



# Feasibility and Safety of a 5 French Transradial Coronary Angiography with a 90 Minute Hospital Discharge

Shazmeen Shahed<sup>1\*</sup>, Kevin S. Levitt<sup>1,2</sup>, Anup K. Gupta<sup>1</sup>, and Mohammad I. Zia<sup>1,3</sup>

<sup>1</sup>Michael Garron Hospital, University of Toronto, Canada

<sup>2</sup>Women's College Hospital, University of Toronto, Canada

<sup>3</sup>Sunnybrook Health Sciences Centre, University of Toronto, Canada

## Abstract

**Background:** Transradial coronary angiographies (TRA) across Canada are performed using varying radial sheath sizes. Some studies have demonstrated lower complication rates with TRA using 5 French sheaths. Using 5 French sheaths along with optimal discharge times can result in improved access to this potentially life-saving procedure.

**Objective:** To retrospectively analyze the feasibility of using 5 French sheath and discharging patients within 90-minutes of a coronary angiography.

**Methods:** Patients undergoing TRA with a 5 French sheath were retrospectively analyzed. Radial artery patency was assessed by Allen's test pre-operatively. Patient demographics, risk factors, anti-platelet drugs, heparin, angiogram quality, time to clamp release and discharge were recorded. Patients were contacted after 24-hours to learn about potential complications after discharge.

**Results:** Four hundred patients were retrospectively analyzed and the mean age of the sample was  $64 \pm 10.6$  years, of which 65% were males. Thirty-two percent were smokers, 58% were dyslipidemic, 33% were diabetic, 63% were hypertensive. Fifty-eight percent of patients were on Aspirin and 6% were on dual anti-platelet therapy. Average heparin dose was  $58 \pm 9$  units/kg. Angiographic quality was diagnostic in 100% of cases. Median time from sheath pull to clamp release was 80 minutes (interquartile range (IQR) 75 to 85) and from sheath pull to discharge was 90 minutes (IQR 85 to 95). Complication rate due to post-clamp removal bleeding was 1%.

**Conclusion:** Based on the study, using a 5 French catheter and optimizing post-procedure discharge time to 90-minutes, results in improved workflow in the catheterization laboratory and enhances patient satisfaction without compromising patient safety or angiographic quality.

**Keywords:** Coronary angiography; TRA procedures

## Introduction

### Brief summary

Transradial coronary angiographies (TRA) across Canada are performed using varying radial sheath sizes due to lack of standardization. Performing this procedure using 5 French sheaths and optimizing discharge times can result in improved work flow in cardiac catheterization laboratories. This could potentially improve access to this lifesaving procedure. We aim to share our center's experience of using a 5 Fr catheter with a 90-minute discharge.

Coronary angiography (CA) is the precursor to treating coronary artery disease (CAD) and is a widely used gold standard diagnostic procedure. Studies that have been done to reduce the invasiveness of CA indicate that TRA decreases hemorrhagic complications while enabling early ambulation [1-4].

Some studies have indicated that while performing transradial procedures, decreasing the caliber of the catheter results in fewer complications. Rates of arterial occlusion and intraprocedural patient discomfort were also found to decrease [5-9]. While this should also be theoretically applicable to TRA, the same has not been systematically studied.

Worldwide, TRA procedures are performed using different sheath sizes with varying post-procedure discharge times. Performing the procedure using 5 French sheaths, combined with optimal discharge times can potentially increase patient turnover in cardiac catheterization laboratories and result in better access to this life-saving procedure. With this study, we aim to share our center's experience of using a 5 French sheath with a 90-minute discharge time for coronary angiographies.

## Materials and Methods

### Research design and setting

This retrospective feasibility study was conducted at Michael Garron Hospital (MGH), Toronto, Ontario which has one of the

**Submitted:** 29 May, 2019 | **Accepted:** 19 June, 2019 | **Published:** 21 June, 2019

**\*Corresponding author:** Shazmeen Shahed, Michael Garron Hospital, University of Toronto, Canada. Tel: 1-647-550-7060; Email: shazmeenshahed@gmail.com

**Copyright:** © 2019 Shahed S, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

**Citation:** Shahed S, Levitt KS, Gupta AK, Zia MI (2019) Feasibility and Safety of a 5 French Transradial Coronary Angiography with a 90 Minute Hospital Discharge. JSM Clin Med 5 1: 4.



19 catheterization laboratories of Ontario. MGH is a diagnostic only site and an average of 1450 angiographies are performed annually.

### Sampling

From April 2017 to June 2018, 700 patients who underwent coronary angiographies at MGH were sampled. Patients were not excluded on the basis of clinical presentation, gender, race, weight or height. Written consent was obtained from all patients for the procedure, and the study was approved by the Ethics Review Board of Michael Garron Hospital.

### Inclusion Criteria and Exclusion Criteria

The study included patients presenting with stable angina, unstable angina, atypical angina pain or angina after Coronary Artery Bypass Graft (CABG) or Percutaneous Coronary Intervention (PCI) requiring elective angiography. To accurately assess the applicability of a 90-minute discharge time, the study excluded in-patients and patients who were admitted post-procedure requiring immediate CABG or PCI. Patients requiring conversion from radial to femoral access were also excluded from the sample. Patients were excluded if their Right Radial Allen's test was positive or if the LIMA graft needed to be cannulated. After applying the inclusion and exclusion criteria, a total of 400 patients were retrospectively analyzed.

### Instrumentation and Angiographic Technique

All angiographies were performed using standard procedures by an experienced physician. Allen test was performed pre-procedure to determine the patency of radial artery. As per standard protocol, lidocaine was administered as a local anesthetic and an introducer needle was used to gain access to radial artery. Vasodilation was done using Nitroglycerine (100-250mcg). A 5 French hydrophilic coated radifocus introducer sheath by Terumo that provides pathway to a 5 French JR-4 catheter by Infiniti and 5 French FL-3.5 by Impulse was used to obtain standard angiographic views. Heparin (4000-5000 units) was administered intravenously to prevent radial artery occlusion.

Once the introducer sheath was retracted, the radial clamp was placed for hemostasis while ensuring patency of the radial artery. The clamp was disengaged after a median time of 80 minutes and radial artery patency was checked. Further to occurrence of hemostasis from the catheterization site, patients were allowed to ambulate under supervision. Subsequent to ambulation, at a median time of 90 minutes from sheath retraction, patients were discharged with an accompaniment. After disengagement of the clamp at 80 minutes, on non-occurrence of hemostasis, patients were clamped for an additional 60 minutes and discharged only if no further complications were observed. Discharge instructions included, a return to emergency in case of chest pain, bleeding at the site of catheterization or persistent numbness of hand. As per standard of care at the institution, a follow-up call was arranged within 24 hours to answer the following questions:

1. Was there bleeding from the catheterization site?
2. Has the swelling of the hand increased abnormally?

3. Was there increased numbness or tingling sensation of the hand?

### Statistical analysis and endpoints

The following parameters were recorded: patient age, gender, risk factors, antiplatelet therapy, angiogram quality, heparin dosage administered, time to clamp release, time to discharge, radial patency at discharge and bleeding complications. Quantitative variables were presented as arithmetic mean  $\pm$  standard deviation and qualitative variables were presented as percentages. For skewed variables, median and inter-quartile range was reported.

Data pertaining to the following endpoints was recorded and analyzed:

1. Time to clamp removal post TRA
2. Time to discharge post TRA
3. Bleeding post procedure
4. Bleeding at 24 hours

## Results

### Baseline characteristics

Four hundred patients were retrospectively analyzed for the study. The mean age of the study sample was  $64 \pm 10.6$  years, of which 65% were males. (Table 1) represents the demographics of the sample. (Table 1) demonstrates risk factors of the sample. Based on analyzed data, 32% of patients were smokers, 58% were dyslipidemic, 33% were diabetic and 63% were hypertensive. Medical records indicate that 36% of patients were not on any anti-platelet therapy, 58% were on aspirin and 6% on dual anti-platelet therapy and as shown in (Table 1).

**Table 1:** Demographics and Clinical Characteristics.

	Total (n=400)
*Age (years)	64 $\pm$ 10.6
**Male	260 (65)
**Hypertension	253 (63)
**Smoking	127 (32)
**Dyslipidemia	231 (58)
**Diabetes	131 (33)
**No Antiplatelet	145 (36)
**Aspirin	232 (58)
**Aspirin + Plavix	12 (3)
**Aspirin + Ticagrelor	11 (3)
*Heparin (units/kg)	58 $\pm$ 8.8
***Time to Clamp Release (minutes)	80 (75, 85)
***Time to Discharge (minutes)	90 (85, 95)
**Bleeding	4 (1)

\* Values are mean  $\pm$  SD  
\*\* Values are n (%)  
\*\*\* Values are median (25<sup>th</sup> and 75<sup>th</sup> percentiles)



Of the 6% on dual therapy, 3% were on aspirin and plavix, and the remaining 3% on aspirin and ticagrelor. Patients that were on Vitamin K antagonists or NOACS were not bridged. Vitamin K antagonists were held for 5 days prior and NOACS were held for 2 days prior. Routine INR check was not performed on the day of the procedure as per our protocol.

### Peri-procedural Findings

Mean heparin dose administered to patients after sheath removal was  $58 \pm 9$  units/kg. Angiographic quality observed during the procedure was diagnostic in 100% of cases. The median time to clamp release was 80 minutes (IQR 75-85 minutes) and to discharge was 90 minutes (IQR 85-95 minutes) as demonstrated in (Figure 1). There was no hematoma formation at catheterization site on clamp removal. Complication rate of the procedure was 1% as bleeding at catheterization site was observed in 4 patients after the scheduled clamp removal of 80 minutes. In this case, the patients were clamped for an added 60 minutes as per standard of care at our institution and thereafter discharged with an accompaniment.

Figure 2 demonstrates the minimum, maximum and average time from sheath pull to clamp release and discharge along with the clinical characteristic pertaining to each. The recorded minimum time to clamp release was 60 minutes and time to discharge was 75 minutes after sheath pull. The maximum time taken to release the clamp was 165 minutes and the patient was discharged at 180 minutes. The delay was due to non-hemostasis at scheduled clamp removal and patient was clamped further for 85 minutes until hemostasis.

### Post-discharge Findings

Patients were contacted within 24 hours of discharge to collect data on complications. They responded in the negative to post-discharge bleeding at the catheterization site and to increased swelling or tingling of the hand. As per standard of care,

the cardiologist is informed if patients have an emergency room visit in relation to the procedure. Patients were also educated to call the clinic if any complications arise. However, there were no reported visits by the patients to the emergency room or calls to the clinic regarding complications.

### Discussion

The results of this study indicate that a 5 French catheter for coronary angiography along with 90-minute post-procedure discharge time is a feasible methodology as the resulting complication rate is only 1%.

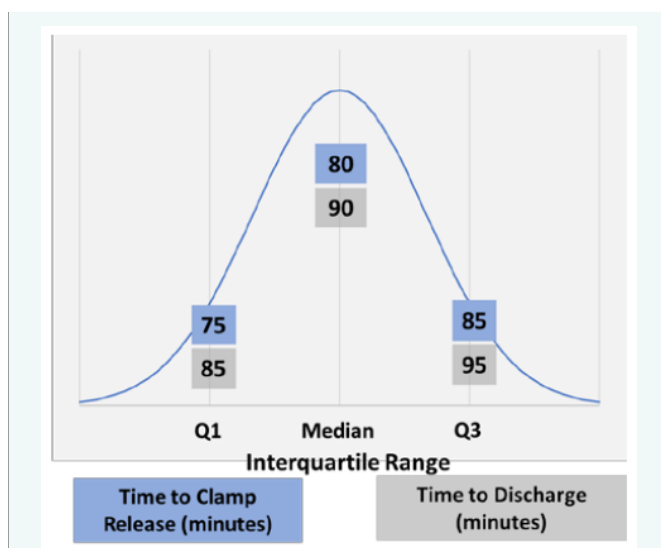
Based on the sample population, mean age of patients is  $64 \pm 10.6$  years. Senior population of Canada was 14% in 2009 and is projected to increase to 25% by 203 [10]. This will result in an increased demand for angiographies which can be addressed by either increasing the number of cardiac catheterization laboratories across the country or increasing the efficiency of the procedure. The former poses a significant logistical challenge. Hence, it is imperative to identify bottlenecks in the diagnostic process to address the current and future needs of cardiac care.

During this study, we identified the long compression time of the radial artery post-angiography as one of the bottlenecks. To address this, we used a 5 French catheter and clamped the patient for 80 minutes. The patient was discharged at 90 minutes post-angiography. These results in reduced use of logistical resources reduced workload and increased patient turnover. The complication rate with this catheter size and discharge time combination is only 1%. As a smaller caliber sheath requires lesser clamp time to achieve hemostasis and prolonged compression time correlates to increased chances of radial artery occlusion [11], it is advisable to use the smallest caliber sheath necessary for catheterization. This also minimizes trauma to the inner lumen of the artery during sheath insertion and removal.

The use of 5-French catheter optimizes overall procedure time, leading to improved patient satisfaction. It also has the benefit of reducing wait times for the procedure and potentially has significant prognostic implications. Typically, patients waiting to undergo angiographies are susceptible to acute coronary syndrome and hence more prone to ER visits. By performing angiographies using a 5 French catheter, a 90-minute discharge and reducing procedure wait times, ER resources could also be more efficiently utilized.

### Study limitations and future direction

First, this study is a retrospective feasibility study of a 5 French catheter; hence, data cannot be directly compared to that obtained with varying catheter sizes. Future studies should involve randomized controlled trials to enable direct comparison. Second, to better quantify the impact of reduced discharge time on wait times for angiography using 5 French catheter, future studies could be done by multiple operators across centers to capture the effect on wait times. This would also help reduce any inherent bias associated with a single center. Future studies should also compare the use of hemostatic patches as an alternative to using radial clamps to help accelerate patient turnover. Learnings from



**Figure 1** Time to Clamp Release and Time to Discharge Quartile.



	CLAMP RELEASE TIME (MINUTES)	DISCHARGE TIME (MINUTES)	GENDER	AGE (YEARS)	RISK FACTORS	ANTIPLATELET DRUGS	HEPARIN (UNITS/KG)
Minimum	60	70	F	75	-	-	55
Maximum	165	180	F	69	Hypertension	ASA	60
Average	80	91	N/A	64	Smoking - 32% Diabetes - 33% Dyslipidemia - 58% Hypertension - 63%	Single Antiplatelet - 58% Dual Antiplatelet - 6% No Antiplatelet - 36%	58

**Figure 2** Outcome of the Study and Associated Population Characteristics.

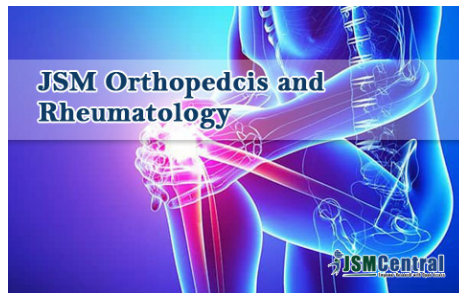
using 5 French catheter should be documented and disseminated across operators to familiarize them of technical differences and specifics associated with it, to help operators from multiple centers conduct the study.

## Conclusions

We believe that our data contributes important findings to the current limited literature on angiographies with 5 Fr. This study with its low complication rate supports the use of a 5 French catheter for TRA with a discharge time of 90 minutes without compromising patient safety. Furthermore, workflow in the catheterization laboratory is improved which leads to reduced use of logistical resources, reduced workload and increased patient turnover. Thus, at our institution, 5 Fr catheters for angiographies have been adapted as a standard diagnostic catheter.

## References

- Agostoni P, Biondi-Zoccai GG, de Benedictis ML, Rigattieri S, Turri M, Anselmi M, et al. Radial versus femoral approach for percutaneous coronary diagnostic and interventional procedures; systematic overview and meta-analysis of randomized trials. *J Am Coll Cardiol.* 2004; 44: 349-356.
- Jolly SS, Amlani S, Hamon M, Yusuf S, Mehta SR. Radial versus femoral access for coronary angiography or intervention and the impact on major bleeding and ischemic events: a systematic review and meta-analysis of randomized trials. *Am Heart J.* 2009; 157: 132-140.
- Kiemeneij F, Laarman GJ, Odekerken D, Slagboom T, van der Wieken R. A randomized comparison of percutaneous transluminal coronary angioplasty by the radial, brachial and femoral approaches: the Access study. *J Am Coll Cardiol.* 1997; 29: 1269-1275.
- Jang JS, Jin HY, Seo JS, Yang TH, Kim DK, Kim DK, et al. The transradial versus the transfemoral approach for primary percutaneous coronary intervention in patients with acute myocardial infarction: a systematic review and meta-analysis. *EuroIntervention.* 2012; 8: 501-510.
- Jang JS, Jin HY, Seo JS, Yang TH, Kim DK, Kim DK, et al. Feasibility and application of single 5F multipurpose catheter in coronary and peripheral angiography via a transradial approach. *Int J Cardiol.* 2011; 151: 182-186.
- Gobeil F, Lefèvre T, Louvard Y, Piéchaud JF, Morice MC. Coronary angioplasty using 5 French guiding catheters: preliminary experience. *Catheter Cardiovasc Interv.* 2000; 51: 107-109.
- Schussler JM, Smith R, Schreibfeder M, Hill D, Anwar A. Five French (5 Fr) guiding catheters for percutaneous coronary angioplasty and stent placement: an initial feasibility study. *Catheter Cardiovasc Interv.* 2000; 51: 352-357.
- Schöbel WA, Spyridopoulos I, Hoffmeister HM, Seipel L. Percutaneous coronary interventions using a new 5 French guiding catheter: results of a prospective study. *Catheter Cardiovasc Interv.* 2001; 53: 308-312.
- Gwon HC, Doh JH, Choi JH, Lee SH, Hong KP, Park JE, et al. A 5fr catheter approach reduces patient discomfort during transradial coronary intervention compared with a 6fr approach: a prospective randomized study. *J Interv Cardiol.* 2006; 19: 141-147.
- <https://www.statcan.gc.ca/pub/11-402-x/2010000/chap/pop/pop02-eng.htm>
- Pancholy S, Coppola J, Patel T, Roke-Thomas M. "Prevention of radial artery occlusion-Patent hemostasis evaluation trial (PROPHET study): A randomized comparison of traditional versus patency documented hemostasis after transradial catheterization." *Catheterization and Cardiovascular Interventions.* 2008; 72: 335-340.



Our motto is to advance scientific excellence by promoting open access. We are committed in the widest possible dissemination of research and uplift future innovation



[Submit Manuscript](#)