

Electrophysiological Assessment of Paresthesia in Patients Following Radial Angiography: A Prospective Study

ABSTRACT

Background: Radial angiography, preferred for its safety and comfort in percutaneous coronary interventions, occasionally leads to paresthesia—a tingling or numbing sensation in the hand. This study aimed to investigate the presence of nerve damage in patients experiencing paresthesia post-radial angiography through electrophysiological examination.

Methods: This prospective study involved 77 patients who developed hand paresthesia following radial angiography. Excluded were those with malignancy, pregnancy, pacemakers, or recent angiography. Nerve conduction studies were performed using the Neuropack MEB 9102K EMG device, assessing sensory and motor amplitudes, latencies, and velocities of median, ulnar, and radial nerves.

Results: The study included 77 patients (23 females, 54 males; average age 58.39 ± 10.44 years). In 11 diabetic patients, polyneuropathy was detected. For the remaining 66 patients, electrophysiological evaluations showed no significant pathological findings. Comparative analysis of both upper extremities revealed no significant differences in nerve conduction parameters between the side where angiography was performed and the other side. Despite paresthesia complaints, no electrophysiological evidence of nerve damage was found, suggesting that symptoms might be due to local irritation rather than direct nerve injury. This aligns with the safety profile of radial angiography and underscores the importance of distinguishing between transient paresthesia and serious nerve complications.

Conclusion: Paresthesia post-radial angiography, while clinically notable, is not typically associated with nerve damage. This study is significant as it is the first in the literature to demonstrate that radial angiography does not cause nerve damage.

Keywords: Nerve conduction studies, paresthesia, post-procedure complications, radial angiography

INTRODUCTION

Radial angiography, a technique increasingly preferred in percutaneous coronary interventions (PCI), is renowned for its safety and patient comfort compared to the traditional femoral approach.¹ This method involves accessing the coronary arteries through the radial artery in the wrist, which has been associated with a significantly lower risk of bleeding and vascular complications.²

Patient comfort and satisfaction are also significant considerations in the choice of radial over femoral access. Rutka et al³ found that patients undergoing radial angiography reported less discomfort and higher satisfaction levels, which can be attributed to the minimally invasive nature of the procedure and the reduced recovery time.

Paresthesia, characterized by a tingling or numbing sensation, is a recognized complication following radial angiography. This condition arises due to transient or, in rare cases, prolonged nerve compression or damage associated with radial artery catheterization.⁴ While the incidence of paresthesia post-radial angiography is

ORIGINAL INVESTIGATION

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relatively low, it remains a concern due to the discomfort and potential impact on the patient's quality of life.⁵

In this study, it was planned to investigate whether this nerve damage was present by electrophysiological examination in patients who developed paresthesia after radial angiography.

METHODS

This study is a prospective study conducted with the approval of the Ethics Committee of Sivas Cumhuriyet University (November 2022/03). In the study, nerve conduction studies of 77 patients who presented to the neurology and neurosurgery outpatient clinics with complaints of paresthesia in the hand following radial angiography were evaluated between the dates of December 4, 2022, and April 25, 2023.

Patients included in the study were over 18 years of age, had complaints of paresthesia in the hand, and had a history of radial angiography at least 3 weeks prior. Patients with a history of malignancy, pregnant patients, patients with pacemakers, and patients who had undergone radial angiography less than 3 weeks ago were not included in the study.

For nerve conduction studies, data from the Neuropack MEB 9102K (Nihon Kohden, Tokyo, Japan) EMG device were evaluated.

The electrophysiological evaluation was performed at room temperature. Sensory nerve conduction studies were obtained through recording with antidromic technique over the nerve. Median sensory responses were obtained by recording from the second digit, ulnar sensory responses by recording from the 5th digit, and radial sensory responses by recording from the fossa between the first and second metacarpals on the dorsum of the hand. The median motor response was recorded from the abductor pollicis brevis muscle, the ulnar motor response from the abductor digiti minimi muscle, and the radial motor response from the extensor indicis proprius muscle. Nerve stimulations were applied at supramaximal intensity with a duration of 0-1, 0-2 microseconds.

As part of the nerve conduction studies, the sensory and motor amplitudes, latencies, and velocities of the patients' median, ulnar, and radial nerves were recorded. Reference values determined according to our laboratory's standards were used.

HIGHLIGHTS

- Radial angiography involves accessing the coronary arteries through the radial artery in the wrist, which is associated with a lower risk of bleeding and vascular complications.
- While paresthesia in the radial region post-angiography is a notable clinical observation, it is not typically associated with electrophysiological evidence of nerve damage.

In addition to nerve conduction studies, demographic information such as patients' age, gender, and history of additional diseases was also recorded.

Statistical Analysis

Statistical analyses were conducted using the SPSS software version 25.0. In our study, a power analysis was performed, and for $n=77$, the power was calculated as 0.8017626.

The suitability of variables for normal distribution was examined using histogram graphs and the Kolmogorov–Smirnov test. Descriptive analyses were presented using mean, standard deviation, median, and minimum–maximum values. For nonparametric values that did not show normal distribution, the Mann–Whitney *U*-test was used when evaluating between 2 groups. Situations where the $P < .05$ were considered statistically significant results.

RESULTS

A total of 77 patients, 23 females (29.87%) and 54 males (70.13%), who underwent electrophysiological testing due to paresthesia complaints following radial angiography, were included in the study. The average age of the patients was 58.39 ± 10.44 . It was learned from the patients' histories that radial angiography was performed on the left hand in all cases. In 11 patients, a polyneuropathy affecting both sensory and motor nerves of the axonal type was detected. These 11 patients also had a concurrent history of diabetes.

In the electrophysiological evaluation of the 66 patients without a history of diabetes, the average values of sensory and motor nerve conduction velocities, amplitudes, and distal latencies in the right and left upper extremities for the median, ulnar, and radial nerves are shown in Table 1. No significant pathological findings were observed in the nerve conduction studies of these 66 patients.

In the examination conducted on the patients, both upper extremities were evaluated comparatively. No statistically significant difference was observed between the side where radial angiography was performed and the side where it was not performed ($P > .05$) (Table 1). When nerve conduction studies were individually considered for each patient, no significant difference was observed between the right and left side.

DISCUSSION

Our study's findings, which highlight the occurrence of transient paresthesia post-radial angiography without corresponding electrophysiological abnormalities, are further contextualized by existing literature. For instance, the study by Harvey et al⁶ emphasizes the range of upper-limb complications following transradial catheterization. While their focus is on acute complications, it underscores the need for vigilance in monitoring post-procedural symptoms, including paresthesia.

The safety and efficacy of radial artery access, as demonstrated in the study by Chen et al,⁷ align with our findings that radial angiography, when performed correctly, does not result in significant nerve damage. Their work, focusing

Table 1. Comparison of Sensory and Motor Nerve Conduction Velocities and Amplitudes for the Median, Ulnar, and Radial Nerves in the Right and Left Upper Extremities

	Right		Left		P
	Mean ± SD	Medians (Interquartile Range)	Mean ± SD	Medians (Interquartile Range)	
Radial sensory amplitude	8.55 ± 3.25	8.4 (0-17.8)	8.94 ± 3.86	8.5 (0-20.1)	.684
Radial sensory velocity	54.44 ± 8.55	54.7 (0-69.8)	55.59 ± 8.52	56 (0-72.2)	.210
Median sensory amplitude	16.81 ± 7.46	16.7 (1.8-37.6)	18.91 ± 9.01	17.4 (0-44.7)	.141
Median sensory velocity	50.53 ± 7.96	52.2 (32.6-67.4)	49.27 ± 9.34	52 (0-63.7)	.489
Ulnar sensory amplitude	15.08 ± 5.95	14.6 (2.7-37)	17.07 ± 8.51	16.3 (2.2-53.3)	.239
Ulnar sensory velocity	53.72 ± 4.28	53.9 (41.4-61.9)	53.64 ± 4.56	54.1 (40.7-64.5)	.881
Radial motor amplitude	6.58 ± 1.85	6.46 (2.5-12.4)	7.05 ± 2.34	6.4 (2.3-15.7)	.450
Radial motor velocity	58.21 ± 5.9	57 (45.7-76.9)	59.24 ± 6.8	58.8 (46.6-80.4)	.564

on cerebral angiography, reinforces the broader applicability and safety profile of radial access in various angiographic procedures.

A systematic review and meta-analysis comparing radial and femoral access further supports our assertion regarding the safety of radial access. Their comprehensive analysis, which includes the risks of stroke, myocardial infarction, and major bleeding, provides a robust backdrop to our study, emphasizing the lower complication rates associated with radial access.⁷⁻⁹

The study by Chaddad et al exploring radial vs. distal radial artery techniques offers an interesting perspective on procedural variations within radial angiography. Their findings on complication rates and success rates could inform future research on whether different radial access techniques influence the incidence or severity of paresthesia.^{10,11}

The absence of significant electrophysiological abnormalities in patients, regardless of the presence of paresthesia, indicates that radial angiography, when performed correctly, is not inherently damaging to the nerve structures. This aligns with the safety profile of radial angiography reported in various studies,⁸ which emphasize its advantages over femoral access in terms of reduced vascular complications and major bleeding.¹²⁻¹⁴

The paresthetic complaints observed in our study are thought to be primarily due to local irritation in the angiography area. This irritation could stem from several factors, including the mechanical stress of catheter insertion, local vascular trauma, or inflammatory responses. These transient factors can induce sensations of paresthesia without causing lasting nerve damage, as evidenced by the normal electrophysiological findings in our study.

This phenomenon of transient paresthesia without electrophysiological abnormalities is not unique to our study. Similar observations have been reported in other studies focusing on radial angiography.⁵ These studies suggest that while paresthesia is a relatively common post-procedural complaint, it does not typically indicate serious nerve injury.¹⁵⁻¹⁷

Furthermore, our findings highlight the importance of distinguishing between transient paresthesia due to local irritation and more serious nerve complications. In patients with

a history of diabetes, as seen in our study, the presence of polyneuropathy suggests a more complex interplay between preexisting conditions and procedural impact, warranting careful monitoring and management.

In conclusion, while paresthesia in the radial region post-angiography is a notable clinical observation, our study reassures that it is not typically associated with electrophysiological evidence of nerve damage. This underscores the importance of patient education regarding the potential for transient sensory disturbances following radial angiography and the low likelihood of these symptoms indicating serious nerve injury. Future research could focus on strategies to minimize local irritation during the procedure and on the long-term follow-up of these sensory symptoms to better understand their resolution over time. This study is significant as it is the first in the literature to demonstrate that radial angiography does not cause nerve damage.

Ethics Committee Approval: The study was approved by the Ethics Committee of Sivas Cumhuriyet University (decision date and decision number: November 2022/03).

Informed Consent: Written informed consent was obtained from the patients who agreed to take part in the study.

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