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Original Article

Comparison of Outcome of Traditional Radial Artery versus Distal Artery Approach in Patients undergoing Coronary Intervention

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ABSTRACT

Although most interventional cardiologists favor radial artery (RA) access because to its ergonomic practicality, data on distal artery (DRA) access with relation to RA patency has not been compared in major trials. **Objective:** To compare the access feasibility of distal radial artery vs Forearm radial artery for cardiac catheterization operations. **Methods:** A cross sectional study of total of 198 patients undergoing radial coronary operations were monitored for radial artery occlusion (RAO) and other local problems with DRA and FRA access. Purposive sampling was performed. The inclusion criteria include all participants who had a palpable distal or proximal radial pulse. The patient was free to choose between the two approaches. Patients having an inappropriate radial pulse were eliminated. **Results:** The main objective was fulfilled by 11.7% in the FRA and 10.4% in the DRA group (p-value=0.24). Cannulation time was greater in the DRA group compared to the FRA group; however, this had no effect on hemostasis time (254 20 vs. 254 17; p-value=0.72). Hematoma (26.4% vs. 12.5%; OR (95% CI): 3.18 (1.09–5.63); p-value 0.001) was more prevalent with FRA, while radial artery spasm (18.6 % vs. 22.9 %; OR (95 % CI): 0.53 (0.03 – 0.95); p-value=0.01). **Conclusions:** When compared to Forearm Radial Artery access, Distal Radial Artery access is linked with poorer cannulation success rates and greater RAO rates. It is, however, linked to the production of lower hematomas.

INTRODUCTION

Despite the fact that coronary artery disease (CAD), often known as heart disease, is one of the major causes of mortality throughout the world, recent advances in coronary intervention procedures have helped lower the mortality and morbidity rates associated with CAD. In the past ten years, there has been a notable rise in the percentage of coronary angiograms and percutaneous coronary interventions (PCI) procedures that utilize the radial first method as the standard. At the moment, more than seventy % of arterial accesses during cardiac operations are performed using it [1-3]. Before cardiac catheterization became commonplace, the transfemoral technique was the most common way to get access to the coronary arteries [4]. The femoral route was the initial entry point for the interventional cardiology procedures that were performed. Campeau first shown that the radial artery might be utilized for cardiovascular (CV) therapies in the year 1989 [5]. Following that, a number of studies indicated a high success rate and a low risk of problems associated with accessing the radial artery in the forearm (FRA) [6]. Patients undergoing PCI who have access to the radial artery have a lower risk of bleeding issues and a lower

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risk of passing away as a result. It is now suggested as the method of choice for percutaneous coronary intervention (PCI) in cases with acute coronary syndrome (ACS) [7]. In the past, CV treatments were solely performed through the use of FRA access. On the other hand, access through the distal radial artery (DRA) was just made available in Japan in 2017 [8]. Since then, a great number of studies have demonstrated that DRA access is a secure and convenient alternative to the traditional routes of RA access. Although most interventional cardiologists favor right FRA access owing to its ergonomic practicality, data on DRA access with reference to RA patency has not been compared in major studies. As a result, one of our primary objectives was to perform a comparative analysis of the results obtained from the two methodologies with regard to RAO for coronary diagnostic and interventional operations.

METHODS

This was an observational research at the Armed Forces Institute of Cardiology, comparing DRA and FRA access in catheterization patients from January to December 2019. Sample size was calculated by WHO calculator and came 198. All participants were provided with written informed consent. The authors used no strategy to eliminate selection bias. Three skilled operators with extensive expertise in conventional and DRA access took both radial accesses. Purposive sampling was performed. Before the trial, everyone had completed more than 100 DRA operations. The research included all participants who had a palpable distal or proximal radial pulse. The patient was free to choose between the two approaches. Exclusion criteria Patients having an inappropriate radial pulse and who had a coronary artery bypass graft (CABG) and a history of radial access failure were also excluded. The CV risk factors were determined in accordance with industry standards. No ultrasound-guided punctures or Allen's tests were conducted because they are not routine at our institute. Before the artery puncture, a local anesthetic (lidocaine) was applied. FRA puncture was carried out using the usual procedure and DRA access was obtained using the method published by Malik *et al.* [9]. To avoid vasospasm and thrombosis, the sheath was subsequently given a combination of heparin (5000 units) and isosorbide dinitrate (1 mg). Hemostasis was obtained using a radial band, which was then removed after hemostasis was achieved. At discharge, a color Doppler ultrasonography was performed to search for stenosed arteries. The prevalence of RAO following DRA and FRA access was the main outcome. The time to cannulate the intended place of radial access and acute local problems were the secondary goals (radial artery spasm, hematoma, paresthesia, local edema, ecchymosis). The (SPSS) version 26 was used for the analysis. Continuous variables were given as mean and standard deviation, and categorical data as frequency (n) and percentages. For categorical data, Chi square was employed, and for continuous data, Student's t-test (normal distribution) or Mann-Whitney test (abnormal distribution). The Kolmogorov-Smirnov test was used to determine if the data were normally distributed. A statistically significant p-value of less than 0.05 was evaluated.

RESULTS

This observational study included 198 patients (102 in category 1 and 96 in category 2). Table 1 shows the baseline and procedural characteristics. There were 23.5% females in group 1 and 22.9% females in group 2 with mean age of 54 ± 10 vs. 54 ± 6 (p-value 0.95). All baseline characteristics were statistically matched.

Variable		FRA (n=102)	DRA (n=96)	p-value
Age		54 ± 10	54 ± 6	0.95
Females		23.5%	22.9%	0.82
BMI		25 ± 9	25 ± 5	0.91
DM		25.4%	26.3%	0.70
HTN		17.6%	18.7%	0.68
Dyslipidemia		29.4%	32.2%	0.24
CKD		2.9%	3.1%	0.98
Smoking		16.6%	17.5%	0.54
Antiplatelet therapy	Aspirin	89.2%	92.7%	0.12
	Clopidogrel	69.5%	70.8%	0.72
	Dual antiplatelet	43.4%	42.8%	0.85
Sheath size	5F	26.4%	27%	0.76
	6F	73.6%	73%	0.94
ACT		134 ± 13	132 ± 14	0.21
Hemostasis time		254 ± 20	254 ± 17	0.72
Time to cannulation		4.7 ± 2.5	6.8 ± 3.1	0.004
Cannulation failure		9.7%	15.4%	<0.001

Table1: Baseline and procedural characteristics

Table 2 compares the complication rate between groups 1 and 2. The rate of primary end point (RAO) was 11.7 % in group 1 and 10.4 % in group 2 (OR (95 % CI): 3.24(1.15 – 8.42); p-value=0.24), respectively. Similarly, the differences in paresthesia (p-value=0.37) and ecchymosis (p-value=0.57) between the two techniques were statistically insignificant. FRA was associated with hematoma (26.4 % vs. 12.5 %; OR (95 % CI): 3.18 (1.09 – 5.63); p-value 0.001). whereas radial artery spasm (18.6 % vs. 22.9 %; OR(95 % CI): 0.53 (0.03 – 0.95); p-value=0.01) and local edoema (1.3 % vs. 2.6 %; OR(95 % CI): 0.86 (0.21 – 3.98; p-value=0.02) were higher with DRA. The difference in hemostasis time was statistically negligible (254 20 vs. 254 17; p-value=0.72), while the time to cannulation was shorter with FRA (4.7 2.5

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vs. 6.8 3.1; p-value=0.004). RAO was substantially related to time to cannulation (p=0.007), 6F sheath (p=0.04), smoking (p=0.001), and female gender (p=0.001). Diabetes (p-value=0.005) and delay to cannulation (p-value=0.02) were linked with paresthesia. The failure to cannulate FRA and DRA was statistically significant (9.7% vs. 15.4%; p-value 0.001).

Variable	FRA (n=102)	DRA (n=96)	OR (95%CI)	p-value
Radial artery occlusion	11.7%	10.4%	3.24 (1.15 – 8.42)	0.24
Hematoma	26.4%	12.5%	3.18 (1.09 – 5.63)	<0.001
Spasm	18.6%	22.9%	0.53 (0.03 – 0.95)	0.01
Paresthesia	2.9%	3.1%	2.76 (1.12 – 4.65)	0.37
Local edema	1.3%	2.6%	0.86 (0.21 – 3.98)	0.02
Ecchymosis	9.5%	8.9%	1.54 (0.57 – 2.65)	0.57

Table 2: Complications with FRA and DRA

DISCUSSION

This is Pakistan's first research to examine DRA and FRA access in patients having cardiac catheterization operations. In terms of problems following cannulation, this study found mixed advantages for each radial access location. The major end goal (RAO), ecchymosis, and paresthesias were non-significantly different between the two groups, however additional local sequelae such as radial artery spasm and local edoema were substantially linked with DRA and hematoma with FRA. Furthermore, there appears to be no benefit to DRA access in terms of hemostasis time, and DRA access increased the time to cannulation. DRA access takes longer to cannulate and has a higher failure rate due to greater tortuosity and angulation at the point of puncture, whereas FRA cannulation is conducted in a reasonably straight arterial section. Even though the cannulation indicated satisfactory flow from the artery, we were unable to implant the wire. This discovery should be examined further using various types of sheaths and cannulation procedures. The fact that the primary end aim was not fulfilled with DRA access should not prevent interventional cardiologists from becoming acquainted with this approach, as it can be employed as an alternate route in problematic FRA cannulations. As a result, DRA access is an advantageous adjunct to other traditional arm access sites, potentially reducing the necessity for femoral punctures. Unlike earlier studies that excluded patients with weak, weakly perceptible DRA, we included all patients, even those with weak arterial pulse [9,10]. When compared to FRA access, this might explain the high cannulation failure rate (15.4 %) and lengthy cannulation time. While some studies had lower success rates even after eliminating weakly perceptible pulses, our cannulation success rate was comparable to these strong exclusion criterion studies. The failure rate has been linked to angulation and tortuosity in the DRA and its path over the anatomical snuff box, as well as the presence of small branches under the deep palmar arch in various studies. Another reason for greater puncture failure in DRA is the artery's diameter, which is thought to be lower than in FRA. A research found that DRA had a lower success rate than FRA because to a smaller mean DRA diameter [11]. However, because we did not employ ultrasound guidance to locate the artery before cannulation in our investigation, the puncture rate might have been lower; however, there is no data to corroborate this, and data on ultrasound-guided DRA puncture has limitations. When compared to the Western population, South Asians have smaller body habitus and hence a predisposition for tiny radial arteries, increasing their risk of procedural difficulties and puncture failure [12-14]. Although several researches have indicated a favorable positive rate of distal radial artery cannulation, the only randomized research to date comparing this strategy to the classic radial route revealed a substantial increase in DRA cannulation failure rate [15]. Furthermore, Kiemeneij, the first to evaluate this puncture location, experienced 11% technique failure, essential a return to the standard radial method [16]. There are several explanations for DRA's reduced success rates in cannulation: a) Small size of the radial artery in the area of snuffbox, which often increases the chance of contraction; b) the high asymmetry of the artery, which causes challenging to advance the wire; and c) the unstable angle of the hand. The DRA is practically more difficult, which necessitates a longer learning curve than adjacent radial artery cannulation 0 [17]. No randomized trial has been conducted on the use of the distal radial approach, despite the fact that previous studies exploring the viability of DRA included percentages of ACS ranging from 25 to 45 % [18-20]. Kim *et al.*, recently used the left snuffbox technique, with a high success rate (97.6%) [21]. A research have reported similar positive outcomes with effective PCI utilizing DRA in instances of ACS. Koutouzis *et al.*, favors, that DRA in cases of primary PCIs [22]. Another research proved, that DRA can be utilized in difficult revascularization patients. Gasparini *et al.*, proved the usefulness of PCI through left DRA patients using a 7-Fr Glide sheath Slender [23]. Before attempting cannulation, Doppler ultrasonography was employed in situations where the distal radial artery pulse was missing or faint. Our research has significant limitations. For starters, this was an observational research, and no measure of effect can be drawn from it. Second, the investigation was not sufficiently powered to detect a slight variation in DRA patency using ultrasonography settings between the two groups. Third, no specific hemostasis devices were employed for patent

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hemostasis of both access sites, which might have resulted in a larger RAO in our study. The results cannot be generalized to other ethnic groups with higher artery diameters. Finally, ultrasound guided punctures were not employed, which may have resulted in higher DRA cannulation rates.

CONCLUSIONS

Although DRA access is a safe and effective location for coronary operations, RAO and cannulation failure rates are significant with this technically hard technique. The incidence of vascular problems, such as paresthesia and ecchymosis, were comparable in both the DRA and FRA groups. Large randomized controlled studies are required to assess the benefits of DRA over FRA.

Conflicts of Interest

The author declare no conflict of interest.

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