şimdiye kadar, Türk popülasyon grubunda dTR yaklaşım ile proksimal transradial (pTR) yaklaşımı karşılaştıran veriler bulunmamaktadır. Bu nedenle, bu çalışma dTRA yaklaşımın, geleneksel pTR yaklaşıma göre etkinlik ve güvenliğini karşılaştırmayı amaçlamıştır.

Gereç ve Yöntem: Eylül 2021 ile Haziran 2022 tarihleri arasında üçüncü basamak bir kalp merkezinde transradial anjiyografi planlanan hastalar bu çalışmaya dahil edildi. Hastalar rastgele ve eşit sayıda seçilerek, distal dTR yaklaşım veya geleneksel pTR yaklaşım ile koroner görüntülemesi yapıldı. Hastalar, proksimal (n=79) ve distal transradial (n=77) yaklaşım açısından randomize edildi. Birincil sonlanım noktası prosedürel başarısızlık olarak tanımlandı.

Bulgular: dTR yaklaşımın kanülasyon başarı oranı, proximal pTR yaklaşıma kıyasla önemli ölçüde daha düşüktü (pTRA %89.6 ve dTRA %79; p= 0.002). Radial arter trombotik komplikasyon oranları gruplar arasında farklı değildi (proksimal %10.6 vs distal %5.8; p=0.288). Kanülasyon süresi ve toplam prosedür süresi, dTRA grubunda (20–40 dakika, median 25 dakika) proksimal radial gruba (15–30 dakika, median 20 dakika) göre daha uzundu (p=0.005). Ancak, bu toplam prosedür süresini etkilemedi; dTRA için 3.3 dakika (1.6–6.4) ve proksimal radial için 2.4 dakika (1.6–3.7) olarak bulundu.

Sonuç: Distal radyal yaklaşım göreceli olarak daha uzun bir girişimdir ve radyal arterde trombotik komplikasyonlar açısından avantaj sağlamadığı görülmüştür.

Anahtar sözcükler: Distal radyal girişim; proksimal radyal girişim; radyal arter oklüzyonu.

Introduction

Over the past decades, there has been an advance in the treatment of ischemic heart disease, including changes in the access site of invasive coronary procedures. Conventional radial access has been shown to have many advantages over the femoral approach not only in patients with coronary artery disease[1,2] but also in patients who underwent carotid artery stenting and cerebral angiography;[3,4] thus, transradial angiography is recommended by the current guidelines as a preferred site of intra-arterial access.[5]

Distal radial access in the anatomical snuffbox is a relatively new method. Proximal and distal transradial accesses are compared in patients who underwent angiography due to coronary artery disease. Although it has been demonstrated that, there has been an increased rate of radiation exposure in patients who underwent distal transradial angiography, radial artery occlusion (RAO) rates and hemostasis time are significantly low as compared to patients who underwent proximal transradial angiography.[6,7] Radiation exposure could depend on the operator; thus, the experience of the operator plays an important role in the design of the study.

The main objective of this study was to demonstrate the feasibility and safety of distal radial access compared with conventional transradial angiography in patients with stable coronary disease in Turkish population group.

Materials and Methods

This was a single-center prospective clinical study, and 154 consecutive patients who underwent coronary angiography or percutaneous coronary intervention from September 2021 to June 2022 were included. Patients with impalpable proximal or distal radial pulse were excluded. The exclusion criteria are patients with acute coronary syndrome, those with a lack of radial pulse those with bradycardia, and the patients who had previous radial intervention were excluded. The ethics committee of our hospital approved the study (Decision no: 2023.06-63).

The patients were randomized in terms of proximal (n=79) and distal transradial (n=77) access. The primary endpoints were defined as procedure failure, secondary practice endpoints were time of the procedure, and complications and RAO assessed by Doppler performed 24 h after the procedure.

Transradial Angiography

6 French introducer sheath (Terumo Co, Tokyo, Japan) as the standard access was used for all patients. The overlying skin of radial artery was infiltrated with 2% lidocaine. Radial artery puncture was performed with 20 G need using Seldinger method. After placement of sheath, 5 mg diltiazem, 200 mg nitroglycerin, and 5000 units of heparin were administered through radial artery sheet to prevent arterial spasm. Once coronary angiography was ended, the sheath was removed and a radial band was deployed to ensure hemostasis. Activating clotting time was not measured. If the initial randomized access site failed, further attempts to obtain vascular access were considered as crossover. Coronary angiographies were performed by two interventional cardiologists and each of them had experience in distal puncture technique over 3 months and performed more than 50 cases. Fluoroscopy time and radiation dose were measured in minutes and by milligray (mGy), respectively.

Ultrasonography

After the procedure, the characteristics of radial artery were evaluated using Siemens Acuson S 300 and 4 MHz transducer. The diameter of the artery was determined 2 cm proximally to the styloid process. RAO or monophasic flow at the radial artery was accepted as occlusive complication.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences, version 24.0 (SPSS Inc., Chicago, Illinois, USA). Whether the variables show normal distribution, visual (histograms and probability curves) and analytical methods (Kolmogorov–Smirnov or Shapiro–Wilk) were evaluated. Numerical variables showing normal distribution were mean±standard deviation (SD), numerical variables not showing normal distribution were expressed as median (interquartile range) and categorical variables as percentage (%). Numerical variables were evaluated using Student t-tests and the Mann–Whitney U-test between the two groups. Chi-square or Fisher exact tests were used to compare categorical variables. Logistic regression analysis was performed to identify independent predictors of RAO. A $p<0.05$ was considered statistically significant throughout this study.

Results

The main baseline characteristics of patients, according to randomization arm, were represented in Table 1. Mean age of all patients was 60 years, the study group consists of 77.3% men, 42.2% of the main patient group had diabetes mellitus, and 42.2% of them had arterial hypertension.

Demographic characteristics, body mass index (BMI), blood pressure, risk factors of coronary artery disease, and left ventricular ejection fraction were comparable in two randomization arms.

Hematoma rates were similar 5.9% between groups. All of these hematomas were mild according to the EASY criteria

Table 1. Baseline characteristics of the patients (after crossover between groups)

Variables	All patients (n=154)		Distal (n=69)		Proximal (n=85)		p
	n	%	n	%	n	%	
Age (years)	60.0±9.6		59.1±9.5		60.7±9.6		0.320
Gender (male)	119	77.3	58	84.1	61	71.8	0.070
Height (cm)	169.2±8.8		170.8±7.4		167.8±9.6		0.046
Weight (kg)	82.2±17.5		83.9±16.2		80.7±18.5		0.284
BMI (kg/m^2)	28.7±5.7		28.8±5.5		28.6±5.8		0.835
Diabetes mellitus	65	42.2	23	33.3	42	49.4	0.045
Hypertension	65	42.2	27	39.1	38	44.7	0.486
Hyperlipidemia	43	27.9	13	18.8	30	35.3	0.024
Ejection fraction (%)	60 (50–60)		60 (50–60)		57 (47–60)		0.565
Angiography duration (min)	25 (20–35)		25 (20–40)		20 (15–30)		0.005
Fluoroscopy duration (min)	2.6 (1.6–5.9)		3.3 (1.6–6.4)		2.4 (1.6–3.7)		0.110
Radiation dose (mSv)	200 (117–317)		191 (128–278)		200 (108–421)		0.680
Contrast amount (mL)	70 (60–100)		70 (56–90)		73 (60–100)		0.079
Radial artery diameter (mm)	2.92±0.67		2.86±0.57		2.95±0.75		0.515
Radial artery wall thickness (mm)	0.60 (0.20–0.80)		0.80 (0.18–0.90)		0.60 (0.20–0.70)		0.012
Depth of radial artery (mm)	7.21±2.36		7.29±2.39		6.35±2.09		0.453

Data are presented as percentage, mean±standard deviation or median (interquartile range). BMI: Body mass index.

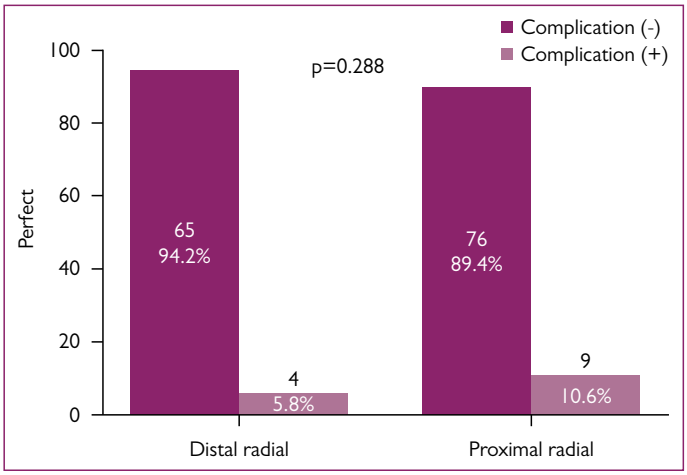

Figure 1. The comparison of distal transradial and proximal transradial angiography in terms of complications.

and managed conservatively. The success rate of cannulation of the distal transradial approach (dTRA) was significantly lower compared to the proximal transradial approach (pTRA) (pTRA 89.6% [8/77] and pTRA [%79] %100 p = 0.002). In dTRA group, six patients were converted to pTRA and two patients to the femoral approach. In two patients underwent dTRA, the access site was switched to femoral artery because of unsuccessful catheterization (the presence of loops in the right arm and arteria lusoria malformation).

The time of cannulation and total procedural time were longer in the dTRA group (20–40 min, median 25 min) compared to the proximal radial group (15–30 min, median 20 min) p = 0.005. However, this did not affect the total scope time duration 3.3 min (1.6–6.4) versus 2.4 min (1.6–3.7). There has been not any difference in term of radial artery thrombotic complications in two patient groups. (pTRA 10.6% vs. dTRA 5.8% [p=0.288, respectively]). When both patient groups were compared in terms of all complications, no difference in complications was observed (Fig. 1).

Table 2. Univariable regression analysis to predict radial artery occlusion

Variables	OR	95% CI	p
Age	1.019	0.958–1.083	0.556
Gender (male)	0.634	0.183–2.199	0.473
Height	1.012	0.935–1.094	0.772
Weight	0.957	0.908–1.009	0.107
BMI	0.816	0.674–0.956	0.036
Diabetes mellitus	0.583	0.171–1.982	0.387
Hypertension	1.191	0.381–3.727	0.764
Hyperlipidemia	1.162	0.338–3.994	0.811
Ejection fraction	0.979	0.926–1.035	0.460
Duration of procedure	1.003	0.975–1.032	0.817
Duration of scope	0.981	0.889–1.083	0.705
Radiation dose	0.997	0.993–1.002	0.233
Amount of radiopaque	0.996	0.984–1.009	0.535
Vessel diameter	0.591	0.225–1.554	0.286
Wall thickness of vessel	0.641	0.101–4.063	0.637
Distance of vessel to the skin	0.710	0.382–1.320	0.280
Distal	0.520	0.153–1.766	0.294

OR: Odds ratio; CI: Confidence interval.

Logistic regression analysis was performed to identify independent predictors of RAO. BMI was found to be the independent risk factor of RAO in all patient groups (OR: 0.816, CI: [0.674–0.956], p=0.036) (Table 2).

Discussion

In this study, it is aimed to compare distal transradial angiography and proximal transradial angiography in terms of RAO, radiation exposure, and procedure time. Differently from

other studies' results, there has been no significant difference in radial exposure in two patient groups.

Distal transradial angiography is a relatively new interventional technique, introduced by Dr. Kiemeneij in 2017. Distal radial artery is a branch of the radial artery and is located at this narrow snuff box. Although diameter of distal radial artery and it tortuosity may downward the success rates of punctuation and cannulation, it has been stated in this data that, distal radial artery can be used safely in diagnostic and therapeutic coronary artery intervention.[8] The success rates of distal transradial punctuation vary, Lin et al. reported that, the success rates of distal transradial access among 200 patients were only 79%,[7] on the other hand, there have been studies which demonstrate 96% success rate of distal transradial puncture.[9] The predictors of success rates include the experience of current operator, anomaly of radial artery, patients' vital signs, and patients' anxiety status.

Crossover rates in dTRA were 13.3% in DAPRAO study[10] and 22% in ANGIE[11] study similar with our study. Although a learning curve was demonstrated with a reduction of the crossover rates in the dTRA procedures, crossover rates remained higher dTRA as compared to pTRA interventions which constitute a drawback of the procedure. Smaller diameter and angulated course of the dTRA in comparison to relatively straight radial arterial segment at the forearm may explain the difference.

Our analysis suggests that RAO or thrombotic complications are common complications at 24 h (5–10%). Clinically, the absence of radial pulse is often accepted as occluded artery, however, this can underestimate the true incidence of RAO. Sanmartin et al.[12] indicated that among 275 patients, RAO incidence defined by absence of pulse was 4.4% whereas absence of radial artery flow was found to be at 10.5% with ultrasonographic examination. It is therefore recommended to use a more objective tool to evaluate radial artery-related complications, namely occlusion and thrombosis; monophasic waveforms with Doppler ultrasonic examination could be a better method for this purpose. The incidence of RAO varies in terms of the timing of the postprocedural assessment of radial artery patency. Acute RAO rates are higher and decline with time. It is illustrated in PROPHET study that, among 436 patients, the acute incidence of RAO (12%) was almost halved by the passage of 28 days (%7).[13] This decline can be explained by the spontaneous recanalization of radial artery. The recently published distal radial approached to prevent RAO (DAPRAO) study and anatomical snuffbox for coronary angiography and interventions (ANGİE) study both showed similar RAO rates (8.8 in DAPRAO and 7.9% in ANGİE)[10,11] with our study. The recently released DİSCO trial similarly showed no significant difference in RAO rates between two groups.

A strict hemostasis strategy was used to prevent RAO and experience can explain much lower RAO complications in both groups in this study. With the results of DİSCO trial, the belief that dTRA may lower the RAO rates is still debatable.

In summary, distal transradial angiography access time remains to be longer as compared to conventional transradial angiography. There has been no difference in terms of complication in two patient groups.

We acknowledge that our study has one significant limitation that is being conducted in one center with all procedures being performed by two operators. Hence, its long-scale application may be limited. Second, patients with acute coronary syndrome have been excluded from the study. Thus, the results of this study could not be applied in such patient group. Third, patients with previous radial artery angiography have been excluded from the study, as well. Future trials are needed to predict radial artery-related complication in this patient group.

Conclusion

dTRA had a relatively long access time with no advantages in terms of thrombotic complications in radial artery. Thus, distal TRA could be an efficient option in patients with hemorrhagic diathesis or patients who could not interrupt anticoagulant medicament before the procedure.

Disclosures

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Ethics Committee Approval: The study was approved by the University of Health Sciences Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Training and Research Hospital Clinical Research Ethics Committee (no: 2023.06-63, date: 22/08/2023).

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