

## INCIDENCE AND RISK FACTORS OF FOREARM HEMATOMA AFTER TRANSRADIAL PERCUTANEOUS CORONARY INTERVENTION

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### Contribution

SSS conceived the idea and designed the study. Data collection and manuscript writing was done by SSS, MTM, NA, FQ, MAK, and ZRB. All the authors contributed equally to the submitted manuscript.

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### ABSTRACT

**Objective:** To determine the incidence and risk factors of forearm hematoma after trans-radial percutaneous coronary intervention (TRA-PCI).

**Methodology:** In this observational study we included 450 consecutive patients who were referred to catheterization unit of Ch. Pervaiz Elahi Institute of cardiology between February 2019 and September 2019 were included. Patients planned for TRA were only included in analysis. We recorded demographic details, previous and presenting medical and clinical history, and renal parameters for each patient. Allen's test was performed in each patient to determine the eligibility TRA. Incidence of forearm hematoma was noted immediately after the procedure.

**Results:** Out of 450 subjects enrolled in this study included, 324 (72%) were men and 126 (28.0%) were women, the mean age of the patients was 54±10 years. Forearm hematoma was diagnosed in only 51 (11.3%) patients. out of 51, 24 (47.0%) had grade I, 17 (33.3%) had grade II and 9 (17.6%) had grade III and 1 (1.96%) patients had grade IV hematoma. On univariate analysis, being women [odds ratio 2.2 (1.2-4.0), p-value=0.01], obesity [odds ratio 2.8 (1.54-5.76), p-value=0.001], and >1 puncture attempt [odds ratio 4.5 (2.36-8.51), p<0.001], were independent risk factors of forearm hematoma.

**Conclusion:** Incidence of hematoma after trans-radial percutaneous coronary intervention is 11.3%. Female gender, obesity and higher number of puncture attempts are independent risk factors of hematoma. Hematoma is mostly grade I-II in nature and can be managed easily only through conservative management.

**Keywords:** Transradial percutaneous coronary intervention, forearm hematoma.

## INTRODUCTION

Percutaneous coronary intervention (PCI) has been now widely performed all around the globe for management of acute coronary syndrome.<sup>1</sup> Trans-radial and trans-femoral are two preferred approaches of access for PCI.<sup>2</sup> Many studies have shown the superiority of trans-radial access (TRA) over trans-femoral access (TFA) such as STEMI-RADIAL, RIFLE-STEACS and RIVAL trials.<sup>3-5</sup> Trans-radial access has greatly reduced the access complications associated with trans-femoral access such as bleeding and hematoma formation. However, the adoption of TRA has been slower over the decades. Many of the consultants are still reluctant because of the fear that they will lose their expertise for TFA, that is still needed in some complex cases such as those with anatomic arterial variants present in 5.0% patients or when large access catheter is needed.<sup>6</sup>

Moreover, TRA is associated with minimum number but is not without complications, radial artery occlusion (RAO) and forearm hematoma are two highly reported complications.<sup>7,8</sup> Some studies have reported that female gender, older age, previous radial artery catheterization, anatomic variants and use of radial sheath larger than the artery diameter as risk of vascular complications.<sup>9,10</sup> A study by Bernat et al. concluded that many of the vascular complications of TRA can be avoided using non-occlusive post-procedural hemostasis.<sup>11</sup>

Although hematoma is less frequent as compared to RAO, and it ranges from mild to compartment syndrome. The reported incidence of hematoma varies from 0.04%-14.4% in different studies.<sup>12,13</sup> The aim of present study is to determine the incidence and risk factors of forearm hematoma after TRA-PCI.

## METHODOLOGY

In this observational study we included 450 consecutive patients who were referred to catheterization unit of Ch. Pervaiz Elahi Institute of cardiology between February 2019 and September 2019 were included. Patients planned for TRA were included in analysis. Patients planned for second time TRA catheterization, those having +Ve Allen's test, in whom stenting was not advised and those in

whom PCI was performed by trainees were excluded. Institutional clearance for ethical issues was taken.

We recorded demographic details, previous and presenting medical and clinical history, and renal parameters for each patient. Allen's test was performed in each patient to determine the eligibility TRA. TRA was achieved in all patients using right forearm.

Consultant cardiologists performed all intervention procedures. The access area was anesthetized with 1.0% lidocaine before inserting the puncture needle. The access site was secured using 6 Fr radial sheath. After the procedure, nitroglycerine was given in the radial sheath to prevent post-procedural vasospasms. After that sheath was removed and pressure bandage was applied over the insertion area for hemostasis. Patency of radial artery was assessed immediately and after 15 minutes by using pulse oximetry of index figure. If no pulse detected the pressure bandage was loosed until recovery of pulse on pulse oximetry. All patients were advised to make fist of the hand and release at shorter intervals during the compression period.

In all patients, incidence of forearm hematoma was noted immediately after removal of bandage after 24 hours of intervention or before 24 hours if patient felt pain or the staff on duty noted forearm swelling. If noted hematoma was graded according to the criteria reported by Bertrand et al. study. Grade I hematoma; size of hematoma <5 cm in diameter, grade II; hematoma size 5-10 cm, grade III; hematoma size >10 cm, grade IV; extending to elbow and grade V; compartment syndrome. Only analgesia and mild compression was given for management of grade I and II hematoma. For grade III and IV hematoma management we stopped any ongoing anti-thrombotic agents and elastic bandage was applied to the area of swelling.

Collected data was entered in SPSS v23 software. Univariate analysis was done to determine the risk factors of hematoma, odds ratio and p-value was calculated for each individual variable.

## RESULTS

Patient demographics and baseline clinical values are presented in Table 1. This study included 450 subjects, 324 (72.0%) men and 126 (28.0%) women, of mean age 54±10 years. Forearm hematoma was diagnosed in only 51 (11.3%) patients. out of 51, 24 (47.0%) had grade I, 17 (33.3%) grade II and 9 (17.6%) grade III and 1 (1.96%) patients grade IV hematoma.

**Table 1: Data of baseline Study Variables**

Characteristics	Summary
<b>Total Number</b>	<b>450</b>
Age (years)	54±10
BMI (kg/m <sup>2</sup> )	27.4±3.9
<b>Gender</b>	
Male	324 (72%)
Female	126 (28.0%)
<b>Risk factors</b>	
Hypertension	247 (55%)
Diabetes	184 (41%)
Smoking	147 (33%)
Dyslipidemia	176 (39%)
Previous history of Radial artery cannulation	11 (2.4%)
Forearm Hematoma	51 (11.3%)

On univariate analysis, being women, obesity, and >1 puncture attempt were independent risk factors of forearm hematoma. While there was no association of old age, smoking, hypertension, diabetes, low EF and multi-vessel stenting with hematoma formation. There were 22 (43.3%) women in hematoma versus 102 (25.5%) in non-hematoma group [odds ratio 2.2 (1.2-4.0), p-value 0.01]. There were 16 (31.3%) obese patients in hematoma group versus 53 (13.3%) in non-hematoma group [odds ratio 2.8 (1.54-5.76), p-value 0.001]. There were 15 (29.4%) patients in hematoma group in whom >1 number of attempt was needed and only 42 (10.5%) in non-hematoma group [odds ratio 4.5 (2.36-8.51), p-value <0.0001]. The details of all risk factors is presented in Table 2.

## DISCUSSION

Hematoma after TRA-PCI is a rare but common complication. Hematoma usually occurs after removal of radial sheath and may progress from access site to the whole forearm. It commonly occurs due bleeding from the access site.

In present study, hematoma was diagnosed in 11.3% patients after PCI and majority of our patients were having grade I or grade II hematoma. We managed all these patients with compression bandage and there was no need for blood transfusion in any patient with hematoma. This incidence is similar to the study of Garg et al. reported hematoma formation in 10.2% patients after TRA-PCI and Bertrand et al. who reported incidence of hematoma in 9.5% patients.<sup>14,15</sup> While some studies have reported lower incidence of hematoma, Hromádka et al. and Susanu et al. reported hematoma in 6.28% and 6.12% patients after TRA-PCI respectively.<sup>16,17</sup>

The variation in incidence of hematoma may be due to diversity in definition to define hematoma in different studies, experience of interventionists and size of sheath used to vascular access. However, the sheath size may or may not be the predictor of hematoma, a recent study compared the outcomes of TRA-PCI with sheath versus without sheath, the authors did not reported any significant in incidence of hematoma in sheath and sheath-less PCI groups.<sup>18</sup> In present study, we used standard 6 French sheath for vascular access in all patients.

We also evaluated the risk factors or hematoma and found that female gender, obesity, and >1 puncture attempts as significant risk factors of hematoma. Another study reported similar results, that study reported advanced age, BMI, higher number of puncture attempts as risk factors of hematoma.<sup>14</sup> We did not found advance age as risk of hematoma formation.

Susanu et al. in a study on association of operator's experience with vascular complications of TRA-PCI, reported >2 as cut-off value for prediction of vascular complications after TRA-PCI.<sup>17</sup>

There are some limitations of present study, we used 6 F sheath in all patients regardless of the diameter of radial artery, may be the use of small diameter sheath in patients with smaller diameter radial artery can help to reduce the incidence of hematoma by reducing the severity of damage to the vessel lumen. Secondly, procedures were done by different cardiologists, so experience of the operator may also effect the incidence of hematoma.

**Table 2: Univariate Analysis of Risk Factors of Hematoma**

Characteristics	Hematoma	No-Hematoma	OR (95% CI)	P-value
Total (N)	51	399	-	-
Age > 60 Years	11 (21.6%)	107 (26.8%)	0.75 (0.37-1.51)	0.42
Women	22 (43.3%)	102 (25.5%)	2.2 (1.2-4.0)	0.01
Smoking	13 (25.5%)	134 (33.6%)	0.67 (0.34-1.21)	0.24
Hypertension	28 (54.9%)	219 (54.9%)	1.0 (0.5-1.79)	0.99
Diabetes	26 (51.0%)	158 (39.6%)	1.58 (0.88-2.84)	0.12
Obesity (BMI ≥30 Kg/m <sup>2</sup> )	16 (31.3%)	53 (13.3%)	2.8 (1.54-5.76)	0.001
Low EF (<40%)	8 (15.7%)	84 (21.0%)	0.7 (0.31-1.54)	0.37
Previous Radial Artery Cannulation	3 (5.9%)	8 (2.0%)	3.0 (0.78-11.90)	0.1
>1 puncture Attempt	15 (29.4%)	42 (10.5%)	4.5 (2.36-8.51)	<0.0001
Multi-vessel stenting	29 (56.8%)	254 (63.6%)	0.75 (0.41-1.36)	0.34

## CONCLUSION

Incidence of hematoma after trans-radial percutaneous coronary intervention was 11.3%. Female gender, obesity and higher number of puncture attempts are independent risk factors of hematoma. Hematoma is mostly grade I-II in nature and can be managed easily only through conservative management.

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