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Comparison of the Right and Left Distal Radial Access for Coronary Procedures

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Abstract: *Distal radial coronary access is effective. This study examined if the access location affects vascular access and procedure success. A prospective database was created to compare rDRA and lDRA using propensity score matching. Access time, coronary procedure success, radial spasm, ionising radiation exposure, and patient comfort were observed. The rDRA and lDRA compared 182 of 385 procedures. Approach success was comparable (97.6%vs.97.6%, p=1.0), access time (sec) was shorter (39 (25-60)vs.50 (29-90); p=0.0026), and procedural success was 100% vs. 100% (p=1.000). Radial spasm was not statistically significant (2.2%vs.6.62%, p=0.150). There were no significant differences between the groups in dose-area product (32 (20-57.1) Gy.m2 vs. 32.5 (19.4-46.3) Gy.m2; p=0.487) or fluoroscopy time (min; 4.4 (2.6-9)vs.4.3 (2.5-7.5); p=0.215. No study population had vascular access concerns. Those undergoing coronary procedures spent about same time in the catheterization laboratory after switching to the rDRA as they did with the lDRA, but the rDRA required less time to get access to the heart.*

Key Words: Distal Radial Access, Coronary Procedures, Catheterization, Coronary Diagnosis

Introduction

Several studies have shown that DRA in the anatomical snuffbox for coronary processes is feasible and safe, with benefits including less time spent on hemostasis, fewer problems at the puncture site, and a lower risk of radial artery occlusion (RAO) compared to the more traditional transradial access (TRA) (Babunashvili A., Dundua D. 2011). Despite the fact that the left distal radial access (lDRA) was initially used to promote the method, primary practices with the right distal radial approach (rDRA) have been recorded as the number of interventions has increased (Valsecchi O., Vassileva A., Cereda A. F., et al. (2018). Several randomised controlled trials (RCTs) have compared right to left access in similar settings, such as the standard TRA (Guo X., Ding J., Qi Y., et al. 2013; Tokarek T., Dziewierz A., Plens K., et al. 2022).To the best of our information, however, no research comparing the rDRA and lDRA exists to aid interventional cardiologists in making a decision about whether or not to use the distal radial approach. Since the DRA is used for both diagnostic and therapeutic cardiac procedures, this research sought to evaluate the influence of the contact location on vascular access and procedural performance.

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Materials and Methods

Population and Study Design

Prospectively included were coronary diagnostic and/or interventional operations conducted between July 2021-July 2022 by three expert operators utilising the DRA in a single centre. Patients' demographic information, medical history, vascular access, angiographic findings, and procedure outcomes were all entered into a specialised database.

The research was done with the approval of an ethical committee and in accordance with the principles of the Helsinki Declaration and applicable law. Prior to any cardiac catheterization, all patients provided written informed consent.

Inclusion and Exclusion Criteria

Inclusion Criteria

1. Sign for coronary diagnostic and interventional invasive events.
2. Patients 18 years.
3. Normal Barbeau's test.

Exclusion Criteria

1. Upper-extremity arteriovenous fistula (brachial).
2. Previous bypass surgery on the coronary arteries.
3. Action taken at some point in the course of learning.
4. Radial artery distal diameter 2.0 mm.
5. An allergy to iodinated contrast has prevented premedication in the past.
6. Woman who might be pregnant.

Endpoint Definitions

The most important outcome was DRA accomplishment. The DRA method is deemed effective. when a sheathing introducer may be successfully introduced into the damaged artery.

Secondary objectives were the incidence of coronary procedure effectiveness, the incidence of radial spasm, the quantity of ionising radiation exposure, the degree of patient pain, and the incidence of access-related vascular complications (Lee J. W., Park S. W., Son J. W., Ahn S. G., Lee S. H. 2018).

The time it takes to get the introducer sheath in place after the anaesthetic needle makes contact with the skin is known as the "access time" (Sgueglia G. A., Lee B. K., Cho B. R., et al. 2021)

The survey method defined radial artery spasm by the existence of enduring limb suffering, a stressful reaction to catheter handling, a painful reaction to introducer removal, and trouble manipulating a catheter after becoming "trapped" by the RA with problematic issue on removal of introducer. Depending on the operator, radial spasm was identified after the second dosage of the spasmolytic medicine when at least two of the five signs were presented or when only one symptom was observed (Ruiz-Salmerón R. J., Mora R., Vélez-Gimón M., et al. 2005).

The dose-area product (DAP) in Gy.m2 and fluoroscopy duration were used to calculate the amount of radiation exposure (min).

The VAS was used to assess how much discomfort the perforation site and the hemostatic firmness were causing to the patient. Mild discomfort was characterised as a rating of three or less (Kiemeneij F. 2017)

RAO, severe local haemorrhage, arterial dissection, pseudoaneurysms, and arteriovenous fistula were the vascular problems associated with access.

The absence of flow on Doppler colour ultrasonography (US) following the removal of the hemostasia device was taken to indicate RAO.

The EASY (Early Discharge After Transradial Stenting of Coronary Arteries Study) classification was used to describe access-related forearm hematoma. Ia, below the styloid procedure of the radius; Ib, between 5 and 10 centimetres above the styloid process; III, the forearm; IV, the upper arm above the elbow (Tsigkas G., Papageorgiou A., Moulias A., et al. 2022).

Procedural Issues

All of the procedures were carried out with the help of ultrasound, with the interventional cardiologist choosing between the rDRA and the lDRA.

Sublingual diazepam (10 mg) was given 30-35 minutes prior to induction of dermal local anaesthetic to reduce the risk of arterial spasm. Before trying a direct radial artery catheterization (DRA), a nonpathological Barbeau's test and US examination of the radial artery from the rupture site to the brachial artery were required.

The US guided access method has been formerly discussed [2, 13]. In a nutshell, we used a transducer L25[(6-13 MHz) (FUJIFILM Sonosite, Bothell, WA)], to scan the distal radial artery. The tortuosity and arterial size of the radial artery (RA) were measured and analysed over its complete journey to the anatomic pannus, from the initial axial web space. To use the rDRA, the patient's right hand would be positioned on the ipsilateral side, thumb flexed, with the wrist somewhat ulnar deviated, once the puncture site had been selected. The lDRA involved the patients reaching as far as possible with their left hand towards their right groin while pronating their wrist and flexing their thumb with a very tiny amount of ulnar deviation. Then, between 5 and 8 mL of mepivacaine 2% was given subcutaneously. Then, utilising a single-wall approach and ultrasound guidance, a 21-scale micro-puncture needle was inserted into the axial plane. A 5F or 6F sheath was introduced after ultrasound or fluoroscopy confirmed that the tiny guidewire was in the proper location (Prelude Ideal Hydrophilic Introducer Kit, Utah). Then, 50 international units per kilogramme of unfractionated heparin and 2 mg of verapamil were injected intraarterially as a bolus (Bossard M., Lavi S., Rao S. V., et al. 2018). The ACT was kept between 250 and 300 seconds with extra doses of unfractionated heparin given during the interventional operations to reach 100 IU/kg (Lawton J. S., Holland J. E. T., Bangalore S., et al. 2022). Hemostasis was achieved with compression for 1-4 hours with standard compressive bandages after the radial glide sheath was detached. After the prescribed amount of time had passed, we unwrapped the gauze plug from the puncture site by releasing the elastic bandage. The gauze plug was changed and left in place for an additional hour if bleeding persisted. The patency of the RA was confirmed with a final US Doppler examination, and any difficulties relating to vascular access were identified.

Statistical Analysis

Due to the lack of randomization in the technique (either rDRA or lDRA), a propensity score matching (PSM) was used to account for confounding factors. The accessibility route was used as the dependent variable in a logistic regression model, which yielded the propensity scores. Period, sex, bmi, diabetes and high blood pressure, hyperlipidemia, diabetes, drug habit, previous cardiomyopathy, previous cardiac arrest, glomerular filtration prior to the surgery, left ventricular pericardial effusion before the surgery, fibrillation, form of anticoagulant therapy, and prior coronary processes were chosen as independent factors prior to selecting the pathway and type of coronary procedure. The PSM was calibrated to a thickness of 0.1 and followed a 1:1 technique without replacement. There are now 91 matching sets. Model was well standardized (Hosmer-Lemeshow; p=0.78) with a predictive power of 0.86 (95% CI, 0.84-0.78; p 0.001). Rendering to the "intention to treat" principle, the data were evaluated (before potential crossover). The section Supplementary Material contains the standard deviations and the propensity score distribution. The percentage of categorical variables was measured by chi-square test. The Kolmogorov-Smirnov test is utilised to check for non-normality in continuously distributed variables. Data were linked using the t-student or Mann-Whitney tests, depending on whether the variables were regularly distributed or not. All statistics were applied in SPSS (25.0) and a p value of 0.05 was measured significant.

Results

Among those 382 individuals, 385 procedures were performed between July 2021 and July 2022. A total of 182 operations were associated post-PSM (rDRA vs. lDRA), and the outcomes are displayed in the following tables. Figure 1 shows the study's flowchart.

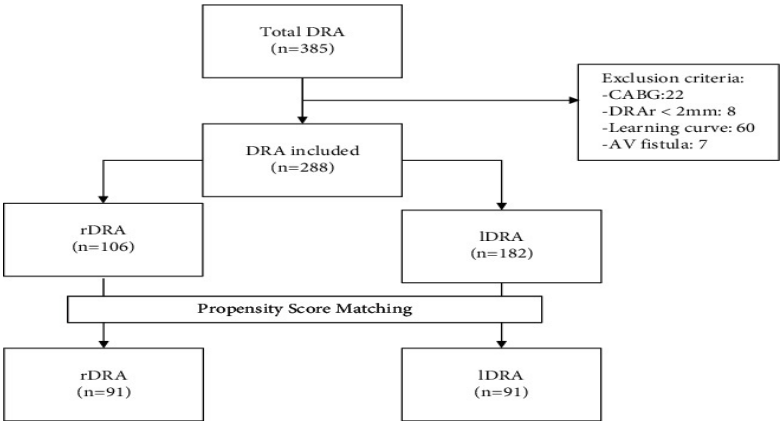

Figure 1: Flow chart. CABG stands for coronary artery bypass graft; DRAr refers to the distal RA; AV stands for arteriovenous; rDRA denotes the right RA; and lDRA denotes the left RA.

Table 1. Baseline Clinical Characteristics.

	rDRA (n= 91)	lDRA (n = 91)	P-value
Mean age years; SD	69.7; 11.3	69.05; 11.8	0.60
Female gender n; %	31; 35.0%	33; 37.4%	0.46
Mean BMI (kg/m2); SD	27.35; 4.8	27.03; 4.28	0.64
Hypertension n; %	62; 69.2%	67; 72.6%	0.65
Dyslipidemia n; %	49; 54.9%	48; 51.6	0.56
DM n; %	30; 32.0%	29; 32%	1.0
Smoking habit			0.141
Nonsmoker n; %	50; 52.7%	58; 68.1%	
Previous smoker n; %	27; 31.8%	19; 19.8%	
Current smoker n; %	14; 16.5%	12; 12.1%	
Family history of ischemic heart disease n; %	4; 3.3%	7; 6.6%	0.351
Prior MI n; %	15; 18.7%	13; 16.5%	0.335
Prior stroke n; %	5; 4.4%	2; 1.1%	0.147
Prior heart failure n; %	30; 31.8%	33; 35.0%	0.705
Mean GFR (ml/minute/1.73 m^2); SD	78.1; 16.2	74.2; 17.2	0.161
Mean LVEF; SD	54; 17.1	57; 15.8	0.196
Atrial fibrillation n; %	14; 14.3%	22; 23.1%	0.182
Oral anticoagulants			0.697
Acenocoumarol n; %	10; 12.1%	11; 13.2%	
Dabigatran n; %	2; 3.3%	2; 1.7%	
Apixaban n; %	2; 1.7%	7; 6.9%	
Edoxaban n; %	11(1.1%	2; 1.7%	

Table 2. Preprocedural Characteristics and Vascular Access Characteristics.

	rDRA (n = 91)	lDRA (n = 91)	P-value
Preprocedural characteristics			
Previous coronary angiography n; %	23; 25.3%	18; 19.8%	0.205
Previous PCI n; %	21; 23.1%	18; 19.8%	0.476
Coronary angiography indication			0.497
Chronic coronary syndrome n; %	19; 20.9%	23; 25.3%	
Acute coronary syndrome n; %	27; 30.7%	19; 20.9%	
Valvular heart disease n; %	21; 23.1%	25; 27.5%	
Myocardiopathy n; %	15; 16.5%	18; 19.8%	
Other n; %	9; 9.9%	6; 6.6%	
Outpatient coronary procedures n; %	48; 52.7%	59; 64.8%	0.098
Vascular access characteristics			
Arterial pulse strength scale			0.409
Absent	1; 1.1%	0; 0%	
Weak	12; 13.2%	17; 18.7%	
Normal	75; 82.5%	73; 80.2%	
Strong	3; 3.3%	1; 1.1%	
Distal RA size, mm (SD)	2.3; 0.2	2.5; 0.3	0.92
Proximal RA size, mm (SD)	2.6; 0.6	2.9; 0.8	**0.009**
Distal RA depth, mm (SD)	3.4; 0.1	3.3; 0.1	0.519
Introducer size			**0.041**
5 French n; %	37; 40.7%	24; 26.4%	
6 French n; %	54; 59.3%	67; 73.6%	
Postprocedural RA ultrasound evaluation n; %	91; 100%	87; 95.6%	0.076
Hemostasis time, (hour), mean, (SD)	2.6; 1.1	2.8; 1.0	0.350

Table 3. Angiographic and Procedural Characteristics.

	Right distal radial access (n = 91)	Left distal radial access (n = 91)	p value
Angiographic characteristics			
LMCAD n; %	7 (7.7%)	3 (3.3%)	0.193
Number of diseased vessels			**0.042**
One vessel n; %	31 (35.0%)	49 (53.8%)	
Two vessels n; %	31 (34.1%)	20 (22.0%)	
Three vessels n; %	14 (15.4%)	10 (11.0%)	
Procedural characteristics			
Type of coronary procedures			0.745
Diagnostic n; %	64 (70.3%)	69 (75.8%)	
Interventional or combined n; %	27 (30.7%)	22 (24.2%)	
Specific techniques			0.341
FFR n; %	4 (4.4%)	5 (5.5%)	
OCT n; %	4 (4.4%)	0 (0%)	
IVUS n; %	1 (1.1%)	2 (2.2%)	
Catheter extender n; %	1 (1.1%)	2 (2.2%)	
Rotational atherectomy n; %	0 (0%)	1 (1.1%)	
Cutting balloon n; %	1 (1.1%)	3 (2.3%)	
Intracoronary lithotripsy n; %	1 (1.1%)	0 (0%)	
Thrombus aspiration n; %	4 (4.4%)	0 (0%)	
Special PCI procedures			0.306
Bifurcation n; %	2 (2.2%)	1 (1.1%)	
CTO n; %	1 (1.1%)	1 (1.1%)	
LMCAD n; %	1 (1.1%)	1 (1.1%)	
Volume of contrast, (mL), mean (SD)	82.1 (60.4)	73.5 (49.6)	0.304
Heparin dose, (IU), median (IQR)	4000 (3100–8000)	3500 (3100–6500)	0.349

Table 4. Endpoints.

	Right distal radial access (n = 91)	Left distal radial access (n = 91)	p value
Primary endpoint			
DRA success	88 (97.6%)	88 (97.6%)	1.0
Secondary endpoints			
Access time, (sec), median (IQR)	39 (25–60)	50 (30–90)	**0.035**
Coronary procedural success after DRA	88 (100%)	88 (100%)	1.0
Procedural time, (min), median (IQR	27 (15–40)	25 (17–41)	0.360
RA occlusion n; %	0 (0)	0 (0)	1.0
RA spasm n; %	2 (2.2%)	6 (6.6%)	0.150
Hematoma n; %	0 (0)	0 (0)	1.0
DAP, (Gy.m2), median (IQR)	32 (20–57.1)	32 (19–46)	0.487
Fluoroscopy time, (min), median (IQR)	4.4 (2.6–9.3)	4.3 (2.5–7.5)	0.215
VAS patient comfort for access, mean (SD)	2.1 (0.3)	2.3 (0.7)	0.494
VAS patient comfort for hemostasia, mean (SD)	2.1 (0.2)	2.1 (0.3)	0.497

Baseline Clinical Characteristics

Table 1 displays the baseline clinical features. Neither group was any different from the other.

Preprocedural and Vascular Access Characteristics

Table 2 displays data on preprocedural and vascular access variables. The proximal RA size in the lDRA group was larger than that in the rDRA group (2.6 mm (0.6) vs. 2.9 mm (0.8); p=0.009), and a larger percentage of patients in the lDRA group went on to use a 6F introducer sheath (73.6% vs. 59.3%; p=0.041). There were no notable changes between the groups with regard to clinical presentation, arterial pulse strength, distal artery size and depth, or postprocedural US radial examination.

Angiographic and Procedural Characteristics

The angiographic and procedural characteristics are presented in Table 3. Only the extension of the coronary artery disease was higher in the rDRA group compared with the lDRA group (p=0.042). Once the sheath was inserted into the distal RA, all coronary procedures could be performed in both groups with no differences in the interventional or diagnostic procedures, use of specific techniques, procedure complexity, volume of contrast, and heparin dose between the groups.

Endpoints

Detailed comparisons of the outcomes are shown in Table 4. Both the lDRA and the rDRA showed nearly identical levels of success with their respective approaches (97.6% vs. 97.6%; p=1.0). The rDRA group averaged a shorter access time (39 seconds (25-60) versus 50 seconds (30-90); p=0.035). There were no significant differences between the groups in terms of the length of the procedure, the incidence of RA spasm, or the amount of time spent in ionising radiation. The level of patient satisfaction with vascular access and hemostasis was high and comparable across groups. In addition, after PSM, none of the groups showed any signs of vascular access-related problems such as severe bleeding, blockage of the

forearm RA, arterial dissection, or major hematoma.

Discussion

This study found that (a) both rDRA and lDRA groups had a high rate of success with their respective approaches, (b) the rDRA group had a shorter access time than the lDRA group, and (c) the two groups had similar rates of coronary procedural success, radial spasm, ionising radiation exposure, patient comfort, and vascular access-related complications.

Equivalence of the Right and the Left Distal Radial Access

While DRA has been described in detai, it has not yet seen the widespread use that was anticipated. To date, there are no accurate correlations seen between rDRA and the lDRA available to practitioners who favour the correct strategy for coronary operations, which may bound the development of the method despite the fact that it is feasible via the right access.

Our findings demonstrate that the rDRA and lDRA are statistically equal, with the rDRA having a marginal advantage in terms of access time (39 seconds (25-60) vs. 50 seconds (30-90); p=0.035). Consistent with previous reports [2-4, 10, 12], There were no significantly different in coronary operational effectiveness, operating time, radial spasm, ionising exposure to radiation, or arterial access-related problems, and patient comfort was comparable across the two groups. In addition, the DRA was utilised for a multitude of procedures, demonstrating the safety and feasibility of both distal strategies, even when performing intracoronary diagnostic imaging or complex percutaneous coronary interventions (such as rotational atherectomy and intracoronary lithotripsy) in a number of medical setups.

The findings lead us to conclude that the rDRA and the lDRA are functionally equal, and that operators can choose between the two methods based on personal choice or the individual needs of each patient. Some components of the technique covered in our protocol are outlined here.

Preoperative Ultrasound Evaluation and Distal Radial Access Method

Advantages of US-guided puncture include better patient selection (Chugh Y., Kanaparthy N. S., Piplani S., et al. 2021); Lee J. W., Son J. W., Go T. H., et al. 2022), assessment of anatomical landmarks (Hadjivassiliou A., Kiemeneij F., Nathan S., Klass D. 2021) and pinpoint localization of the puncture site. Patients with small-caliber arteries, which are associated with increased access failure, were excluded from selection in our protocol due to the required examination of the arteries by US prior to the surgery. Thus, the success rate of gaining access was extremely high (97.6% in both groups) compared to researches that did not frequently employ US and found far lower success rates.

In addition to reducing the complexity of arterial puncture, US has the potential to reduce the time required to become proficient at the procedure. Different types of vascular access had different learning curves. However, if your success rate is over 95%, you may have surpassed the learning curve [18-20]. Success rates in our CathLab were found to be more than 95% after the first 20 cases were completed by each operator.

Choose the puncture kit with care. A collapsed introducer sheath and guidewire are a result of the RA's convoluted path near its distal end as it traverses the snuffbox. It might be possible to implant the sheath without kinking by using fine hydrophilic sheaths with an appropriate profile and enough stiffness, as those offered by the perforation kit being used our CathLab This is due to the employment of miniature guidewires with a flexible tip and a rigid body.

Successful DRA may be achieved with the use of US in the preprocedural examination of applicants and the US-guided puncture, as well as through the selection of the suitable material.

Limitations

For starters, this was a study conducted at a single location, which may restrict generalisation to other populations. In contrast, this is the first research that directly compares the right and left DRA methods. Second, the study's nonrandomization may bias the findings. While the interventional cardiologist criteria for classifying patients as rDRA or lDRA may introduce some bias, PSM analysis is likely to mitigate this effect. Third, the potential underestimation of vascular access-related difficulties due to the small sample size. However, vascular problems were less common when US-guided puncture was used. Finally, 31-day US Doppler follow-up was not performed, thus our study's benefits regarding RA patency cannot be extrapolated to the long term; nonetheless, nonsignificant clinical problems were discovered at 5-to-12-month follow-up.

Conclusions

Compared to left-handed DRA, right-handed DRA yielded comparable approach success and procedural performance with a marginally shorter access time. To better understand the optimal applications of rDRA in patients undergoing invasive coronary procedures, more research is needed.

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