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**ORIGINAL ARTICLE**

# Upper Extremity Function Following Transradial Percutaneous Coronary Intervention: Results of the ARCUS Trail

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## ABSTRACT

**Background:** Regardless of the recent rise in the number of articles published on transradial access (TRA) for diagnostic coronary intervention and complications of the upper extremity may be underestimated. The aim of this study to investigate the prevalence of upper extremity disorder by comparing the transradial and transfemoral artery percutaneous coronary intervention (TR-PCI).

**Study Design:** This was cross-sectional study and conducted in the Ayub teaching hospital Abbotabad, for six months July 2022 to December 2022.

**Materials and Methods:** The total participants were 250 which included 200 TRA and 50 TFA participants and involving any type of cerdiointervention, thrombectomies for acute ischemic stroke, and carotid artery stents. The participants were selected by sampling technique were interviewed in the Khyber teaching hospital Peshawar. We analyzed dependent and independent variables. Data analysis statistically by SPSS 22 version. The upper extremity scores were analyzed using Chi-squared test.

**Results:** There were total 250 participants which include 80%TRA and 20% TFA in this research. The majority of the participants in TRA were in the age group (59.2±6.7) years and in TFA group (55.5±7.1) years. The baseline characteristics of the total participants was no significant difference between transradial artery (TRA) and transradial femoral artery (TFA). During follow-up, Cochran's Q-test revealed a significant increase in UED in the intervention extremity of the TRA group p=0.003 and in the TFA group's right upper extremity (p=0.001). During follow-up, 1% TRA participants had RAO, which recanalized over time. Three weeks after the procedure, 10% of participants in the TRA group were referred to a hand specialist then TFA participants.

**Conclusion:** Transradial arterial access (TRA) for percutaneous coronary artery intervention has been linked to lower access site complication rates and higher patient satisfaction when compared to transfemoral access (TFA) after 3 weeks follow up.

**Keywords:** Transradial artery (TRA), Transfemoral artery (TFA), Rotational acetabular osteotomy (RAO).

## INTRODUCTION

Cardiovascular disease (CVD) is the most common cause of death worldwide. Medical therapy and revascularization are the integral parts of CAD planning, and they can be successfully done through coronary artery bypass grafting (CABG) or percutaneous coronary intervention (PCI). The femoral or radial arteries, for example, provide direct exposure to the coronary arteries for diagnostic or therapeutic procedures.[1] Coronary artery disease is responsible for approximately half of all cardiovascular (heart and blood vessel) deaths. By trying to insert a catheter through a peripheral artery, sufficient blood supply through the coronary arteries can be regained. This means allowing vessels to be tried to introduce through the aorta to dilate coronary artery constriction or arterial scaffolds to be placed to keep the coronary arteries exposed.[2]

The femoral artery and the radial artery, are the two main peripheral arteries that can provide significant exposure. Whereas becoming more popular, the transradial method can be more challenging than the transfemoral approach, which may result in extended procedure times and equipment problems.[3] The benefits and drawbacks of both approaches to help inform healthcare decisions. The risks of myocardial infarction and stroke were comparable across groups. Transradial access lowered myocardial infarctions, all-cause death in the first month after intervention, bleeding, and local problems at the access site.[4]

There are several significant benefits to transradial access (TRA) over traditional transfemoral access (TFA). With over ten years of data reported by interventional cardiologists has demonstrated that TRA has a reduced risk of hemorrhagic access site comorbidities than TFA. Even after cardiac interventionalists' widespread use as well as personal choice for TRA, neurointerventionalists have been slow to adopt this strategy.[5, 6]

Patients who have TFA instead of TRA for neuroendovascular procedures are significantly more vulnerable to have access site and neurological complications then TRA patients have a higher risk to have vascular spasm and wound infections.[7] Femoral artery catheterization necessarily involves a painful procedure with adverse effects such as bleeding, damage of vessels, and artery occlusion. The use of radial artery catheterisation offers an essentially beneficial substitute for exploring long and painful aortic arches and neck vasculature, and that patients receiving similar effects.[8, 9]

## METHODOLOGY

This study was conducted in Ayub Teaching Hospital Abbotabad from July 2022 to December of 2022. The total participants were 250. According to included criteria there were 200 TRA participants and 50 TFA participants, with >6 participants and involving any type of cerdiointervention, thrombectomies for acute ischemic stroke, and carotid artery stents. The animal series were left out or excluded. The upper extremity was determined by evaluating force of muscles. All measurements were made prior to the procedure, as well as 24 hours, three weeks, two months, and six months later, regarding (ASHT). The Numeric Rating Scale for Pain (NRSP) was used to assess pain, the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire was used to assess upper extremity disabilities, and the Boston Carpal Tunnel Questionnaire was used to assess Carpal Tunnel Syndrome (BCTQ). All the data were analyzed using Statistical Package for Social Sciences (SPSS) version 22. The upper extremity scores were analyzed using Chi-squared test.

## RESULTS

The total number of participants was 250, with 200(80%) TRA and 50(20%) TFA participants. Complete baseline and follow-up data for the intervention and upper extremity were collected in 250 participants.

In the TRA group, UED did not significantly different then TFA group at three weeks after the procedure. According to a complete case evaluation of patients with sufficient information for measurements constituting UED and was present in the intervention extremity in 55 (39.2%) of the TRA participants and 6 (33%) of the TFA participants (p= 0.043). This occurred in 205 participants, with 89 (43.4%) and 18 (62%), respectively, at the six-month follow-up. In the TRA and TFA participants, for UED at three

weeks to the important factors were found to be elbow extension, wrist flexion, and wrist extension. During follow-up, Cochran's Q-test revealed a significantly greater in UED in the intervention extremity of the TRA group p=0.003 and TFA group's right upper extremity (p=0.001).

Table 1: Primary endpoint content: Upper Extremity dysfunction after three weeks

| Criteria | Starting primary endpoint | Recently primary endpoint |
|---|---|---|
| ≥ 2 point greater show in the symptom severity or BCTQ | YES | NO |
| ≥ 16% increase to DASH then baseline | YES | NO |
| Greater NRSP score regarding the UED >2 points then baseline | YES | YES |
| Absent od signal radial artery during ultrasound | YES | YES |
| ≥61N reduced in palmar grip strength | YES | ≥18% decrease |
| ≥13N reduced key grip strength | YES | ≥17 decrease |
| ≥16% reduced the strength of wrist and elbow | YES | YES |
| ≥1.5 filament increase of the hand according to WEST | YES | ≥3 filament increase |
| ≥1.5 cm increase circumferences of hand | YES | ≥3 cm increase |
| ≥ 1.5 cm increase circumferences of hand | YES | ≥3 cm increase |

The primary endpoint, which included eight criteria, after 3 weeks checkup in the presence of UED were shown in Table 1.

Table 2: Baseline characteristics of the total participants

| Category | | Total No. patients =250 | TRA n=200 | TFA n=50 | P-value |
|---|---|---|---|---|---|
| Man | | 250 | 200(80%) | 50(20%) | 0.576 |
| Age | | 61.5±6.1 | 59.2±6.7 | 55.5±7.1 | 0.544 |
| BMI | | 24.1±4.0 | 22.2±4.0 | 20.16±4.8 | 0.456 |
| Height | | 165.3±8.1 | 164.2±8.0 | 165±8.0 | 0.512 |
| Smoking | Current | 30(12%) | 25(12.5%) | 5(10%) | 0.603 |
| | Previous | 197(79%) | 170(85%) | 27(54%) | 0.66 |
| | Never | 47(19%) | 45(23%) | 2(4%) | 0.65 |
| Diabetes Mellitus | | 178(71.2%) | 135(68%) | 43(86%) | 0.444 |
| B.P | | 216(86.4%) | 188(94%) | 28(56%) | 0.085 |
| Family history of HD | | 166(66.4%) | 124(62%) | 42(84%) | 0.078 |
| Previous TR-PCI | | 204(82%) | 178(89%) | 26(52%) | 0.535 |
| Right hand dominance | | 181(72.4%) | 135(68%) | 46(92%) | 0.544 |
| Prescribed calcium antagonist | | 192(77%) | 165(83%) | 27(54%) | 0.822 |

Mean±SEM: ANOVA SPSS 20 Test *p<0.0; **<0.01; ***p<0.001:

There was no significant difference between transradial artery (TRA) and transradial femoral artery (TFA) were shown in Table 2.

Table 3: To evaluate the primary endpoint and long-term upper extremity dysfunction were assessed during follow-up.

| Time period | TRA | | Time period | TFA | | P-value* | |
|---|---|---|---|---|---|---|---|
| | Intervention Extremity | | | Right upper Extremity | | $X^2$ | |
| | Complete case Analysis | Partial case Analysis | | Complete case Analysis | Partial case Analysis | Complete case Analysis | Partial case Analysis |
| 3 weeks (n= 140) | 55(39.2%) | 69(49.2%) | 3 weeks (n= 18) | 6(33%) | 9(50%) | 0.043 | 0.065 |
| 2 months (n=205) | 89(43.4%) | 95(46.3%) | 2 months (n=29) | 18(62%) | 20(69%) | 1.011 | 1.011 |
| 6 months (n=240) | 201(84%) | 213(89%) | 6 months (n=42) | 31(74%) | 36(86%) | 0.162 | 0.251 |
| Cochrane Q test | 9.5 | 7.0 | | 20.5 | 17.5 | | |
| p-value | <0.003 | 0.012 | | <0.002 | <0.001 | | |

Mean±SEM: ANOVA SPSS 20 Test *p<0.0; **<0.01; ***p<0.001:

Table 4: To evaluate the Complications site at the following percutaneous coronary intervention

| | TRA (N=200) | | | TFA (N=50) | | | P-value |
|---|---|---|---|---|---|---|---|
| | Day 1 | 3 weeks | 6 months | Day 1 | 3 weeks | 6 months | |
| Minor hematoma | 95(48%) | 55(28%) | 2(1%) | 15(30%) | 6(12%) | 2(4%) | P=0.324 |
| Major hematoma | 100(50%) | 41(21%) | 0(0%) | 18(36%) | 9(18%) | 0(0%) | P=0.333 |
| Minor bleeding | 35(18%) | 11(6%) | 1(1%) | 6(12%) | 0(0%) | 0(0%) | P=0.212 |
| RAS | 15(8%) | 10(5%) | 12(6%) | 3(6%) | 1(2%) | 2(1%) | P=0.345 |
| RAO | 6(3%) | 4(2%) | 2(1%) | 5(10%) | 3(6%) | 2(4%) | P=0.123 |
| Hand specialist | 1(1%) | 12(6%) | 20(10%) | 1(2%) | 1(2%) | 2(4%) | P=0.423 |

Mean±SEM: ANOVA SPSS 20 Test *p<0.0; **<0.01; ***p<0.001:

Access-site complications were not different between both participants group. Hematomas did not differ based on the number and types of needle until successful access. During follow-up, 2 (1%) TRA participants had RAO, which re-canalized over time. Three weeks after the procedure, 10% of participants in the TRA group were referred to a hand specialist as compared to TFA shown in Table 4.

## DISCUSSION

Transradial artery access (TRA) is linked to reduce bleeding and vessels problems related to health than transfemoral artery access (TFA), in patients with acute coronary arteries disorder. When compared to TFA, the use of TRA for coronary angiography and PCI may be linked to better assessments of life expectancy and reduce costs.

Transradial exposure has a variety of benefits over femoral artery access, including very few hematomas, and radial artery access becoming the first preference for coronary intervention. Transradial artery problems such as bleeding, RAO, and hematomas occurred in all patients, and both major and minor bleeding events were linked to a greater likelihood of short- and long-term fatalities.[10, 11] In the current study, the effect of access site-related bleeding, RAO, and hematoma complications from 1 day, 3 months, and 6 months was attributed in participants undergoing PCI and was not divergent strategies in the TRA group. Hematomas did not differ depending on the type of puncture or the number of needle movements. TFA participants did

not reach out to hand specialists as frequently as TRA participants.[12, 13]

In contrast to previous research, the UED at three weeks after TR-PCI enhanced significantly with time in our study, between the transradial and transfemoral methods. The DASH questionnaire was selected because the individual's personal level of well-being and capacity to do activities is also important to the success of which upper extremity they use. Patients who are troubled are much more likely to restrict their everyday routines and regular exercise for up to a year following a myocardial infarction. Besides that, when merged with slow access (>28 days) to a cardiac rehab center, this frustration and nervousness can lead to decreased physical activity, resulting in glycogen depletion of the (upper extremity) muscles.[14] The UED included important factors such as forearm muscles triceps and biceps in both groups and there was a positive impact in UED in the intervention extremity and upper extremity in TRA then TFA group.[15, 16]

During the intervention, the forearm extremity and contralateral extremity diameter elevated significantly as time passed was noticed, suggesting a secondary cause, such as a calcium channel blocker adverse reactions or cardiac arrest.[17] I n our research to find that there was no significant changes in hand muscle and RAO following transradial artery of PCI. There was also no lowering in hand and finger strength after the procedure of TR-PCI.[18, 19]

The UED progression more times in smokers participants then non-smokers. The muscle mass and power damage in the participants who used smoking, increases the probability of musculoskeletal pain, and affects cardiometabolic risk by continuing to increase inflammation and reactive oxygen species, resulting in skeletal muscle destruction. Many signs and symptoms include high blood pressure and heart disorder previous data. Our guideline is to take into account multivariate variables when harm to different sorting long term issues after TR-PCI. There has been limited research into the effect of patient chronic conditions such as obesity and smoking on nerve transfer outcomes.[20, 21]

## CONCLUSION

Transradial arterial access (TRA) for percutaneous coronary artery intervention has been linked to lower access site complication rates and higher patient satisfaction when compared to transfemoral access (TFA) at three weeks checkup.

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