RESEARCH ARTICLE

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Transulnar Versus Transradial Access in Post-CABG Patients Undergoing Coronary Angiography

ABSTRACT

Objective: Patients with a history of coronary artery bypass grafting (CABG) often present with advanced age, comorbidities, and diffuse atherosclerosis, making coronary angiography more complex. While the transfemoral route has been traditionally preferred, transradial access has emerged as a safer and more comfortable alternative. Recently, transulnar access has also gained interest, especially when radial access is not feasible. To compare the efficacy and safety of transulnar versus transradial access in CABG patients undergoing coronary angiography.

Method: In this retrospective, single-center study, 37 post-CABG patients who underwent coronary angiography between 2022 and 2024 via left radial (n=18) or left ulnar (n=19) access were evaluated. Baseline demographics, risk factors, laboratory data, procedural parameters, and complications were analyzed. All procedures were performed with 6 Fr catheters.

Results: The groups were comparable in terms of demographics, risk factors, and laboratory findings. There were no significant differences in procedure time, fluoroscopy duration, radiation dose, or catheter use. However, puncture time was significantly shorter in the transradial group (15.8 ± 8 vs. 28.2 ± 17 min, p=0.007). No major complications occurred in either group. Femoral crossover was more frequent in the transulnar group, though not statistically significant (21.1% vs. 0%, p=0.059).

Conclusions: Transulnar access is a safe and effective alternative to transradial access in CABG patients undergoing coronary angiography. While puncture time was longer in the transulnar group, overall procedural success and safety were comparable. Transulnar access may be especially useful when radial access is limited.

Keywords: Transulnar, CABG, Transradial, Coranary Angiography, Vascular Access Complications.

Koroner Anjiyografi Uygulanan Koroner Bypass Geçirmiş Hastalarda Transulnar ve Transradial Girişim Yöntemlerinin Karşılaştırılması

ÖZET

Amaç: Koroner arter bypass greftleme (CABG) öyküsü olan hastalar genellikle ileri yaş, ek hastalıklar ve yaygın ateroskleroz ile başvurur, bu da koroner anjiyografiyi daha karmaşık hale getirir. Geleneksel olarak transfemoral yol tercih edilirken, transradial erişim daha güvenli ve konforlu bir alternatif olarak öne çıkmıştır. Son zamanlarda, radial erişimin mümkün olmadığı durumlarda, transulnar erişim de ilgi görmeye başlamıştır. CABG geçirmiş hastalarda koroner anjiyografi sırasında transulnar ve transradial erişim yöntemlerinin etkinliğini ve güvenliğini karşılaştırmak.

Yöntem: Bu retrospektif, tek merkezli çalışmada, 2022 ile 2024 yılları arasında sol radial (n=18) veya sol ulnar (n=19) erişim yoluyla koroner anjiyografi yapılan 37 post-CABG hastası değerlendirildi. Hastaların demografik özellikleri, risk faktörleri, laboratuvar verileri, işlem parametreleri ve komplikasyonlar analiz edildi. Tüm işlemler 6 Fr kateterler ile gerçekleştirildi.

Bulgular: Gruplar demografik özellikler, risk faktörleri ve laboratuvar bulguları açısından benzerdir. İşlem süresi, floroskopi süresi, radyasyon dozu veya kateter kullanımı açısından anlamlı bir fark saptanmadı. Ancak, ponksiyon süresi transradial grupta belirgin şekilde daha kısaydı (15.8 ± 8 dk vs. 28.2 ± 17 dk, p=0.007). Her iki grupta da majör komplikasyon gözlenmedi. Femoral geçiş oranı transulnar grupta daha yüksek olmasına rağmen, istatistiksel olarak anlamlı bulunmadı (21.1% vs. 0%, p=0.059).

Sonuç: Transulnar erişim, CABG geçirmiş hastalarda koroner anjiyografi sırasında transradial erişime güvenli ve etkili bir alternatif sunmaktadır. Transulnar grupta ponksiyon süresi daha uzun olmasına rağmen, genel işlem başarısı ve güvenliği benzerdir. Radial erişimin sınırlı olduğu durumlarda, transulnar erişim özellikle yararlı olabilir.

Anahtar Kelimeler: Ulnar Erişim, CABG, Radyal Erişim, Koroner Anjiyografi, Vasküler Girişim Komplikasyonları.

INTRODUCTION

Those who undergo coronary artery bypass grafting (CABG) are usually of older age and frequently display a greater incidence of comorbidities, cardiovascular risk factors, and extensive atherosclerotic disease. Therefore, they represent a particularly challenging subset of the cardiovascular patient population (1). During follow-up after CABG, additional assessments such as coronary and graft angiography (CGAG) and percutaneous coronary intervention (PCI) might be required, depending on the patient's symptoms, the development of new clinical signs, physical examination findings, and imaging results (2).

In individuals who have received CABG, the selection of an appropriate access route during cardiac catheterization is a critical clinical decision that influences both procedural outcomes and patient safety. Historically, post-CABG coronary and graft angiography (CGAG) as well as percutaneous coronary interventions (PCI) have been performed via the conventional transfemoral approach. However, particularly for left internal mammary artery (LIMA) grafts, the standard left transradial access represents a feasible and effective alternative (2).

Among the main advantages of the transradial approach are its lower incidence of local complications and the ease of post-procedural patient management. Throughout the full range of clinical scenarios—from planned diagnostic catheterization to elective percutaneous transluminal coronary angioplasty (PTCA), stent placement, and even urgent PTCA—transradial access has shown similar procedural success rates compared to the transfemoral approach. This is true even in patients receiving intensive antithrombotic therapy, including oral anticoagulants (3) and glycoprotein IIb/IIIa inhibitors (4–6), with significantly reduced hemorrhage at the puncture site along with other adverse events (7). Numerous meta-analyses and randomized controlled trials have demonstrated that transradial access offers advantages over transfemoral access, particularly in reducing vascular complications and major bleeding (8–11). Furthermore, The bulk of these studies have reported no significant differences in short-term or one-year major adverse cardiovascular events (8–10,12).

Although the radial artery is frequently preferred due to easier hemostasis and a significantly reduced incidence of hemorrhagic complications, ulnar artery access is considered a viable alternative in bypass patients due to the anatomical configuration of the grafts.

The transulnar approach has received comparatively less attention as a potential route for cardiac catheterization. However, studies have demonstrated that it shares a similarly high success rate and an exceptionally low incidence of access-site complications with the transradial approach for both diagnostic and therapeutic coronary interventions, thereby establishing it as a safe and effective alternative (7). It is worth mentioning that the greater part of these studies have not involved individuals with a background of CABG

In patients with a documented history of CABG surgery, previous studies comparing transradial and transfemoral angiography have shown no significant differences between the approaches in terms of contrast volume, procedure duration, or fluoroscopy time (13). In our study, we retrospectively evaluated the effectiveness and safety of ulnar and radial artery access in individuals with a history of prior CABG. Specifically, procedural parameters such as the number of catheters used, fluoroscopy time, and radiation dose were assessed to determine how different access routes influenced patient management.

MATERIAL AND METHODS

Patient Selection: Patients with a history of prior CABG surgery who underwent coronary angiography through left transradial or right transulnar access between 2022 and 2024 were included in this single-center, retrospective study. Patients with neoplastic diseases, active inflammatory or infectious diseases, end-stage liver disease, or hematological disorders were excluded. The study cohort consisted of 37 patients. Indications for coronary angiography were determined by the primary physicians according to current guidelines, based on patient symptoms, noninvasive test results, ECG changes, and cardiac enzyme levels. The study complied with the Declaration of Helsinki and obtained approval from the local ethics committee.

This study was approved by the Clinical Research Ethics Committee of Sakarya University on October 21, 2022 (Approval No: E.16214662-050.01.04-176909-122). Informed written consent was obtained from all study participants.

Patient Data and Angiography: Demographic characteristics, cardiovascular risk factors, and medication histories were collected from hospital records. Venous blood samples collected at admission were used for laboratory analyses.

All percutaneous procedures were performed using 6 Fr catheters via the left radial or ulnar artery using standard techniques. Patients received appropriate antiplatelet and anticoagulant therapy per current guidelines. Coronary angiography was performed using Toshiba Infinix 8000 V and Toshiba Infinix 8000 G5 systems (Toshiba Medical Systems, Nasushiobara, Japan). Puncture time, procedure time, contrast volume, number of catheters used, radiation dose, and any procedural complications were retrieved from angiography unit records. Blood pressure and heart rate during the procedure were also recorded.

Statistical Analysis: Data analysis was carried out using IBM SPSS Statistics version 22. The distribution of continuous variables was evaluated through the Kolmogorov–Smirnov test. Categorical variables were expressed as frequencies and percentages, whereas continuous variables were reported as mean ± standard deviation or median (interquartile range). The Chi-square or Fisher's exact test was utilized for categorical variables. For normally distributed data, independent groups were compared using the Student's t-test, with a p-value of < 0.05 considered statistically significant.

RESULTS

The study population included 37 patients, consisting of 26 males (70%) and 11 females (30%). Coronary angiography was performed via the left transulnar route in 19 patients (51%) and via the left transradial route in 18 patients (49%). The demographic, clinical, and laboratory characteristics of the population were compared (Table 1). The two groups demonstrated no substantial differences in height, weight, or body mass index. (p = 0.907, 0.126, and 0.088, respectively). Likewise, there were no remarkable differences between the groups regarding systolic or diastolic blood pressure during the procedure (p = 0.09 and 0.847, respectively). There was also no remarkable difference observed in the peak heart rate (75 ± 7.8 vs. 73 ± 10.9, p = 0.468). The smoking status was alike between the two groups, with no remarkable difference observed (p = 0.795). In the transulnar group, 15 patients (78.9%) had diabetes mellitus, compared to 12 patients (66.7%) in the transradial group (p = 0.401). Hypertension was present in 17 patients (89.5%) in the transulnar group and 16 patients (88.9%) in the transradial group.

Table1. Baseline Demographic and Clinical Characteristics.

Characteristics		transulnar (n=19)	transradial (n=18)	P-value
Age (years)		66.1 ± 6.2	68.2 ± 8.3	0.384
Gender (male), n (%)		13 (68.4)	13 (72.2)	0.543
Height (cm)		167 ± 9.4	167 ± 8.5	0.907
Weight (kg)		84 ± 13	77 ± 11	0.126
BMI (kg/m^2)		30 ± 3.5	27 ± 4.6	0.088
Systole (mm/Hg)		135 [130-150]	130 [125-132]	0.330
Diastole (mm/Hg)		80 ± 7.7	80 ± 8.3	0.847
Heart rate		75 ± 7.8	73 ± 10.9	0.468
Comorbidity	Diabetes mellitus, n (%)	15 (78.9)	12 (66.7)	0.401
	Hypertension, n (%)	17 (89.5)	16 (88.9)	0.954
	Prior stroke, n (%)	-	1 (5.6)	0.486
	Hyperlipidemia, (n, %)	8 (42.1)	2 (11.1)	0.038
	Chronic kidney disease, (n, %)	4 (21.1)	3 (16.7)	0.532
Smoking, n (%)		6 (31.6)	6 (33.3)	0.795
Laboratory Parameters	Glucose (mg/dL)	169 ± 61	151 ± 64	0.420
	Urea (mg/dL)	42 ± 16	39 ± 14	0.691
	Creatinine (mg/dL)	1.1 ± 0.8	0.9 ± 0.2	0.316
	Sodium (mmol/L)	137 ± 4.9	138 ± 3.0	0.303
	Potassium (mmol/L)	4.3 ± 0.3	4.5 ± 0.5	0.163
	LDL-C (mg/dl)	124 ± 45	125 ± 48	0.967
	HDL-C (mg/dl)	45 ± 10	47 ± 12	0.593
	Triglyceride (mg/dl)	206 ± 107	178 ± 107	0.453
	Hemoglobin (mg/dl)	13 ± 1.7	12.5 ± 1.9	0.379
	WBC count (μL)	8,7[6,4-11,5]	8,1[7,1-9,5]	0.408

Data were shown as mean ± standard deviation and n (%). IQR[interquartile range]; BDI, body mass index; WBC, white blood cell; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol

Serum creatinine levels did not differ markedly between the groups (1.1 ± 0.8 vs. 0.9 ± 0.2, p = 0.316). In the same way, there were no remarkable differences between the groups concerning LDL levels (124 ± 45 vs. 125 ± 48, p = 0.967) and HDL (45 ± 10 vs. 47 ± 12, p = 0.593) cholesterol levels. Hemoglobin and white blood cell (WBC) counts were similar across the groups, with no statistically remarkable differences observed (p = 0.379 and p = 0.408, respectively).

The coronary syndrome types and procedural characteristics of the included patients were compared (Table 2). The number of patients presenting with STEMI, NSTEMI, or stable angina did not differ markedly between the two groups (p = 0.987). Although the number of puncture attempts did not differ considerably between the transulnar and transradial access groups (p = 0.147), the puncture time was notably shorter in the transradial access group (28.2 ± 17 vs. 15.8 ± 8 minutes, p =

0.007). The groups showed no remarkable difference in the number of catheters utilized during the procedure (p = 0.934). Moreover, no noteworthy variations were detected between the groups regarding procedure duration or fluoroscopy time (p = 0.800 and p = 0.798, respectively). No vascular spasm was observed in the transulnar group, whereas one patient (5.6%) in the transradial group experienced spasm (p = 0.486). Femoral crossover was required in 4 patients (21.1%) in the transulnar group for various reasons, whereas no crossover was needed in the transradial group (p = 0.059). Radiation exposure was similar across the groups, with no significant difference observed. (326 ± 159 vs. 375 ± 233, p = 0.457).

Table 2. Angiographic and Procedural Characteristics.

Characteristics	Transulnar (n=19)	Transradial (n=18)	P-value
Coronary syndrome type, (n, %)			
Stemı	1 (5.3)	1 (5.6)	0.987
nonstemı, usap	10 (52.6)	9 (50.0)	
stable angina	8 (42.1)	8 (44.4)	
Puncture count, (n, %)			
1	12 (63.2)	16 (88.9)	0.147
2	5 (26.3)	2 (11.1)	
3	2 (10.5)	-	
Number of catheters, (n, %)			
1	4 (21.1)	4 (22.2)	
2	8 (42.1)	9 (50.0)	0.934
3	6 (31.6)	4 (22.2)	
4	1 (5.3)	1 (5.6)	
Puncture time (s)	25 [15-40]	15 [10-16]	0.007*
Fluoroscopy time (dk)	16.4 ± 8.2	15.7 ± 6.9	0.798
Processing time (dk)	24.9 ± 10.6	25.9 ± 11.2	0.800
Amount of contrast (ml)	187 ± 60	216 ± 90	0.247
Spazm, (n, %)	-	1 (5.6)	0.486
Loop, tortuosity, (n, %)	1 (5.3)	-	0.514
Femoral cross over, (n, %)	4 (21.1)	-	0.059
Amount of radiation (mGy)	326 ± 159	375 ± 233	0.457

Nonstemi, non-ST elevation myocardial infarction; Stemi, ST elevation myocardial infarction; Usap, unstable angina pectoris. *=p<o.oo5

DISCUSSION

This study aimed to compare coronary angiography through the transulnar and transradial approaches in patients who had previously undergone CABG. While the puncture time was shorter in the transradial group, no statistically meaningful disparities were identified between the two groups in other parameters.

Earlier investigations have illustrated that the transulnar approach can be securely employed for coronary angiography and percutaneous coronary interventions, much like the transradial approach (14-16). There are studies demonstrating the safe use of the transradial approach in individuals with a prior CABG (17). However, there is a lack of satisfactory studies on the use of the transulnar approach in CABG patients. In these studies, the indications for coronary procedures in CABG patients ranged from ST-elevation myocardial infarction (STEMI) to positive stress tests. In our study, the distribution of these indications was comparable between the two groups, with no remarkable difference noted (p = 0.987). A meta-analysis conducted in 2016 showed no remarkable differences between the transulnar and transradial approaches in terms of arterial access time, fluoroscopy time, and the volume of contrast used (18). Another meta-analysis similarly reported no remarkable difference between the two approaches regarding procedure time, fluoroscopy time, and contrast volume (19). In our study, procedure time did not differ substantially between the two groups (24.9 ± 10.6 vs. 25.9 ± 11.2, p = 0.8), fluoroscopy time (16.4 ± 8.2 vs. 15.7 ± 6.9, p = 0.798), and contrast volume (187 ± 60 vs. 216 ± 90, p = 0.247) in CABG patients. However, the puncture time was substantially shorter in the transradial group (28.2 ± 17 vs. 15.8 ± 8, p = 0.007). This variation may be explained by the deeper course of the ulnar artery in comparison to the radial artery, as well as the procedural team's greater experience with radial puncture. Furthermore, radiation exposure did not differ substantially between the two groups (326 ± 159 vs. 375 ± 233, p = 0.457). In a study by Li et al., no significant difference in radiation exposure was observed between the transulnar and transradial approaches (20).

The ulnar artery typically courses larger and less tortuous in the forearm and is sometimes more easily palpable at the wrist (21-23). In our study,

one patient (5.3%) in the transulnar group had a tortuous ulnar artery, whereas no tortuous radial arteries were observed in the transradial group. Nevertheless, no meaningful discrepancy was found (p = 0.514). A meta-analysis analyzing data from seven randomized controlled trials (RCTs) involving 5721 patients (TUA = 2874 and TRA = 2847) showed no distinction in the prevalence of access-site complications and major hematomas between the two groups (16). Another study also found no difference in major complications between the transulnar and transradial approaches (20). In our study, no complications such as major hematomas, arterial occlusion, hand ischemia, arteriovenous fistula, or pseudoaneurysm were observed. We attribute this finding to the limited number of subjects included in the sample.

In a study involving 120 patients, temporary ulnar artery spasm was observed in one patient (2.5%) in the ulnar group, while permanent radial artery spasm occurred in four patients (5%) in the radial group. It was found that radial artery spasm developed significantly more frequently than ulnar artery spasm (15). In our study, no patients in the transulnar group developed ulnar artery spasm, whereas one patient in the transradial group experienced spasm. Nonetheless, no clear difference was identified between the two groups (p = 0.486). This outcome may be a consequence of the low patient count. The lower incidence of spasm in the ulnar artery can be explained by the ulnar artery's typically larger, straighter course and its lower number of alpha receptors compared to the radial artery, which may make it less prone to catheter-induced vasospasm than the radial artery (20, 24).

A meta-analysis found that a higher rate of crossover to different access sites occurred in transulnar access compared to transradial access (18). In our study, femoral crossover was performed in 4 patients (21.1%) in the transulnar group, whereas no crossover to a different access site occurred in the transradial group. Nevertheless, no substantial differences were observed between the groups when analyzed from a statistical perspective. (p = 0.059). We believe this result is due to the greater experience of the operators with transradial access and the limited number of patients.

Limitations

This study was subject to various limitations. This study was a retrospective, single-center investigation with a relatively limited sample size, and all procedures were performed by operators with considerable expertise in the transradial technique. Patients were followed during their hospital stay, but long-term follow-up was not conducted.

CONCLUSION

This retrospective, single-center study suggests that transulnar access is a highly effective and safe alternative for both diagnostic and therapeutic transcatheter procedures in CABG patients. It demonstrates similar access success, procedural success, and complication rates compared to the more commonly used transradial technique. Particularly in cases where radial access is not possible, the ulnar artery can be safely considered as an alternative vascular access route for CABG patients.

Article Information

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