



Comparison of single-catheter with two-catheter concept in older female patients undergoing transradial coronary angiography

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Abstract

Background: The aim of this study was to compare the efficacy outcomes of the traditional Judkins left and right catheters with those of the recently introduced Tiger catheter in female participants aged 65 years and older who underwent transradial coronary angiography.

Methods: A cohort of 160 female patients aged 65 and older who were scheduled for coronary angiography (CAG) were divided into two groups according to the use of Tiger ($n = 80$) or Judkins ($n = 80$) catheters for radial angiography at a ratio of 1:1, respectively. We analyzed the effectiveness of the Tiger and Judkins catheters, the incidence of catheter failure, contrast volume, CAG time, fluoroscopy time, dose–area product (in mGy/cm²), and the occurrence of radial spasm.

Results: The Judkins catheter group had a significantly longer processing time than the Tiger catheter group, with an equivalent level of radiation exposure. The duration of fluoroscopy was longer, and the amount of contrast medium used was higher, but the frequency of radial spasm was not significantly different.

Conclusion: The present investigation revealed that implementation of Tiger catheters for geriatric individuals with elevated frailty and female patients with more narrow radial artery diameters was associated with decreased overall procedure duration, contrast volume utilization, and fluoroscopy duration.

Keywords

Transradial access · Radial catheter · Tiger catheter · Frail patients · Radial artery spasm

Since Campeau's initial attempts in 1989, the transradial technique for cardiac catheterization has witnessed numerous modifications thanks to accumulated clinical experience and technological advancements [1]. It has been demonstrated that transradial catheterization is practical, efficient, and safe in terms of minimizing significant entry-site complications, hospital staff time, and financial costs [2]. After procedures, patients frequently value the ability to resume normal activities without having to endure the agony of prolonged bed rest.

Following percutaneous coronary intervention (PCI), female patients exhibit a greater susceptibility to hemorrhage and vascular complications in comparison with their male counterparts. These complications have been found to be significantly linked to inferior clinical outcomes in individuals diagnosed with acute coronary syndrome (ACS; [3–5]). Women have a greater risk of being afflicted with ACS compared with men. It has been demonstrated that the radial artery route reduces the risk of hemorrhage in PCI patients; however, not all randomized studies of women have consistently demonstrated the benefit of radial

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access [6]. This is due to the fact that the radial artery approach is more challenging in female patients. Observational studies indicate that women are significantly less likely than men to require a radial access procedure [7].

As risk factors accumulate over time, older individuals are inherently more susceptible to atherosclerosis [8]. The prevalence of angina pectoris in individuals aged 65 and older is almost 4% [9]. In addition, these patients tend to have multiple noncardiac comorbidities (renal failure, respiratory failure, lower limb arteriopathy, neoplastic pathology, stroke, insulin-dependent diabetes, chronic anemia), which can be difficult to manage given the possibility of an associated social problem (intellectual status, unstable family environment; [10]).

The objective of the present investigation was to compare the performance of the conventional Judkins (3.5 L/4R Boston Scientific [Marlborough, MA, USA]) left and right catheters with those of the Tiger (3.5 Taha Medical Centre, Seyhan, Adana, Türkiye) catheter in female patients aged 65 years and older who underwent transradial coronary angiography.

Methods

The study encompassed a cohort of 160 individuals who underwent coronary angiography at our establishment between June and December 2022. The patients were required to provide written informed consent prior to the initiation of the medical procedure. Following this, the participants were assigned in a randomized manner to one of two catheter groups: either the Judkins (6 Fr, 3.5 L/4R Boston Scientific) or Tiger-1 (6 Fr, 3.5 Taha Medical Centre) group. The research encompassed all individuals who underwent planned coronary angiography for the purpose of diagnosis. The study excluded patients who had a medical history of coronary artery bypass grafting, cardiogenic shock, an abnormal Allen test result, an arteriovenous fistula, or a graft. The study received approval from the institutional review board.

The procedures were conducted by proficient and experienced operators (UO, MK) under the supervision of a senior interventional fellow who had previously con-

ducted over 200 transradial coronary angiographies of the radial artery. Both Judkins and Tiger catheters are available for use by each operator.

The procedure involved the insertion of a hydrophilic-coated 6F sheath measuring 7 cm in length, using a 21G needle and a 40-cm 0.018 guidewire. Following this, intra-arterial administration of 200 µg of nitroglycerin and 5000 IU of unfractionated heparin was made for patients with a palpable right radial artery.

The catheter manipulation procedure was executed utilizing either a 30-degree left anterior oblique or anteroposterior projection. A conventional 153-cm-long guidewire with a J-shaped curve, a diameter of 3 mm, and a thickness of 0.035 in, was utilized for the purpose of catheter insertion and exchange. After the successful completion of angiography of the left coronary artery (LCA), a wire exchange technique was employed using a 190-cm J exchange wire. This involved the retraction of the Judkins left (JL) catheter and the advancement of the Judkins right (JR) catheter using the aforementioned wire. Verification of the wire localization was made under fluoroscopic guidance. Upon reaching the aortic cusp, the JR catheter tip was positioned, followed by the removal of the guidewire, placement of the right coronary artery (RCA), and acquisition of RCA angiograms.

The Tiger catheter was attached to a guidewire and introduced into LCA through the aortic cusp. To achieve accurate RCA angiography, the catheter was relocated from the left coronary ostium to the right atrium of the Valsalva to appropriately involve the ostium of the RCA.

Arteriography revealed radial spasms in instances of catheter manipulation difficulty and right arm pain. The procedure of radial arteriography was not often used. After the surgery, the radial entrance site was hemostasized using a compression band. After 2 h, the compression was gradually decreased, and the band was taken off after the bleeding had stopped.

Statistical analysis

The SPSS software (Statistical Package for the Social Sciences, version 22; SPSS Inc.,

Chicago, IL, USA) was utilized to perform the statistical analysis. Categorical variables are represented using percentages, whereas continuous variables are represented using the mean ± standard deviation. Student's *t* test was used to compare variables that exhibited a normal distribution, whereas the Mann–Whitney *U* test was employed to compare variables that did not conform to a normal distribution. We used either the chi-square test or Fisher's exact test to compare categorical variables, depending on the specific circumstances. A *p* value of less than 0.05 was indicative of statistical significance.

Results

A total of 160 patients were randomly assigned to either the Tiger catheter group or the Judkins catheter group, with each group consisting of 80 patients. There was no statistically significant difference in the baseline characteristics between the two groups. According to the data presented in **Table 1**, there was no statistically significant difference between the two groups with respect to drug intake, blood pressure, or heart rate.

The aim of the present study was to assess the efficacy of the Tiger and Judkins catheters with respect to catheter failure, contrast volume, duration of coronary angiography, fluoroscopy time, dose–area product (in mGy/cm²), and the occurrence of radial spasm. The assessment of the procedure indicated that among the patients who received the Tiger catheter, nine individuals required an extra catheter, whereas, in the group that received the Judkins catheter, five individuals required an additional catheter (**Table 2**). The statistical analysis of the data yielded a *p* value of 0.26. The processing time of the Judkins catheter group was observed to be significantly longer than that of the Tiger catheter group (7.7 ± 0.9 min vs. 6.6 ± 0.7 min, $p < 0.001$). Both cohorts were subjected to an equivalent level of radiation exposure. The duration of fluoroscopy was significantly longer in the Judkins catheter group compared with the Tiger catheter group (3.3 ± 0.7 min vs. 2.44 ± 0.3 min, $p < 0.001$; **Fig. 1**). The amount of contrast medium used during the procedure was found to be

Variable	Tiger catheter (n = 80)	Judkins catheter (n = 80)	p
Age (years), mean ± SD	71 ± 5	72 ± 5	0.476
Body mass index (kg/m ²), mean ± SD	25.8 ± 2.2	26.5 ± 2.3	0.060
Systolic blood pressure (mm Hg), mean ± SD	130 ± 12	133 ± 10	0.064
Diastolic blood pressure (mm Hg), mean ± SD	77 ± 8	76 ± 9	0.066
Heart rate (bpm), mean ± SD	80 ± 16	82 ± 12	0.337
Diabetes mellitus, n (%)	11 (14%)	17 (21%)	0.214
Hypertension, n (%)	33 (41%)	41 (51%)	0.207
Dyslipidemia, n (%)	19 (24%)	25 (32%)	0.291
Peripheral artery disease, n (%)	6 (7%)	4 (5%)	0.517
Previous PCI, n (%)	26 (33%)	30 (38%)	0.510
Medication, n (%)			
Acetylsalicylic acid	28 (35%)	35 (43%)	0.260
Beta-blockers	32 (40%)	42 (52%)	0.114
ACE-inhibitors	27 (34%)	34 (42%)	0.257
Statin	19 (24%)	25 (32%)	0.291
Nitrates	18 (23%)	22 (28%)	0.468
Calcium channel blockers	24 (30%)	33 (41%)	0.139
P2Y12 inhibitors	20 (25%)	23 (29%)	0.595

PCI percutaneous coronary intervention, ACE angiotensin-converting enzyme

Variable	Tiger catheter (n = 80)	Judkins catheter (n = 80)	p
Need for additional catheter, n (%)	9 (11%)	5 (6%)	0.266
Contrast volume used (mL), mean ± SD	73.7 ± 0.8	84.9 ± 0.9	<0.001
Total procedure time (min), mean ± SD	6.6 ± 0.7	7.7 ± 0.9	<0.001
Fluoroscopy time (min), mean ± SD	2.44 ± 0.32	3.3 ± 0.7	<0.001
DAP (mGy/cm ²), mean ± SD	855.91 (746.3–948.4)	984.86 (962.2–1096)	0.410
Radial spasm, n (%)	5 (6%)	10 (12%)	0.177
Number of right coronary image, mean ± SD	1.88 ± 0.33	1.85 ± 0.35	0.649
Number of left coronary image, mean ± SD	4.78 ± 0.9	5 ± 0.8	0.139

DAP dose–area product

significantly higher in the Judkins catheter group than in the Tiger catheter group (84.9 ± 0.9 mL vs. 73.7 ± 0.8 mL, $p < 0.001$; **Fig. 2**). The frequency of radial spasms exhibited no significant difference between the two groups, as indicated in **Table 2**.

Discussion

Approximately 58% of individuals diagnosed with coronary artery disease are

aged 65 years or older, leading to a growing demand for invasive procedures to be performed on these patients, particularly in the acute phase of coronary syndromes [11]. Due to the smaller mean radial artery diameters in female patients compared with male patients, research into catheter selection for coronary angiography is particularly crucial [12].

Angioplasty in older adults has been associated with an increased incidence of hospital complications in retrospective in-

vestigations [13]. Vascular complications at the site of arterial puncture, acute renal failure, myocardial infarction, and stroke are the most common complications; they increase the risk of in-hospital mortality by three- to eightfold [14]. The OCTOPLUS trial conducted a randomization of almost 400 patients aged 80 or older to compare the radial and femoral angioplasty routes. The results indicated that the rate of vascular complications was significantly lower in the radial group (1.6% vs. 6.5%, $p = 0.03$; [15]). These findings are supported by Klinker's study, which demonstrated a shorter hospital stay with the radial approach; this is a crucial aspect of the management of these geriatric and frail patients [16]. In 2012, Jinnouchi demonstrated a shorter hospital stay (1.5 days) and earlier ambulation with the radial approach, which guarantees greater patient comfort [17]. Despite numerous randomized trials, and the evaluation of various radial catheter techniques, the potential benefits of catheter selection based on patient characteristics are currently unknown [18, 19]. Furthermore, the available data suggest that the utilization of radial access as opposed to femoral access results in greater benefits for female patients in relation to ischemic and particularly hemorrhagic complications [20, 21].

Therefore, a gender- and age-related evaluation of different catheter systems for radial access is urgently needed. The Tiger catheter and the Judkins catheter are frequently utilized catheters for this particular medical intervention. The selection of catheters in older and female patients is contingent upon various factors, including but not limited to the dimensions and convolutions of the radial artery, the nature and gravity of the coronary artery ailment, and the expertise and inclination of the operator.

There are anatomical variations between the radial and femoral approaches. The majority of catheters exhibit a tendency to relocate from the descending aorta and aortic arch toward the right side of the ascending aorta, owing to their inherent "memory" or proclivity to maintain or revert to their initial configuration. In contrast to the abbreviated-tipped catheters used for accessing the RCA, the substantially elongated-tipped catheters

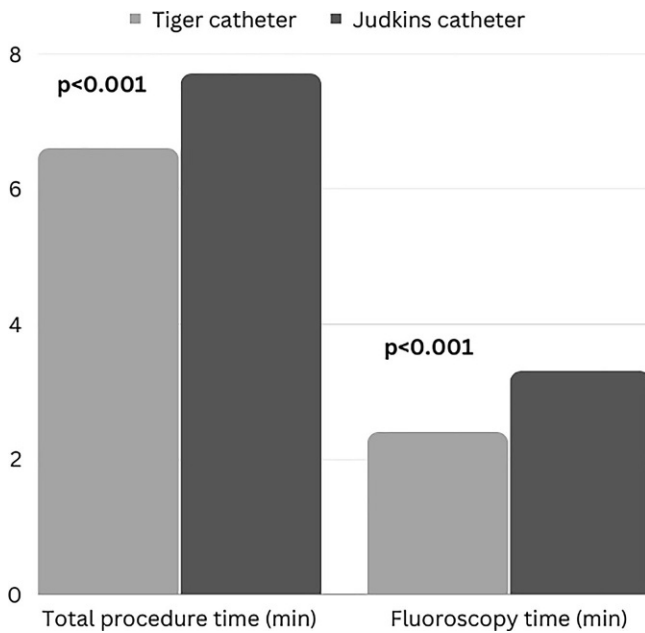


Fig. 1 ▲ Fluoroscopy time and total procedure time for Tiger and Judkins catheters

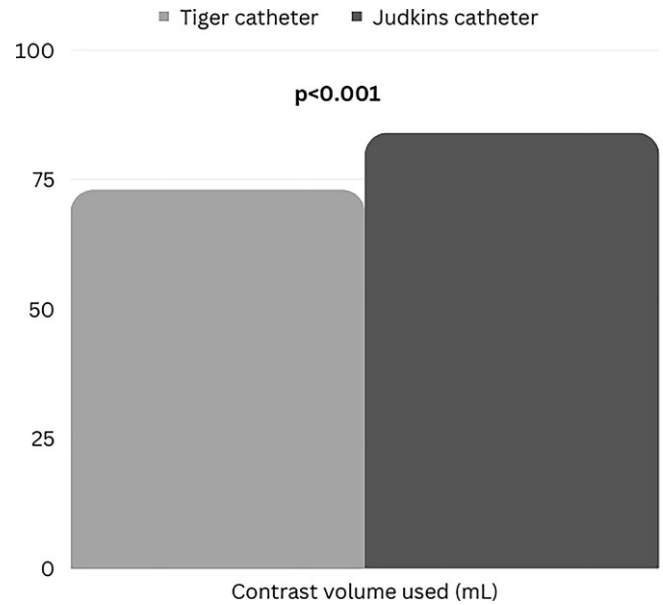


Fig. 2 ▲ Total contrast volumes for Tiger and Judkins catheters

are requisite for accessing the LCA via the femoral approach. Consequently, to investigate the coronary arteries through the femoral approach, it is necessary to employ two distinct types of catheters. By contrast, catheters are inserted through the subclavian and innominate arteries of the patient and advanced toward the ascending aorta using the radial approach. The placement of catheters in the ascending aorta is a widely accepted procedure, typically positioned centrally or with a slight deviation to the left [22].

The anatomical distinctions between the transradial and transfemoral methods pose a challenge in accessing the coronary arteries through a femoral diagnostic catheter in the course of a transradial procedure. The Judkins catheter, located on the left side, is commonly utilized in transradial procedures. However, it presents a challenge due to the upward force it stores as a result of the angle formed between the innominate artery and the ascending aorta. The rubbing of the catheter tip against the ceiling of the left main coronary artery results in injury to the artery and may cause disengagement from the ostium [23]. Radial artery spasm complicates transradial procedures [24]. Catheter exchanges via the restricted radial artery may cause arm pain and spasm.

Utilizing the Tiger catheter instead of the conventional Judkins catheter resulted in a statistically significant reduction in the amount of time spent on fluoroscopy, the volume of contrast medium utilized, and the total duration of the operation among female patients older than 65. Even if the dose–area product was lower when the Tiger catheter was used, the difference was not statistically significant. Our analysis revealed that only one catheter was used to achieve these reductions, which is a significant finding. In settings characterized by a high volume of cases, as was the case in the facility where our investigation was carried out, the adoption of multiple procedures may lead to a decrease in the expenses associated with coronary angiograms, an enhancement in the effectiveness of the procedures, and a reduction in the level of radiation exposure experienced by operators. Furthermore, it could potentially improve the efficacy of procedures.

In light of the prevalence of older patients requiring invasive, diagnostic, and therapeutic radiographic investigations, it is becoming increasingly evident that contrast-induced nephropathy is a major cause of morbidity in this population. While it is improbable that all cases of acute renal failure due to contrast can be prevented, identifying risk factors and using appro-

priate prophylactic regimens may help to reduce the incidence of contrast-induced nephropathy [25]. In our study, the fact that the amount of contrast medium used was less in the group utilizing the Tiger catheter demonstrates its significance in relation to contrast-medium-related renal failure in older women.

Conclusion

The findings of this investigation indicate that the utilization of Tiger catheters in older patients with high frailty and women with smaller radial artery diameters than men was linked to reduced total procedure duration, contrast volume, and fluoroscopy duration when compared with Judkins catheters. The utilization of the Tiger catheter may offer notable benefits to operators who perform a large number of procedures, prioritize procedural efficiency, and minimize radiation exposure. The present study offers significant evidence in favor of employing the Tiger catheter for transradial procedures, particularly in mitigating radial artery spasms resulting from frequent catheter replacements and in shortening the duration of the procedure for patients who are unable to endure prolonged supine positioning. Given the low incidence of failure associated with the use of a single catheter for

both the left and right coronary arteries, it is our contention that commencing with a single-catheter methodology and subsequently transitioning to a Judkins catheter, if required, is a reasonable course of action. The implementation of this protocol has the potential to reduce the duration of the procedure and the overall fluoroscopy time.

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Data availability statements. The data that support the findings of this study are not open to the public due to the confidentiality of personal data and are only available from the corresponding author upon reasonable request. Data are located in controlled access data storage at Kahramanmaraş Sütçü İmam University, Faculty of Medicine.

Declarations

Conflict of interest. M. Kerkütüoğlu and E. Çelik declare that they have no competing interests.

Ethics committee approval was obtained from Kahramanmaraş Sutcuimam University (2018/01-271) and institutional approval from the relevant institution before starting the research.

References

- Campeau L (1989) Percutaneous radial artery approach for coronary angiography. *Cathet Cardiovasc Diagn* 16:3–7
- Louvard Y, Lefevre T, Allain A, Morice MC (2001) Coronary angiography through the radial or the femoral approach: the CARAFE study. *Cathet Cardiovasc Intervent* 52:181–187
- Rao SV, Eikelboom JA, Granger CB et al (2007) Bleeding and blood transfusion issues in patients with non-ST-segment elevation acute coronary syndromes. *Eur Heart J* 28:1193–1204
- Eikelboom JW, Mehta SR, Anand SS et al (2006) Adverse impact of bleeding on prognosis in patients with acute coronary syndromes. *Circulation* 114:774–782
- Moscucci M, Fox KA, Cannon CP et al (2003) Predictors of major bleeding in acute coronary syndromes: the global registry of acute coronary events (GRACE). *Eur Heart J* 24:1815–1823
- Rao SV, Hess CN, Barham B et al (2014) A registry-based randomized trial comparing radial and femoral approaches in women undergoing percutaneous coronary intervention: the SAFE-PCI for women (study of access site for enhancement of PCI for women) trial. *JACC Cardiovasc Interv* 8:857–867
- Feldman DN, Swaminathan RV, Kaltenbach LA et al (2013) Adoption of radial access and comparison of outcomes to femoral access in percutaneous coronary intervention: an updated report from the national cardiovascular data registry (2007–2012). *Circulation* 127:2295–2306
- Avezum A, Makdisse M, Spencer F et al (2005) Impact of age on management and outcome of acute coronary syndrome: observations from the global registry of acute coronary events (GRACE). *Am Heart J* 149(1):67–73
- Hemingway H, McCallum A, Shipley M et al (2006) Incidence and prognostic implications of stable angina pectoris among women and men. *JAMA* 295(12):1404–1411
- Lakatta EG (2003) Arterial and cardiac aging: major shareholders in cardiovascular disease enterprises: part III: cellular and molecular clues to heart and arterial aging. *Circulation* 107(3):490–497
- Alexander KP, Roe MT, Chen AY et al (2005) Evolution in cardiovascular care for elderly patients with non-ST-segment elevation acute coronary syndromes: results from the CRUSADE national quality improvement initiative. *J Am Coll Cardiol* 46(8):1479–1487
- Saito S, Ikei H, Hosokawa G, Tanaka S (1999) Influence of the ratio between radial artery inner diameter and sheath outer diameter on radial artery flow after transradial coronary intervention. *Catheter Cardiovasc Interv* 46(2):173–178
- Batchelor WB, Anstrom KJ, Muhlbauer LH et al (2000) Contemporary outcome trends in the elderly undergoing percutaneous coronary interventions: results in 7,472 octogenarians. National cardiovascular network collaboration. *J Am Coll Cardiol* 36(3):723–730
- Klein LW, Block P, Brindis RG et al (2002) Percutaneous coronary interventions in octogenarians in the american college of cardiology-national cardiovascular data registry: development of a nomogram predictive of in-hospital mortality. *J Am Coll Cardiol* 40(3):394–402
- Louvard Y, Benamer H, Garot P et al (2004) Comparison of treatment outcomes in patients } or = 80 years undergoing transradial versus transfemoral coronary intervention. *Am J Cardiol* 94(9):1177–1180
- Klinke WP, Hilton JD, Warburton RN et al (2004) Comparison of treatment outcomes in patients } or = 80 years undergoing transradial versus transfemoral coronary intervention. *Am J Cardiol* 93(10):1282–1285
- Jinnouchi H, Sakakura K, Wada H et al (2012) Transradial percutaneous coronary intervention for acute myocardial infarction reduces CCU stay in patients 80 or older. *Int Heart J* 53(2):79–84
- Kim SM, Kim DK, Kim DI et al (2006) Novel diagnostic catheter specifically designed for both coronary arteries via the right transradial approach. *Int J Cardiovasc Imaging* 22:295–303
- Xanthopoulos I, Stavrou K, Davlouros P et al (2018) Randomised comparison of JUDKINS vs. tiGER catheter in coronary angiography via the right radial artery: the JUDGE study. *EuroIntervention* 13(16):1950–1958
- Gargiulo G, Ariotti S, Vranckx P et al (2018) Impact of sex on comparative outcomes of radial versus femoral access in patients with acute coronary

Vergleich zwischen Ein-Katheter- und 2-Katheter-Konzept bei älteren Patientinnen mit transradialer Koronarangiographie

Hintergrund: Ziel der vorliegenden Studie war es, die Ergebnisse zur Wirksamkeit der herkömmlichen Links- und Rechtskatheter nach Judkins mit den vor Kurzem eingeführten Tiger-Kathetern bei Teilnehmerinnen im Alter von 65 Jahren und mehr zu vergleichen, bei denen eine transradiale Koronarangiographie erfolgt war.

Methoden: Eine Kohorte von 160 Patientinnen im Alter von mindestens 65 Jahren, bei denen eine Koronarangiographie geplant war, wurde in einem Verhältnis von 1:1 in 2 Gruppen eingeteilt, je nachdem, ob die Verwendung von Tiger- ($n = 80$) oder Judkins-Kathetern ($n = 80$) für die Radialisangiographie erfolgte. In die Auswertung flossen ein: die Wirksamkeit der Tiger- und Judkins-Katheter, die Inzidenz eines Katheterversagens, Kontrastmittelvolumen, Koronarangiographiedauer, Durchleuchtungsdauer, Dosis-Flächen-Produkt (DAP; in mGy/cm²) und das Auftreten eines Radialisspasmus.

Ergebnisse: Bei einem äquivalenten Maß an Strahlenexposition war in der Gruppe mit Judkins-Katheter die Verfahrensdauer signifikant länger als in der Gruppe mit Tiger-Katheter. Die Durchleuchtungsdauer war länger und die Menge an benötigtem Kontrastmittel größer, aber die Häufigkeit eines Radialisspasmus unterschied sich nicht signifikant.

Schlussfolgerung: Die vorliegende Untersuchung ergab, dass die Einführung von Tiger-Kathetern bei geriatrischen Patienten mit erhöhter Gebrechlichkeit und bei Patientinnen, die geringere Radialarteriendurchmesser aufweisen, mit einer Verminderung der Gesamtverfahrensdauer, des eingesetzten Kontrastmittelvolumens und der Durchleuchtungsdauer einherging.

Schlüsselwörter

Radialisarterienspasmus · Transradialer Zugang · Radialiskatheter · Tiger-Katheter · Gebrechliche Patienten

- syndromes undergoing invasive management: data from the randomized MATRIX-access trial. *JACC Cardiovasc Interv* 11(1):36–50
21. Huang FY, Huang BT, Wang PJ et al (2016) Gender disparity in the safety and efficacy of radial and femoral access for coronary intervention: a systematic review and meta-analysis. *Angiology* 67(9):810–819
 22. Ochiai M, Ikari Y, Yamaguchi T et al (2000) New long-tip guiding catheters designed for right transradial coronary intervention. *Catheter Cardiovasc Interv* 49(2):218–224
 23. Ikari Y, Ochiai M, Hangaishi M et al (1998) Novel guide catheter for left coronary intervention via a right upper limb approach. *Cathet Cardiovasc Diagn* 44(2):244–247
 24. Goldberg SL, Renslo R, Sinow R, French WJ (1998) Learning curve in the use of the radial artery as vascular access in the performance of percutaneous transluminal coronary angioplasty. *Cathet Cardiovasc Diagn* 44(2):147–152
 25. Palli E, Makris D, Papanikolaou J et al (2014) Contrast-induced nephropathy in aged critically ill patients. *Oxid Med Cell Longev* 2014:756469

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