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## Feasibility and Safety of Distal Radial Artery Access in Anatomical Snuffbox for Coronary Angiography and Coronary Intervention

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### ABSTRACT

**Background:** There is limited data on feasibility and safety of coronary interventions performed using radial artery at anatomical snuffbox as vascular access point in South Asian region. Our study attempts to evaluate the feasibility and safety of coronary angiography and percutaneous coronary intervention using transradial access at anatomical snuffbox.

**Methods:** Transradial access at anatomical snuffbox was attempted in 128 consecutive patients, who were planned for coronary angiography and/or percutaneous coronary intervention. Success in vascular access, completion of planned procedure and complications encountered, including patency of radial artery after the procedure, were investigated.

**Results:** A total of 128 patients (76 males [59.4%]; 52 females [40.6%]) between 44-78 years of age (mean age, 59.0 +/- 10.2 years) were included in the study. Distal radial artery puncture and sheath placement was successful in all patients however planned procedure was completed in 126 (98.4%) patients. Total 90 coronary angiographies and 36 percutaneous coronary interventions were performed of which five were primary percutaneous coronary intervention. We encountered brachial artery spasm among two patient (1.5%) and significant pain and swelling among three patients (2.3%). No bleeding complication, numbness or parasthesia were observed on follow-up. Patients had average pain rating of 2.4 +/- 1.1 in visual analogue pain rating scale. There were no instances of radial artery occlusion after the procedure.

**Conclusions:** Distal radial artery, at anatomical snuffbox, is a safe and feasible alternative vascular access site for coronary angiography and percutaneous coronary intervention.

**Keywords:** Cardiac catheter; coronary angiography; feasibility studies; percutaneous coronary intervention; radial artery; vascular access device

### INTRODUCTION

For both diagnostic coronary angiography (CAG) and percutaneous coronary intervention (PCI) a transradial approach as vascular access is preferable and recommended to traditional transfemoral intervention.<sup>1</sup> Traditionally for the optimal radial artery puncture, distal third of forearm was used. However, radial artery cannulation in the anatomical snuffbox has recently been introduced as an alternative access point.<sup>3, 4</sup>

The anatomical snuffbox approach reduces risk of limb ischemia by maintaining forward flow through superficial palmar arch.<sup>5</sup> It also provides comfortable and more natural positioning of hand for the patient during the procedure. Studies have shown that distal radial

access in anatomical snuffbox is a safe alternative to conventional radial access; however, data from South Asian region is limited.<sup>4, 6-9</sup>

Our study attempts to evaluate the feasibility and safety of CAG and PCI using transradial access in the anatomical snuffbox in Nepalese population.

### METHODS

This was a prospective, observational study done at Department of Cardiology, Shahid Gangalal National Heart Center, Bansbari, Kathmandu between 15<sup>th</sup> August 2018 and 15<sup>th</sup> February 2019. The study protocol was approved by the Institutional review board (IRB) of Shahid Gangalal National Heart Center, Nepal. Informed

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consent was taken from the study participants. Patients assigned to principal investigator for CAG and/or PCI were included in the study. Patients who did not have palpable pulse in the anatomical snuffbox of either hand and those who did not give consent for the study were excluded. Total 128 consecutive patients, who were planned for CAG and/or PCI during the study period, were enrolled.

All patients, after disinfection, were covered with sterile drape with hole placed over dorsal side of patients planned hand. If right hand was used for vascular access, it was placed at the right side adjacent to the patient and if the left hand was used, it was placed over patient's abdomen with hand directing towards right groin. The operator was positioned at the right side of the patient for distal radial artery puncture. Two to three ml of 2% lignocaine was injected in radial fossa. The patient was asked to grasp his/her thumb under the other four fingers, with the hand slightly abducted. Vascular access was achieved using seldinger technique using 21 gauge open needle and 0.021" metallic wire at anatomical snuffbox with needle angled at approximately 45 degrees and directed medial to laterally. Small skin incision was given and radial hydrophilic sheath was introduced. 6 French radial sheath and guide catheters were used for all cases of PCI and 5 French radial sheath and guide catheters were used in all cases undergoing CAG. Choice of catheter was under primary operator's discretion as per the need of the patient. Only glyceryltrinitrate 200mcg was used intraarterially to reduce risk of vasospasm and unfractionated heparin (3000 IU for CAG and 8000 IU for PCI) was used for anticoagulation. After completion of the procedure, sheaths were immediately removed and hemostasis was obtained with application of compressive bandage with gauze.

Patient's relevant information including site of access, nature of intervention, success of intervention, presence of radial artery spasm and other complications were collected during the procedure. Complications including palpable hematoma, major bleeding that is difficult to control by external compression and inflammation with pain and swelling at the site of access were also noted immediately after completion of procedure and also during first OPD visit. Visual analogue scale (VAS) was used for assessing the pain which consisted of a horizontal line divided equally and numbered from 0 to 10 which has at its extremes the words "no pain" at 0 and "unbearable pain" at 10 and patient were asked to identify the level of perceived pain. The radial artery pulse at the forearm and anatomical snuffbox was checked by palpation after removal of hemostatic compressive bandage from puncture point and on first OPD follow-up for obstruction. All analyses were performed with the Statistical Package for Social Science, version 22. The

quantitative data was expressed as means with standard deviation and qualitative variables were summarized as absolute frequencies and percentages.

## RESULTS

One hundred and twenty eight patients were studied between 15<sup>th</sup> August 2018 and 15<sup>th</sup> February 2018. Patient and procedural characteristics are summarized in Table 1 and Table 2. Distal radial artery puncture and sheath placement was successful in all patients however CAG could not be completed in two of them, both due to wire advancement failure in proximal radial artery due to radial loops in both the hands, so they underwent procedure via femoral approach. Total of 126 procedures were performed through radial access out of which 95 procedures were performed via right distal radial approach and remaining 31 procedures via left distal radial approach (Table 3). Total 90 coronary angiographies and 36 PCIs were performed. In 36 PCI cases, including 5 primary PCI, the success rate of PCI via snuffbox approach was 100%. There was no problem with guide catheter support for PCI of either right or left coronary arteries. Multivessel PCI was performed in seven cases (Figure 1). Six patients who had undergone prior coronary angiography using forearm radial artery underwent PCI via distal radial artery at anatomical snuffbox of same hand successfully without any procedural difficulty or complications. During coronary angiography using five French Radifocus Optitorque™ radial tiger shaped angiographic catheter via left distal radial approach, there was difficulty cannulating the left coronary system among seven patients which was successfully performed after switching to Judkins left diagnostic catheter. We encountered brachial artery spasm among two patients during the procedure both being coronary angiography through the right distal radial access. Most patients' had little pain with mean pain rating of 2.4 +/- 1.1 in visual analogue pain rating scale with 0 being no pain and 10 being unbearable pain. However, three patients complained of minor swelling with significant pain in hand which occurred when performing their daily chores on first follow-up (Table 4). Nature of swelling could not be defined in these cases and were possibly due to either inflammation or minor hematoma. None of the patient had any radial artery occlusion post procedure and on follow-up OPD visit with radial artery palpable in both forearm and anatomical snuffbox. No major bleeding, requiring prolonged hospital stay, surgery or transfusion was encountered. No instances of numbness or paraesthesia were observed on follow-up.

Table 1. Patient Characteristics.

Patient Characteristics	N (%)
Mean Age	59+/- 10.2 years

Sex	Male	76 (59.38%)
	Female	52 (40.62%)
Comorbidities	Hypertension	98 (76.5%)
	T2DM	59 (46.09%)
	Smoking	29 (22.7%)
	CAD	104 (82.5%)
	Atrial fibrillation	6 (4.6%)

**Table 2. Procedural Characteristics.**

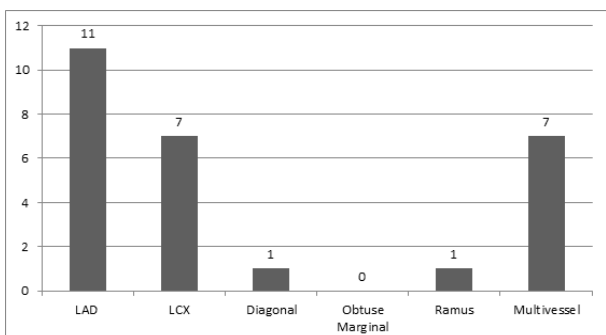
Procedural Characteristics	N (%)		
Successful Puncture	128 (100%)		
CAG	Male	51 (39.8%)	
	Female	39 (30.6%)	
PCI	Male	Primary	5 (3.9%)
		Elective	19 (14.8%)
	Female	Primary	0 (0%)
		Elective	12 (9.4%)
Failed to complete procedure	2 (1.6%)		

**Table 3. Vascular Access Site.**

Vascular Access Site	N (%)	
Right Distal Radial	CAG	67 (53.2%)
	PCI	28 (22.2%)
Left Distal Radial	CAG	8 (6.3%)
	PCI	23 (18.3%)

**Table 4. Complications encountered.**

Complications	N (%)	
Pain and swelling in hand (hampering daily chores)	3 (2.3%)	
Major bleeding complications	0	
Radial Artery Occlusion	Forearm	0
	Distal	0
Spasm	2 (1.5%)	
Parasthesia	0	



**Figure 1. PCI by vessels.**

## DISCUSSION

Our findings demonstrated that distal radial artery access in the anatomical snuffbox is a feasible and safe access site for coronary angiography and intervention. We had higher success rate (98.4%) in achieving the vascular access and completing the planned procedure compared to past studies which showed success rate in between 88% to 90%.<sup>4,6,10</sup> This was probably due to exclusion of patients whose pulse was not palpable or very feeble at anatomical snuffbox. Our finding was comparable to results of a study done in one of tertiary center in Nepal which had success rate of 97.6%.<sup>9</sup> Failure in our study was related to wire advancement failure in proximal radial artery due to the radial loops.

There were very few complications including minor swelling with pain at access site and radial artery spasm which we encountered in 2.3% and 1.5% of the patients respectively. Pain and swelling eventually subsided in few days with cold compression at the site of vascular access in all patients. Even though patients undergoing PCI were under aspirin and clopidogrel, there were no instances of major vascular bleeding. These few and infrequent complications were comparable to past studies.<sup>4,6,8,9</sup> The rate of low complications especially bleeding complication may be related smaller diameter of radial artery in anatomical snuffbox.<sup>10</sup> However, although diameter of radial artery at anatomical snuffbox is smaller than at wrist, we were able use 6 French sheath and perform PCI without any difficulty in all cases. Therefore distal radial access at anatomical snuffbox could be considered in patients with high bleeding risk.

The rate of radial artery occlusion after coronary intervention through conventional radial access ranges from 1-10% whereas our study showed that radial pulse was palpable after the procedure in all patients indicating no instances of radial artery occlusion.<sup>11</sup> Hence due to higher patency of radial artery, repeat intervention when required can be performed using same access site in future. Furthermore it would potentially allow radial artery to be used as a graft or for creating shunts if required in future. Successful radial access through anatomical snuffbox would also allow antegrade angioplasty of previously occluded radial arteries at proximal site.

Advantages of anatomical snuffbox approach that has been previously reported were confirmed in this study. The arm position during the intervention was more natural for the patients and hence allowed comfortable positioning of arm in cases where hand positioning would be a problem as in case of frozen shoulder. Operator experienced more comfort using left radial access as

he was not required to lean over the patient for the procedure.

In this study, we had difficulty cannulating the left coronary artery using five French Radifocus Optitorque™ radial tiger shaped angiographic catheter while using left distal radial approach. Successful cannulation of left coronary artery in these cases was done after switching to Judkins left diagnostic catheter. Therefore, switching to Judkins left diagnostic catheter would be a solution if there is any difficulty in cannulating left coronary artery while using tiger shaped catheter from left distal radial access.

There were some limitations in present study. This was a single center study with small number of cases. Furthermore, complications were only evaluated during hospitalization and first OPD visit. We did not evaluate amount of radiation exposure during the procedure and did not take in account the time taken to achieve vascular access. Comparison with other access sites could not be drawn due to lack of control group. Nevertheless, our study gives early insight of feasibility and safety of distal radial artery at anatomical snuffbox as an alternative vascular access for diagnostic and therapeutic coronary interventions. However, further large, prospective, multicenter, randomized studies comparing distal transradial approach to other conventional approach is required before any conclusions are drawn on superiority in terms of safety and feasibility of one approach over the other.

## CONCLUSIONS

Distal radial artery in anatomical snuffbox appears to be safe and feasible alternative vascular access point for coronary angiography and coronary intervention.

## CONFLICT OF INTEREST

None.

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