

# Transradial Approach to Coronary Interventions in Central Nepal

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## ABSTRACT

**Background:** The transradial approach (TRA) has gained popularity worldwide and it is the preferred access in many cardiac centers in Nepal. This technique offers numerous advantages and has been practiced by many interventional cardiologists. The aim of this study is to document single operator experience with TRA and its complications.

**Methods:** an observational prospective study conducted in Chitwan Mutu Aspatal (CMA). The study was approved by the Ethical Committee. Informed and written consent was taken from all the participants. TRA was done without any assessment for dual hand circulation

**Results:** A total of 214 patients were included with 114(53.27%) males and 100(46.73%) females. The mean age was (62.51 ± 12.47) years. The total transradial success rate was 88.78% for Coronary interventions. The crossover rate from radial to femoral access was 11.22%. Crossover from radial approach to femoral approach occurred in 11.22% of patients. Subclavian or aortic tortuosity was noted in 39 (18.22%) patients, radial artery vasospasm which did not respond to multiple doses of intra-arterial nitroglycerin and IV analgesia in 7(3.27%) patients, puncture failure in 5(2.3%) patients, and radial loop in 10(4.67%) patients.

**Conclusion:** TRA is safe and can be applied in the majority of cases. It is associated with early ambulation, reduction in hospital stay, and less cost, making way for interventions in an outpatient care regimen. The routine assessment of dual hand circulation before TRA might not be necessary.

**Keywords:** Coronary interventions; Percutaneous coronary intervention; Transradial; Transfemoral; Complications

## INTRODUCTION

In recent years, there has been a paradigm shift in the approach to coronary interventions, with increasing utilization of radial access as an alternative to the traditional femoral access. Following the first report of radial Coronary Angiography(CAG) by Campeau in 1989 and radial Angioplasty(PCI) by Kiemeneij et al. in 1993, there is an increase in use of transradial arterial (TRA) access throughout the world.<sup>1,2</sup> The major advantage of the TRA is the reduction in the complications related to the site of puncture. Additionally, it is associated with early ambulation, reduction in hospital stay, and consequently reduction in costs, making way for interventions in an outpatient care regimen.<sup>3</sup> The dual blood supply of the hand limits the potential for limb-threatening ischemia.<sup>4</sup> We have started transradial access as the first choice during coronary interventions in our cardiac hospital "Chitwan Mutu Aspatal" (CMA) since the beginning

of Cath. Lab. services. It is the first superspeciality cardiac dedicated hospital in the Bagmati province in Nepal outside the capital city.

## METHOD

It was an observational prospective study conducted in Chitwan Mutu Aspatal (CMA). The study was approved by the Ethical Committee. Informed and written consent was taken from all the participants. TRA was done without any assessment for dual hand circulation. The patients were prepared for radial and femoral approaches. All the procedures were done through the right radial artery. Under local anesthesia (2–3 ml, Xylocaine 5%), radial punctures were performed using the transradial kit which consisted of a 20-gauge needle, a 0.018" guide-wire, and a short (7 cm long) sheath. Five and Six-French sheath was used for all patients. After sheath insertion, a cocktail containing 200 µg nitroglycerin and 2500 IU

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unfractionated heparin (UFH) was injected into the radial artery. For diagnostic CAG, 5F Tiger (TIG) catheter (Terumo, Japan) was used to cannulate both left and right coronary arteries. Occasionally, Judkin's left (JL 6/3.5) and Judkin's right (JR6/3.5) catheters were used to cannulate the left and right coronary artery respectively whenever required. For patients with PCI, Judkin's guiding catheters (JL6/3.5 and JR 6/4) and extra back-up (EBU) guiding catheter (6F/3.5) were the most widely used catheters for coronary engagement. All patients were loaded with dual antiplatelet drugs (300mg aspirin and 600mg clopidogrel or 180mg Ticagrelor) for elective and Primary PCI. UFH (70 to 100 IU/kg) is the standard anticoagulation before the procedure. A drug-eluting stent (DES) ("Xience", Abbott Vascular or "Onyx", Medtronic) was used whenever stenting is indicated. The radial sheath was removed immediately after the procedure and compression was performed proximal to puncture site for 3-4 hours using radial compression band. Thereafter, a light pressure bandage was applied and removed in the next day. Most of the elective PCI patients were discharged on the next day provided that no complications occurred in the first 6 hours after the procedure. Patients with primary PCI were discharged after 72 hours when they were stable. The site of radial puncture was examined before discharge and after 15 days. Radial artery patency was assessed by checking the radial pulse. Radial artery occlusion (RAO) was considered present in the absence of a radial pulse distal to the puncture site. Statistical analyses were performed using the Microsoft Excel. Continuous variables were analyzed and presented as mean  $\pm$  SD whereas categorical variables were given as numbers (percentages). The comparison between categorical variables was done by chi-square test.  $p < 0.05$  was considered statistically significant.

## RESULTS

A total of 214 consecutive patients were included over a period of 8 months in 2023AD. 68 (31.77%) enrolled patients were more than 70 years in age. There were 114 males (53.27%) and 100 females (46.73%).

The age ranged from 31 to 92 years (mean of  $62.51 \pm 12.47$ ). Baseline characteristics of the patients are summarized in Table 1.

Variables	Frequency (%)
Age in years	62.51 $\pm$ 12.47
Male	114 (53.27%)
Female	100 (46.73%)

During the study period, we performed subsequent 214 transradial procedures, out of which 70 (32.71%) were PCI including Primary, Elective and Adhoc PCI. Total transradial technical success rate was 88.78%. The PCI procedures included single-vessel disease, multi-vessel disease, total occlusions, bifurcational lesions and left main stem (LMS) disease. Crossover from radial approach to femoral approach occurred in 11.22% of patients. Subclavian or aortic tortuosity was noted in 39 (18.22%) patients, radial artery vasospasm which did not respond to multiple doses of intra-arterial nitroglycerin and IV analgesia in 7 (3.27%) patients, puncture failure in 5 (2.3%) patients, and radial loop in 10 (4.67%) patients. Other causes for crossover are shown in Table 2.

\*Which did not respond to multiple doses of intra-arterial nitroglycerin and IV analgesia.

\*\*Such as high origin of the radial artery, abnormal origin of the right subclavian artery, and abnormal

Characteristics	Frequency (%)
Tortuous subclavian artery or aorta	39 (18.22%)
Radial artery spasm*	7 (3.27%)
Puncture failure	5 (2.3%)
Radial loop	10 (4.67%)
Failure to engage the ostium of coronary arteries with guiding catheter during PCI (n=70)	4 (5.71%)
Inadequate support of the guiding catheter	2 (2.86%)
Anatomic variations**	2 (2.86%)
Inability to cross the coronary lesion with balloon or stent	1 (1.43%)

right coronary artery origin. Crossover from radial to femoral access was higher in elderly patients (above 70 years) than younger patients (4.8% versus 3.2%);

however, the difference between the two groups was statistically not significant ( $p$  value=0.052).

The frequency of various complications was as follow: None of the patients had palpable forearm hematoma, however bruise was noted in few patients. Wire entrapment in radial artery was noted in one patient, which was removed surgically. Radial artery occlusion (RAO) was observed in 4patients (1.87%). There were no cases of hand ischemia, pseudoaneurysm, arteriovenous fistula, or bleeding complications that need surgical repair or blood transfusions (Table 3).

<b>Table 3. Complications during Transradial interventions. (n=214)</b>	
<b>Complications</b>	<b>Frequency (%)</b>
Radial artery occlusion (RAO)	4 (1.87%)
Entrapment of wire	1(0.47%)

## DISCUSSION

The radial approach is a better alternative to the classical femoral approach for coronary interventions. The radial artery is very superficial, making it easy to puncture, and bleeding is controlled by compression. There are no major nerves or veins near the radial artery, thus minimizing the risk of nerve and vascular injuries.<sup>5</sup> The benefits of TRA are less bleeding, lower morbidity, early ambulation, lower total hospital costs, patient preference and comfort, early discharge, less chance of developing ischemia due to dual blood supply of the hand, and easy access for the patients with myocardial infarction (MI) and aortic aneurysm.<sup>6</sup> The approach is advantageous for people with severe occlusive aortoiliac disease or difficulty lying down (e.g., due to back pain, obesity, or congestive heart failure).<sup>7</sup> Results from our study show that the transradial PCI was associated with high procedural success rates and favorable clinical outcomes in all patients, both in the elective and emergency (STEMI) settings. Patients with STEMI are the most intensely anticoagulated, and many receive thrombolytic therapy prior to arrival at the PCI center. So, they have high risk of bleeding. Thus,

the potential for access-site complications is highest in this group and the potential benefit from TRA is greatest.<sup>8,9</sup> The RIVAL (radial versus femoral access for coronary angiography and intervention in patients with acute coronary syndromes) study showed that TRA is associated not only with a lower rate of local vascular complications in the overall population, but also with a reduction in mortality in the setting of PCI.<sup>10,11</sup> These results have been confirmed in another randomized study, the RIFLE-STEACS study (radial versus femoral randomized investigation in ST-segment elevation acute coronary syndrome). This trial specifically compared the TRA and the TFA for primary PCI, in which a relative reduction in access-site complications and in mortality of nearly 40% was found with TRA.<sup>12</sup> According to the latest (2018) European Society of Cardiology (ESC) guidelines on myocardial revascularization, the radial access should be the standard approach for coronary angiography and PCI in all clinical settings (class I, level of evidence A).<sup>13</sup> There are potential disadvantages to the TRA. The TRA is technically more complex than the TFA due to the greater difficulty in cannulating the artery, the possibility of spasm, anatomical variations in the arteries of the upper limb, and the change in manipulation of the catheters that is necessary to cannulate the coronary arteries.<sup>14,15</sup> All these difficulties result in an increase in the length of procedural time and the need for a significant learning curve.<sup>15,16</sup>

Moreover, TRA is usually more demanding and needs longer procedural time in elderly patients because of the frequent presence of specific vascular abnormalities such as tortuosity, calcifications, or arterial loops.<sup>2</sup> TRA has been associated with a greater access crossover rate, which was reported to be 4–7% in various studies.<sup>17</sup> In our study, the crossover rate was 11.22%, with higher rates in older patients ( $\geq 70$  years old) than younger patients. However, the difference between the two groups was statistically not significant. In the meta-analysis of elderly patients by Alnasser et al., access site crossover rate was higher for TRA compared to the TFA (11% vs. 3%,  $p=0.0003$ ), but remains acceptably low.<sup>18</sup> While serious bleeding

complications are uncommon, the TRA bears the risk of radial artery occlusion (RAO). The incidence of RAO varies between 3 and 10%, according to different studies and protocols.<sup>19</sup> The incidence of RAO is determined by incomplete anticoagulation, the ratio between the sheath and artery size and the prolonged arterial compression.<sup>20</sup> Therefore, smaller guiding catheters are potentially advantageous leading to less arterial spasm, pain, and post-procedural RAO. Prolonged and forceful post-procedure radial artery compression is perhaps the most common cause of RAO.<sup>20</sup> Patent or non-occlusive artery hemostasis i.e., applying enough pressure to the radial access site to achieve hemostasis and yet maintaining antegrade flow in the radial artery has been shown to drastically reduce the incidence of RAO. Allen test or the oximetry/plethysmography test have not been shown

to be predictive of hand ischemia in case of RAO, it remains uncertain whether the assessment of dual hand circulation before TRA is required.<sup>21</sup>

## CONCLUSION

The TRA for CAG and PCI is effective and safe and can be applied in the majority of cases. It dramatically reduces access site complications. The routine assessment of dual hand circulation before TRA might not be necessary, however more studies are needed to confirm our results.

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