

Can radial artery pulse grading predict radial artery spasm during transradial approach?

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Abstract

Background: Radial artery spasm (RAS) has been defined as one of the major disadvantage of transradial approach.

Aim: The aim of this study was to investigate the predictive value of radial artery pulse grading on RAS during transradial approach.

Methods: The present study prospectively included 115 consecutive patients who underwent transradial coronary catheterisation at a single centre. Patients were divided into two groups: those with RAS and those without.

Results: The incidence of RAS was 16.5% (n = 19). Multivariate logistic regression analysis demonstrated that female sex, guiding catheter usage, and radial artery pulse grading ≤ 2 independently predicted RAS (odds ratio [OR] 8, 95% confidence interval [CI] 1.8–36.2, p = 0.007, OR 10.6, 95% CI 2.2–51.2, p = 0.03 and OR 25.8, 95% CI 6.1–108.5, p < 0.001, respectively). These three variables were weighted proportionally to their respective OR for RAS (female sex [1.5 points], guiding catheter usage [2 points], and radial artery pulse grading ≤ 2 [5 points]). Two risk strata were defined (low risk, score 0–4, high risk, score 5–8.5), and high risk was associated with increased incidence of RAS (n = 13 [61.9%] vs. n = 6 [6.4%], p < 0.001).

Conclusions: Radial artery pulse grading together with female sex and guiding catheter usage are independent predictors of RAS, and by using a simple risk score high-risk patients for RAS can be identified.

Key words: pulse grading, radial artery spasm, transradial approach

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INTRODUCTION

Radial artery has become the most popular vascular access route for coronary interventions with a markedly decreased incidence of major access-site complications and early patient ambulation compared to transfemoral approach [1–5].

However, one of the major and well-defined disadvantages of the transradial approach is radial artery spasm (RAS), which causes severe discomfort and access site crossover [6–8]. The incidence of RAS is not negligible and implies the need for risk factor determination before the procedure. Although previous studies have reported several RAS associated factors, radial artery pulse grading has not been investigated yet [7–10]. We hypothesised that radial artery pulse grading may predict RAS.

In this study, our aim was to investigate the predictive value of radial artery pulse grading on RAS and derive a risk score.

METHODS

Patients

The present study prospectively included 115 patients who underwent transradial coronary catheterisation at the institution of Acibadem Maslak Hospital. Eligible patients were all aged ≥ 18 years with clinical indication for diagnostic coronary angiography or percutaneous coronary intervention (PCI), in whom the right or left radial artery could be successfully cannulated.

Procedure

All procedures were performed by three interventional cardiologists experienced with radial interventions at a single centre that performs transradial approach as the default strategy in the cardiac catheterisation laboratory. Our clinic is a secondary centre where an average of annually 750 coronary interventions are performed and the percentage of transradial approach is about 80% of all coronary interventions.

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All patients were examined in a warm room. The patient's forearm was supported in one of the examiner's hands while the other was used to palpate along the radialvolar aspect of the patient's forearm at the wrist. This was done by curling the fingers around the distal radius from the dorsal toward the volar aspect, with the tips of the first, second, and third fingers aligned longitudinally over the course of the artery. The radial artery pulse grading was assessed by two interventional cardiologists.

Intensity of the pulse was graded on a scale of 0 to 4 [11]:

- grade 0 — indicates no palpable pulse;
- grade 1 — indicates a faint, but detectable pulse;
- grade 2 — indicates a slightly more diminished pulse than normal;
- grade 3 — indicates a normal pulse, which implies easily detectable;
- grade 4 — indicates a bounding pulse.

The right radial approach was the default approach for vascular access. The left radial artery was the preferred site in patients with previous coronary artery bypass grafting using a left internal mammary artery or in patients in whom right radial artery was occluded. Barbeau's test was performed at baseline to confirm the presence of dual circulation and patency of the palmar arch [12]. Absence of return of the ulnar artery signal within 2 min after cessation of compression was defined as an abnormal Barbeau's test.

The arm was extended and supported with the wrist in mild hyperextension. After sterile preparation and injection of 2% prilocaine at the puncture site, a 20-gauge open bore needle was used to enter the right radial artery 1–1.5 cm proximal to the radial styloid process. Observing a pulsatile flow, a 0.025-inch straight guidewire was advanced. The needle was removed and routinely a 6 Fr short (7 cm) hydrophilic sheath (Radiofocus Introducer II, Terumo, Tokyo, Japan) was introduced. To prevent thrombosis, 70 IU/kg unfractionated heparin was also injected through the side port of the sheath. To prevent RAS, depending on operator preference 100–200 µg nitroglycerin and/or 2 mg verapamil were injected through the side port of the sheath. Verapamil was not administered in patients with hypotension, bradycardia, high-grade atrioventricular block, myocardial infarction complicated with cardiogenic shock, moderate to severe left ventricular systolic dysfunction, or severe aortic stenosis. Nitroglycerin was not also administered in patients with severe aortic stenosis, hypotension, or myocardial infarction complicated with cardiogenic shock. Preoperative sedative agents are not routinely used for transradial coronary catheterisation, and this usually depends on operator preference.

Selective angiography of radial, brachial, or subclavian artery was only performed if difficulty was encountered during guidewire or catheter advancement. The underlying cause (spasm or anatomical variation) was determined and, at

operator's discretion, continued with either extra intra-arterial administration of nitroglycerin and/or verapamil or with primary access site conversion.

For diagnostic procedures, a single diagnostic universal 5 Fr Tiger catheter (Terumo, Leuven, Belgium) was used. Judkins, Amplatz, multipurpose, and pigtail 5 Fr or 6 Fr catheters were also used when needed. For coronary interventions, 6 Fr Judkins, EBU, and Amplatz guiding catheters (Medtronic, USA) were used.

In case of planned or ad-hoc PCI an additional bolus of 30 IU/kg unfractionated heparin was administered. Platelet glycoprotein IIb/IIIa inhibitors were administered as clinically indicated during the procedure. The radial sheath was immediately removed at the end of the procedure and a radial compression device (TR Band, Terumo, Tokyo, Japan) was applied at the access site.

Analysis of patient data

Demographics of the patients and angiographic data such as radial artery site, procedural time (which was defined by the time interval between the initiation of the puncture of the radial artery to onset of RAS or completion of the last coronary angiographic view), number, type, and size of the catheters used, administration of nitroglycerin and verapamil, and RAS were all recorded.

Clinical definition of RAS

Operator-assessed RAS was determined based on a questionnaire addressing five signs:

- persistent forearm pain;
- pain response to catheter manipulation;
- pain response to sheath withdrawal;
- difficult catheter manipulation after being trapped by radial artery;
- considerable resistance on withdrawal of the sheath.

Patients who had at least two of these five signs were diagnosed as having clinical RAS [13].

Doppler ultrasound measurements

All sonographic examinations were performed by one experienced cardiologist who had no knowledge of the catheterisation procedure using a Vivid 7 Pro (GE Medical Systems, GE Vingmed Ultrasound, Hortern, Norway) ultrasound machine with a multifrequency linear probe. The subject's right and left forearms were in supination with a pillow placed under the wrists. The probe was placed on the ventral wrist parallel to the long axis of the forearm, using the colour mode to localise the radial artery. The measurements were collected at the segment 5 mm proximal to the radial styloid process. The luminal diameter of the radial artery was assessed by superimposing two-dimensional sonography to the comparative image of the colour Doppler.

Exclusion criteria

Exclusion criteria were as follows:

- radial artery pulse grade 0;
- fever, thyrotoxicosis, and uncontrolled hypertension;
- marked bradycardia;
- arterio-venous fistula;
- patent ductus arteriosus, idiopathic hypertrophic sub-aortic stenosis;
- severe aortic valve dysfunction and severe mitral stenosis;
- severe left ventricular systolic dysfunction and cardiogenic shock were intended to be excluded from the study.

Statistical analysis

Quantitative variables were expressed as mean (\pm standard deviation), and qualitative variables were expressed as percentage (%). Data were tested for normal distribution using the Kolmogorov-Smirnov test. A comparison of parametric values between two groups was made using a two-tailed Student t-test, and for nonparametric values Mann-Whitney U test was used. Categorical variables were compared using the χ^2 test or Fisher's test. Spearman rho and Pearson tests were used for correlation analysis. Binary logistic regression analysis was used to evaluate independent association between RAS and clinical parameters. The relationship between RAS and radial artery pulse grading was analysed using the area under the receiver operator characteristic (ROC) curve (AUC). An interobserver reliability of radial artery pulse grading was analysed by using the Cohen's weighted kappa (K_w). A p value < 0.05 was considered statistically significant. All statistical analyses were carried out using SPSS version 18.0 (SPSS, Chicago, IL, USA).

RESULTS

Patients' characteristics

The study population consisted of 115 patients (mean age 60 ± 11 years, range 31–84 years, 39 women) undergoing transradial coronary catheterisation. The patients were divided into two groups: those with RAS (+) ($n = 19$; 16.5%) and those without RAS (–) ($n = 96$; 83.5%). The baseline clinical characteristics of patients included in the study are presented in Table 1.

Radial artery spasm was significantly higher in female patients ($p = 0.003$). Height ($p = 0.04$) and wrist circumference ($p = 0.047$) were found to be significantly lower in patients with RAS. Other baseline clinical characteristics were not different between the two groups ($p > 0.05$).

Radial artery examinations

Radial artery pulse grading ≤ 2 ($p < 0.001$) was more frequent in patients with RAS. Radial artery pulse grading was found to be significantly correlated with radial artery diameter ($r = 0.650$, $p < 0.001$), and radial artery diameter ($p = 0.008$) was also found to be significantly lower in patients with RAS.

Procedural characteristics

Number of catheters used ($p = 0.03$), guiding catheter usage ($p = 0.001$), primary PCI rate ($p = 0.025$), and access site crossover ($p = 0.001$) were higher in patients with RAS (Table 2).

Predictors of RAS and risk scoring

The effects of different variables on RAS were calculated in univariate analysis for each. The variables for which the unadjusted p value was < 0.05 in logistic regression analysis were identified as potential risk markers and included in the full model. Female sex, guiding catheter usage and pulse grading ≤ 2 were analysed with multivariate logistic regression model. Multivariate logistic regression analysis demonstrated that female sex, guiding catheter usage, and radial artery pulse grading ≤ 2 independently predicted RAS (odds ratio [OR] 8, 95% confidence interval [CI] 1.8–36.2, $p = 0.007$, OR 10.6, 95% CI 2.2–51.2, $p = 0.03$, and OR 25.8, 95% CI 6.1–108.5, $p < 0.001$, respectively; Table 3). We developed a simple risk scoring system by using these variables as risk indicators. The independent predictors of RAS were assigned a risk score based on their ORs and then the total risk score was calculated for each patient with a range of 0–8.5 points (Table 3). Two risk strata were defined (low risk [score 0–4], high risk [score 5–8.5]). High risk was associated with increased incidence of RAS and access site crossover ($n = 13$ [61.9%] vs. $n = 6$ [6.4%], $p < 0.001$ and $n = 3$ [14.3%] vs. $n = 1$ [1.1%], $p = 0.019$, respectively) (Fig. 1). ROC curve demonstrated good diagnostic accuracy for radial artery pulse grading ≤ 2 in predicting RAS (AUC = 0.8, 95% CI 0.67–0.93, $p < 0.001$) (Fig. 2).

Interobserver reliability

The interobserver reliability of radial artery pulse grading was found to be good ($K_w = 0.896$, 95% CI 0.811–0.980).

DISCUSSION

In the present study, the main findings are as follows: (a) radial artery pulse grading together with female sex and guiding catheter are independent predictors of RAS; (b) RAS and access site crossover can be predicted by a simple risk score.

The radial artery is particularly prone to vasospasm because of its muscular nature and α -adrenoceptor-predominance [13]. Both circulating catecholamines, through activation of $\alpha 1$ -adrenoceptor and mechanical stimuli (sheath introduction, guidewire and catheter manipulation), cause smooth muscle cell contraction, which results in RAS [14, 15].

According to previous studies, the incidence of RAS has varied considerably between 2% and 34% due to the inconsistency in prophylactic therapy and criteria for diagnosis [7–10]. The incidence of RAS in the present study is correlated with these previous findings.

Several RAS-associated factors have been identified including patient-related factors (female gender, young age, low

Table 1. Clinical characteristics of the study group

	RAS (+) group; n = 19	RAS (-) group; n = 96	p
Age [years]	59 ± 13.5	60.5 ± 11.2	0.6
Women	12 (63.2%)	27 (28.1%)	0.003
Wrist circumference [cm]	18.3 ± 1.6	19.2 ± 1.8	0.047
Height [cm]	164.1 ± 8.5	169.9 ± 9.7	0.04
Weight [kg]	79.9 ± 11.5	82.3 ± 14.1	0.49
Body surface area	1.89 ± 0.14	1.94 ± 0.2	0.19
Diabetes mellitus	5 (26.3%)	29 (30.2%)	0.73
Hypertension	11 (57.9%)	55 (57.9%)	0.99
Coronary artery disease	3 (15.8%)	26 (27.1%)	0.3
Smoking	5 (26.3%)	31 (32.3%)	0.61
Systolic BP [mm Hg]	139.7 ± 19.6	132.8 ± 19.3	0.16
Diastolic BP [mm Hg]	78.9 ± 10.7	76.9 ± 11.4	0.49
Heart rate [bpm]	74.8 ± 12.8	71.9 ± 11.3	0.34
Haemoglobin [mg/dL]	13.1 ± 1.4	13.6 ± 1.7	0.25
Fasting glucose [mg/dL]	120.9 ± 25.4	118.5 ± 38.5	0.79
Total cholesterol [mg/dL]	216.8 ± 57.2	208.2 ± 38.1	0.61
LDL-C [mg/dL]	141.7 ± 43.9	136.2 ± 30.1	0.67
HDL-C [mg/dL]	45.6 ± 12.1	40.8 ± 10	0.13
Triglyceride [mg/dL]	133.2 ± 104.1	187.7 ± 138.6	0.18
Clinical presentation:			0.13
Stable angina pectoris	5 (26.3%)	49 (51%)	
Acute coronary syndromes	11 (57.9%)	35 (36.5%)	
Other conditions	3 (15.8%)	12 (12.5%)	
Medications:			
ACEI	8 (42.1%)	42 (43.8%)	0.9
Beta-blocker	9 (47.4%)	48 (50%)	0.83
Calcium-channel blocker	5 (26.3%)	22 (22.9%)	0.75
Alpha-blocker	0 (0%)	1 (1%)	0.99
Antiaggregan	15 (78.9%)	73 (76%)	0.79
Statin	5 (26.3%)	26 (27.4%)	0.93
Nitrate	1 (5.25%)	7 (7.3%)	0.99
Diuretic	5 (26.3%)	24 (25%)	0.9

ACEI — angiotensin converting enzyme inhibitor; BP — blood pressure; HDL-C — high-density lipoprotein-cholesterol; LDL-C — low-density lipoprotein-cholesterol; RAS — radial artery spasm

body mass index, short stature, small radial artery diameter, diabetes mellitus, dyslipidaemia, anxiety, anomalous radial artery) and technical factors (low radial-artery-to-sheath ratio, non-hydrophilic coated sheaths, unsuccessful access at first attempt, prolonged cannulation, multiple catheter exchanges, excessive catheter manipulations, limited operator experience) [8, 15–21]. In the present study, radial artery pulse grading, which was found to be correlated with radial artery diameter, female sex, and larger catheter size were demonstrated as predictors of RAS.

Many preventive measures have been suggested to prevent spasm of the radial artery such as sedation, adequate analgesia, hydrophilic coated sheaths, and intra-arterial vasodilators [7, 8, 17]. Various drugs have been extensively evaluated to prevent spasm of radial artery, but there is currently no agreement on the optimal agents. The majority of previous reports advocated the use of intra-arterial vasodilators, most frequently verapamil and/or nitroglycerin [7, 8, 17, 18]. In a head-to-head comparison study between nitroglycerin and verapamil there was no statistically significant difference in the

Table 2. Procedural characteristics of the study group

	RAS (+) group; n = 19	RAS (-) group; n = 96	P
Pulse grading:			< 0.001
Grade 1	0 (0%)	0 (0%)	
Grade 2	13 (68.4%)	8 (8.3%)	
Grade 3	6 (31.6%)	79 (82.3%)	
Grade 4	0 (0%)	9 (9.4%)	
Radial artery diameter [mm]	20.2 ± 3.8	23.4 ± 3.7	0.008
Previous transradial intervention	1 (5.25%)	1 (1%)	0.3
Radial artery site; right	18 (94.7%)	94 (97.9%)	0.42
Nitroglycerin + verapamil	6 [31.6%]	26 (27.1%)	0.69
Sedation	1 [5.3%]	7 (7.3%)	0.99
Number of arterial punctures > 1	1 (5.25%)	1 (5.2%)	0.99
Preprocedural forearm angiography	2 (10.5%)	8 (8.3%)	0.67
Catheter:			0.001
5 Fr diagnostic	3 (15.8%)	60 (62.5%)	
6 Fr diagnostic	3 (15.8%)	7 (7.3%)	
6 Fr guiding	13 (68.4%)	29 (30.2%)	
Number of catheters used	2 ± 0.9	1.6 ± 0.8	0.03
Primary PCI rate	4 (21.1%)	4 (4.2%)	0.025
PCI rate	13 (68.4%)	29 (30.2%)	0.002
Procedure time [min]	26.1 ± 15.6	22 ± 16.2	0.12
Femoral switch	4 (21.1%)	0 (0%)	0.001
Following ipsilateral transradial intervention	0 (0%)	1 (1%)	0.99
Operators:			0.77
1	7 (36.8%)	37 (38.5%)	
2	6 (31.6%)	36 (37.5%)	
3	6 (31.6%)	23 (24%)	

PCI — percutaneous coronary intervention; RAS — radial artery spasm

Table 3. Effects of variables on catheter entrapment in univariate and multivariate logistic regression analyses

	OR (95% CI)	P	Score
Univariate predictors			
Female sex	4.4 (1.6–12.3)	0.005	
Pulse grading ≤ 2	23.8 (7.1–79.8)	< 0.001	
Guiding catheter	5 (1.7–14.5)	0.003	
Multivariate predictors			
Female sex	8 (1.8–36.2)	0.007	1.5
Guiding catheter	10.6 (2.2–51.2)	0.003	2
Pulse grading ≤ 2	25.8 (6.1–108.5)	< 0.001	5

CI — confidence interval; OR — odds ratio

incidence of RAS [22]. Furthermore, a recent study indicated that beyond the learning curve preventive administration of intra-arterial verapamil offers no advantage over ad hoc ap-

plication in terms of access site conversion rates [23]. It was also reported that 72.2% of Japanese operators do not use any medication for spasm prophylaxis [23]. In keeping with these recent reports, the preventive use of vasodilators may not be mandatory, especially in centres with high-volume transradial catheterisation. In our centre, in appropriate cases, a bolus of intra-arterial nitroglycerin and/or intra-arterial verapamil is given prophylactically. In the present study, it was found that the administration of intra-arterial vasodilator, whether nitroglycerin or verapamil, had no relationship with the development of radial artery spasm.

Although these previously defined preventive measures have been suggested, it is not always possible to prevent RAS. Thus, patient selection is of prime importance in preventing RAS, and the defined simple risk score developed by using following risk indicators: radial artery pulse grading together with female sex and guiding catheter usage, can be used to select patients for transradial approach.

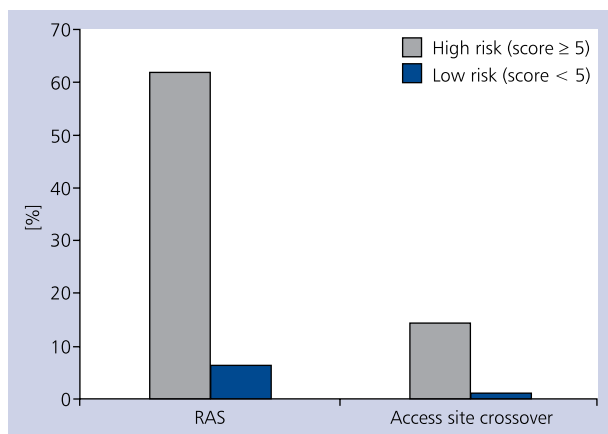


Figure 1. The incidence of radial artery spasm (RAS) and access site crossover were higher in high-risk patients

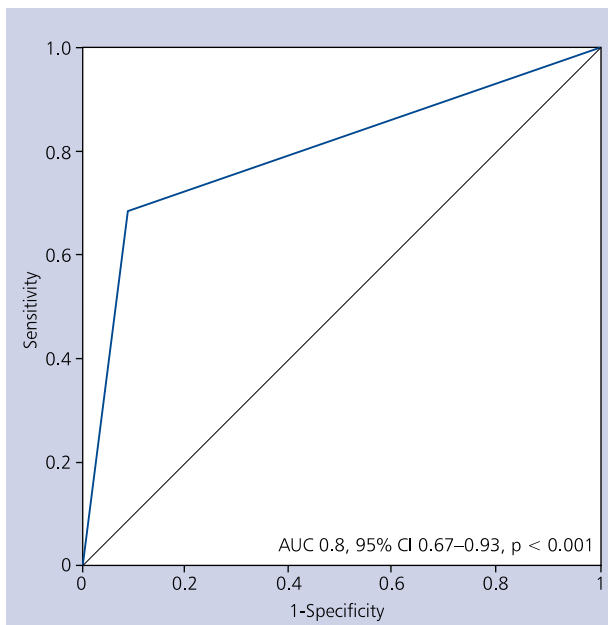


Figure 2. Receiver operating characteristic curve analysis for radial artery pulse grading ≤ 2 in predicting radial artery spasm (area under curve [AUC] = 0.8, 95% confidence interval [CI] 0.67–0.93, $p < 0.001$)

Limitations of the study

The major limitation of this study is small sample size, and it was conducted in a single, moderate-volume institution. Further prospective studies are warranted to confirm the findings of the present study and whether radial artery pulse grading can be used for patient selection and whether patients with low grade should directly undergo transfemoral approach. Routine forearm angiography was not performed in order to determine radial artery anomaly. RAS was not defined as the demonstration of reduced radial artery diameter by angiog-

raphy or ultrasound. Another limitation may be the absence of routine preprocedural sedation and hydrophilic catheter use, which have been well proven to reduce the incidence of radial spasm.

CONCLUSIONS

Our study demonstrated that radial artery pulse grading together with female sex and guiding catheter are independent predictors of RAS, and by using a simple risk score high-risk patients for RAS and access site crossover can be identified.

Conflict of interest: none declared

References

- Rathore S, Morris JL. The radial approach: is this the route to take? *J Interv Cardiol.* 2008; 21(5): 375–379, doi: [10.1111/j.1540-8183.2008.00382.x](https://doi.org/10.1111/j.1540-8183.2008.00382.x), indexed in Pubmed: [18705638](https://pubmed.ncbi.nlm.nih.gov/18705638/).
- Caputo RP, Simons A, Giambartolomei A, et al. Transradial cardiac catheterization in elderly patients. *Catheter Cardiovasc Interv.* 2000; 51(3): 287–290, indexed in Pubmed: [11066107](https://pubmed.ncbi.nlm.nih.gov/11066107/).
- Kiemeneij F, Laarman GJ, Odekerken D, et al. A randomized comparison of percutaneous transluminal coronary angioplasty by the radial, brachial and femoral approaches: the access study. *J Am Coll Cardiol.* 1997; 29(6): 1269–1275, indexed in Pubmed: [9137223](https://pubmed.ncbi.nlm.nih.gov/9137223/).
- Amoroso G, Laarman GJ, Kiemeneij F. Overview of the transradial approach in percutaneous coronary intervention. *J Cardiovasc Med (Hagerstown).* 2007; 8(4): 230–237, doi: [10.2459/01.JCM.0000263494.10865.0f](https://doi.org/10.2459/01.JCM.0000263494.10865.0f), indexed in Pubmed: [17413298](https://pubmed.ncbi.nlm.nih.gov/17413298/).
- Rathod KS, Jones DA, Bromage DI, et al. Radial primary percutaneous coronary intervention is independently associated with decreased long-term mortality in high-risk ST-elevation myocardial infarction patients. *J Cardiovasc Med (Hagerstown).* 2014 [Epub ahead of print]; 16(3)–177, doi: [10.2459/JCM.000000000000122](https://doi.org/10.2459/JCM.000000000000122), indexed in Pubmed: [25000249](https://pubmed.ncbi.nlm.nih.gov/25000249/).
- Numasawa Y, Kawamura A, Kohsaka S, et al. Anatomical variations affect radial artery spasm and procedural achievement of transradial cardiac catheterization. *Heart Vessels.* 2014; 29(1): 49–57, doi: [10.1007/s00380-013-0324-3](https://doi.org/10.1007/s00380-013-0324-3), indexed in Pubmed: [23430268](https://pubmed.ncbi.nlm.nih.gov/23430268/).
- Kiemeneij F, Vajifdar BU, Eccleshall SC, et al. Evaluation of a spasmolytic cocktail to prevent radial artery spasm during coronary procedures. *Catheter Cardiovasc Interv.* 2003; 58(3): 281–284, doi: [10.1002/ccd.10445](https://doi.org/10.1002/ccd.10445), indexed in Pubmed: [12594687](https://pubmed.ncbi.nlm.nih.gov/12594687/).
- Ho HH, Jafary FH, Ong PJ. Radial artery spasm during transradial cardiac catheterization and percutaneous coronary intervention: incidence, predisposing factors, prevention, and management. *Cardiovasc Revasc Med.* 2012; 13(3): 193–195, doi: [10.1016/j.carrev.2011.11.003](https://doi.org/10.1016/j.carrev.2011.11.003), indexed in Pubmed: [22226169](https://pubmed.ncbi.nlm.nih.gov/22226169/).
- Goldberg SL, Renslo R, Sinow R, et al. Learning curve in the use of the radial artery as vascular access in the performance of percutaneous transluminal coronary angioplasty. *Cathet Cardiovasc Diagn.* 1998; 44(2): 147–152, indexed in Pubmed: [9637436](https://pubmed.ncbi.nlm.nih.gov/9637436/).
- Hildick-Smith DJ, Lowe MD, Walsh JT, et al. Coronary angiography from the radial artery: experience, complications and limitations. *Int J Cardiol.* 1998; 64(3): 231–239, indexed in Pubmed: [9672402](https://pubmed.ncbi.nlm.nih.gov/9672402/).
- Hill RH, Smith RB. Examination of the Extremities: ulses, Bruits, and hlebitis. In: Walker HK, Hall WD, Hurst JW, editors. *Clinical Methods: The History, hysical, and Laboratory Examinations.* 3rd ed Boston: Butterworths; 1990; 148.
- Barbeau GR, Arsenault F, Dugas L, et al. Evaluation of the ulno-palmar arterial arches with pulse oximetry and plethysmography: comparison with the Allen's test in 1010 patients. *Am Heart J.*

- 2004; 147(3): 489–493, doi: [10.1016/j.ahj.2003.10.038](https://doi.org/10.1016/j.ahj.2003.10.038), indexed in Pubmed: [14999199](https://pubmed.ncbi.nlm.nih.gov/14999199/).
13. Jia DA, Zhou YJ, Shi DM, et al. Incidence and predictors of radial artery spasm during transradial coronary angiography and intervention. *Chin Med J (Engl)*. 2010; 123(7): 843–847, indexed in Pubmed: [20497675](https://pubmed.ncbi.nlm.nih.gov/20497675/).
 14. He GW, Yang CQ. Characteristics of adrenoceptors in the human radial artery: clinical implications. *J Thorac Cardiovasc Surg*. 1998; 115(5): 1136–1141, doi: [10.1016/S0022-5223\(98\)70414-3](https://doi.org/10.1016/S0022-5223(98)70414-3), indexed in Pubmed: [9605084](https://pubmed.ncbi.nlm.nih.gov/9605084/).
 15. Kiemeneij F, Fraser D, Slagboom T, et al. Hydrophilic coating aids radial sheath withdrawal and reduces patient discomfort following transradial coronary intervention: a randomized double-blind comparison of coated and uncoated sheaths. *Catheter Cardiovasc Interv*. 2003; 59(2): 161–164, doi: [10.1002/ccd.10444](https://doi.org/10.1002/ccd.10444), indexed in Pubmed: [12772232](https://pubmed.ncbi.nlm.nih.gov/12772232/).
 16. Goldsmit A, Kiemeneij F, Gilchrist IC, et al. Radial artery spasm associated with transradial cardiovascular procedures: results from the RAS registry. *Catheter Cardiovasc Interv*. 2014; 83(1): E32–E36, doi: [10.1002/ccd.25082](https://doi.org/10.1002/ccd.25082), indexed in Pubmed: [23785005](https://pubmed.ncbi.nlm.nih.gov/23785005/).
 17. Varenne O, Jégou A, Cohen R, et al. Prevention of arterial spasm during percutaneous coronary interventions through radial artery: The SPASM study. *Catheter Cardiovasc Interv*. 2006; 68(2): 231–235, doi: [10.1002/ccd.20812](https://doi.org/10.1002/ccd.20812).
 18. Coppola J, Patel T, Kwan T, et al. Nitroglycerin, nitroprusside, or both, in preventing radial artery spasm during transradial artery catheterization. *J Invasive Cardiol*. 2006; 18(4): 155–158, indexed in Pubmed: [16729400](https://pubmed.ncbi.nlm.nih.gov/16729400/).
 19. Ercan S, Davutoglu V, Yuce M. Anxiety score as a risk factor for radial artery spasm during transradial procedures. *JACC Cardiovasc Interv*. 2013; 6(11): 1214–1215, doi: [10.1016/j.jcin.2013.04.025](https://doi.org/10.1016/j.jcin.2013.04.025), indexed in Pubmed: [24262623](https://pubmed.ncbi.nlm.nih.gov/24262623/).
 20. Sciahbasi A, Romagnoli E, Trani C, et al. Evaluation of the “learning curve” for left and right radial approach during percutaneous coronary procedures. *Am J Cardiol*. 2011; 108(2): 185–188, doi: [10.1016/j.amjcard.2011.03.022](https://doi.org/10.1016/j.amjcard.2011.03.022), indexed in Pubmed: [21530937](https://pubmed.ncbi.nlm.nih.gov/21530937/).
 21. Kiemeneij F. Prevention and management of radial artery spasm. *J Invasive Cardiol*. 2006; 18: 159–160.
 22. Chen CW, Lin CL, Lin TK, et al. A simple and effective regimen for prevention of radial artery spasm during coronary catheterization. *Cardiology*. 2006; 105(1): 43–47, doi: [10.1159/000089246](https://doi.org/10.1159/000089246), indexed in Pubmed: [16254422](https://pubmed.ncbi.nlm.nih.gov/16254422/).
 23. Hizoh I, Majoros Z, Major L, et al. Need for prophylactic application of verapamil in transradial coronary procedures: a randomized trial. The VTRIAL (is Verapamil In TransRadial Interventions Omittable?) trial. *J Am Heart Assoc*. 2014; 3(2): e000588, doi: [10.1161/JAHA.113.000588](https://doi.org/10.1161/JAHA.113.000588), indexed in Pubmed: [24732918](https://pubmed.ncbi.nlm.nih.gov/24732918/).

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Czy wskaźnik tętna na tętnicy promieniowej jest czynnikiem predykcyjnym kurczu tętnicy promieniowej w czasie zabiegów z dostępu promieniowego?

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Streszczenie

Wstęp: Kurcz tętnicy promieniowej (RAS) jest jednym z poważniejszych problemów związanych z dostępem promieniowym.

Cel: Celem niniejszej pracy była ocena wartości predykcyjnej wskaźnika tętna na tętnicy promieniowej w odniesieniu do wystąpienia RAS w trakcie zabiegów z dostępu promieniowego.

Metody: Do badania włączono prospektywnie 115 kolejnych chorych poddanych cewnikowaniu serca z dostępu przez tętnicę promieniową w jednym ośrodku. Pacjentów podzielono na dwie grupy w zależności od tego, czy wystąpił u nich RAS.

Wyniki: Częstość RAS wynosiła 16,5% (n = 19). W wieloczynnikowej analizie regresji logistycznej wykazano, że płeć żeńska, używanie cewników prowadzących i wskaźnik tętna na tętnicy promieniowej ≤ 2 były niezależnymi czynnikami predykcyjnymi RAS (odpowiednio, iloraz szans [OR] 8; 95% przedział ufności [CI] 1,8–36,2; $p = 0,007$; OR 10,6, 95% CI 2,2–51,2; $p = 0,03$ i OR 25,8; 95% CI 6,1–108,5; $p < 0,001$). Tym zmiennym przypisano wagi proporcjonalne do obliczonych dla nich ilorazów szans wystąpienia RAS (płeć żeńska [1,5 punktu], używanie cewnika prowadzącego [2 punkty] i wskaźnik tętna na tętnicy promieniowej ≤ 2 [5 punktów]). Wyróżniono dwie grupy ryzyka (niskie ryzyko: liczba punktów 0–4, wysokie ryzyko: liczba punktów 5–8,5). Kwalifikacja do grupy wysokiego ryzyka wiązała się z częstszym występowaniem RAS (n = 13 [61,9%] vs. n = 6 [6,4%], $p < 0,001$).

Wnioski: Wskaźnik tętna na tętnicy promieniowej oraz płeć żeńska i używanie cewników prowadzących są niezależnymi czynnikami predykcyjnymi wystąpienia RAS. Stosowanie prostej skali oceny ryzyka pozwala zidentyfikować pacjentów z grupy wysokiego ryzyka RAS.

Słowa kluczowe: skala oceny tętna, kurcz tętnicy promieniowej, dostęp promieniowy

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