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ORIGINAL ARTICLE

Vascular access and angiographic lesion morphology in elective percutaneous coronary intervention



Osama Tayeh ^{a,*}, Federica Ettori ^b

^a Critical Care Department, Faculty of Medicine, Cairo University, Egypt

^b Cardiothoracic Department, Spedali Civili, Brescia University, Italy

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Abstract Many coronary interventionists have a perception that the radial route may not facilitate complex PCI. This study evaluates the association between target lesion morphology, vessel characteristics and angiographic outcome in elective PCI cases carried out through radial versus femoral artery approach.

Methods: Elective PCI cases over a 23 month period at a tertiary care hospital were reviewed for this analysis. Modified ACC/AHA classification was used to ascertain the impact of different arterial accesses in elective PCI on the angiographic outcome with the complex angiographic lesion morphologies.

Results: 343 Patients and 407 lesions were analyzed. Radial access was the final route in 253 procedures treating a total of 300 lesions, while femoral access was the final route in 90 PCI procedures for treating 107 lesions. Lesion complexity incidence in radial PCI group by using modified ACC/AHA classifications A, B1, B2, and C were 4.67%, 15%, 60.33% and 20%, respectively. While in the femoral PCI, the incidence of lesion types was 6.54%, 15.89%, 42.99%, and 34.58%, respectively. By summation of the complex end of the spectrum for ACC/AHA lesion types B2 plus C, the incidence was 241 lesions (80.33%) in radial PCI vs. 83 lesions (77.57%) in femoral PCI, $P = 0.25$. Angiographic successful outcome according to the combined end point was achieved in 283 lesions (94.33%) for radial PCI vs. 92 lesions (85.99%) in femoral PCI, $P = 0.004$.

Conclusion: This study confirms that a default radial PCI is an effective strategy for the majority of complex lesions in elective PCI.

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* Corresponding author. Address: Critical Care Medicine Department, Kasr Elini hospital, Cairo University, Egypt. Mobile: +20 1005012070.

E-mail address: osama_tayeh@hotmail.com (O. Tayeh).

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1. Introduction

Heterogeneity of the composition, distribution, and location of atherosclerotic plaque within the native coronary artery results in unique patterns of stenosis morphology in patients with coronary artery disease (CAD). These patterns have been used to identify risk factors for procedural outcome and complications after percutaneous coronary intervention (PCI).¹ Many

studies²⁻⁵, have confirmed that complex coronary lesions remain predictive of adverse events after PCI, such as abrupt vessel closure, primarily due to thrombus or dissection which were reported in 3–8% of patients and were associated with certain lesion characteristics.⁶⁻⁸ Also the type of lesion attempted to strongly influence the success rate, as the chance of dilating a chronic total occlusion averages 65%, and specific clinical and anatomic factors that affect this rate have been identified.⁹ Quite different is the success rate for total occlusion associated with ST-segment elevation myocardial infarction (STEMI), success rate over 90% can be expected in this subgroup.¹⁰ In PCI, the landmark ACCESS study demonstrated fewer major access site complications for radial compared to other access routes.¹¹ Despite a perception among some operators that the radial route may not facilitate complex PCI, experienced radial operators claim few practical limitations with the technique.¹² Small studies suggest that radial route can support complex PCI in selected cases.^{13,14} The extent to which radial access may be a limiting factor in contemporary PCI is yet to be quantified, and the interplay between complex lesion morphology and angiographic outcome in elective radial access PCI has not been evaluated in wide scale. This study evaluates the association between target lesion morphology, vessel characteristics and angiographic outcome in elective PCI cases carried out by radial artery versus femoral artery approach.

2. Methods

All cases of elective PCI over a 23 month period (starting from March 2007 till the end of January 2009) at a tertiary care hospital (Cardiothoracic department, Spedali Civili, Brescia University, Italy) were reviewed for this analysis. All the data were entered into a database detailing arterial access route, target vessel and lesion characteristics, and angiographic success or failure on a lesion-by-lesion basis after the end of each procedure.

Criteria established by a joint American college of cardiology/American heart association task force (ACC/AHA) suggested that procedure success and complication rates were

related to a number of different lesion characteristics.¹⁵ Over the decade following the publication of these criteria, despite substantial improvements in the techniques used for coronary intervention, the most complex lesion morphologies (i.e., “type C” lesions) remain associated with reduced procedural success in patients with ischemic CAD.¹⁶

Therefore, we applied the vessel and lesion characteristics according to modified ACC/AHA classification of the primary target stenosis with type B divided into type B1 (one adverse characteristic of type B characteristics) and type B2 (≥ 2 adverse characteristic of type B characteristics), on the basis of prior work suggesting the cumulative importance of multiple adverse lesion characteristics (Table 1 and 2).¹⁷⁻²¹

Coronary Interventions were carried out by the authors who reported lesion characteristics and outcomes according to a standard template, which was created prospectively at the time of database record creation. Modified ACC/AHA classification was used to ascertain the impact of different arterial accesses in elective PCI on the angiographic outcome with the complex angiographic lesion morphologies.

The study population was stratified according to arterial access used to perform elective PCI into two groups; radial group and femoral group. The choice between femoral or radial artery access was left to the discretion of the operator. The radial approach is the default strategy at the Brescia catheterization laboratory – Spedali Civili.

Clinical variables such as were assessed age, gender, smoking, diabetes mellitus, hypertension, dyslipidemia, and prior myocardial infarction. Angiographic outcome was recorded as successful if the visual angiographic estimate of residual coronary stenosis was $< 20\%$ in stented segments or $< 50\%$ in balloon angioplasty segments, with the presence of TIMI III flow in the target vessel on a lesion-by-lesion basis.^{1,22}

3. Statistical analysis

Data were coded and computed on a statistical package for social sciences SPSS version 17 for windows for statistical analysis. PCI cases undertaken were evaluated on grounds of lesion characteristics and lesion-specific angiographic

Table 1 American College of Cardiology/American Heart Association Task Force (ACC/AHA) classification of the primary target stenosis. From Ryan TJ et al.¹⁵

<i>Type A Lesions (high success, 85%; low risk)</i>	
- Discrete (< 10 mm length)	- Little or no calcification
- Concentric	- Less than totally occlusive
- Readily accessible	- Not ostial in location
- Non angulated segment, $< 45^\circ$	- No major branch involvement
- Smooth contour	- Absence of thrombus
<i>Type B Lesions (moderate success, 60–85%; moderate risk)</i>	
- Tubular (10–20 mm length)	- Moderate to heavy calcification
- Eccentric	- Total occlusion < 3 months old
- Moderate tortuosity of proximal segment	- Ostial in location
- Moderately angulated segment, $> 45^\circ$, $< 90^\circ$	- Bifurcation lesions requiring double guide wires
- Irregular contour	- Some thrombus present
<i>Type C Lesions (low success, 60%; high risk)</i>	
- Diffuse (> 2 cm length)	- Total occlusion > 3 months old
- Excessive tortuosity of proximal segment	- Inability to protect major side branches
- Extremely angulated segments $> 90^\circ$	- Degenerated vein grafts with friable lesions

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