Original Article



# Transradial Angiography with Dedicated Catheter: A Tertiary Care Center Experience

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## Article Info

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## Abstract

**Objective:** To demonstrate the safety and feasibility of tiger catheter for trans-radialcoronary angiography.

**Methodology:** It was a retrospective observational study conducted at the Peshawar Institute of Cardiology. A total of 2728 patients were included over a period of 1 year, from Apr 01, 2021, to Mar 31, 2022, who underwent radial angiography with a tiger catheter. All data was collected through the hospital database. Angiography clips were analyzed by senior consultant cardiologists for the occurrence of any complications.

**Results:** Among 2728 patients, 60.63% of patients were males, and 39.36% were females. The mean fluoroscopy time was 0.85±0.36 minutes. The mean contrast volume used was 33.33±10.19 ml. The rate of any major complication was extremely low. Radial artery spasm was the most common complication and occurred in 3.9% of cases. Coronary artery ostial dissection occurred in only 4 cases, and all were successfully stented. Switching over to Judkins left (1.94%) and Judkins right (1.76%) catheter in cases of difficult engagement was also very low.

**Conclusion:** Our study has demonstrated that radial angiography performed with a Tiger catheter is associated with low contrast volume and fluoroscopy time and an extremely low rate of any major complication.

**Keywords:** Radial angiography, Tiger catheter, Judkins catheter, Fluoroscopy time, Contrast volume.



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# Introduction

Coronary artery disease has a high mortality and is considered to be a leading cause of death throughout the world.[1,2] Invasive coronary angiogram is an important tool for the definite diagnosis of coronary artery disease.In one US registry, more than a million patients undergo coronary angiography each year.[3] Despite improvements in healthcare standards and advancements in non-invasive testing of coronary artery disease, the usage of invasive coronary angiography is not declining.[4]

There are different routes through which percutaneous coronary intervention (PCI) and CAG can be performed, including femoral, brachial, and radial arteries.[5] In 1989, Campeaon performed the first radial angiography, and in 1993, the first radial PCI was performed by Kiemeneji et al., after which the trans-radial route gained popularity.Traditionally, the femoral artery has been the preferred route for PCI. However, due to the increased number of side effects such as hematoma, arterial pseudoaneurysms, increased bleeding, and arteriovenous fistula, the trans-radial approach is commonly employed.[2] A previous study done on a comparison of transradial and transfemoral routes for PCI showed that the transradial approach was far superior to transfemoral in regards to ecchymosis, thrombophlebitis, hematoma formation, and bleeding. Also, early mobilization and overall reduced morbidity are achieved with the trans-radial approach.[6-8]

Various catheters are being used for the trans-radial route; these include Judkins Left and Judkins Right, which are the conventional femoral route catheters that are used for the right and left coronary arteries, respectively.[9] Single catheters such as Tiger (tiger II; Terumo TM) have been developed for both coronary arteries. With single catheters, one can avoid the need to exchange catheters and minimize the mechanical irritation sustained by limb vessels. Also, the duration of the procedure and fluoroscopy time is decreased, along with reduced use of contrast.[10] Despite these advantages, many operators still prefer to use traditional femoral catheters for radial angiography and have doubts about the safety profile of tiger catheters. Initially, there was a general idea prevailing about tiger catheters that they were notorious for causing serious ostial coronary artery dissections. However, with the improvement in technique and expertise, minimal complications were noted with the tiger catheter. So, the study was conducted to look for the effectiveness of tiger catheters in terms of complications, fluoroscopy time, and contrast volume.

Objective:

The objective of this study was to look for the feasibility and cost-effectiveness of the Tiger Catheter for trans-radial angiography.

# Methodology

This was a retrospective observational single-center study. All patients who underwent radial angiography for any indication, i.e., stable IHD, ACS including STEMI, or preoperative assessment, were included from Apr 01, 2021, to Mar 31, 2022. Patients were excluded if they had radial artery loops, subclavian or aortic tortuosities, or if they were post-CABG. Patients who underwent angiography from the left radial route were also excluded. Radial angiography was performed by highly experienced consultant interventionists with an experience of at least1000 procedures per year. In most of the procedures, 6Fr radial sheaths were used for radial artery cannulation with a little deviation to 7 FR if complex PCI is anticipated. After sheath insertion, 5000 IU of Heparin and nitroglycerine 200 mcg was given to all patients. All radial angiographies were proceeded with Terumo Tiger catheter 5 French catheters. Data was retrieved from the hospital database, i.e., HMIS and patients' angiography proformas stored in hospital electronic medical records. Fluoroscopy time and contrast volume are noted for each angiography. Any possible complication, such as forearm hematoma, radial artery spasm, perforation, etc, was also noted. In case of failure to achieve coronary engagement or proper coronary artery opacification with Tiger catheter, crossover to Cordis JL and JR was also noted.After the procedure, the TR band was applied to all patients.

### Statistical Analysis

All results are expressed in the form of tables as appropriate. Continuous variables age, contrast volume, and fluoroscopy time are expressed as mean and standard deviations. Frequencies and percentages are calculated for categorical variables like gender, rate of hematoma, and coronary artery dissection. Statistical analysis is performed using the statistical package for social sciences, 22 (SPSS, Chicago, USA. Version ZZZ).

# Results

A total of 2728 patients were analyzed. 60.63% were males and 39.36% were females. The mean age was 57.40 ± 22.90 years. Unstable angina (51.7%) was the most common presentation for coronary catheterization, followed by stable angina (32.33%). All angiographies were started with a tiger catheter. In case of failure to achieve proper engagement with tiger catheter or proper coronary artery opacification, JL was used in 1.94% of patients for LMS engagement and JR in 1.76%of cases for RCA engagement. The mean fluoroscopy time was 0.85±0.36 minutes. The mean contrast volume used was 33.33±10.19 ml.

No significant complication noted during catheterization of left main stem. However, 4 cases of right coronary artery dissection were noted and one patient had flow limiting dissection which was successfully man-

aged with stenting. Forearm hematoma was found in 1.3% of cases. Radial artery spasm was found in 3.9% of patients. And radial artery perforation occurred in 52 (1.9%) patients.

## Discussion

Since the advent of coronary angiography, the trans-

**Table 1. Baseline characteristics of study participants**

| Baseline characteristics | No of patients (n= 2728) | % |
|---|---|---|
| Mean age ± SD | 57.40 ± 22.90 | |
| Gender | | |
| Male | 1654 | 60.63 |
| female | 1074 | 39.36 |
| Hypertension | 1287 | 47.17 |
| Diabetes | 440 | 16.12 |
| Smoking | 83 | 3.04 |
| BMI (Mean ± SD) kg/m2 | 29.15 ± 13.94 | |
| Atrial Fibrillation | 13 | 0.47 |
| Prior PCI | 82 | 3.0 |

**Table 2. CAD presentation in study participants**

| CAD presentation | No of patients (n= 2728) | % |
|---|---|---|
| No symptoms, No Angina (14 Days) | 22 | .8 |
| Non-STEMI (7 days) | 138 | 5.05 |
| Non-STEMI (8 to 30 days) | 24 | .87 |
| Stable angina (42 days) | 882 | 32.33 |
| STEMI (7 days) | 198 | 7.25 |
| STEMI (8 to 30 days) | 32 | 1.17 |
| Symptoms unlikely to be ischemic (14 days) | 6 | .21 |
| Unstable angina (60 days) | 1426 | 52.27 |

**Table 3. Procedural characteristics of angiographies conducted with tiger catheter**

| Procedural characteristics | No of patients | % |
|---|---|---|
| Mean Fluoroscopy time | 0.85 ± 0.36 minutes | |
| Mean Contrast volume | 33.33 ± 10.19 ml | |
| Crossover to JL | 53 | 1.94 |
| Crossover to JR | 49 | 1.76 |
| Switched to femoral route | 29 | 1.06 |
| Complications: | | |
| Forearm hematoma | 37 | 1.3 |
| RCA dissection | 4 | 0.14 |
| Radial artery spasm | 108 | 3.9 |
| Radial artery Perforation | 52 | 1.9 |

**Table 4. Characteristics of participants and procedure in the Judkins group**

| Baseline characteristics | No of Patients (n=173) | % |
|---|---|---|
| Mean age ± SD | 59 ± 11.77 | |
| Gender | | |
| Crossover to JR | | |
| Male | 120 | 69.4 |
| Female | 53 | 30.6 |
| Hypertension | 133 | 76.9 |
| Diabetes | 36 | 20.8 |
| Smoking | 15 | 8.7 |
| Mean Contrast Volume ± SD | 40.31 ± 8.86 ml | |
| Mean Fluoroscopy Time ±SD | 2.6 ±0.89 minutes | |
| Radial artery spasm | 8 | 4.6 |

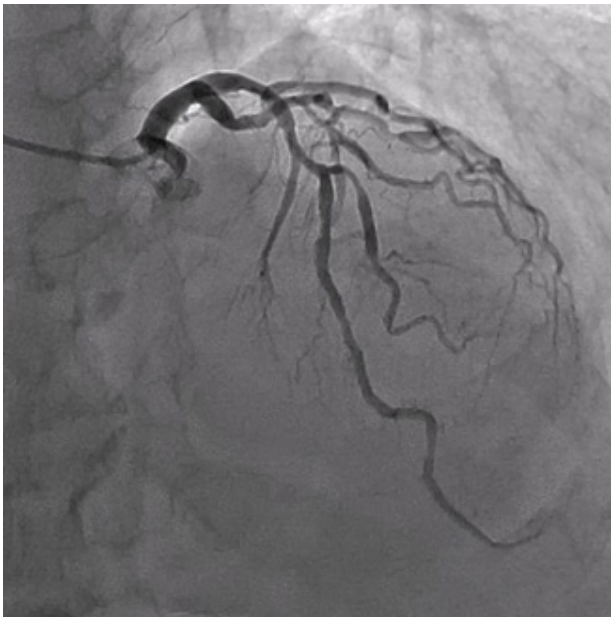

Figure 1: LCA angiography with tiger catheter.

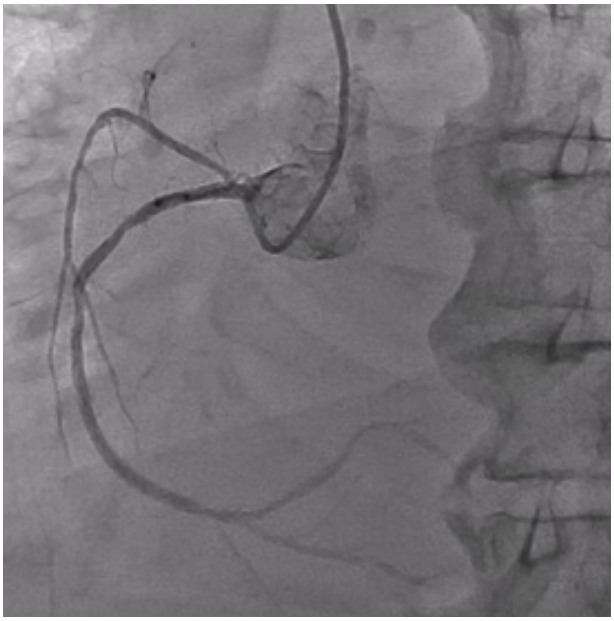

Figure 2: RCA angiography with tiger catheter.

femoral approach has been the most commonly employed route, even for many years after the introduction of radial artery cannulation. However, over the past few decades, transradial catheterization has gained popularity over the transfemoral approach because of its lower rate of complications, early ambulation, short hospital stay, and more patient comfort and satisfaction. Transradial angiographies can be done by both traditional Judkins catheters that are also employed for femoral approach and also by dedicated radial catheters such as Tiger.

Previous studies have shown that the trans-radial approach has increased radiation exposure to operators and patients.[11,12] This is mostly because of the tortuosity of neck and arm vessels and radial artery spasms. This has led to the concept of a single-catheter approach using dedicated catheters for transradial procedures. Previous studies have shown a reduction in both fluoroscopy time[13,14] and hence radiation dose, as well as contrast volume when using dedicated radial catheters such as tiger catheters as compared to separate transfemoral Judkins catheters. Moreover, the overall procedure time is also shortened with the use of a single catheter as it obviates the need for catheter exchange, and hence, the irritation caused to the radial artery with catheter exchange results in spasms. Our fluoroscopy time and contrast volume are less than in previous studies. Mainly because all the angiographies


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were performed by senior consultant interventionists. Also, patients with aortic or radial tortuosities were excluded. Radial artery spasm was found in 3.9% of patients. However, the crossover to the femoral route because of radial artery spasm occurred only in 1.06% of cases. In one study, the frequency of radial artery spasms with a Judkins catheter was reported to be around 6%.[14]

Employing a single dedicated radial catheter for both RCA and LMS will result in a significant cost reduction compared to using two separate catheters. And this can be of great economic value in high volume centers like ours. Also, in high-volume centers, considering rapid patient turnover, the short procedure time offered by Tiger catheters is of great benefit.

Despite these benefits, many operators experience difficulty during the engagement of coronary arteries with a tiger catheter and maintaining a stable position during the injection. In our study, crossover to JL was noted more than crossover to JR in cases of poor ostial engagements. However, the frequency is not much different.

Difficult anatomies like tortuous aorta are considered a hindrance for trans-radial catheters and trans-radial angiographies and may result in higher fluoroscopy time. However, Brain et al. showed significantly lower fluoroscopy time with tiger catheters than when angiography was switched to JL and JR catheters for the reason of aortic tortuosities.[15]

We also presented some scanty data about the Judkins catheter, as in the initial few days, Judkins was the default catheter for diagnostic angiography, even from the radial route. Later on, due to the operator's feasibility, expertise, and cost reduction, there was a shift towards the Tiger catheter. Both contrast volume (40.31±8.86 ml vs. 33.33±10.19ml) and fluoroscopy time (2.6±0.89 minutes vs. 0.85±0.36 minutes) are higher in the Judkins group as compared to the Tiger group. Also, the overall frequency of radial artery spasms (4.6% vs 3.9%) is also higher in the Judkins group. However, as it was not a randomized trial, we couldn't draw some meaningful results.

One study[13] has shown better image quality and coronary opacification with Judkins catheters. But taking into consideration the low complication rate, short procedure time associated with Tiger catheters and low procedure cost, starting procedure with the single catheter seems to be a reasonable choice.

## Limitations:

It is not a randomized study, and we are not comparing the performance of the tiger catheter with the Judkins catheter. Results support the usage of tiger catheters and not other radial catheters. Inherent biases associated with retrospective nature of the study cannot be ruled out.

## Conclusion:

Our study has demonstrated considerably lower radiation exposure and reduced the amount of contrast while performing radial Coronary angiography with Tiger catheters, and it seems that initiating the procedure with a single catheter is a reasonable and effective approach.

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